BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Application of Pacific Gas and Electric Company for Approval of Modifications to its SmartMeter™ Program and Increased Revenue Requirements to Recover the Costs of the Modifications (U 39 M)	Application 11-03-014 (Filed March 24, 2011) **(NOT CONSOLIDATED)**
Application of Utility Consumers' Action Network for Modification of Decision 07-04-043 so as to Not Force Residential Customers to Use Smart Meters.	Application 11-03-015 (Filed March 24, 2011) **(NOT CONSOLIDATED**
Application of Consumers Power Alliance, Public Citizen, Coalition of Energy Users, Eagle Forum of California, Neighborhood Defense League of California, Santa Barbara Tea Party, Concerned Citizens of La Quinta, Citizens Review Association, Palm Springs Patriots Coalition Desert Valley Tea Party, Menifee Tea Party - Hemet Tea Party – Temecula Tea Party, Rove Enterprises, Inc., Schooner Enterprises, Inc., Eagle Forum of San Diego, Southern Californians For Wired Solutions To Smart Meters, and Burbank Action For Modification of D.08-09-039 and A Commission Order Requiring Southern California Edison Company (U338E) To File An Application For Approval of A Smart Meter Opt- Out Plan.	Application 11-07-020 (Filed July 26, 2011) **(NOT CONSOLIDATED**

PACIFIC GAS AND ELECTRIC COMPANY'S RESPONSE TO ADMINISTRATIVE LAW JUDGE'S OCTOBER 18, 2011 RULING DIRECTING IT TO FILE CLARIFYING RADIO FREQUENCY INFORMATION

ANN H. KIM
CHONDA J. NWAMU
Law Department
Pacific Gas and Electric Company
77 Beale St., B30A
P.O. Box 7442
San Francisco, CA 94120
Telephone: (415) 973-6650
Facsimile: (415) 973-0516
E-Mail: CJN3@pge.com

Attorneys for
PACIFIC GAS AND ELECTRIC COMPANY

Dated: November 1, 2011

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Application of Pacific Gas and Electric Company for Approval of Modifications to its SmartMeter™ Program and Increased Revenue Requirements to Recover the Costs of the Modifications (U 39 M)	Application 11-03-014 (March 24, 2011)

PACIFIC GAS AND ELECTRIC COMPANY'S RESPONSE TO ADMINISTRATIVE LAW JUDGE'S OCTOBER 18, 2011 RULING DIRECTING IT TO FILE CLARIFYING RADIO FREQUENCY INFORMATION

I. INTRODUCTION

On October 18, 2011, Administrative Law Judge (ALJ) Yip-Kikugawa issued *Administrative Law Judge's Ruling Seeking Clarification* from Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E), Southern California Edison Company (SCE) and Southern California Gas Company (SoCalGas) (collectively, the utilities or IOUs), in the above-captioned proceeding. Specifically, the Ruling directs the utilities to file clarifying information concerning the frequency and duration of radio frequency (RF) emissions from wireless smart meters by November 1, 2011. PG&E hereby timely responds to the Ruling.

II. PG&E'S SMARTMETERS™ COMPLY WITH FEDERAL COMMUNICATIONS COMMISSION (FCC) RADIO FREQUENCY (RF) EMISSIONS STANDARDS

PG&E's SmartMeters™ RF emissions are substantially below the Federal Communications Commission's (FCC) limits for radio transmitters of all types, including SmartMeters™. Indeed, and as PG&E noted in its Response to the Division of Ratepayer Advocates' *Motion to Amend the Scope of the Proceeding to Include Data on RF Emissions and to Order PG&E To Serve Supplemental Testimony on the Costs of an Analog Meter*, "the CPUC has previously found that PG&E's SmartMeters™ comply with FCC RF emissions standards. Specifically, the Commission found that '[a]ll radio devices in PG&E's SmartMeters™ are

licensed or certified by the FCC and comply with all FCC requirements.'[1] Further, the FCC itself has articulated that PG&E's SmartMeters™ comply with RF emissions levels."[2] (*See, PG&E's Opposition to DRA's Motion, p.3)(August 8, 2011*);(*see also, FCC letters, Attachments A and B*).

PG&E continues to recommend and support its proposed radio-off SmartMeter™ as the most feasible alternative to its SmartMeter™ Program, as fully described in Application (A.) 11-03-014 and supporting Testimony. PG&E's radio-off proposal provides an opt-out alternative with no wireless RF communications for customers who want to limit wireless telecommunications technology in their lives.

III. PG&E's RESPONSES TO THE CLARIFYING QUESTIONS IN THE OCTOBER 18, 2011 ALJ RULING

On September 14, 2011, ALJ Yip-Kikugawa held a combined workshop to consider alternatives for customers who may wish to opt-out of receiving wireless smart meters. During the workshop, various parties raised questions and made comments concerning the frequency and duration of the RF-transmissions from the wireless smart meters. The ALJ subsequently requested that the utilities respond to eleven RF-related questions as set forth below.

Each of PG&E's SmartMeter™ vendors – Silver Springs Network (SSN), General Electric (GE), Landis + Gyr (L+G), and Aclara – has confirmed that their SmartMeter™ products fully comply with applicable FCC regulations. PG&E's SmartMeter™ vendors provided the below RF-related data, as applicable to their respective products, in response to the ALJ Ruling.

---

1 CPUC Decision 10-12-001, Finding of Fact 2.

2 FCC Letters to Cindy Sage, dated August 6, 2010, and the Honorable Lynn C. Woolsey, dated April 21, 2011

Question 1:

What is an average duration (in seconds) that a residential smart meter transmits in a 24 hour period?

Response 1:

Electric: As PG&E has described many times previously, both in this proceeding and publicly, a typical PG&E electric SmartMeter™ communicates intermittently throughout the day for a total cumulative period of approximately 45 seconds per 24-hour period. This typical cumulative communication period is comprised of thousands of very brief communications.

This reflects the findings of a detailed SSN study in which SSN collected actual field data from 88,000 deployed meters and compared the number of transmissions per meter for roughly 30 minutes each in order to determine that half of the meters transmitted for less than 45 seconds-per-day and half of the meters transmitted for longer than 45 seconds-per-day. In the study, a small number of electric SmartMeters™ in the outer range of the population communicated somewhat longer than 45 seconds-per-day, which resulted in an overall mean duration of approximately 62 seconds.[3]

Gas: The PG&E gas SmartMeter Module (MTU) has a single radio that utilizes the licensed 450-470 MHz band. The module is a one way transmitter; i.e., it sends but does not receive signals. The average duration that a gas SmartMeter™ Module transmits in a 24-hour period is 0.676 seconds. This is a calculated value based on observed individual transmission rates of 0.16 seconds each, and the designed transmission frequency of between 4.15 and 4.35 transmissions per day.

Question 1.a.:

How is this average computed or measured?

Response 1.a.:

Electric: SSN supplies PG&E with the "chipset" contained in the electric SmartMeters™ that GE and L+G supply to PG&E. The chipset, referred to as a "Network Interface Card" or "NIC," processes and stores the data and provides the radio communication back to PG&E. SSN has conducted several studies on these data to compute the type and duration of these transmissions.

In the SSN study referenced in Response 1, SSN calculated the median transmission-time by collecting actual field data from 88,000 deployed meters. By checking the number of transmissions per meter for roughly 30 minutes each, SSN computed the length of these

---

[3] PG&E's electric SmartMeters™ have two radios installed: 1) a radio that utilizes the licensed 902-928 megahertz (MHz) band for connection to the PG&E back office, and 2) a 2.4 gigahertz (GHz) radio to transmit to devices in the customer premises. The transmissions measured and addressed in this Response relate to the 900 MHz radio. Currently, PG&E does not have any SmartMeters™ utilizing the 2.4 GHz radio.

transmissions per 24-hour day. In another study, SSN worked with PG&E to evaluate the transmissions of roughly 50,000 meters over a 48-hour period to similarly compute these numbers.

Gas: The duration of each transmission from the gas SmartMeter™ Module is less than 0.16 seconds. Using the typical transmission rate of 4.228 transmissions per 24 hours, the average duration over a 24-hour period is approximately 0.676 seconds (4.228 x 0.16 = 0.676).

Question 2:

How many times in total (average and maximum) is a smart meter scheduled to transmit during a 24-hour period?

Response 2:

Electric: Table 2-1 presents scheduled electric SmartMeter™ system messages and their durations. As noted in Response 1, the information presented applies only to the 900 MHz radio. Table 2-1 presents data for all "scheduled" messages; i.e., those inherently required to sustain communications in the network that occur routinely without user intervention. "Non-Scheduled" messages created only at non-recurring times are addressed in Response 3.

TABLE 2-1

Electric System Message Type	**Transmission Frequency Per 24-Hour Period: Average**	**Transmission Frequency Per 24-Hour Period: Maximum (99.9th Percentile)**
[a]	[b]	[c]
Meter Read Data	6	6
Network Management	15	30
Time Synch	360	360
Mesh Network Message Management	9,600	190,000
Weighted Average Duty Cycle	45.3 Seconds[4]	875.0 Seconds

The electric system message types are defined as:

- Meter Read Data refers to the messages generated by each meter to transmit energy usage data.
- Network Management refers to network tasks that need to be performed to maintain the health of the network (e.g., route establishment).
- Time Synch refers to network administration messages needed to update the internal clock in the NIC.
- Mesh Network Message Management refers to activities required to forward routed messages.

Gas: Table 2-2 presents scheduled gas SmartMeter™ system messages and their durations.

TABLE 2-2

Gas System Message Type	**Transmission Frequency Per 24-Hour Period: Average**	**Transmission Frequency Per 24-Hour Period: Maximum**
[a]	[b]	[c]
Meter Read Data	4.228	4.305
Weighted Average Duty Cycle	0.676 Seconds	0.689 Seconds

[4] As stated in Response 1, a small number of electric SmartMeters™ communicate somewhat longer than 45 seconds-per-day, which resulted in an overall mean duration of approximately 62 seconds.

Question 2.a.:
How many of those times (average and maximum) are to transmit electric usage information?

Response 2.a.:

Electric: Generally, the Meter Read Data messages shown in Table 2-1 transmit electric usage data from the meter generating the data. Mesh Network Message Management messages also transmit electric usage data from neighbor meters.

Gas: In Table 2-2, the Meter Read Data messages transmit gas usage data.

Question 2.b.:
How many of those times (average and maximum) are for other purposes? What are those other purposes? Please specify number of times (average and maximum) by type/category of transmission.

Response 2.b.:

Electric: The scheduled electric messages are shown in Table 2-1 and defined in Response 2. The Network Management and Time Synch messages are for administration and mesh maintenance, as explained in Response 2. They are required to sustain the routing capability of the mesh network.

Gas: There are no other standard messages than the usage data transmission.

Question 3:
Under what scenarios does a meter transmit outside of the daily schedule, i.e., unscheduled transmission such as on-demand read, tamper/theft alert, last gasp, firmware upgrade etc.?

Response 3:

Electric: For purposes of providing this data, PG&E is using data for all messages that inherently are required to sustain communications in the network, and occur routinely without user intervention as "scheduled"; messages created only at non-recurring times such as startup or to satisfy non-typical events or user requests are considered "non-scheduled".

Table 3-1 shows the categories of electric messages generated outside of the daily schedule. These messages are event-driven and are not predictable on any given day.

TABLE 3-1

Electric Message Type	Scenario
Interrogation for network (Initial)	Initial attempt to discover network availability or after an outage restoration
Interrogation for network (Extended)	Infrequent polling when network discovery is not immediate
Network Activation	Upon successful discovery of network route either upon initial startup or outage restoration
Last gasp	Upon loss of power
On-demand read	Request from PG&E back-office user
Firmware upgrade	Pushed from PG&E back-office user
Power status check	Request from PG&E back-office user
Other 'as-triggered' alarms	Sent as needed (e.g., power restored)
Meter disconnect or reconnect	Request from PG&E back-office user

Gas: The only unscheduled transmission would be for a tamper alarm. Tamper alarms are rare.

Question 4:
Typically, how much of the communication between the customer's meter and the utility is unscheduled vs. scheduled?

Response 4:

Electric: Typically, the majority of the communication between the customer's electric SmartMeter™ and PG&E is scheduled. SSN estimates that very little of the overall electric SmartMeter™ transmission time would be for unscheduled transmissions.

Gas: Aclara estimates that effectively 100 percent of the transmissions are due to scheduled activity. Tamper alarms are rare.

Question 5:

Are there any other factors that go into determining duration and/or frequency of meter transmissions (e.g., if a meter can't access the network when it's trying to send data, type of a meter etc.)? If yes, please identify these factors.

Response 5:

Electric: With respect to PG&E's electric SmartMeter™ system, there are no other factors that go into determining the duration or frequency of the electric meter system transmission other than those discussed in Responses 2 and 3.

Gas: With respect to PG&E's gas SmartMeter™ system, there are no other factors that go into determining the duration or frequency of the gas meter system transmission other than those discussed in Responses 2 and 3.

Question 6:
What is the amount of RF emission at the source when a meter is transmitting data (instantaneous maximum peak level, averaged over 30 minutes)?

Response 6:

Table 6-1 provides the requested data for electric SmartMeters™ and gas SmartMeter™ Modules.

TABLE 6-1[5]

Radio Type	Transmit Power	Antenna Gain (Decibel Isotropic)	Instantaneous Peak Level (Effective Isotropic Radiated Power)	Average Exposure Over 30 Minutes	Percent of FCC Allowable RF Emissions
[a]	[b]	[c]	[d]	[e]	[f]
Electric 900 MHz	1000 mW	4.0 dBi	2500 mW	0.35 μW/cm2	0.058%
Electric 2.4 GHz[6]	125 mW	None	125 mW	N/A	N/A
Gas Standard Module	132 mW	None	132 mW	0.01μW/cm2	0.0033%
Gas Extended Range Module	794 mW	None	794 mW	0.059μW/cm2	0.02%

[5] Average electric exposure has been calculated from duty cycles consistent with field observations at a distance of 20 centimeters. Average gas exposure has been calculated based on system specifications.

[6] As stated in Response 1, the 2.4 GHz radio is not currently in use in PG&E's SmartMeter™ system.

Question 7:
Does the amount of RF emission vary depending on duration of transmission/volume of data being sent? For example, are RF emissions higher when there is a larger volume of data to be transmitted?

Response 7:

Electric: While the power-level in PG&E's electric SmartMeters™ is fixed, the total RF energy varies based on the duration of the communication. When a larger volume of data is transmitted, the duration of the communication may increase, resulting in a greater emission of RF energy.

Gas: The usage read data messages are fixed in length and fixed in scheduled transmissions. Only tamper alarms are sent outside of scheduled transmissions. As noted earlier, tamper alarms are very rare.

Question 8:
Are there any other factors that impact the amount of RF emissions? If so, please identify the factor(s) and its impact on RF emissions.

Response 8:

Electric: PG&E is not aware of any other factors that affect the amount of RF emissions at the electric endpoint, i.e., at the customer's premises.[7]

Gas: PG&E is not aware of any other factors that affect the amount of RF emissions at the gas endpoint, i.e., at the customer's premises.[8]

---

[7] PG&E notes that in addition to electric meters, there are network devices – generally mounted on PG&E distribution facilities at 25 feet or higher above the ground – called Relays or Access Points that receive the data from electric meters and forward the data over a public network cellular back haul (850 MHz or 1900 MHz) to the PG&E data center.

[8] PG&E notes that in addition to gas meters, there are network devices – generally mounted on PG&E distribution facilities at 25 feet or higher above the ground – called Data Collection Units (DCUs) which receive the data from the gas SmartMeter™ Modules and forward the data over a public network cellular back haul (850 MHz or 1900 MHz) to the PG&E data center. The DCUs also send out one network administration message per day over the 450-470 MHz band.

Question 9:
Is there RF emission when the meter is not transmitting? If yes, what is the amount of RF emission?

Response 9:

Yes, all digital circuitry – from that contained in clocks, in stereo equipment, or in answering machines – emits de minimus RF that is governed by FCC limits for unintentional RF emissions.[9]

Table 9-1 provides the requested data for electric SmartMeters™ and gas SmartMeter™ Modules.

TABLE 9-1

Meter Type	RF Measured Value With Radio Off	FCC Allowable RF Emissions
[a]	[b]	[c]
Electric: GE	39.3 dBμV/m	49.0 dBμV/m
Electric: L+G	24.7 dBμV/m	49.0 dBμV/m
Gas: Aclara	No discernable emissions	40.0 – 54.0 dBμV/m

Electric: Note that PG&E's electric system communications equipment is installed inside of either of two SmartMeters™, one manufactured by GE and the other manufactured by L+G. Both of these meters are tested during meter certification testing and have been shown to emit de minimus RF when the SSN communications radio is turned off. The radio-off RF emissions are below FCC limits for unintentional RF emissions.

Gas: With respect to PG&E's gas SmartMeter™ Modules, there are no RF emissions when the Module is not transmitting.

[9] See Code of Federal Regulations, Title 47, Part 15, for a Class B digital device.

Question 10:

Is there a difference in the amount of RF emissions for a wireless smart meter with the radio off and a smart meter with the radio out? If yes, what is that difference and how is it calculated?

Response 10:

Table 10-1 provides the requested data for electric SmartMeters™ and gas SmartMeter™ Modules.

TABLE 10-1

Meter Type	RF Measured Value With Radio Out	RF Measured Value With Radio Off	FCC Allowable RF Emissions
[a]	[b]	[c]	[d]
Electric: GE	38.3 dBμV/m	39.3 dBμV/m	49.0 dBμV/m
Electric: L+G	31.3 dBμV/m	24.7 dBμV/m	49.0 dBμV/m
Gas: Aclara	No discernable emissions	No discernable emissions	40.0 – 54.0 dBμV/m

Electric: Both of PG&E's electric SmartMeter™ manufacturers test the meters without any communications radio installed during meter certification. The information provided in Table 10-1 reflects the measured values of the RF emissions from the electric SmartMeters™ with the radio out.

Note that the difference between the radio-out RF-emissions shown in Table 10-1 and the radio-off RF-emissions presented in Table 9-1 (and re-presented in Table 10-1 for comparison purposes) are de minimus.

Gas: With respect to PG&E's gas SmartMeter™ Modules, there are no discernable RF emissions when the radio is off.

Question 11:

Is there a difference in the amount of RF emissions for a wireless smart meter with the radio off and an analog meter? If yes, what is that difference and how is it calculated?

Response 11:

Electromechanical meters emit no RF. Therefore, there is a de minimus difference in RF between radio-off and an analog meter. Please also see PG&E's Response to Question 9.

IV. CONCLUSION

PG&E respectfully submits the requested clarifying information concerning the frequency and duration of RF emissions from its electric and gas SmartMeter™ technology.

Respectfully Submitted,

ANN H. KIM
CHONDA J. NWAMU

By: /S/
CHONDA J. NWAMU

ANN H. KIM
CHONDA J. NWAMU
Law Department
Pacific Gas and Electric Company
77 Beale St., B-30A
P.O. Box 7442
San Francisco, CA 94120
Telephone: (415) 973-6650
Facsimile: (415) 973-0516
E-Mail: CJN3@pge.com

Attorneys for
PACIFIC GAS AND ELECTRIC COMPANY

Dated: November 1, 2011

COMMENT | VOLUME 2, ISSUE 12, E512-E514, DECEMBER 2018

Download Full Issue

Planetary electromagnetic pollution: it is time to assess its impact

Priyanka Bandara • David O Carpenter

Open Access • Published: December, 2018 • DOI: https://doi.org/10.1016/S2542-5196(18)30221-3 •

Planetary Health Alliance mov wa r a productive second annual meeting, a discussion on the rapid global proliferation of artificial electromagnetic fields would now be apt. The most notable is the blanket of radiofrequency electromagnetic radiation, largely microwave radiation generated for wireless communication and surveillance technologies, as mounting scientific evidence suggests that prolonged exposure to radiofrequency electromagnetic radiation has serious biological and health effects. However, public exposure regulations in most countries continue to be based on the guidelines of the International Commission on Non-Ionizing Radiation Protection[1] and Institute of Electrical and Electronics Engineers,[2] which were established in the 1990s on the belief that only acute thermal effects are hazardous. Prevention of tissue heating by radiofrequency electromagnetic radiation is now proven to be ineffective in preventing biochemical and physiological interference. For

example, acute non-thermal exposure has been shown to alter human brain metabolism by NIH scientists,[3] electrical activity in the brain,[4] and systemic immune responses.[5] Chronic exposure has been associated with increased oxidative stress and DNA damage[6, 7] and cancer risk.[8] Laboratory studies, including large rodent studies by the US National Toxicology Program[9] and Ramazzini Institute of Italy,[10] confirm these biological and health effects in vivo. As we address the threats to human health from the changing environmental conditions due to human activity,[11] the increasing exposure to artificial electromagnetic radiation needs to be included in this discussion.

Due to the exponential increase in the use of wireless personal communication devices (eg, mobile or cordless phones and WiFi or Bluetooth-enabled devices) and the infrastructure facilitating them, levels of exposure to radiofrequency electromagnetic radiation around the 1 GHz frequency band, which is mostly used for modern wireless communications, have increased from extremely low natural levels by about 10^{18} times (figure). Radiofrequency electromagnetic radiation is also used for radar, security scanners, smart meters, and medical equipment (MRI, diathermy, and radiofrequency ablation). It is plausibly the most rapidly increasing anthropogenic environmental exposure since the mid-20th century, and levels will surge considerably again, as technologies like the Internet of Things and 5G add millions more radiofrequency transmitters around us.

Figure thumbnail gr1

Figure **Typical maximum daily exposure to radiofrequency electromagnetic radiation from man-made and natural power flux densities in comparison with International Commission on Non-Ionizing Radiation Protection safety guidelines[1]**

Show full caption

Anthropogenic radiofrequency electromagnetic radiation levels are illustrated for different periods in the evolution of wireless communication technologies. These exposure levels are frequently experienced

daily by people using various wireless devices. The levels are instantaneous and not time-averaged over 6 minutes as specified by International Commission on Non-Ionizing Radiation Protection for thermal reasons. Figure modified from Philips and Lamburn[12] with permission. Natural levels of radiofrequency electromagnetic radiation were based on the NASA review report CR-166661.[13]

View Large Image | Download Hi-res image

Unprecedented human exposure to radiofrequency electromagnetic radiation from conception until death has been occurring in the past two decades. Evidence of its effects on the CNS, including altered neurodevelopment[14] and increased risk of some neurodegenerative diseases,[15] is a major concern considering the steady increase in their incidence. Evidence exists for an association between neurodevelopmental or behavioural disorders in children and exposure to wireless devices,[14] and experimental evidence, such as the Yale finding, shows that prenatal exposure could cause structural and functional changes in the brain associated with ADHD-like behaviour.[16] These findings deserve urgent attention.

At the Oceania Radiofrequency Scientific Advisory Association, an independent scientific organisation, volunteering scientists have constructed the world's largest categorised online database of peer-reviewed studies on radiofrequency electromagnetic radiation and other man-made electromagnetic fields of lower frequencies. A recent evaluation of 2266 studies (including in-vitro and in-vivo studies in human, animal, and plant experimental systems and population studies) found that most studies (n=1546, 68·2%) have demonstrated significant biological or health effects associated with exposure to anthropogenic electromagnetic fields. We have published our preliminary data on radiofrequency electromagnetic radiation, which shows that 89% (216 of 242) of experimental studies that investigated oxidative stress endpoints showed significant effects.[7] This weight of scientific evidence refutes the prominent claim that the deployment of wireless technologies poses no health risks at the currently permitted non-thermal radiofrequency exposure levels. Instead, the evidence supports the International EMF Scientist Appeal by 244 scientists from 41 countries who have published on the subject in peer-reviewed literature and collectively petitioned the WHO and the UN for

immediate measures to reduce public exposure to artificial electromagnetic fields and radiation.

Evidence also exists of the effects of radiofrequency electromagnetic radiation on flora and fauna. For example, the reported global reduction in bees and other insects is plausibly linked to the increased radiofrequency electromagnetic radiation in the environment.[17] Honeybees are among the species that use magnetoreception, which is sensitive to anthropogenic electromagnetic fields, for navigation.

Man-made electromagnetic fields range from extremely low frequency (associated with electricity supplies and electrical appliances) to low, medium, high, and extremely high frequency (mostly associated with wireless communication). The potential effects of these anthropogenic electromagnetic fields on natural electromagnetic fields, such as the Schumann Resonance that controls the weather and climate, have not been properly studied. Similarly, we do not adequately understand the effects of anthropogenic radiofrequency electromagnetic radiation on other natural and man-made atmospheric components or the ionosphere. It has been widely claimed that radiofrequency electromagnetic radiation, being non-ionising radiation, does not possess enough photon energy to cause DNA damage. This has now been proven wrong experimentally.[18, 19] Radiofrequency electromagnetic radiation causes DNA damage apparently through oxidative stress,[7] similar to near-UV radiation, which was also long thought to be harmless.

At a time when environmental health scientists tackle serious global issues such as climate change and chemical toxicants in public health, there is an urgent need to address so-called electrosmog. A genuine evidence-based approach to the risk assessment and regulation of anthropogenic electromagnetic fields will help the health of us all, as well as that of our planetary home. Some government health authorities have recently taken steps to reduce public exposure to radiofrequency electromagnetic radiation by regulating use of wireless devices by children and recommending preferential use of wired communication devices in general, but this ought to be a coordinated international effort.

We declare no competing interests. We thank Alasdair Philips for assistance with the figure and Victor Leach and Steve Weller for assistance with the ORSAA Database, which has enabled our overview of the scientific evidence in this area of research.

References

1. International Commission on Non-Ionizing Radiation Protection
ICNIRP guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz).
Health Phys. 1998; **74**: 494-522

View in Article

PubMed • Google Scholar

2. Institute of Electrical and Electronics Engineers
IEEE C95.7-2014—IEEE recommended practice for radio frequency safety programs, 3 kHz to 300 GHz.
IEEE Standards Association, 2014
https://standards.ieee.org/standard/C95_7-2014.html
Date accessed: November 6, 2018

View in Article

Google Scholar

3. Volkow ND • Tomasi D • Wang GJ • et al.
Effects of cell phone radiofrequency signal exposure on brain glucose metabolism.
JAMA. 2011; **305**: 808-813

View in Article

Scopus (231) • PubMed • Crossref • Google Scholar

4. Schmid MR • Loughran SP • Regel SJ • et al.

Sleep EEG alterations: effects of different pulse-modulated radio frequency electromagnetic fields.

J Sleep Res. 2012; **21**: 50-58

View in Article

Scopus (77) • PubMed • Crossref • Google Scholar

5. Kimata H

Microwave radiation from cellular phones increases allergen-specific IgE production.

Allergy. 2005; **60**: 838-839

View in Article

Scopus (11) • PubMed • Crossref • Google Scholar

6. Zothansiama • Zosangzuali M • Lalramdinpuii M • Jagetia GC

Impact of radiofrequency radiation on DNA damage and antioxidants in peripheral blood lymphocytes of humans residing in the vicinity of mobile phone base stations.

Electromagn Biol Med. 2017; **36**: 295-305

View in Article

Scopus (54) • PubMed • Crossref • Google Scholar

7. Bandara P • Weller S

Biological effects of low-intensity radiofrequency electromagnetic radiation—

time for a paradigm shift in regulation of public exposure.

Radiat Protect Australas. 2017; **34**: 2-6

View in Article

Google Scholar

8. Carlberg M • Hardell L

Evaluation of mobile phone and cordless phone use and glioma risk using the bradford hill viewpoints from 1965 on association or causation.

Biomed Res Int. 2017; **2017**: 9218486

View in Article

Scopus (66) • PubMed • Crossref • Google Scholar

9. **Cell phone radio frequency radiation.** National Toxicology Program, US Department of Health and Human Services, 2018

https://ntp.niehs.nih.gov/results/areas/cellphones/index.html

Date accessed: November 8, 2018

View in Article

Google Scholar

10. Falcioni L • Bua L • Tibaldi E • et al.

Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8GHz GSM base station environmental emission.

Environ Res. 2018; **165**: 496-503

View in Article

Scopus (147) • PubMed • Crossref • Google Scholar

11. Myers SS

Planetary health: protecting human health on a rapidly changing planet.

Lancet. 2018; **390**: 2860-2868

View in Article

Scopus (136) • PubMed • Summary • Full Text • Full Text PDF • Google Scholar

12. Philips A • Lamburn G

Natural and human-activity-generated electromagnetic fields on Earth.

Childhood Cancer. 2012; (London; April 24–26, 2012.)

View in Article

Google Scholar

13. Raines JK

NASA-CR-166661. Electromagnetic field interactions with the human body: observed effects and theories. NASA Technical Reports Server.

https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19810017132.pdf

Date: 1981

Date accessed: October 10, 2018

View in Article

Google Scholar

14. Divan HA • Kheifets L • Obel C • Olsen J

Prenatal and postnatal exposure to cell phone use and behavioral problems in children.

Epidemiology. 2008; **19**: 523-529

View in Article

Scopus (143) • PubMed • Crossref • Google Scholar

15. Zhang X • Huang WJ • Chen WW

Microwaves and Alzheimer's disease.

Exp Ther Med. 2016; **12**: 1969-1972

View in Article

Scopus (16) • PubMed • Crossref • Google Scholar

16. Aldad TS • Gan G • Gao XB • Taylor HS

Fetal radiofrequency radiation exposure from 800–1900 mhz-rated cellular telephones affects neurodevelopment and behavior in mice.

Sci Rep. 2012; **2**: 312

View in Article

Scopus (115) • PubMed • Crossref • Google Scholar

17. Taye RR • Deka MK • Rahman A • Bathari M

Effect of electromagnetic radiation of cell phone tower on foraging behaviour of Asiatic honey bee, *Apis cerana* F. (Hymenoptera: Apidae).

J Entomol Zool Stud. 2017; **5**: 1527-1529

View in Article

Google Scholar

18. Smith-Roe SL, Wyde ME, Stout MD, et al. Evaluation of the genotoxicity of cell phone radiofrequency radiation in male and female rats and mice following subchronic exposure. Environmental Mutagenesis and Genomics Society Annual Conference; Raleigh, NC, USA; Sept 9–13, 2017.

View in Article

Google Scholar

19. Ruediger HW

Genotoxic effects of radiofrequency electromagnetic fields.

Pathophysiology. 2009; **16**: 89-102

View in Article

Scopus (137) • PubMed • Summary • Full Text • Full Text PDF • Google Scholar

Article info

Publication history

Published: December 2018

Identification

DOI: https://doi.org/10.1016/S2542-5196(18)30221-3

Figures

Figure thumbnail gr1

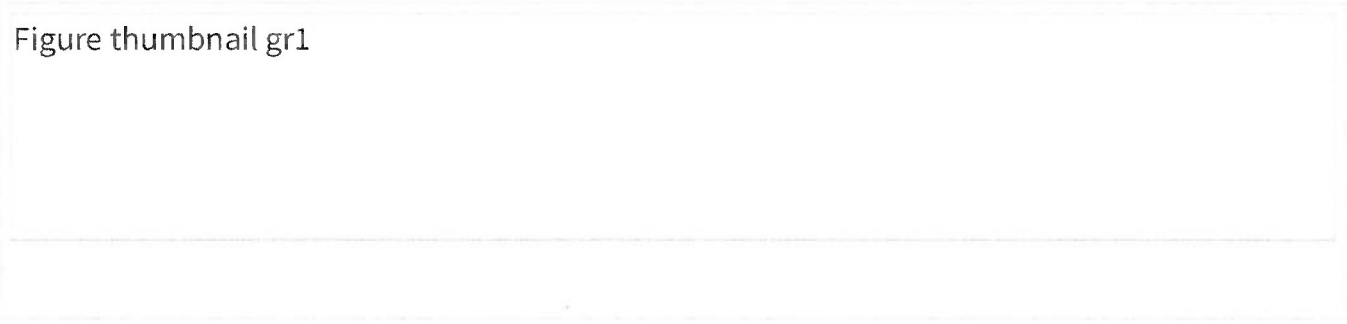


Figure Typical maximum daily exposure to radiofrequency electromagnetic radiation from man-m...

The Lancet Infectious Diseases

The Lancet Microbe

The Lancet Neurology

The Lancet Oncology

The Lancet Planetary Health

The Lancet Psychiatry

The Lancet Public Health

The Lancet Regional Health – Americas

The Lancet Regional Health – Europe

The Lancet Regional Health – Southeast Asia

The Lancet Regional Health – Western Pacific

The Lancet Respiratory Medicine

The Lancet Rheumatology

eBioMedicine

eClinicalMedicine

CLINICAL INITIATIVES

The *Lancet* Clinic

Commissions

Series

Picture Quiz

Preprints

ACCESS

Access our content

Personal subscriptions

Existing print subscribers

Request institutional access

Research4Life

CONNECT

Lancet Alerts

Lancet Webinars

Contact us

Customer service

Our global team

Conferences

The content on this site is intended for science and health care professionals.

To: His Excellency Antonio Guterres, Secretary-General of the United Nations; Honorable Dr. Tedros Adhanom Ghebreyesus, Director-General of the World Health Organization; Honorable Inger Andersen, Executive Director of the U.N. Environment Programme; U.N. Member Nations

International Appeal:
Scientists call for Protection from Non-ionizing Electromagnetic Field Exposure[1]

We are scientists engaged in the study of biological and health effects of non-ionizing electromagnetic fields (EMF). Based upon peer-reviewed, published research, we have serious concerns regarding the ubiquitous and increasing exposure to EMF generated by electric and wireless devices. These include– but are not limited to– radiofrequency radiation (RFR) emitting devices, such as cellular and cordless phones and their base stations, Wi-Fi, broadcast antennas, smart meters, and baby monitors as well as electric devices and infra-structures used in the delivery of electricity that generate extremely-low frequency electromagnetic field (ELF EMF).

Scientific basis for our common concerns

Numerous recent scientific publications have shown that EMF affects living organisms at levels well below most international and national guidelines. Effects include increased cancer risk, cellular stress, increase in harmful free radicals, genetic damages, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being in humans. Damage goes well beyond the human race, as there is growing evidence of harmful effects to both plant and animal life.

These findings justify our appeal to the United Nations (UN) and, all member States in the world, to encourage the World Health Organization (WHO) to exert strong leadership in fostering the development of more protective EMF guidelines, encouraging precautionary measures, and educating the public about health risks, particularly risk to children and fetal development. By not taking action, the WHO is failing to fulfill its role as the preeminent international public health agency.

Inadequate non-ionizing EMF international guidelines

The various agencies setting safety standards have failed to impose sufficient guidelines to protect the general public, particularly children who are more vulnerable to the effects of EMF. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) established in 1998 the "Guidelines For

Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz)"[1]. These guidelines are accepted by the WHO and numerous countries around the world. The WHO is calling for all

nations to adopt the ICNIRP guidelines to encourage international harmonization of standards. In 2009, the ICNIRP released a statement saying that it was reaffirming its
1998 guidelines, as in their opinion, the scientific literature published since that time "has provided no evidence of any adverse effects below the basic restrictions and does not necessitate an immediate revision of its guidance on limiting exposure to high frequency electromagnetic fields[2]. ICNIRP continues to the present day to make these assertions, in spite of growing scientific evidence to the contrary. It is our opinion that, because the ICNIRP guidelines do not cover long-term exposure and low-intensity effects, they are insufficient to protect public health.

The WHO adopted the International Agency for Research on Cancer (IARC) classification of extremely low frequency magnetic fields (ELF-MF) in 2002[3] and radiofrequency radiation (RFR) in 2011[4]. This classification states that EMF is **a *possible human carcinogen (Group 2B).*** Despite both IARC findings, the WHO continues to maintain that there is insufficient evidence to justify lowering these quantitative exposure limits.

Since there is controversy about a rationale for setting standards to avoid adverse health effects, we recommend that the United Nations Environmental Programme (UNEP) convene and fund an independent multidisciplinary committee to explore the pros and cons of alternatives to current practices that could substantially lower human exposures to RF and ELF fields. The deliberations of this group should be conducted in a transparent and impartial way. Although it is essential that industry be involved and cooperate in this process, industry should not be allowed to bias its processes or conclusions. This group should provide their analysis to the UN and the WHO to guide precautionary action.

1. children and pregnant women be protected;
2. guidelines and regulatory standards be strengthened;
3. manufacturers be encouraged to develop safer technology;
4. utilities responsible for the generation, transmission, distribution, and monitoring of electricity maintain adequate power quality and ensure proper electrical wiring to minimize harmful ground current;
5. the public be fully informed about the potential health risks from electromagnetic energy and taught harm reduction strategies;
6. medical professionals be educated about the biological effects of electromagnetic energy and be provided training on treatment of patients with electromagnetic hypersensitivity;
7. governments fund training and research on electromagnetic fields and health that is independent of industry and mandate industry cooperation with researchers;
8. media disclose experts' financial relationships with industry when citing their opinions regarding health and safety aspects of EMF-emitting technologies; and
9. white-zones (radiation-free areas) be established.

---

[1] http://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf

[2] http://www.icnirp.org/cms/upload/publications/ICNIRPStatementEMF.pdf

[3] https://publications.iarc.fr/98

[4] https://publications.iarc.fr/126

Initial release date: May 11, 2015
Date of this version: July 4, 2024

Inquiries, including those from qualified scientists who request that their name be added to the Appeal, may be made by contacting Elizabeth Kelley, M.A., Director, EMFscientist.org, at info@EMFscientist.org.
Note: the signatories to this appeal have signed as individuals, giving their professional affiliations, but this does not necessarily mean that this represents the views of their employers or the professional organizations they are affiliated with.

Signatories

Armenia
Prof. Sinerik Ayrapetyan, Ph.D., UNESCO Chair - Life Sciences International Postgraduate Educational Center, Armenia

Australia
Dr. Priyanka Bandara, Ph.D., Independent Environmental Health Educator/Researcher, Advisor, Environmental Health Trust, Doctors for Safer Schools, Australia
Dr. Peter French BSc, MSc, MBA, PhD, FRSM, Conjoint Senior Lecturer, University of New South Wales, Australia
Dr. Gautam (Vini) Khurana, Ph.D., F.R.A.C.S., Director, C.N.S. Neurosurgery, Australia
Mr. Victor Leach, Radiofrequency Protection Consultant App. Physics (RMIT), MSc (Melb.), MARP, MORSA, Member, f Oceanic Radiofrequency Advisory Association, Inc. (ORSAA), Australia
Dr. Gautam (Vini) Khurana, Ph.D., F.R.A.C.S., Director, C.N.S. Neurosurgery, Australia
Dr. Don Maisch, Ph.D. , Australia
Dr. Julie McCredden, Ph.D., President, Oceania Radiofrequency Radiation Advisory Association, Inc. (ORSAA), Australia
Dr. Mary Redmayne, Ph.D., Department of Epidemiology & Preventive Medicine, Monash University, Australia
Dr. Charles Teo, BM, BS, MBBS, Member of the Order of Australia, Director, Centre for Minimally Invasive Neurosurgery at Prince of Wales Hospital, NSW, Australia
Mr. Steven Weller, MSc, Ph.D student, Centre for Environment and Population Health, College of Medicine and Dentistry, Griffith University; Member of Oceanic Radiofrequency Advisory Association (ORSAA) Australia

Austria
Dr. Michael Kundi, MD, University of Vienna, Austria
Prof. Pierre Madl, EE MSc & PhD, Paris Lodron, University of Salzburg (PLUS), Radiological Measurement Laboratory (RMLS), Edge Institute (AT), Austria
Dr. Gerd Oberfeld, MD, Public Health Department, Salzburg Government, Austria
Dr. Bernhard Pollner, MD, Pollner Research, Austria
Prof. Dr. Hugo W. Rüdiger, MD, Austria

Bahrain
Dr. Amer Kamal, MD, Physiology Department, College of Medicine, Arabian Gulf University, Bahrain

Belgium
Prof. Marie-Claire Cammaerts, Ph.D., Free University of Brussels, Faculty of Science, Brussels, Belgium
Mr. Joris Everaert, M.Sc., Biologist, Species Diversity team, Research Institute for Nature and Forest, Belgium
Dr. Andre Vander Vorst, PhD, professor emeritus, University Louvain-la-Neuve, Belgium

Brazil
Ms. Vânia Araújo Condessa, MSc., Electrical Engineer, Belo Horizonte, Brazil
Prof. Dr. João Eduardo de Araujo, MD, University of Sao Paulo, Brazil
Dr. Francisco de Assis Ferreira Tejo, D. Sc., Universidade Federal de Campina Grande, Campina Grande, State of Paraíba, Brazil
Prof. Alvaro deSalles, Ph.D., Federal University of Rio Grande Del Sol, Brazil
Prof. Adilza Dode, Ph.D., MSc. Engineering Sciences, Minas Methodist University, Brazil
Dr. Daiana Condessa Dode, MD, Federal University of Medicine, Brazil
Mr. Michael Condessa Dode, Systems Analyst, MRE Engenharia Ltda, Belo Horizonte, Brazil
Mr. Claudio Fernandez, MEEng, Associate Professor at the Federal Institute of Education, Science and Technology of Rio Grande do Sul, Canoas, Brazil.
Prof. Orlando Furtado Vieira Filho, PhD, Cellular & Molecular Biology, Federal University of Rio Grande do Sul, Brazil

Canada

Dr. Magda Havas, Ph.D., Environmental and Resource Studies, Centre for Health Studies, Trent University, Canada
Dr. Paul Héroux, Ph.D., Director, Occupational Health Program, McGill University; InvitroPlus Labs, Royal Victoria Hospital McGill University, Canada
Dr. Tom Hutchinson, Ph.D., Professor Emeritus, Environmental and Resource Studies, Trent University, Canada
Prof. Ying Li, Ph.D., InVitroPlus Labs, Dept. of Surgery, Royal Victoria Hospital, McGill University, Canada
Mr. James McKay M.Sc, Ecologist, City of London; Planning Services, Environmental and Parks Planning, London, Canada
Prof. Anthony B. Miller, MD, FRCP, Professor Emeritus, University of Toronto, Canada
Prof. Klaus-Peter Ossenkopp, Ph.D., Department of Psychology (Neuroscience), University of Western Ontario, Canada
Dr. Malcolm Paterson, PhD. Molecular Oncologist (ret.), British Columbia, Canada
Prof. Michael A. Persinger, Ph.D., Behavioural Neuroscience and Biomolecular Sciences, Laurentian University, Canada
Dr. Margaret Sears MEng, PhD, Ottawa Hospital Research Institute, Prevent Cancer Now, Ottawa, ON, Canada
Ms. **Sheena Symington, B.Sc., M.A.,** Director, Electrosensitive Society, Peterborough, Canada

China

Prof. Huai Chiang, Bioelectromagnetics Key Laboratory, Zhejiang University School of Medicine, China
Prof. Yuqing Duan, Ph.D., Food & Bioengineering, Jiangsu University, China
Dr. Kaijun Liu, Ph.D., Third Military Medical University, Chongqing, China
Prof. Xiaodong Liu, Director, Key Lab of Radiation Biology, Ministry of Health of China; Associate Dean School of Public Health, Jilin University, China
Prof. Wenjun Sun, Ph.D., Bioelectromagnetics Key Lab, Zhejiang University School of Medicine, China
Prof. Minglian Wang, Ph.D., College of Life Science & Bioengineering, Beijing University of Technology, China
Prof. Qun Wang, Ph.D., College of Materials Science & Engineering, Beijing University of Technology, China
Prof. Haihiu Zhang, Ph.D., School of Food & BioEngineering, Jiangsu University, China
Prof. Jianbao Zhang, Associate Dean, Life Science and Technology School, Xi'an Jiaotong University, China
Prof. Hui-yan Zhao, Director of STSCRW, College of Plant Protection, Northwest A & F University, Yangling Shaanxi, China
Prof. J. Zhao, Department of Chest Surgery, Cancer Center of Guangzhou Medical University, Guangzhou, China

Croatia

Dr. Ivancica Trosic, Ph.D., Institute for Medical Research and Occupational Health, Croatia

Egypt

Prof. Dr. Abu Bakr Abdel Fatth El-Bediwi, Ph.D., Physics Dept., Faculty of Science, Mansoura University, Egypt
Prof. Dr. Emad Fawzy Eskander, Ph.D., Medical Division, Hormones Department, National Research Center, Egypt
Prof. Dr. Heba Salah El Din Aboul Ezz, Ph.D., Physiology, Zoology Department, Faculty of Science, Cairo University, Egypt **Prof. Dr. Nasr Radwan, Ph.D.,** Neurophysiology, Faculty of Science, Cairo University, Egypt

Estonia

Dr. Hiie Hinrikus, Ph.D., D.Sc, Tallinn University of Technology, Estonia
Dr. **Dr. Tarmo Koppel, PhD.,** Tallinn University of Technology, Estonia

Finland

Dr. Mikko Ahonen, Ph.D, University of Tampere, Finland
Dr. Marjukka Hagström, LL.M., M.Soc.Sc, Principal Researcher, Radio and EMC Laboratory, Finland
Prof. Dr. Osmo Hänninen, Ph.D., Dept. of Physiology, Faculty of Medicine, University of Eastern Finland, Finland; Editor-In-Chief, Pathophysiology, Finland
Dr. Kavindra K. Kesari, MBA, Ph.D., Radiation Biologist, University of Aalto, Finland: Assistant Professor, Jaipur National University, India
Dr. Dariusz Leszczynski, Ph.D., Adjunct Professor of Biochemistry, University of Helsinki, Finland
Member of the IARC Working Group that classified cell phone radiation as possible carcinogen.
Prof. Emeritus Rainer Nyberg, EdD, MPS, Abo Akademi University (ret.), Vasa, Finland
Dr. Georgiy Ostroumov, Ph.D. (in the field of RF EMF), independent researcher, Finland

France

Prof. Dr. Dominique Belpomme, MD, MPH, Professor in Oncology, Paris V Descartes University, ECERI Executive Director
Dr. Pierre Le Ruz, Ph.D., Criirem, Le Mans, France
Dr Annie J Sasco, MD, MPH, MS, DrPH, Fmr. Research Dir., French NIH (INSERM); Former. Chief, Unit of Epidemiology for Cancer Prevention International Agency for Research on Cancer; Former Acting Head, Programme for Cancer Control, World Health Organization; France.

Georgia

Prof. Besarion Partsvania, Ph.D., Head of Bio-cybernetics Department of Georgian Technical University, Georgia

Germany

Prof. Dr. Franz Adlkofer, MD, Chairman, Pandora Foundation, Germany
Prof. Dr. Hynek Burda, Ph.D., University of Duisburg-Essen, Germany
Dr. Horst Eger, MD, Electromagnetic Fields in Medicine, Association of Statutory Health Insurance Physicians, Bavaria, Germany
Prof. Dr. Karl Hecht, MD, former Director, Institute of Pathophysiology, Charité, Humboldt University, Berlin, Germany
Dr.Sc. Florian M. König, Ph.D., Florian König Enterprises (FKE) GmbH, Munich, Germany
Dr. rer. nat. Lebrecht von Klitzing, Ph.D., Head, Institute of Environ.Physics; Ex-Head, Dept. Clinical Research, Medical University, Lubeck, Germany
Dr. Cornelia Waldmann-Selsam, MD, Member, Competence Initiative for the Protection of Humanity, Environment and Democracy e.V., Bamberg, Germany
Dr. Ulrich Warnke, Ph.D., Bionik-Institut, University of Saarlandes, Germany

Greece

Dr. Adamantia F. Fragopoulou, M.Sc., Ph.D., Department of Cell Biology & Biophysics, Biology Faculty, University of Athens, Greece
Dr. Christos Georgiou, Ph.D., Biology Department, University of Patras, Greece
Prof. Emeritus Lukas H. Margaritis, Ph.D., Depts. Cell Biology, Radiobiology & Biophysics, Biology Faculty, Univ. of Athens, Greece
Dr. Aikaterini Skouroliakou, M.Sc., Ph.D., Department of Energy Technology Engineering, Technological Educational Institute of Athens, Greece
Dr. Stelios A Zinelis, MD, Hellenic Cancer Society-Kefalonia, Greece

Iceland

Dr. Ceon Ramon, Ph.D., Affiliate Professor, University of Washington, USA; **Professor**, Reykjavik University, Iceland

India

Prof. Dr. B. D. Banerjee, Ph.D., Former Head, Environmental Biochemistry & Molecular Biology Laboratory, Department of Biochemistry, University College of Medical Sciences, University of Delhi, India
Prof. Jitendra Behari, Ph.D., Ex-Dean, Jawaharlal Nehru University; presently, Emeritus Professor, Amity University, India
Prof. Dr. Madhukar Shivajirao Dama, Institute of Wildlife Veterinary Research, India
Associate Prof. Dr Amarjot Dhami, PhD., Lovely Professional University, Phagwara, Punjab, India
Mr. Er. Piyush A. Kokate, MTECH, Scientist C, Analytical Instrumentation Division (AID), CSIR-National Environmental Engineering Research Institute (NEERI), India
Prof. Girish Kumar, Ph.D., Electrical Engineering Department, Indian Institute of Technology, Bombay, India
Dr. Pabrita Mandal PhD. Department of Physics, Indian Institute of Technology, Kanpur, India
Prof. Rashmi Mathur, Ph.D., Head, Department of Physiology, All India Institute of Medical Sciences, New Delhi, India
Prof. Dr. Kameshwar Prasad MD, Head, Dept of Neurology, Director, Clinical Epidemiology, All India Institute of Medical Sciences, India
Dr. Sivani Saravanamuttu, PhD., Dept. Advanced Zoology and Biotechnology, Loyola College, Chennai, India
Dr. N.N. Shareesh, PhD., Melaka Manipal Medical College, India
Dr. R.S. Sharma, MD, Sr. Deputy Director General, Scientist - G & Chief Coordinator - EMF Project, Indian Council of Medical Research, Dept. of Health Research, Ministry/Health and Family Welfare, Government of India, New Delhi, India
Prof. Dr. Dorairaj Sudarsanam, M.Sc., M.Ed., **Ph.D.,** Fellow - National Academy of Biological Sciences, Prof. of Zoology, Biotechnology and Bioinformatics, Department of Advanced Zoology & Biotechnology, Loyola College, Chennai, South India

Iran (Islamic Republic of)

Prof. Dr. Soheila Abdi, Ph.D., Physics, Islamic Azad University of Safadasht, Tehran, Iran
Prof. G.A. Jelodar, D.V.M., Ph.D., Physiology, School of Veterinary Medicine, Shiraz University, Iran
Prof. Hamid Mobasheri, Ph.D., Head BRC; Head, Membrane Biophysics & Macromolecules Laboratory, Institute of Biochemistry & Biophysics, University of Tehran, Iran
Prof. Seyed Mohammad Mahdavi, PhD., Dept of Biology, Science and Research, Islamic Azad University, Tehran, Iran
Prof. S.M.J. Mortazavi, Ph.D., Head, Medical Physics & Engineering; Chair, NIER Protection Research Center, Shiraz University of Medical Sciences, Iran
Prof. Amirnader Emami Razavi, Ph.D., Clinical Biochem., National Tumor Bank, Cancer Institute, Tehran Univ. Medical Sciences, Iran
Dr. Masood Sepehrimanesh, Ph.D., Gastroenterohepatology Research Center, Shiraz University of Medical Sciences, Iran
Prof. Dr. Mohammad Shabani, Ph.D., Neurophysiology, Kerman Neuroscience Research Center, Iran

Israel

Mr. Michael Peleg, M.Sc., radio communications engineer and researcher, Technion - Israel Institute of Technology, Israel
Prof. Elihu D. Richter, MD, MPH, Occupational & Environmental Medicine, Hebrew University-Hadassah School of Public Health & Community Medicine, Israel
Dr. Yael Stein, MD, Hebrew University of Jerusalem, Hadassah Medical Center, Israel
Dr. Danny Wolf, MD, Pediatrician and General Practitioner, Sherutey Briut Clalit, Shron Shomron district, Israel
Dr. Ronni Wolf, MD, Assoc. Clinical Professor, Head of Dermatology Unit, Kaplan Medical Center, Rehovot, Israel

Italy

Prof. Sergio Adamo, Ph.D., La Sapienza University, Rome, Italy
Prof. Fernanda Amicarelli, Ph.D., Applied Biology, Dept. of Health, Life and Environmental Sciences, University of L'Aquila, Italy
Dr. Pasquale Avino, Ph.D., INAIL Research Section, Rome, Italy
Dr. Fiorella Belpoggi, Ph.D., FIATP, Director, Cesare Maltoni Cancer Research Center, Ramazzini Institute, Italy
Prof. Giovanni Di Bonaventura, PhD, School of Medicine, "G. d'Annunzio" University of Chieti-Pescara, Italia
Prof. Emanuele Calabro, Department of Physics and Earth Sciences, University of Messina, Italy
Prof. Franco Cervellati, Ph.D., Department of Life Science and Biotechnology, Section of General Physiology, University of Ferrara, Italy
Vale Crocetta, Ph.D. Candidate, Biomolecular and Pharmaceutical Sciences, "G. d'Annunzio" University of Chieti, Italy
Dr. Agostino Di Ciaula, MD, President Scientific Committee, International Society of Doctors for Environment (ISDE), Italy
Prof. Stefano Falone, Ph.D., Researcher in Applied Biology, Dept. of Health, Life & Environmental Sciences, University of L'Aquila, Italy
Prof. Dr. Speridione Garbisa, ret. Senior Scholar, Dept. Biomedical Sciences, University of Padova, Italy
Dr. Settimio Grimaldi, Ph.D., Associate Scientist, National Research Council, Italy
Prof. Livio Giuliani, Ph.D., Principal Investigator of Finalized Research of the Italian National Health Service; Spokesman, ICEMS-International Commission for Electromagnetic Safety, Italy
Prof. Dr. Angelo Levis, MD, Dept. Medical Sciences, Padua University, Italy
Prof. Salvatore Magazù, Ph.D., Department of Physics and Science, Messina University, Italy
Dr. Fiorenzo Marinelli, Ph.D., Researcher, Molecular Genetics Institute of the National Research Council, Italy
Dr. Arianna Pompilio, PhD, Dept. Medical, Oral & Biotechnological Sciences. G. d'Annunzio University of Chieti-Pescara, Italy
Prof. Dr. Raoul Saggini, MD, School of Medicine, University G. D'Annunzio, Chieti, Italy
Dr. Morando Soffritti, MD, Honorary President, National Institute for the Study and Control of Cancer and Environmental Diseases B. Ramazzini, Bologna. Italy
Prof. Massimo Sperini, Ph.D., Center for Inter-University Research on Sustainable Development, Rome, Italy

Japan

Prof. Tsuyoshi Hondou, Ph.D., Graduate School of Science, Tohoku University, Japan
Prof. Hidetake Miyata, Ph.D., Department of Physics, Tohoku University, Japan
Dr. Yasuhiko Ishihara, PhD., Biomedical Sciences Program, Graduate School of Integrated Sciences for Life, Hiroshima University, University, Japan

Jordan

Prof. Mohammed S.H. Al Salameh, Jordan University of Science & Technology, Jordan

Kazakhstan

Prof. Dr, Timur Saliev, MD, Ph.D., Life Sciences, Nazarbayev University, Kazakhstan; Institute Medical Science/Technology, University of Dundee, UK

New Zealand

Dr. Bruce Rapley, BSc, MPhil, Ph.D., Principal Consulting Scientist, Atkinson & Rapley Consulting Ltd., New Zealand

Nigeria

Dr. Obajuluwa Adejoke PhD, Cell Biology and Genetics Unit, Dept of Zoology, University of Ilorin; Lecturer, Biological Sciences Department, Bio-technology Unit, Afe Babalola University, Nigeria
Dr. Idowu Ayisat Obe, Department of Zoology, Faculty of Science, University of Lagos, Akoka, Lagos, Nigeria
Prof. Olatunde Michael Oni, Ph.D, Radiation & Health Physics, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

Oman

Prof. Najam Siddiqi, MBBS, Ph.D., Human Structure, Oman Medical College, Oman

Poland

Dr. Pawel Bodera, Pharm. D., Department of Microwave Safety, Military Institute of Hygiene and Epidemiology, Poland
Prof. Dr. Stanislaw Szmigielski, MD, Ph.D., Military Institute of Hygiene and Epidemiology, Poland
Prof. dr hab. Wlodzimierz Klonowski, Ph.ed, Dr.Sc., Biomedical Physics, Nalecz Institute of Biocybernetics & Biomedical Engineering, Polish Academy of Sciences, Warsaw, Poland

Portugal

Prof. Hugo Silva, Ph.D., Physics Department, University of Évora, Portugal

Romania

Alina Cobzaru, Engineer, National Institutes Research & Development and Institute of Construction & Sustainability, Romania

Russian Federation

Prof. Vladimir N. Binhi, Ph.D., A.M. Prokhorov General Physics Institute of the Russian Academy of Sciences; M.V. Lomonosov Moscow State University
Dr. Oleg Grigoyev, DSc., Ph.D., Chairman, Russian National Committee on Non-Ionizing Radiation Protection, Russian Federation
Prof. Yury Grigoryev, MD, Former Chairman, Russian National Committee on Non-Ionizing Radiation Protection, Russian Federation
Dr. Natalia Igorevna Khorseva, Ph.D., Senior researcher at the Laboratory of Physics and Chemical Problems of Radiobiology and Ecology, Russian Academy of Sciences, Russian Federation
Dr. Anton Merkulov, Ph.D., Russian National Committee on Non-Ionizing Radiation Protection, Moscow, Russian Federation
Dr. Evgeny Vladimirovich Titov, PhD., Technical Sciences Candidate, Polzunov Altai State Technical University, Russia
Dr. Maxim Trushin, PhD., Kazan Federal University, Russia

Serbia

Dr. Snezana Raus Balind, Ph.D., Research Associate, Institute for Biological Research "Sinisa Stankovic", Belgrade, Serbia
Prof. Danica Dimitrijevic, Ph.D., Vinca Institute of Nuclear Sciences, University of Belgrade, Serbia
Dr. Sladjana Spasic, Ph.D., Institute for Multidisciplinary Research, University of Belgrade, Serbia

Slovak Republic

Dr. Igor Belyaev, Ph.D., Dr.Sc., Cancer Research Institute, Slovak Academy of Science, Bratislava, Slovak Republic

South Korea (Republic of Korea)

Prof. Kwon-Seok Chae, Ph.D., Molecular-ElectroMagnetic Biology Lab, Kyungpook National University, South Korea
Prof. Dr. Yoon-Myoung Gimm, Ph.D., School of Electronics and Electrical Engineering, Dankook University, South Korea
Prof. Dr. Myung Chan Gye, Ph.D., Hanyang University, South Korea
Prof. Dr. Mina Ha, MD, Dankook University, South Korea
Prof. Seung-Cheol Hong, MD, Inje University, South Korea
Prof. Dong Hyun Kim, Ph.D., Dept. of Otorhinolaryngology-Head and Neck Surgery, Incheon St. Mary's Hospital, Catholic University of Korea, South Korea
Prof. Hak-Rim Kim, Department of Pharmacology, College of Medicine, Dankook University, South Korea
Prof. Myeung Ju Kim, MD, Ph.D., Department of Anatomy, Dankook University College of Medicine, South Korea
Prof. Jae Seon Lee, MD, Department of Molecular Medicine, NHA University College of Medicine, Incheon 22212, South Korea
Prof. Yun-Sil Lee, Ph.D., Ewha Woman's University, South Korea
Prof. Dr. Yoon-Won Kim, MD, Ph.D., Hallym University School of Medicine, South Korea
Prof. Jung Keog Park, Ph.D., Life Science & Biotech; Dir., Research Instit.of Biotechnology, Dongguk University, South Korea
Prof. Sungman Park, Ph.D., Institute of Medical Sciences, School of Medicine, Hallym University, South Korea
Prof. Kiwon Song, Ph.D., Dept. of Chemistry, Yonsei University, South Korea

Spain

Prof. Dr. Miguel Alcaraz, MD, Ph.D., Radiology and Physical Medicine, Faculty of Medicine, University of Murcia, Spain
Dr. Alfonso Balmori, Ph.D., Biologist, Consejería de Medio Ambiente, Junta de Castilla y León, Spain
Prof. J.L. Bardasano, D.Sc, University of Alcalá, Department of Medical Specialties, Madrid, Spain
Dr. Claudio Gómez-Perretta, MD, Ph.D., La Fe University Hospital, Valencia, Spain
Prof. Dr. Miguel López-Lázaro, PhD., Associate Professor, Department of Pharmacology, University of Seville, Spain
Prof. Dr. Elena Lopez Martin, Ph.D., Human Anatomy, Facultad de Medicina, Universidad de Santiago de Compostela, Spain
Prof. Dr. Emilio Mayayo, MD, Pathology Unit, School of Medicine, University Rovira I Virgili (URV), Tarragona, Spain
Prof Enrique A. Navarro, Ph.D., Department of Applied Physics and Electromagnetics, University of Valencia, Spain

Sudan

Mr. Mosab Nouraldein Mohammed Hamad, MA, Head, Dept. of Medical Parasitology, Health Sciences, Elsheikh Abdallah Elbadri University, Sudan

Sweden
Dr. Michael Carlberg, MSc, Örebro University Hospital, Sweden
Dr. Lennart Hardell, MD, Ph.D., University Hospital, Örebro, Sweden
Dr. Lena Hedendahl, MD, Independent Environment and Health Research, Luleå, Sweden
Prof. Olle Johansson, Ph.D., Experimental Dermatology Unit, Dept. of Neuroscience, Karolinska Institute, Sweden
Dr. Bertil R. Persson, Ph.D., MD, Lund University, Sweden
Senior Prof. Dr. Leif Salford, MD. Department of Neurosurgery, Director, Rausing Laboratory, Lund University, Sweden
Dr. Fredrik Söderqvist, Ph.D., Ctr. for Clinical Research, Uppsala University, Västerås, Sweden

Switzerland
Dr. phil. nat. Daniel Favre, A.R.A. (Association Romande Alerte, Switzerland

Taiwan (Republic of China)
Prof. Dr. Tsun-Jen Cheng, MD, Sc.D., National Taiwan University, Republic of China
Dr. Jan Martel, Ph.D., Center for Molecular and Clinical Immunology, Chang Gung University, Taiwan

The Netherlands
Dirk K.F. Meijer, em. Professor of Pharmacology, PhD, University of Groningen, Groningen, The Netherlands.

Turkey
Prof. Dr. Mehmet Zülküf Akdağ, Ph.D., Department of Biophysics, Medical School of Dicle University, Diyarbakir, Turkey
Associate Prof. Dr. Halil Abraham Atasoy, MD, Pediatrics, Abant Izzet Baysal University, Faculty of Medicine, Turkey
Prof. Ayse G. Canseven (Kursun), Ph.D., Gazi University, Faculty of Medicine, Dept. of Biophysics, Turkey
Prof. Dr. Mustafa Salih Celik, Ph.D., Former Head, Turkish Biophysical Society; Head, Biophysics Dept; Medical Faculty, Dicle Univ., Turkey
Prof. Dr. Osman Cerezci, Electrical-Electronics Engineering Department, Sakarya University, Turkey
Prof. Dr. Suleyman Dasdag, Ph.D., Dept. of Biophysics, Medical School of Dicle University, Turkey
Prof. Omar Elmas, MD, Ph.D., Mugla Sitki Kocman University, Faculty of Medicine, Department of Physiology, Turkey
Prof. Dr. Ali H. Eriş, MD, faculty, Radiation Oncology Department, BAV University Medical School, Turkey
Prof. Dr. Arzu Firlarer, M.Sc. Ph.D., Occupational Health & Safety Department, Baskent University, Turkey
Associate Prof. Ayse Inhan Garip, PdH., Marmara Univ. School of Medicine, Biophysics Department, Turkey
Prof. Suleyman Kaplan, Ph.D., Head, Department of Histology and Embryology, Medical School, Ondokuz Mayıs University, Samsun, Turkey.
Prof. Dr. Mustafa Nazıroğlu, Ph.D., Biophysics Dept, Medical Faculty, Süleyman Demirel University, Isparta, Turkey
Prof. Dr. Ersan Odacı, MD, Ph.D., Karadeniz Technical University, Medical Faculty, Trabzon, Turkey
Prof. Dr. Elcin Ozgur, Ph.D., Biophysics Department, Faculty of Medicine, Gazi University, Turkey
Prof. Dr. Selim Seker, Electrical Engineering Department, Bogazici University, Istanbul, Turkey
Prof. Dr. Cemil Sert, Ph.D., Department of Biophysics of Medicine Faculty, Harran University, Turkey
Prof. Dr. Nesrin Seyhan, B.Sc., Ph.D., Medical Faculty of Gazi University; Chair, Biophysics Dept; Director GNRK Ctr.; Panel Mbr, NATO STO HFM; Scientific Secretariat Member, ICEMS; Advisory Committee Member, WHO EMF, Turkey
Prof. Dr. Bahriye Sirav (Aral), PhD., Gazi University Faculty of Medicine, Dept of Biophysics, Turkey

Ukraine
Dr. Oleg Banyra, MD, 2nd Municipal Polyclinic, St. Paraskeva Medical Centre, Ukraine
Prof. Victor Martynyuk, PhD., ECS "Institute of Biology", Head of Biophysics Dept, Taras Shevchenko National University of Kiev, Ukraine
Prof. Igor Yakymenko, Ph.D., D.Sc., Institute of Experimental Pathology, Oncology & Radiobiology, National Academy of Sciences of Ukraine

United Kingdom
Michael Bevington, M.A., M.Ed., Chair of Trustees, ElectroSensitivity UK (ES-UK), UK
Mr. Roger Coghill, MA, C Biol, MI Biol, MA Environ Mgt; Member Institute of Biology; Member, UK SAGE Committee on EMF Precautions, UK
Prof. John Frank MD, CCFP, MSc, FRCPC, FCAHS, FFPH, FRSE, LLD, Professor Emeritus, University of Edinburgh; Professor Emeritus, University of Toronto, Scotland, UK
Mr. David Gee, Associate Fellow, Institute of Environment, Health and Societies, Brunel University, UK
Dr. Andrew Goldsworthy BSc PhD, Lecturer in Biology (retired), Imperial College, London, UK

Emeritus Professor Denis L. Henshaw, PhD., Human Radiation Effects, School of Chemistry, University of Bristol, UK
Dr. Mae-Wan Ho, Ph.D., Institute of Science in Society, UK
Dr. Gerard Hyland, Ph.D., Institute of Biophysics, Neuss, Germany, UK
Dr. Isaac Jamieson, Ph.D., Biosustainable Design, UK
Dr. Erica Mallery-Blythe, BSBM, Founder, Physicians' Health Initiative for Radiation and Environment; ICBE-EMF; Hon. Member British Society of Ecological Medicine, UK
Emeritus Professor, Michael J. O'Carroll, PhD., former Pro Vice-Chancellor, University of Sunderland, UK
Mr. Alasdair Phillips, Electrical Engineer, UK
Dr. Syed Ghulam Sarwar Shah, M.Sc., Ph.D., Public Health Consultant, Honorary Research Fellow, Brunel University, London, UK
Dr. Cyril W. Smith, DIC, PhD, Retired 1990 UK
Dr. Sarah Starkey, Ph.D., independent neuroscience and environmental health research, UK

United States
Dr. Hillel Z Baldwin MD, Fellow of the American Association of Neurological Surgeons, Neuroscience Solutions, LLC, USA
Dr. Martin Blank, Ph.D., Columbia University, USA
Prof. Jim Burch, MS, Ph.D., Dept. of Epidemiology & Biostatistics, Arnold School of Public Health, University of South Carolina, USA
Prof. David O. Carpenter, MD, Director, Institute for Health and the Environment, University of New York at Albany, USA
Prof. Prof. Simona Carrubba, Ph.D., Biophysics, Daemen College, Women & Children's Hospital of Buffalo Neurology Dept., USA
Prof. Kent Chamberlin, Ph.D., Professor & Chair Emeritus, Dept. Electrical & Computer Engineering, Univ. of New Hampshire, USA
Dr. Sandra Cruz-Pol, PhD., Professor Electrical Engineering, on Radio Frequencies, Electromagnetics, University of Puerto Rico at Mayaguez; Member of US National Academies of Sciences Committee for Radio Frequencies; Puerto Rico, USA
Dr. Zoreh Davanipour, D.V.M., Ph.D., Friends Research Institute, USA
Dr. Devra Davis, Ph.D., MPH, President, Environmental Health Trust; Fellow, American College of Epidemiology, USA
Dr. James DeMeo, PhD, retired in private research, USA
Mr. Paul Raymond Doyon, EMRS, MAT, MA, Doyon Independent Research Associates, USA
Prof. Om P. Gandhi, Ph.D., Department of Electrical and Computer Engineering, University of Utah, USA
Prof. Beatrice Golomb, MD, Ph.D., University of California at San Diego School of Medicine, USA
Dr. Reba Goodman Ph.D, Columbia University, USA
Dr. Martha R. Herbert, MD, Ph.D., Harvard Medical School, Harvard University, USA
Dr. Gunnar Heuser, M.D., Ph.D., F.A.C.P. Emeritus member, Cedars Sinai Medical Center, Los Angeles, CA; Former Assistant Clinical Professor, UCLA; Former member, Brain Research Institute, UCLA. USA
Dr. Donald Hillman, Ph.D., Professor Emeritus, Michigan State University, USA
Ms. Elizabeth Kelley, MA, Managing Director, International Commission on the Biological Effects of Electromagnetic Fields, USA
Dr. Seungmo Kim, Ph.D., Assistant Professor, Department of Electrical and Computer Engineering, Georgia Southern University, USA
Dr. Ronald N. Kostoff, Ph.D., Gainesville, VA, USA
Ms. Neha Kumar, Founder, Nonionizing Electromagnetic Radiation Shielding Alternatives, Pvt. Ltd; B.Tech - Industrial Biotech., USA
Dr. Henry Lai, Ph.D., University of Washington, USA
Ms. B. Blake Levitt, medical/science journalist, former New York Times contributor, EMF researcher and author, USA
Prof. Trevor G. Marshall, PhD, Autoimmunity Research Foundation, USA
Dr. Albert M. Manville, II, Ph.D. and C.W.B., Adj. Professor, Johns Hopkins University Krieger Graduate School of Arts & Sciences Migratory Bird Management, U.S. Fish & Wildlife Service, USA
Dr. Andrew Marino, J.D., Ph.D., Retired Professor, LSU Health Sciences Center, USA
Dr. Marko Markov, Ph.D., President, Research International, Buffalo, New York, USA
Dr. Jeffrey L. Marrongelle, DC, CCN, President/Managing Partner of BioEnergiMed LLC, USA
Dr. Ronald Melnick, PhD, Senior Toxicologist, (Retired, leader of the NTP's health effects studies of cell phone radio frequency radiation), US National Toxicology Program, National Institute of Environmental Health Sciences, USA
Dr. Samuel Milham, MD, MPH, USA
Mr. L. Lloyd Morgan, Environmental Health Trust, USA
Dr. Joel M. Moskowitz, Ph.D., School of Public Health, University of California, Berkeley, USA
Dr. Imtiaz Nasim, PhD., Idaho National Labs, Idaho falls, USA
Dr. Martin L. Pall, Ph.D., Professor Emeritus, Biochemistry & Basic Medical Sciences, Washington State University, USA
Dr. Jerry L. Phillips, Ph.D. University of Colorado, USA
Dr. William J. Rea, M.D., Environmental Health Center, Dallas, Texas, USA
Ms. Camilla Rees, MBA, Electromagnetichealth.org; CEO, Wide Angle Health, LLC, USA
Dr. Cindy Lee Russell, M.D. Physicians for Safe Technology, USA
Ms. Theodora Scarato, MSW, Environmental Health Trust, USA
Prof. Narenda P. Singh, MD, University of Washington, USA
Prof. Eugene Sobel, Ph.D., Retired, School of Medicine, University of Southern California, USA
Mr. David Stetzer, Stetzer Electric, Inc., Blair, Wisconsin, USA
Dr. Lisa Tully, Ph.D., Energy Medicine Research Institute, Boulder, CO, USA

Supporting Scientists who have published peer reviewed papers in related fields

Olga Ameixa, PhD. Post-Doctoral Researcher, Dept of Biology & CESAM, University of Aveiro Campus, Universitário de Santiago, Portugal
Dr. Pilar Muñoz-Calero, MD, specialist in Pediatrics, Neonatology, Stomatology and Addiction Medicine; President of Fundación Alborada; Medical Director of Alborada Outpatient Hospital; Co-chair of Pathology and Environment and Associate Professor at the Medicine at the Universidad Complutense de Madrid, Spain
Michelle Casciani, MA, Environmental Science, President/Chief Executive Officer, Salvator Mundi International Hospital, Rome, Italy
Enrico Corsetti, Engineer, Research Director, Salvator Mundi International Hospital, Rome, Italy
Dr. Dietmar Hildebrand, Ph.D, Biophysicist, Coinvestigator Biostack Experiments, Germany
Xin Li, PhD candidate MSc, Department of Mechanical Engineering, Stevens Institute of Technology, New Jersey, USA
Dr. Carlos A. Loredo Ritter, MD, Pediatrician, Pediatric Neurologist; President, Restoration Physics, North American Sleep Medicine Society, USA
Dr. Robin Maytum, PhD, Senior Lecturer in Biological Science, University of Bedfordshire, Luton, UK
Prof. Dr. Raúl A. Montenegro, Ph.D, Evolutionary Biology, National University of Cordoba; President, FUNAM; Recognitions: Scientific Investigation Award from University of Buenos Aires, UNEP 'Global 500' Award (Brussels, Belgium), the Nuclear Free Future Award (Salzburg, Austria), and Alternative Nobel Prize (Right Livelihood Award, Sweden), Argentina.
Dr. Raymond Singer, Ph.D., Neurotoxicologist and Board-Certified Forensic Neuropsychologist, Expert witness testimony in over 100 neurotoxicity legal cases, International independent practice
Dr. Hugo Schooneveld, PhD, Biologist, Neuroscientist, Advisor to the Dutch EHS Foundation, Netherlands
Dr. Carmen Adella Sirbu, MD, Neurology, Lecturer, Titu Matorescu University, Romania
Jacques Testart, Biologist, Honorary Research Director at I.N.S.E.R.M. (French National Medical Research Institute), France
Rodolfo Touzet, PhD, Senior regulator on Radiological Safety, Commisión Nacional de Energía Atómica, Buenos Aires, Argentina
Sumeth Vongpanitlerd, Ph.D., retired Electrical Engineer, Thailand Development Research Institute, Bangkok, Thailand

1. https://www.mattioli1885journals.com/index.php/EJOEH/article/view/4971

UNIVERSITY AT ALBANY
State University of New York

Institute for Health and the Environment
WHO Collaborating Center in Environmental Health

20 October 2020

WSSC Water:

Thank you for the opportunity to present to the WSSC Water committee, and respond to the report by Leeka Kheifets, PhD on potential impacts on human health of advanced metering infrastructure.

I am a public health physician who serves as director of the Institute for Health and the Environment, a Collaborating Center of the World Health Organization, as well as a professor of Environmental Health Sciences at the University at Albany School of Public Health. I previously served as Director of the Wadsworth Center of the New York State Department of Health, and as Dean of the University at Albany School of Public Health. I received my medical degree from Harvard Medical School, have more than 450 peer-reviewed publications, six books and 50 reviews and book chapters. I am also co-editor of the "BioInitiative Report," first published in 2007, a comprehensive review of the adverse health effects of radiofrequency electromagnetic fields.

Smart AMI meters and cell phones occupy similar frequency bands of the electromagnetic spectrum, meaning that cell phone research can apply to smart meter radiofrequency radiation (RFR). Smart meter RFR consists of frequent, very intense but very brief pulses throughout the day. Because smart meter exposure over a 24 hour period can be very prolonged (pulses can average 9,600 times a day), and because there is building evidence that the sharp, high intensity pulses are particularly harmful, the cell phone study findings are applicable when discussing adverse health impacts from smart meters.

While the strongest evidence for hazards coming from RFR is for cancer, there is a growing body of evidence showing other effects including impacts to the brain and reproductive system. In addition, some people develop a condition called electro-hypersensitivity (EHS). These individuals respond to being in the presence of RFR with a variety of symptoms, including headache, fatigue, memory loss, ringing in the ears, "brain fog" and burning, tingling and itchy skin. Some reports indicate that up to three percent of the population may develop these symptoms, and that exposure to smart meters is a trigger for development of EHS.

In short:

- Smart meters operate with much more frequent pulses than cell phones, increasing the potential for adverse health impacts.
- Smart meter pulses can average 9,600 times a day, and up to 190,000 signals a day. Cell phones only pulse when they are on.

East Campus, 5 University Place, Room A217, Rensselaer, NY 12144-3429
PH: 518-525-2660 FX: 518-525-2665
www.albany.edu/ihe

- Cell phone RFR is concentrated, affecting the head or the area where the phone is stored, whereas smart meter RFR affects the entire body day and night.
- An individual can choose whether or not to use a cell phone and for what period of time. When smart meters are placed on a home the occupants have no option but to be continuously exposed to RFR. Even if they opt-out neighbors will have transmitting meters elevating the ambient levels in the neighborhood.

I am aware that the WSSC received a report entitled "On potential impacts on human health of advanced metering infrastructure" and I strongly disagree with the conclusion stated at the WSSC Commission meeting on February 19, 2020 at 3:29:40 that "...with smart meters, the exposures are so low that...concern is unwarranted." The research findings by independent scientists point to a clearer relationship between RFR and health effects than industry-funded studies and independent scientists believe that a network of radiofrequency radiation (RFR) generating meters in a neighborhood poses numerous health and environmental issues warranting attention. It does not make sense to dismiss smart meter exposures as "low" because this is a new network of thousands of RFR transmitting devices. Governments should be reducing RFR exposures, not increasing them.

The adverse health impacts of low intensity RFR are real, significant, and for some people debilitating. I want to stress four fundamentals as the WSSC proceeds to consider wireless meters:

- The Federal Communication Commission's "safety" standards do not apply to protection from biological effects of long-term exposure to low intensity RFR.
- There is no safe level of exposure established for RFR.
- People around the world are suffering from low intensity RFR exposure, being at increased risk of developing cancer, electrical sensitivity as well as other medical conditions.
- The Federal Communication Commission's "safety" standards do not apply to flora and fauna and thus the trees and wildlife exposed to the radiofrequency radiation are without any federal regulations or protections.

Published research documents that radiofrequency radiation is a human carcinogen.

Page 15 of the WSSC Report states "*International Agency for Research on Cancer has classified RF as a 'possible human carcinogen' (Group 2B) based on 'limited evidence' from both human and animal studies (Ref.: 15) the weight of evidence has not risen to a level that would change the basis for RF exposure limits.*"

As of 2020, several expert independent scientists have published their evaluation that the scientific evidence has increased and radiofrequency radiation should be classified as proven human carcinogen (Belpomme et al., 2018; Miller et al., 2018; Hardell and Carlberg, 2019).

The 2011 World Health Organization International Agency for Research on Cancer (WHO/IARC) classification of RF-EMFs as a "possible" human carcinogen was based primarily on evidence from human studies that long-term users of mobile phones held to the head resulted in an elevated risk of developing brain cancer. One major reason that the IARC rating was not at "probable" or "known" was the lack of clear evidence from animal studies for exposure leading to cancer.

In 2018, the US National Institute of Environmental Health Sciences National Toxicology Program's (NTP) Studies of Cell Phone Radiation released their findings that chronic exposure to RFR was associated with "clear evidence" of cancer in RFR-exposed male rats (NTP, 2018). In addition, exposed animals had significantly more DNA damage, heart damage and low birth weight (Smith Roe et al., 2020). Similar results in rats have been reported in an independent large scale animal study from the Ramazzini Institute with levels of exposure far lower than the NTP study and similar to those from a mobile phone base station (Falcioni et al., 2018). This evidence, in conjunction with the human studies, demonstrates conclusively that excessive exposure to RF-EMF results in an increased risk of cancer. In light of this new evidence for cancer in rodents in response to prolonged exposure to mobile phone frequencies, the IARC rating should be raised at least to "probable" (Group 2A) if not "known" (Group 1).

Due to the large scale animal studies as well as additional published research since 2011, the WHO/IARC advisory group published their recommendation that IARC should evaluate non-ionizing radiofrequency radiation as a "high priority" in the next five years. Documentation can be found at IARC Monographs on the Identification of Carcinogenic Hazards to Humans Report of the Advisory Group to Recommend Priorities for the IARC Monographs during 2020–2024 on page 148.

Published research documents adverse effects at levels well below FCC limits.

Page 4 of the WSSC Report states *"The exposures to RF from smart meter are neither long enough nor strong enough to approach the safety standards set by the Federal Communications Commission (FCC) and other bodies."*

First, FCC limits are not protective and thus any comparison to these limits has no relevance to impacts on health and the environment. The current weight of scientific evidence refutes the prominent claim that the deployment of wireless technologies poses no health risks at the currently permitted non-thermal radiofrequency exposure levels. Instead, the evidence supports the International EMF Scientist Appeal by 244 scientists from 41 countries who have published on the subject in peer-reviewed literature and collectively petitioned the WHO and the UN for immediate measures to reduce public exposure to artificial electromagnetic fields and radiation (Bandara and Carpenter, 2018).

"Numerous recent scientific publications have shown that EMF affects living organisms at levels well below most international and national guidelines. Effects include increased cancer risk, cellular stress,

increase in harmful free radicals, genetic damage, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being in humans. Damage goes well beyond the human race, as there is growing evidence of harmful effects to both plant and animal life" (Kelley et al., 2015).

The various agencies setting safety standards including the FCC have failed to impose sufficient guidelines to protect the general public, particularly children who are more vulnerable to the effects of EMF. Reliance on FCC limits does not ensure safety.

Published research documents that even low levels of radiofrequency radiation have adverse impacts.

Page 3 of the WSSC Report states *"Because Smart meters are not used in close proximity to human body (unlike cell phones, tablets, computers and even WIFI) and because they transmit relatively infrequently their exposure levels are very low and far below U.S. and international exposure limits."*

Wireless smart meters typically produce atypical, relatively potent and very short pulsed RF/microwaves. Technical spec sheets on AMI water meters show these types of meters transmit very frequently - with a mobile message every 14 seconds at 100 mW and every 71/2 minutes at 1 Watt (See Neptune R900i Spec Sheet). Constant emissions is the only way for meters to transmit information wirelessly in "real time." Smart utility meters transmit very high intensity but short pulses. Even if the duration of the pulse is short, the pulse can be intense and research has found that low level exposures have biological effects (Bioinitiative Report Charts). In addition, the resulting biological effects from an exposure may be due both to the pulsed and polarized characteristics of man-made EMFs emitted wireless technologies which contrast to the non-polarized natural electromagnetic fields humans have been exposed to for decades (Belyaev, 2015, Panagopoulos et al., 2015).

Second, water utility meters are both inside homes as well as outside homes on walls near living spaces for families. The WSSC report states that "about 60% of WSSC water meters are located inside the basement of homes and 40% are located outside the home at the property line." Hence, there are opportunities for people to be in close proximity to the meters and receive intense exposures. Equally important is that people will be exposed day and night.

Hundreds of scientists are calling on policymakers to reduce RF levels to protect the public and the environment and identify smart meters as a source of radiofrequency radiation exposure.

The WSSC Report page 21 states that *"A group of scientists published an appeal in which they question adequacy of existing guidelines for RF from variety of devices, including smart meters...most official organizations do not share this concern."*

The International EMF Scientist Appeal signed by over 250 scientists states "Based upon peer-reviewed, published research, we have serious concerns regarding the ubiquitous and increasing exposure to EMF generated by electric and wireless devices. These include–but are not limited to–radiofrequency radiation (RFR) emitting devices, such as cellular and cordless phones and their base stations, Wi-Fi, broadcast antennas, smart meters…"

There are numerous medical organizations recommending that exposure to radiofrequency be reduced and they include American Academy of Pediatrics, ANSES, France's National Agency for Food, Environmental and Occupational Health Safety, Turin Medical Association of Italy, The American Academy of Environmental Medicine, Swiss Physicians Association of Doctors for Environmental Protection, African Cancer Organisation, The Cyprus National Committee on Environment and Child Health, Austrian Medical Association, Athens Medical Association, Canadian Parliament House Standing Committee on Health.

For anyone to downplay the exposure from smart meters as contributing just a "low" level downplays the actuality that a person's total exposure comes from a combination of sources inside and outside the home. Smart meters would contribute to this total daily exposure. The toxic metal lead is not known to be safe at any level and companies worked for years to downplay the science showing harm. It makes sense to reduce exposure as much as possible.

Children and pregnant women are most vulnerable to radiofrequency radiation.

Children, and especially fetuses, are more vulnerable than adults for most environmental exposures (Sly and Carpenter, 2012). This is because their cells are rapidly dividing and their organ systems are not mature. As a result, events that perturb cellular function early in life can result in abnormalities later. There is a building body of evidence indicating that exposure to RF-EMFs has adverse effects on cognition and neurobehavior, especially in children and adolescents. Of concern is the fact that any adverse effects during development may have life-long consequences and that young people, because they will have a longer life span will receive greater cumulative exposure than adults (Belpomme et. al, 2018).

Research on animals (Bas et al., 2009; Deshmukh et al., 2015; Shahin et al., 2017; Megha et al., 2015; Aldad et al., 2012; Zhang et al., 2015) shows impacts from RFR to the brain such as alterations in neurodevelopment and behavior of offspring, impaired learning and spatial memory, a deleterious impact on hippocampal, pyramidal or cortical neurons and induced markers of oxidative stress and inflammation in the brain. Human data is consistent with these animal studies as they have found higher cell phone radiation associated with behavioral problems and memory damage (Divan et al., 2012; Birks et al. 2017; Foerster et. al., 2018).

The research showing impacts from radiofrequency on the brain again highlights the importance of reducing exposure to children and pregnant women. There is no safe level of radiofrequency radiation identified.

Radiofrequency radiation has been found to interact with other toxic exposures and have synergistic reactions.

Early life exposure to lead has long been known to harm children and impact their ability to pay attention. Two studies have shown that prenatal (Choi et al., 2017) or postnatal (Byun et al., 2017) mobile phone exposure results in greater neurobehavioral effects in children with elevated lead levels than those seen with elevated lead alone. These results indicate that EMFs can have synergistic actions with other environmental contaminants known to cause a reduction in intelligence quotient (IQ).

In addition, replicated results from animal studies show co-carcinogenic and tumor promoting effects from RF-EMF when RF is combined with a known carcinogen (Tillmann et al., 2010; Lerchl et al., 2015). The studies used a very low level of radiofrequency radiation yet found increases in tumors from the combined exposures.

Industry influence is impacting the science on radiofrequency radiation.

The evaluation of RFR health risks is often ignored by government authorities. Conflicts of interest and ties to the industry seem to have contributed to the biased reports by various organizations (Hardell,2007; 2017; Hardell and Carlberg, 2020; Hardell and Nyberg, 2020; Harvard University Press, 2018; Ledford, 2010; Starkey, 2016). The lack of proper unbiased risk evaluation of radiofrequency radiation places populations at risk. I published an article (Carpenter, 2019) on lower frequency electromagnetic radiation and found that when one allows for bias reflected in source of funding, the scientific evidence that magnetic fields increase risk of cancer is neither inconsistent nor inconclusive. It is clear when one excludes biased reports from individuals and organizations that have conflicts of interest that the adverse health effects resulting from exposure to RFR are well-documented, are found consistently in studies from around the world, and require that government and regulatory agencies take action to protect the public from excessive exposure to RFR.

David O. Carpenter, M.D.
Director, Institute for Health and the Environment
University at Albany

Citations

Aldad, T.S. et al. "Fetal radiofrequency radiation exposure from 800-1900 MHz-rated cellular telephones affects neuro- development and behavior in mice." *Scientific Reports*, vol 2, 2012, pp. 312.

Bandara, Priyanka, and Carpenter O., David. "Planetary electromagnetic pollution: it is time to assess its impact." *The Lancet Planetary Health*, vol 2, 2018, pp. 512-514.

Bas, O. et al. "900 MHz elec- tromagnetic field exposure affects qualitative and quantitative features of hippocampal pyramidal cells in the adult female rat." *Brain Research*, vol 1265, 2009, pp. 178-185.

Belpomme, Dominique et al. "Thermal and non-thermal health effects of low intensity non-ionizing radiation: An international perspective." *Environmental Pollution*, vol 242, part A, 2018.

Belyaev, Igor. "Biophysical mechanisms for nonthermal microwave effects." In: Markov, M. (Ed.), *Electromagnetic Fields in Biology and Medicine*, CRC Press, Boca Raton, London, New York, 2015, pp. 49-68.

Birks, L. et al. "Maternal cell phone use during pregnancy and child behavioral problems in five birth cohorts." *Environmental International*, vol 104, 2017, pp. 122-131.

Carlberg, Michael, and Hardell, Lennart. "Comments on the US National Toxicology Program technical reports on toxicology and carcinogenesis study in rats exposed to whole-body radiofrequency radiation at 900 MHz and in mice exposed to whole-body radiofrequency radiation at 1,900 MHz." *International Journal of Oncology*, vol 54, 2018, pp. 111-127.

Carlberg, Michael, and Hardell, Lennart. "Evaluation of Mobile Phone and Cordless Phone Use and Glioma Risk Using the Bradford Hill Viewpoints from 1965 on Association or Causation." *BioMed Research International,* vol 2017, 2017.

Carpenter DO "Extremely low frequency electromagnetic fields and cancer: How source of funding affects results." Environmental Research 178: 108688.2019.

Deshmukh, P.S. et al. "Cognitive impairment and neurogenotoxic effects in rats exposed to low- intensity microwave radiation." *International Journal of Toxicology,* vol 34, 2015, pp. 284-290.

Divan, H.A. et al. "Cell phone use and behavioural problems in young children." *Journal of Epidemiology and Community Health*, vol 66, 2010, pp. 524-529.

Falcioni L. et al. "Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz GSM base station environmental emission." *Environmental Research*, vol 165, 2018, pp. 496-503.

Foerster, M., Thielens, A., Joseph, W., Eeftens, M., & Röösli, M. "A Prospective Cohort Study of Adolescents' Memory Performance and Individual Brain Dose of Microwave Radiation from Wireless Communication." *Environmental Health Perspectives*, vol 126, no. 7, 2018.

Hardell, Lennart. "World Health Organization, radiofrequency radiation and health – a hard nut to crack (Review)." International Journal of Oncology, vol. 51, no. 2, 2017, pp. 405-13.

Hardell L., et al. "Secret ties to industry and conflicting interests in cancer research."American Journal of Industrial Medicine, vol. 50, no. 3, 2007, pp. 227–33.

Hardell L, Carlberg M. Health risks from radiofrequency radiation, including 5G, should be assessed by experts with no conflicts of interest. Oncol Lett. 2020;20(4):15. doi:10.3892/ol.2020.11876

Hardell L, Nyberg R. Appeals that matter or not on a moratorium on the deployment of the fifth generation, 5G, for microwave radiation. Mol Clin Oncol. 2020;12(3):247-257. doi:10.3892/mco.2020.1984

Harvard Press Book "Captured Agency: How the Federal Communications Commission is Dominated by the Industries it Presumably Regulates"

Kelley, Elizabeth et al. "International Appeal: Scientists call for protection from non-ionizing electromagnetic field exposure." *European Journal of Oncology*, vol 20, no. 3, 2015, pp. 180-182.

Kheifets, Leeka et al. "The sensitivity of children to electromagnetic fields." *Pediatrics*, vol 116, 2005.

Ledford, Brandon. "Cell Phones, Electromagnetic Radiation, and Cancer: A Study of Author Affiliation, Funding, Bias, and Results."Proceedings of the Policy Studies Organization, no. 11, 2010.

Lerchl, Alexander et al. "Tumor promotion by exposure to radiofrequency electromagnetic fields below exposure limits for humans." *Biochemical and Biophysical Research Communications*, vol 459, no. 4, 2015, pp. 585-590.

Megha, Kanu et al. "Low intensity microwave radiation induced oxidative stress, inflammatory response and DNA damage in rat brain." *NeuroToxicology*, vol 51, 2015.

Peleg, Michael et al. "Radio frequency radiation-related cancer: assessing causation in the occupational/military setting." *Environmental Research,* vol 163, 2018.

Shahin, S. et al. "2.45GHz Microwave Radiation Impairs Hippocampal Learning and Spatial Memory: Involvement of Local Stress Mechanism Induced Suppression of iGluR/ERK/CREB Signaling." *Toxicological Sciences*, vol 161, 2017, pp. 349-374.

Sly, J.L., and Carpenter, D.O. "Special vulnerability of children to environmental exposures." *Reviews on Environmental Health*, vol 27, 2012, pp. 151-157.

Smith-Roe L., Stephanie et al. "Evaluation of the genotoxicity of cell phone radiofrequency radiation in male and female rats and mice following subchronic exposure" *Environmental and Molecular Mutagenesis,* 2019.

Starkey, Sarah J. "Inaccurate official assessment of radiofrequency safety by the Advisory Group on Non-ionising Radiation" Reviews on Environmental Health, vol. 31, no. 4, 2016.

Yakymenko, Igor et al. "Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation." *Electromagnetic Biology and Medicine*, vol 35, 2015, pp. 186-202.

Zhang, Y. et al. "Effects of fetal microwave radiation exposure on offspring behavior in mice." *Journal of Radiation Research*, vol 56, 2015, pp. 261-268.

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the application of
CONSUMERS ENERGY COMPANY for
authority to increase its rates for the generation
and distribution of electricity and for other relief.
_____/

Case No. **U-18322**

DIRECT TESTIMONY AND EXHIBITS OF WILLIAM S. BATHGATE

On Behalf of

Residential Customer Group

August 15, 2017

I. QUALIFICATIONS

Q. Please state your name and address.

A. My name is William S. Bathgate, and my business address is 10909 Monticello Road Pinckney, MI 48169.

Q. Please state your qualifications and background.

A. I am an engineer having significant experience with the technology used in AMI Meters, including the type of AMI Meter that Consumers Energy Company and Detroit Energy Company have been installing in their respective service territories. My educational background includes:

Bachelors of Science, Western, Illinois University, Macomb, IL and Advanced Masters work from Iowa State University. My course of study was in industrial electrical control system and computer engineering controls. My work experience includes:

Professional Work History

2015 - 2017	**TATA Consulting, Fiat Chrysler Automotive Account – Current Position**
2015 – 2017	Global Program Manager, Vehicle Systems – Auburn Hills, MI
2009 - 2015	**Emerson Electric Corporation, Avocent Division**
2009 – 2015	Global Program Manager, Power Distribution Systems, Emerson Corp., Avocent Div. – Huntsville, AL
1995–2009	**Hewlett-Packard Co.**
2005-2009	Managing Director, General Motors Account – Detroit, MI
2003–2005	Director of HP, Information Systems, Audit & Compliance - Americas, CDN, USA, LA
2000-2003	Director of Global Operations, Ford Motors & Visteon Account – Detroit, MI
1998-2000	Director of HP Programs & Data Center Operations - Toronto, Canada

1995-1998	HP Electronic Systems Engineer, Instruments Division – Palo Alto, CA
1983–1995	**IBM Co.**
1983-1995	IBM Corporation, Electronic Systems Engineer, Systems Division – Armonk, New York
1977-1983	**Textron Corporation**
1977-1983	Textron Corporation, Control Systems Engineer Sundstrand Division – Rockford, IL

Specific Technology Expertise

High tech power management systems, UPS and power distribution
Switched Mode Power Supplies
Electrical and Electronic hardware engineering
Computer systems engineering
Radio Systems design and testing
High Current and High Voltage switches
Internet communications using both wired and wireless technologies
UL, CE (Europe), Africa, Japan, Australia and China product safety certifications
Cyber encryption and protection of Radio Communications using digital signals
RFI/EMI mitigation

My resume is provided as **Exhibit RCG-2** (WSB-1) filed with this testimony.

II. DIRECT TESTIMONY

Q. Please describe the cost impact to residential customers as a result of an AMI smart meter being installed at the homes of residential customers.

A. In contrast to an analog meter, an AMI smart meter itself utilizes significant electric energy, see **Exhibit RCG-3** (WSB-2). Specifically, on average, a smart meter will consume approximately 2.37 kWh per day which equates to approximately 865 kWh per year, at a varying dollar cost depending upon the existence of higher per kWh tariff charges during peak times of the day. The specific costs can range from approximately $0.12135 per kWh inclusive of distribution and fuel optimization charges relative to meter operations during off-peak hours, and approximately $0.19835 for meter

consumption occurring during peak hours. For standard flat rates inclusive of distribution and energy optimization charges of approximately $0.13950 @ 2.37 Average kWh per day amounts to approximately $120.674 annual cost borne by the consumer depending on rate tariffs, distribution charges and fuel recovery. These costs were never disclosed in advance to consumers as an outcome of the installation of an AMI Meter on their home. In fact, the consumer was informed this would help them save money. The evidence is to the contrary. If all the consumers in Michigan were told the new AMI would cost them over $120.00 a year in energy costs there would be a large public outcry. The promotional material provisioned by the utilities represented that the AMI would lead to consumer energy savings. This clearly is not the case. The sad part of this story is that this is hitting every low income person and senior citizens the hardest of all. This represents an added $217.2 Million in annual revenue from Consumer Energy's 1.8 Million customers and 3.8 Billion Tons of CO2 introduced into the atmosphere just to run the AMI meters. The Analog meters in prior use cost no party any energy either for Consumers Energy or the end customer. Just by replacing the Analog Meter with an AMI meter, Consumers Energy has obtained a windfall in revenue without a truthful petition to the Commission and is creating more greenhouse CO2 without obvious notice or disclosure to the public or the FERC.

Q. Please explain why the AMI smart meters consume this amount of energy.

A. The AMI Meter operates continuously measuring voltages and current consumed by the household and EMI/RFI by products from the meter Switched Mode Power Supply (SMPS) which converts the 240 VAC to the various DC voltages. There are current losses in the SMPS operation and there is a 100 ohm resistor shorted across the two 240

VAC line coming into the SMPS. See **Exhibit RCG-5** (WSB-4). This resistor at 240 VAC on its own consumes 1.3 kWh per day. There is also the current consumed by the two other circuit boards which includes a full computer system in the AMI meter including all the RF signals throughout the day to pulsate through the surrounding air and the wires of a household to gather specific energy consumption. Even though the connection for Consumers is a cellular communications type it still pulses constantly with the cell tower just like a cell phone does and consumes power constantly. So, it is not unreasonable to conclude that an average of 2.37 kWh per consumption is typical. In contrast, an analog meter incurs no such energy consumption as it is a current measuring meter which records overall energy consumption without utilizing the two-way pulsating capturing of data concerning specific energy consumption throughout the household.

Q. Do you have recommendations concerning how residential customers that want to keep or to have an analog meter should be treated in view of the increased energy consumption caused by smart meters?

A. First, I recommend that the company and the Commission provide customers who want an analog meter to be given that option, whether it involves retaining an existing analog meter, or involves a requirement that the company replace and install an AMI meter with an analog meter.

Second, I recommend that the Commission eliminate initial and monthly surcharges for opt-out customers that retain or have analog meters, since the opt-out customers pay for all costs via the electric tariffs of the AMI system whether they opt or not, and because the opt-out customers who have not consented to an AMI meter are not causing the costs on a per-unit basis for the AMI infrastructure and installation and operation of the

system. In fact, meter reading can be done without dispatch of a meter reader to customers who choose to retain or have an analog meter by simply taking a photo of their reading each month and communicate their readings to the utility with an annual or semiannual audit by the utility. This was done for many years by the utility with customers and existing phone dial-in meter readings are still available with all the utilities.

Third, I recommend that the increased energy usage that AMI opt-out customers are being charged as I have discussed above be credited against any opt-out surcharges if said surcharges are retained by the Commission. It appears likely that the amount being charged for increased energy consumption caused by the AMI Meters may involve costs which exceed the monthly opt-out surcharges.

Fourth, there should be a full disclosure to the public via an information letter sent via US Mail explaining to consumers that their new AMI Meter is increasing their electric bill to pay for the energy required to run the meter. Otherwise the utility is taking unfair advantage of customers. What I have discovered in AMI meter power consumption is a real condition that can be easily replicated by going to any home, turning off the power breakers off and reading the digital readout on the meter after 24 hours.

Q. Are customers with AMI Meters incurring any other costs or risks that should be considered by the Commission?

A. Yes. The customers with smart meters have increased risk of fires, electrical medical equipment damage and appliance damage occurring due to the AMI Meters design creating EMI/RFI effects commonly called conducted emissions and also called EMC. See **Exhibit RCG-6** (WSB-5) A portion of the customers have concerns relating to the

operation of the AMI Meters and the resulting electromagnetic infiltration of their homes from Electro-Magnetic and Radio Frequency Interference generated within the unfiltered AMI Meter Switched Mode Power Supply (SMPS), to which some persons also suffer negative health effects from early medical equipment failures. Analog meters have no such EMI/RFI artifacts imposed on the electric wires and only the low frequency sinusoidal wave form shown in the **Exhibit RCG-6** (WSB-5) should be present. The large osculating waveform shown in **Exhibit RCG-6** (WSB-5) is not present with an analog meter.

The Commission should fully consider this information for at least two reasons: (1) these costs and risks should be an additional basis for the Commission to rule that customers should have the option to opt out of having the AMI meter at their home and to have instead an Analog Meter, and without incurring surcharges for exercising this option; and (2) the Commission should utilize its review power on a continuous on-going basis over time regarding health and safety issues relating to electric utility service, including this time.

The fire hazard referenced above can result from the operation of the AMI Meters from several sources:

1. The SMPS circuit board has very limited surge protection resulting from incoming voltage transients. The main component on the SMPS that is vulnerable is called a Varistor, which looks like a small black square on the SMPS board. See **Exhibit RCG-7** (WSB-6). This small electronic part cannot withstand more than a 300 Volts AC surge. The part will explode when a line voltage surge exceeds this limit, such as when a tree branch touches the high voltage lines or

lightning strike occurs nearby. Once this Varistor explosion has occurred it permits high voltage transfer to the other circuit board components and the circuit board substrate. This results in the AMI meter literally exploding from the meter socket or in a severe melting of the plastic components, likely leading to a fire and/or severe home damage. Most customers that comment when this occurs say they hear a load pop or a boom, followed by lights flickering, and followed by arcing at the meter housing. This is not how a circuit board should be protected. In series with the Varistor should be a small fuse that would stop voltage progression to the remaining circuit components and interconnections. Every SMPS in the home from a vast array of electronic appliances has a Varistor, such as TV's, PC power supplies, electronically controlled refrigerators, washers, dryers and heating/cooling systems but also has a fuse or fuse-able link that will break the circuit before catastrophic damage progressively results from a surge. There is no sound electronic engineering firm that would permit 240 volts AC to short circuit across the circuit boards due to a component failure such as a Varistor. This is extremely dangerous. Once the progression of the subsequent short circuit begins the line transformer will apply up to 2,000 Amps to the meter housing until either the feed lines to the home disintegrate and vaporize or the transformer line fuse trips out after 50 seconds. By this time the damage is so extensive it is jeopardizing human and animal life. No such condition is possible from an Analog Meter. In fact the occurrence of an Analog Meter fire is almost unheard of.

2. There are also unseen dangers from the meter to meter box contacts. At my own home which was built in 2015, the Analog Meter was replaced with an AMI meter installed in October of 2015. In the winter of 2017, I could not get remote electronic readings from my meter to the utility. The result was that I could only get estimated readings for Feb, March, April and May. Numerous attempts to resolve this issue were unsuccessful. Since I have the instrumentation at home I knew that the meter was transmitting. I was told by the utility that the deployment of AMI meters would eliminate estimated readings. This was not true based on my observations. I decided to ask for an Opt-Out meter to be installed so I could get a meter manually read.

When the AMI meter was removed. I discovered that the one set of contacts had all burned up from excessive heat. See **Exhibit RCG-8** (WSB-7). This was a new meter box in 2015 and in use for about 2 years. It could have easily led to a meter fire without warning. If I had not changed my meter, I would never have known there was a problem. How many other meter boxes are at risk with the same conditions today? The only way we will know is when we begin to see more meter fires. Unfortunately once a fire begins at the meter contacts all evidence of the root cause are near impossible to determine. The utility concludes without any evidence that the meter fire occurred due to customer wiring. Had I known that placing an AMI meter on my home would lead to burned contacts on my home, I would never have permitted its installation. There are supposed to be sensors of high heat within the meter, but it did not detect the condition at my home.

Q. Does CECo's failure to independently test AMI meters put customers at risk? If so, how?

A. The AMI Meter Switched Mode Power Supply (SMPS) design is lacking what is called a differential voltage and common mode current filter circuit to keep it from back-feeding high frequency voltage transients and magnetic currents as an electrical by-product onto the home primary wiring circuits. See **Exhibit RCG-4** (WSB-3) and **Exhibit RCG-6** (WSB-5). The result is magnetic fields and high frequency radio emissions surrounding every room. This class of emissions is called EMI/RFI (commonly called EMC) and is viewed by the FCC as Conducted Emissions. The FCC has limits for Conducted Emissions (please note not the cellular RF meter reading emissions) and any electronic device that has Conducted Emissions in excess of 9 KHz switching oscillators must comply with FCC conducted emissions specifications. See **Exhibit RCG-9** (WSB-8). There are two classes of devices, Class A for industrial application and Class B which is more stringent for computer based applications. The AMI meter has a computer CPU and Memory just like any PC has, and therefore FCC Class B regulations apply. No AMI meter used by Consumers Energy has been independently tested to ensure compliance with the FCC recommended line impedance stabilization network ("LISN") test equipment. LISN tests are done by third parties on behalf of manufacturers and provide manufacturers public documented assurance their products comply with FCC Conducted Emissions standards. Nor has Consumers Energy published any test results for Conducted Emissions from an independent third party. It is important to note that these tests must be performed under varying loads and with typical home appliances, not by some backroom

lab at idle current, because when current demand is applied the variations in Conducted Emissions are exacerbated.

My testing has shown that Conducted Emissions far exceed FCC limits with typical peak to peak voltages of 14-19 Volts and at frequencies ranging from 2 KHz to 36 MHz. In addition, I have found through testing a home under load that measured in excess of 27 Volts peak-to-peak at frequencies exceeding 40 MHz max. See **Exhibit RCG-9** (WSB-8). The oscilloscope trace I have provided is a typical home with no branch circuits active and only measuring the Conducted Omissions from only the AMI meter. As noted in the oscilloscope trace, the frequency of the emissions varies dramatically in phase with the 60 Cycle AC. This makes it very problematic to state that the emissions are of a certain fixed frequency, because they are constantly varying. This makes mitigating these emissions downstream from the AMI meter (with high amperages in the home requiring multiple low pass limits to allow only the 60 cycle frequency to be present) extremely expensive to procure, exceeding $7,000. All medical facilities and data centers used by the US DoD place these filters in line with the main electric service classified in Mil Spec MIL-STD-461F NCE02 for 10 KHz to 10 MHz (see attached **Exhibit RCG-10** (WSB-9) http://incompliancemag.com/article/design-practices-for-military-emc-and-environmental-compliance/). Based on these standards no AMI meter could ever be directly connected to the primary building wiring of sensitive facilities without an EMC mitigating high voltage and high amperage low pass filter between the utility source and the buildings load panels. Every medical office has highly sensitive electronic equipment such as EKG and X ray equipment that are subject to these high conducted emissions which can degrade equipment or affect the reading and operational life if this type of equipment. Yet the

utility has proceeded to install AMI meters in these facilities and not notified the owners of these businesses of the risks they now are subject to as the result of installing an AMI meter.

Q. Are CECo's residential customers similarly at risk, particularly those operating medical equipment?

A. Yes, the same is true for households for residents with life sustaining electronic equipment such as the following:

Tank type Respirator (Iron Lung)

Cuirasses Respirator (Chest Respirator)

Rocking Bed

Electrically operated Respirator

Suction Machine (Pump)

Hemodialysis Equipment (Kidney Machine)

Intermittent Positive Pressure Respirator

Special Air Conditioning (specific humidity control)

Heart Rate Monitor

PD APENA Monitor (Parkinson's disease control)

Diaphragm Stimulator

Oxygen Concentrator

Medical Pump

Press Respirator (for Hypertension treatment)

CP Drum ventilator (for particulate filtering for persons with Cystic Fibrosis lung diseases)

All this essential medical equipment will either unexpectedly fail operation or be unpredictably compromised from normal operation when subjected to the level of Conducted Emissions present in the AMI meter in use by Consumers Energy, or any other utility.

Q. How can the Commission address and alleviate the risks you have described?

A. The only means to prevent harm to the residents of homes and certain medical offices is the elimination of the AMI installation and replacement with an Analog Meter. In fact, National Grid in Massachusetts is trying to address this problem today and has a process in place to assure safe electric service to consumers with this type of medical equipment. See **Exhibit RCG-11** (WSB-10). However, here in Michigan no consideration or accommodation is provided by any utility. Instead, the MPSC until now has approved or acquiesced to the utilities punitive internal polices and directives that a customer must either accept the installation of an AMI type meter or do without electric service and/or to pay opt-out rate surcharges as well. The Commission should undertake actions to reverse and modify these policies. Placing at risk medically vulnerable persons with severe conditions just because the utility wants its way is unconscionable. The current AMI Opt-Out Meter solution provides no protection from harm from Conducted Emissions. The current practice is either accept an AMI which can damage your life sustaining equipment or risk death. The Analog Meter has no electronic components that created Conducted Emission effects. The Commission never provided guidance or conditions

applicable to the AMI rollout. The utilities have done this as they willed. Yet, it is the Commission's role to ensure that SAFE reliable electric service is provided. The Commission should provide new guidance to all Utilities that customer accommodation to their wishes should be provided. Today the lack of guidance has caused harm or ongoing risks of harm to thousands of citizens for a program requiring only an Opt-In offering, resulting in a forced AMI technology implementation by Consumers Energy and the other major providers such as DTE. Even with the amount of time the utilities have had to educate consumers, most residents do not even know they have an AMI meter on their home. 50% of my neighbors I polled have no any idea what an AMI meter is until it is specifically pointed out to them.

Q. Does this complete your testimony?

A Yes.

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the application of CONSUMERS ENERGY COMPANY for authority to increase its rates for the generation and distribution of electricity and for other relief

Case No. **U-18322**

/

EXHIBIT RCG-2 (WSB-1)

TO

DIRECT TESTIMONY AND EXHIBIT OF WILLIAM S. BATHGATE

On Behalf of

Residential Customer Group

August 15, 2017

William S. Bathgate

Certifications - *PMP, ITIL, COBIT, CISA, CRISC, CISM, CGEIT*
US DOD Top Secret Security Clearance
Bachelors of Sciences, Western Illinois University
bill.bathgate@gmail.com
10909 Monticello Road
Pinckney, MI 48169
256-529-1076

Global Technology Professional

Professional Work History

2015 - 2017 TATA Consulting, Fiat Chrysler Automotive Account – Current Position

2015 – 2017 Global Program Manager – Auburn Hills, MI

Manger of Global Programs for enhancements of systems for MOPAR, Secure Vehicle. U-Connect Radio Systems, Connected Vehicle and Autonomous Vehicles. Reports directly to FCA Director of Systems Planning.

2009 - 2015 Emerson Electric Corporation, Avocent Division

2009 – 2015 Global Program Manager, Emerson Corporation, Avocent Div. – Huntsville, AL

Program Manager of a power distribution products portfolio. Responsible for global engineering development and release of newly developed electrical products engineered in the USA and Germany but built in in Mexico and Czech Republic. This product is called MPH and MPH II. This is a computer network controlled high voltage and high amperage load control device engineered for worldwide installations adapted for each local countries either three phase and single phase AC distribution grid. As Program Manager I also provided direction and oversite of product safety testing and certifications, such as UL, CSA, CE, and PSE for product safety compliance in over 100 countries. So far over 1 Million units of the products I developed are in service. This role reported to the Vice President of Engineering of Emerson's Avocent Division.

1995–2009 Hewlett-Packard Co.

2005-2009 Managing Director, General Motors Account – Detroit, MI

Managed Global infrastructures, Global Data Centers, IT Operations, Global Networks, Network and System Security, disaster recovery preparedness and rehearsals. As Managing Director of a Global Team of 600 support personnel, I successfully directed multiple multi-million dollar complex mission critical projects involving modernizing computing facilities and internal systems for power, cooling, networks and automated SCADA control systems.

2003–2005 Director of HP, Information Systems, Audit & Compliance - Americas, CDN, USA, LA

Managed HP Internal IT infrastructures, Data Centers, IT Operations, Networks, Network and System Security. Ensured US government compliance, managed Information Security Audit function, built Disaster Recovery Centers, managed secure VPN, Secure Information Systems Certificate Encryption Authority (CA), CBX, IVR, VOIP systems, systems and network monitoring, Responsible for and managed the staff of 1,100 IT and Network Security professionals in the disciplines of Networks, UNIX, Linux, VM Ware, MS Exchange, and Web B2B and B2C applications. Responsible for and managed the corporate portfolio of projects and programs for all of HP Internal IT within North America and South America.

2000-2003 Director of Global Operations, Ford Motors & Visteon Account – Detroit, MI

Managed Global Ford applications and infrastructures, Ford Data Centers, IT Operations, WAN Networks, $42M Annual Personnel Budget, Network and System Security, VOIP systems, Ford systems and network monitoring. Built new data centers to host control center operations and service desk. Implemented ITIL processes, workflows and CMDB. Responsible for developing the Visteon Corporation Competency Center, that enabled Mainframe application conversions to SAP.

1998-2000 Director of HP Programs & Data Center Operations - Toronto, Canada

Managed HP Canada and CIBC Bank Tier IV Data Centers, IT Operations, 30,000 Unit ATM Secure Network, Network and System Security, Help Desk. New systems Implementation and Operations. Re-engineered data centers for power, cooling and networking to host Canada Operations center and service desk. Implemented processes, incident, problem, change management process workflows and implemented a comprehensive Configuration Management Data Base (CMDB).

1995-1998 HP Electronic Systems Engineer, Instruments Division – Palo Alto, CA

Now this division is called "Keysight Technologies". Developed new automated instrument calibration systems and new circuit designs for oscilloscopes, high precision DC power supplies, EMI & EMC Measurements, Phase Noise, Physical Layer Test Systems, RF & Microwave Test Accessories, Device Current Waveform Analyzers, AC and DC power analyzers. Network analyzers and vector signal analyzers.

1983–1995 IBM Corporation

1983-1995 IBM Corporation, Electronic Systems Engineer, Systems Division – Armonk, New York

Developed Mainframe computer CPU, Memory and Input and Output peripherals for S/370 and S/3090 platforms. Part of the design team for the first IBM PC products, responsible for power supplies, main computer circuit boards and Operating Systems integration. Also assigned to NASA in Houston, Cape Canaveral and Marshall space flight centers for launch control and space vehicle telecommunications using high frequency and microwave RF signals.

1983–1995 Textron Corporation

1977-1983 Textron Corporation, Sundstrand Division, Control Systems Engineer – Rockford, IL

Developed Electronic Control Systems for control of Aerospace applications generating power for inflight services, control of engine start, elevators, rudder and aileron controls. Subcontractor to Lockheed Martin for enhancements to the flight data recorder (Black Box) improving circuit mountings for improved crash survival. Developed control systems for off road construction equipment such as cement mixers, combines, bulldozers and high rise cranes.

Industry Certifications & Expertise

Certified Project Management Professional (PMI/PMP)
Certified in Governance of Enterprise IT (CGEIT)
Certified in Risk and Information Systems Control (CRISC)
Certified Information Systems Auditor (CISA)
Certified Information Security Manager (CISM)
Certified in Control Objectives of IT (COBIT)
Certified in Information Systems IT Infrastructure Library (ITIL) for Operations, Design and Configuration

FCC Amateur Extra Class License Holder
FCC Land Mobile License Holder
FCC Marine Mobile License Holder

High tech power management systems, UPS and power distribution
Switched Mode Power Supplies
Electrical and Electronic hardware engineering
Computer systems engineering
Radio Systems design and testing
High Current and High Voltage switches
Internet communications using both wired and wireless technologies
UL, CE (Europe), Africa, Japan, Australia and China product safety certifications
Cyber encryption and protection of Radio Communications using digital signals
RFI/EMI mitigation

Hold a US DOD Top Secret Clearance and am an instructor of information security encryption control and compliance to the US Missile Defense Agency, NASA, and US Department of Homeland Security.

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the application of CONSUMERS ENERGY COMPANY for authority to increase its rates for the generation and distribution of electricity and for other relief

Case No. **U-18322**

/

EXHIBIT RCG-3 (WSB-2)

TO

DIRECT TESTIMONY AND EXHIBIT OF WILLIAM S. BATHGATE

On Behalf of

Residential Customer Group

August 15, 2017

My Energy Readings

William S. Bathgate

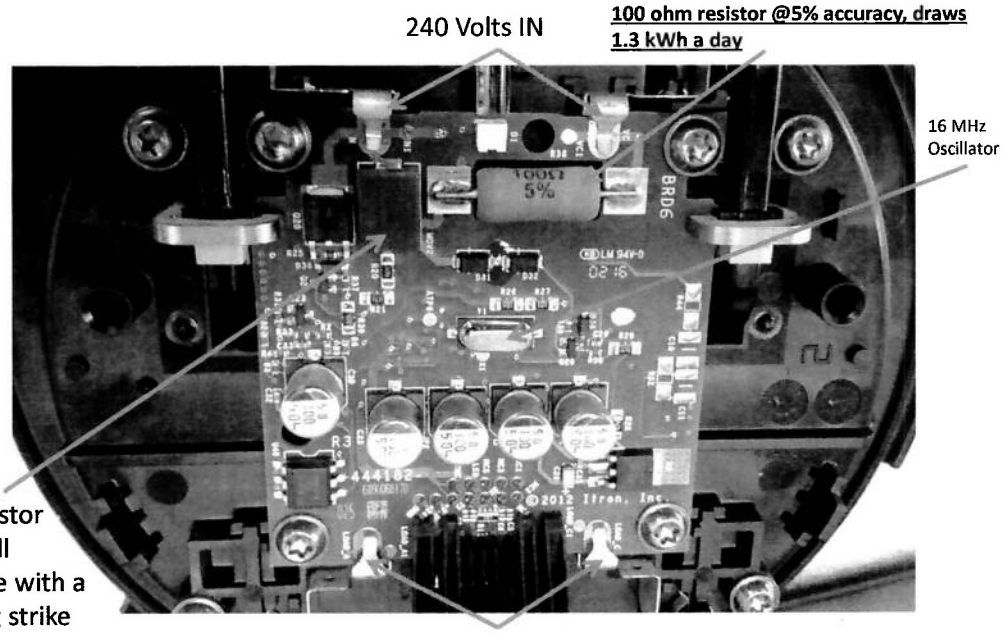
The following information is to support the testimony found in Exhibit RCG-3 (WSB-3)

The first page shows the AMI meter SMPS board noting the location of the 100 ohm resorts that draws 1.3 kWh per day.

The purpose of this second page of this exhibit is to document the energy consumed by the AMI meter at idle on a home with no power breakers on. No branch circuit breakers were turned on and exterior temperatures were in 60's during daylight hours and 45 degrees overnight.

The third page of this exhibit shows the cost per kWh are based on current rates inclusive of distribution charges and fuel optimization costs. The costs can vary based on time of year or tariff effective dates, but are mathematically sound determination of cost factors. Also is the environmental impact of this added energy in CO2

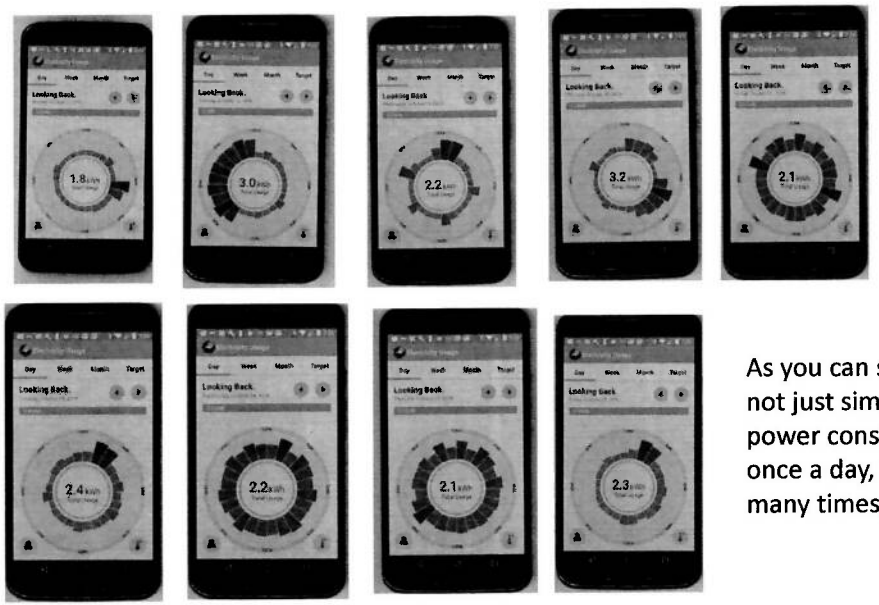
The ITRON Meter SMPS Board



You will notice that there is no Common & Differential mode filter circuit at all, no coil, no fuse and no differential capacitor filter

My Energy Readings

Avg. Daily AMI kWh Use 2.37 kWh @ 0.139 per kWh = $0.319 x (865 kWh/Yr.)



As you can see this is not just simply reading power consumption once a day, but is done many times, all day

Note – No breakers were on and the time and reading of the meter is not a simple "Text" message

Impact to the Environment

Annual Cost per Customer	Rev $ for DTE	Rev $ for CE	kWh per DTE	kWh per CE	CO^2 Per DTE	CO^2 Per CE
$120.67/Yr.	$253.42M	$217.21M	1.816B	1.521B	3.924BT	3.879BT

Total Consumer Costs Yr.	Total kWh Consumed Yr.	Total CO^2 Per Yr. (Coal @ 2.16 lbs kWh)
$470.63M	3.337B	7.803BT

Conclusion: There is absolutely NO evidence the AMI Meter program saves CO^2, energy in kWh or money, in fact it only drains the bank accounts of the consumer, pads utility revenue and adds to Global Warming.

The only way the AMI program will save kWh's is to use it to aggressively ration power to consumers via Demand Response/Time of Use rate structures at 4-10 X normal rates where the elderly, disabled and young families with a parent and small children at home can least afford it or do without power during the Demand Response/Time of Use period. Under this scenario the AMI program is the largest fleecing of the consumer to ever exist and a deception to our citizens regarding reducing costs, CO^2 and protecting our environment.

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the application of CONSUMERS ENERGY COMPANY for authority to increase its rates for the generation and distribution of electricity and for other relief

Case No. **U-18322**

_____/

EXHIBIT RCG-4 (WSB-3)

TO

DIRECT TESTIMONY AND EXHIBIT OF WILLIAM S. BATHGATE

On Behalf of

Residential Customer Group

August 15, 2017

EMI/RFI from the AMI Meter

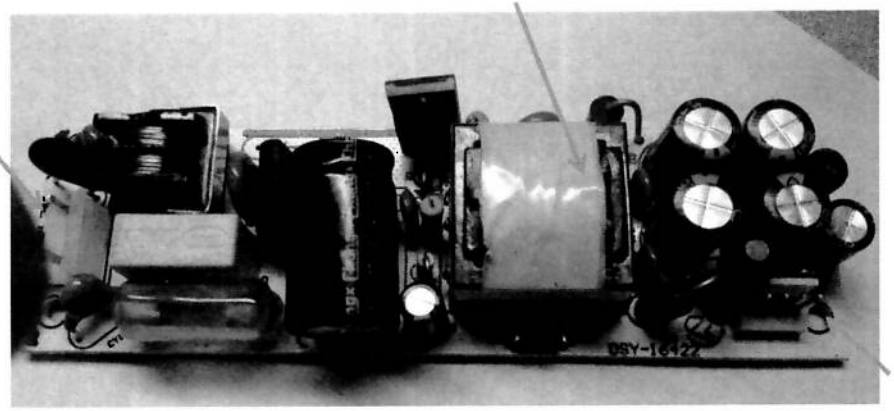
This set of pages shows what a proper UL approved 240 Volt AC to 12 Volt DC Switched Mode Power Supply versus the AMI Meter

SMPS with Proper differential and Common Mode Filter – UL Approved Example

Please note this is an example of a UL approved 240 Volt AC to 12 Volt DC SMPS
This design does not inject high frequency oscillations onto the incoming AC line because it has a common mode & differential filter circuit (left hand side of the circuit board)

Transformer that converts 240 volts to 12 volts

AC In

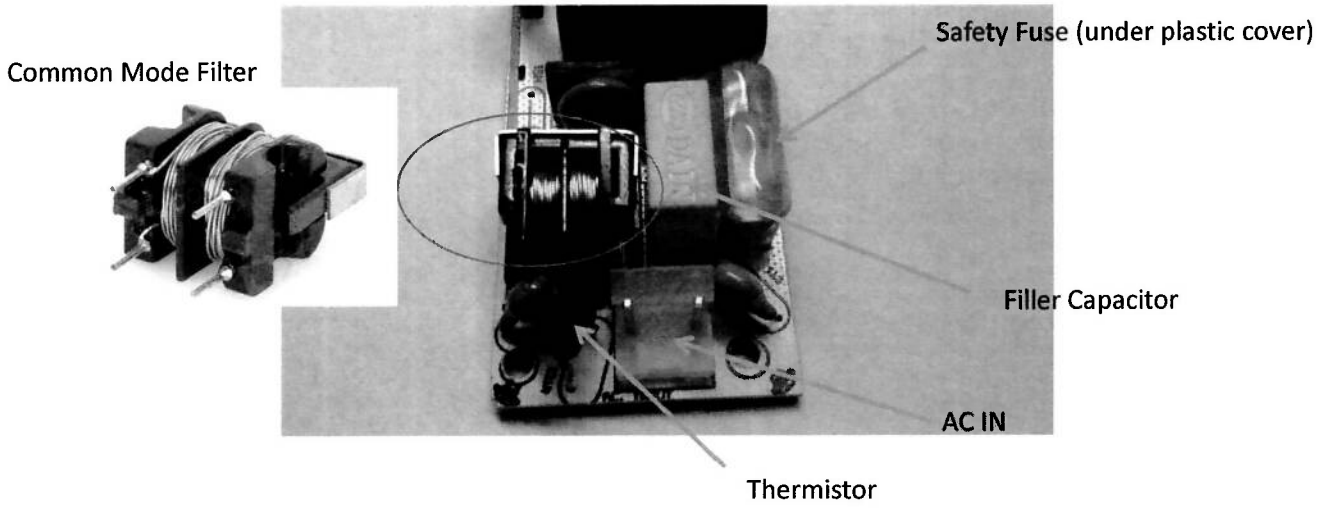


DC Out

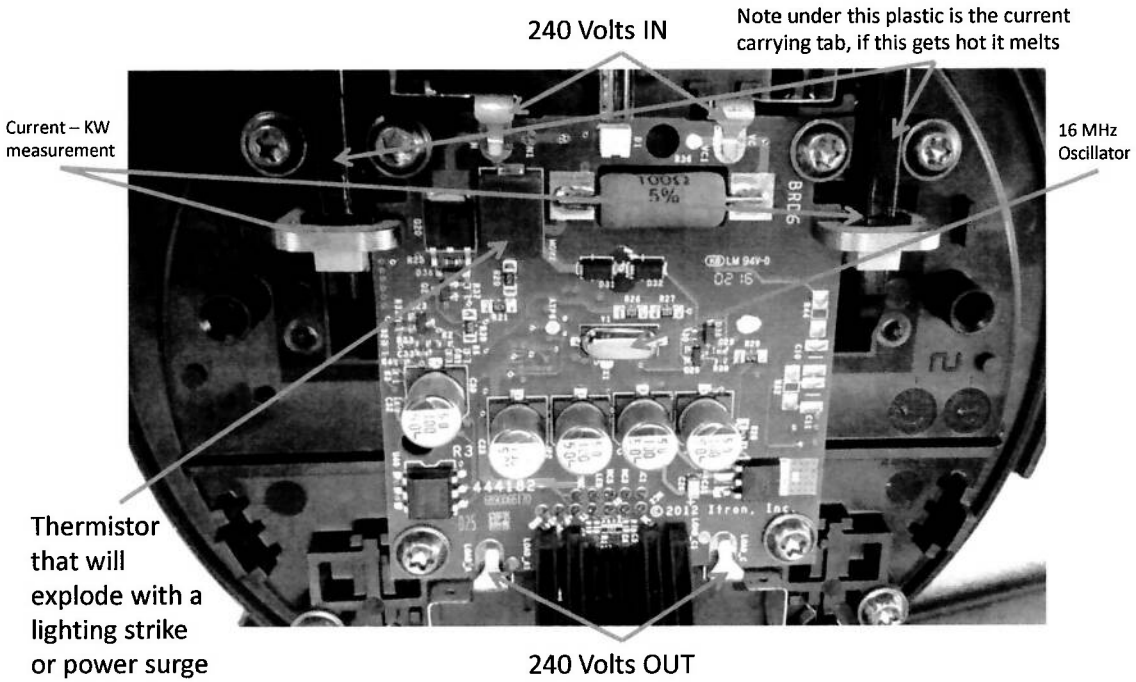
Note the DC Out has + - and a ground lead (center) which is connected to a true ground

Common Mode Filter - Sample

Please note this is an example of the Common Mode Filter in the design example

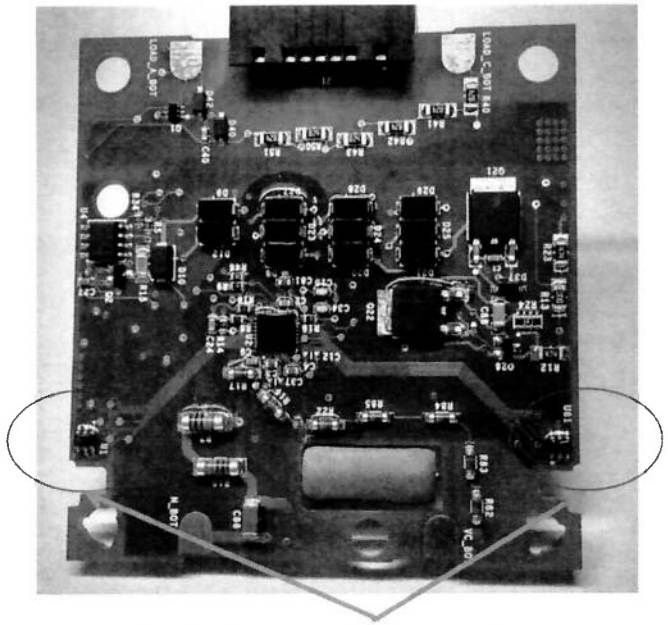


The ITRON Meter SMPS Board



You will notice that there is no Common & Differential mode filter circuit at all, no coil, no fuse and no differential capacitor filter

The ITRON Meter SMPS Board – Back Side of Board



Here are the hall effect sensors that are used to measure Current/kWh

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the application of CONSUMERS ENERGY COMPANY for authority to increase its rates for the generation and distribution of electricity and for other relief

Case No. **U-18322**

/

EXHIBIT RCG-5 (WSB-4)

TO

DIRECT TESTIMONY AND EXHIBIT OF WILLIAM S. BATHGATE

On Behalf of

Residential Customer Group

August 15, 2017

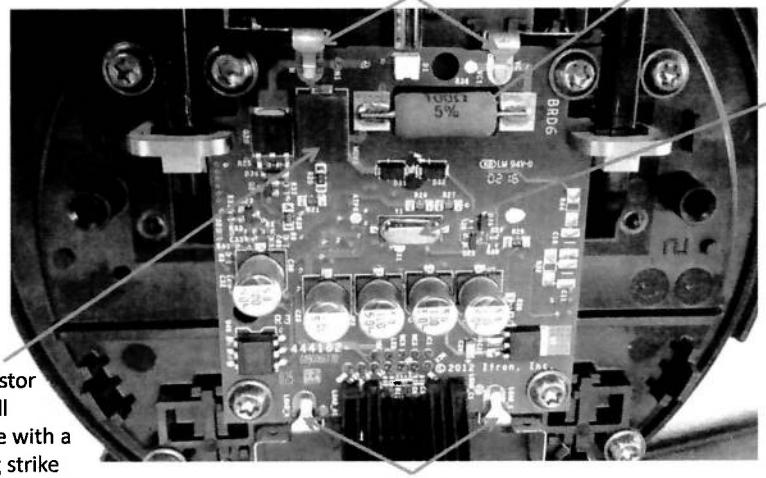
The Power to Run the AMI meter

This next page shows the location of the 100 ohm resistor that consume 1.3 kWh and is a large part of the total 2.37 kWh required to run the meter by itself. The balance of the power 1.07 kWh to make up the total is consumed within the other two remaining boards.

The ITRON Meter SMPS Board

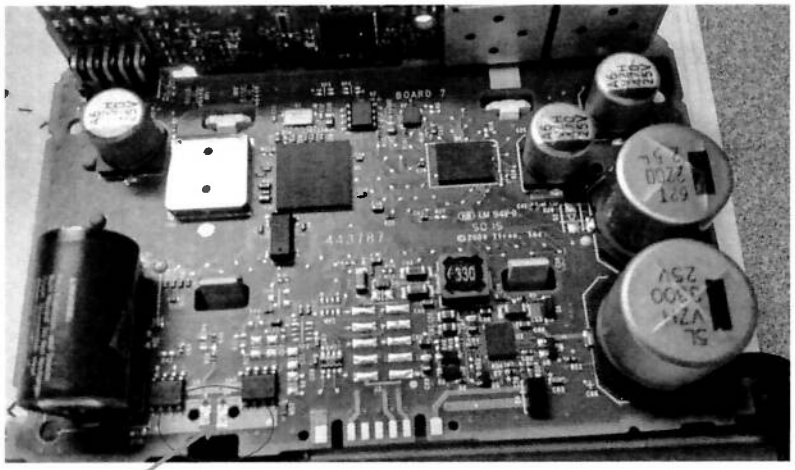
240 Volts IN

100 ohm resistor @5% accuracy, draws 1.3 kWh a day



You will notice that there is no Common & Differential mode filter circuit at all, no coil, no fuse and no differential capacitor filter

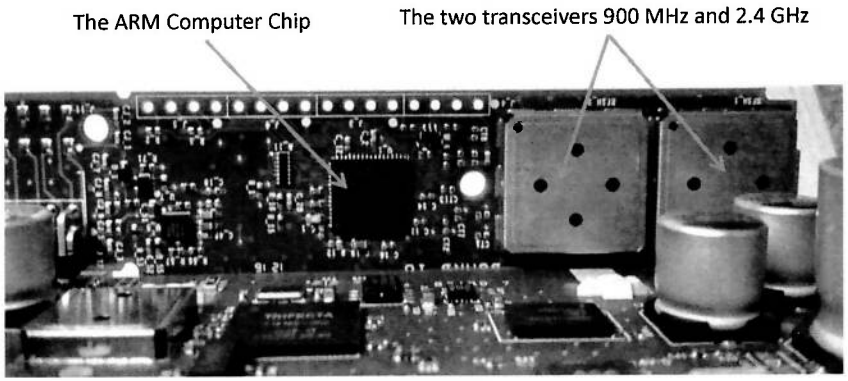
The ITRON Meter System Board



To the disconnect solenoid (24 V)

In this photo is the metrology memory board and additional voltages for the disconnect solenoid (24 V) and is used for the LCD display (on Back of this board)

The ITRON Meter Computer and RF Transceiver Board



In this photo is the computer chip (ARM Chip) board and the two transceivers

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the application of CONSUMERS ENERGY COMPANY for authority to increase its rates for the generation and distribution of electricity and for other relief

Case No. **U-18322**

/

EXHIBIT RCG-6 (WSB-5)

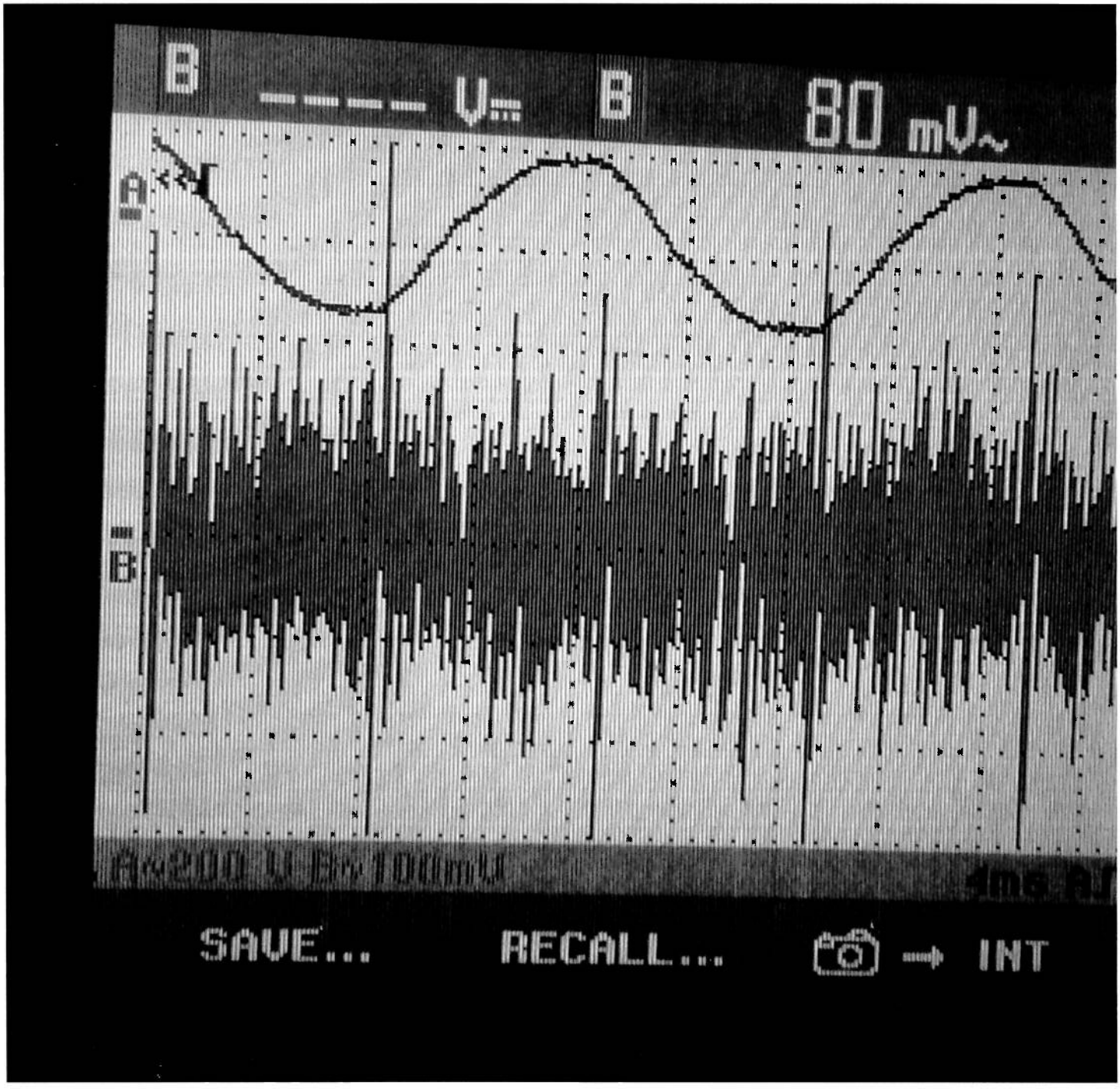
TO

DIRECT TESTIMONY AND EXHIBIT OF WILLIAM S. BATHGATE

On Behalf of

Residential Customer Group

August 15, 2017


B
B
80 mV~
A
B
SAVE...
RECALL...
INT

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the application of CONSUMERS ENERGY COMPANY for authority to increase its rates for the generation and distribution of electricity and for other relief

Case No. **U-18322**

/

EXHIBIT RCG-7 (WSB-6)

TO

DIRECT TESTIMONY AND EXHIBIT OF WILLIAM S. BATHGATE

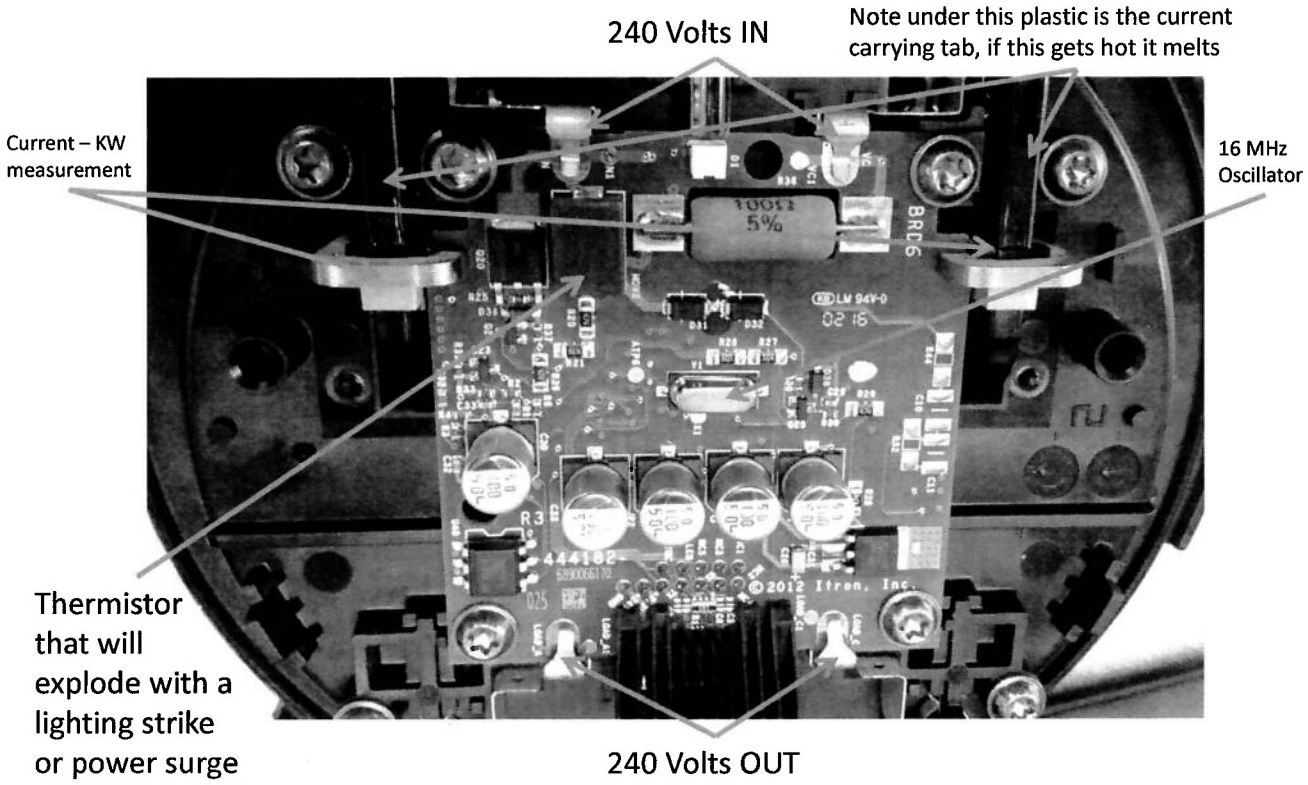
On Behalf of

Residential Customer Group

August 15, 2017

Explosive Parts in an AMI meter

The ITRON Meter SMPS Board



You will notice that there is no Common & Differential mode filter circuit at all, no coil, no fuse and no differential capacitor filter

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the application of CONSUMERS ENERGY COMPANY for authority to increase its rates for the generation and distribution of electricity and for other relief

Case No. **U-18322**

/

EXHIBIT RCG-8 (WSB-7)

TO

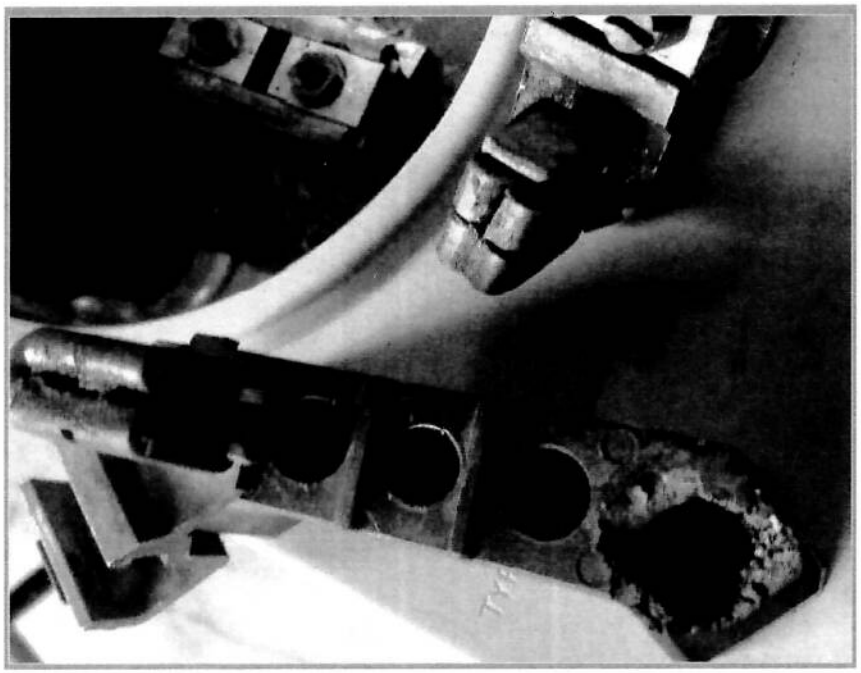
DIRECT TESTIMONY AND EXHIBIT OF WILLIAM S. BATHGATE

On Behalf of

Residential Customer Group

August 15, 2017

Bad Contacts from AMI meter installed



STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the application of CONSUMERS ENERGY COMPANY for authority to increase its rates for the generation and distribution of electricity and for other relief

Case No. **U-18322**

_____/

EXHIBIT RCG-9 (WSB-8)

TO

DIRECT TESTIMONY AND EXHIBIT OF WILLIAM S. BATHGATE

On Behalf of

Residential Customer Group

August 15, 2017

Module 8:

EMC Regulations

Introduction

The goal of electromagnetic compatibility, or EMC, is to design electronic systems that are electromagnetically compatible with their environment. EMC requirements exist so that electronic systems designers have a set of guidelines that explain the limits of what is considered electromagnetically compatible. There is not, however, one all-encompassing set of EMC guidelines. Instead, EMC guidelines are created by individual product manufacturers, and by the government. Requirements set forth by the government are legal requirements that products must meet, while the requirements set forth by the manufacturer are self-imposed and often more stringent than those set forth by the government.

Government Requirements

Not all countries have the same EMC requirements. In fact, each country is responsible to enforce their own set of requirements. This does not, however, mean that each country has a unique set of EMC requirements. In fact, the various EMC requirements set forth by all the countries of the world are very similar, and many countries are moving toward accepting an international standard for EMC requirements know as the CISPR 22 standards. These standards have been adopted throughout much of Europe and were developed in 1985 by CISPR (the French translation meaning International Special Committee on Radio Interference).

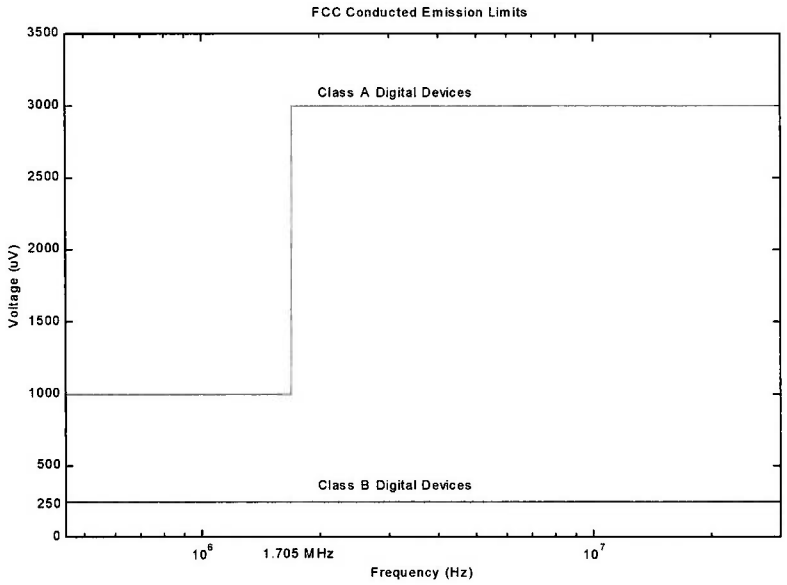
In the United States the Federal Communications Commission (FCC) is charged with the regulation of radio and wire communication. Radio frequency devices are the primary concern in EMC. A radio frequency device is defined by the FCC as any device that is capable of emitting radio frequency energy by radiation, conduction or other means whether intentionally or not. Radio frequencies are defined by the FCC to be the range of frequencies extending from 9 kHz to 3000 GHz. Some examples of radio frequency devices are digital computers whose clock signals generate radiated emissions, blenders that have dc motors where arcing at the brushes generates energy in this frequency range, and televisions that employ digital circuitry. In fact nearly all digital devices are considered radio frequency devices.

With the advent of computers and other digital devices becoming popular, the FCC realized that it was necessary to impose limits on the electromagnetic emissions of these devices in order to minimize the potential that they would interfere with radio and wire communications. As a result the FCC set limits on the radiated and conducted emissions of digital devices. Digital devices are defined by the FCC as any unintentional radiator (device or system) that generates and uses timing pulses at a rate in excess of 9000 pulses (cycles) per second and uses digital techniques... . All electronic devices with digital circuitry and a clock signal in excess of 9 kHz are covered under this rule, although there are a few exceptions.

The law makes it illegal to market digital devices that have not had their conducted and radiated emissions measured and verified to be within the limits set for by the FCC regulations. This means that digital devices that have not been measured to pass the requirements can not be sold, marketed, shipped, or even be offered for sale. Although the

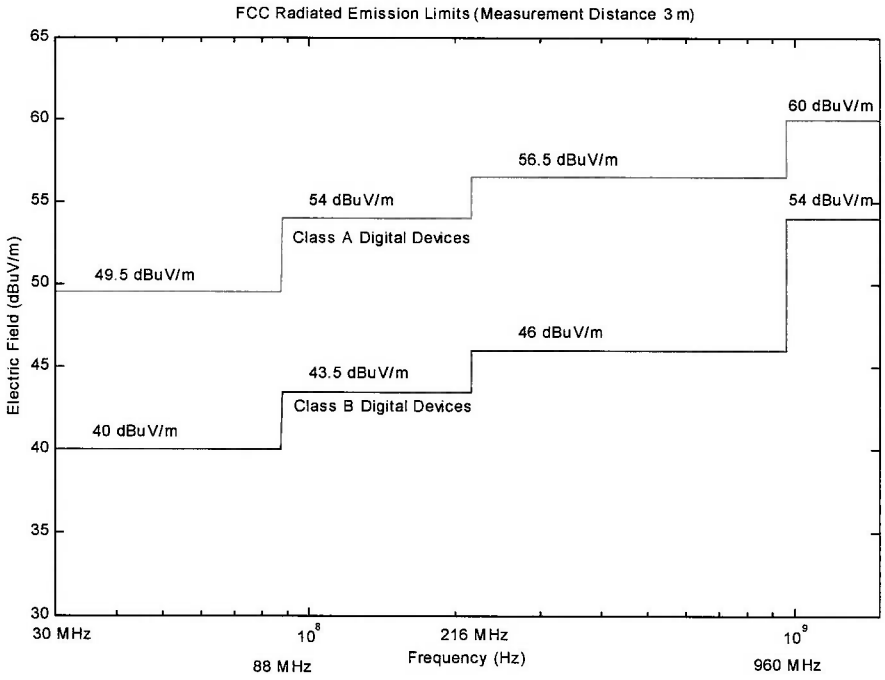
penalties for violating these regulations include fines and or jail time, companies are more concerned with the negative publicity that would ensue once it became known that they had marketed a product that fails to meet FCC regulations. Furthermore, if the product in question were already made available to the public, the company would be forced to recall the product. Thus it is important that every unit that a company produces is FCC compliant. Although the FCC does not test each and every module, they do perform random tests on products and if a single unit fails to comply, the entire product line can be recalled.

The FCC has different sets of regulations for different types of digital devices. Devices that are marketed for use in commercial, industrial or business environments are classified as Class A digital devices. Devices that are marketed for us in residential environments, notwithstanding their use in commercial, industrial, or business environments are classified as Class B digital devices. In general the regulations for Class B devices are more stringent than those for Class A devices. This is because in general digital devices are in closer proximity in residential environments, and the owners of the devices are less likely to have the abilities and or resources to correct potential problems. The following table shows a comparison of the Class A and Class B conducted emissions limits, where you can clearly see that the regulation for Class B devices are more strict than those for Class A devices. A comparison for radiated emissions will be shown later. Personal computers are a subcategory of Class B devices and are regulated more strictly than other digital devices. Computer manufacturers must test their devices and submit their test results to the FCC. No other digital devices require that test data be sent to the FCC, rather the manufacturer is expected to test their own devices to be sure they are electromagnetically compatible and the FCC will police the industry through testing of random product samples.



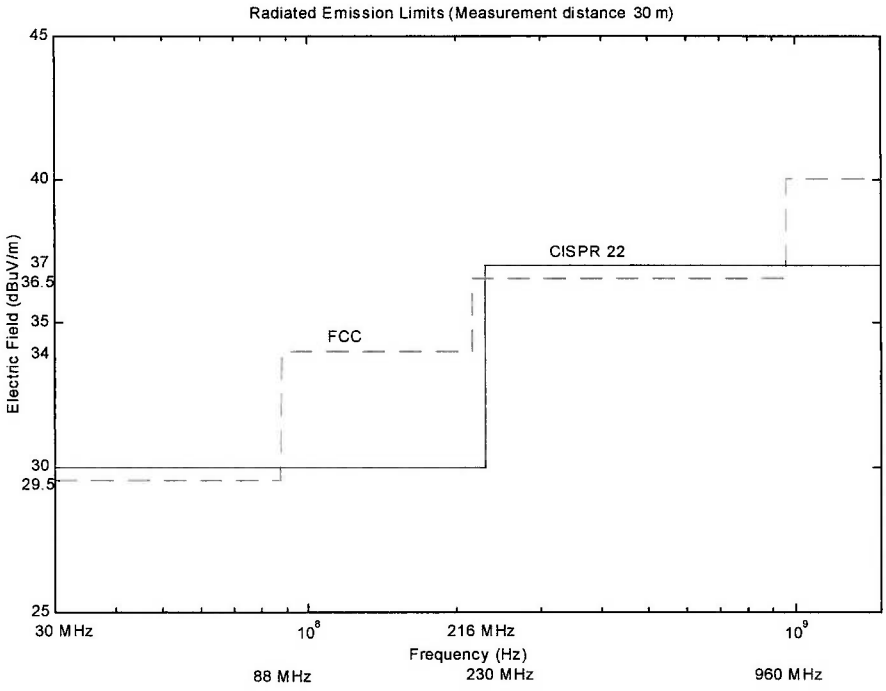
Since the FCC regulations are concerned with radiated and conducted emissions of digital products, it is useful to understand what these emissions are. Conducted emissions are the currents that are passed out through the unit's AC power cord and placed on the common power net. Conducted emissions are undesirable because once these currents are onto the building wiring they radiate very efficiently as the network of wires acts like a large antenna. The frequency range of conducted emissions extends from 450 kHz to 30 MHz. Devices are tested for compliance with conducted emissions regulations by inserting a line impedance stabilization network (LISN) into the unit's AC power cord. Current passes through the AC power line and into the LISN, which measures the interference current and outputs a voltage for measurement purposes. The actual FCC regulations set limits on these output voltages from the LISN even though the current is what is truly being regulated. Radiated emissions are the electric and magnetic fields radiated by the device that may be received by other devices, and cause interference in those devices. Although radiated emissions are both electric and magnetic fields, the FCC and other regulatory agencies only require that electric fields be measured for certification. The magnitudes of these fields are measured in dBμV/m and the frequency range for radiated emissions extends from 30 MHz to 40 GHz. Radiated field measurements for FCC compliance are done in either a semianechoic chamber or at an open field test site. The product under test must be rotated so that the maximum radiation will be achieved and measurements must be made both with the measurement antenna in vertical and horizontal polarizations with respect to the ground plane.

The method for measuring radiated emissions varies depending on the type of device being measured. Class A digital devices must be measured at a distance of 10 m from the product and Class B devices are to be measured at a distance of 3 m from the product. As explained earlier, the Class B devices, which are marketed for residential use, have stricter regulations and thus must be measured in closer proximity than Class A devices. The following graph displays the radiated emission limits that are defined by the FCC for Class A and Class B digital devices. Because the measurement distances defined by the two requirements are different, we must scale the measurement distances so that they are both at the same distances in order to achieve an accurate comparison. One way to do this is with the inverse distance method, which assumes that emissions fall off linearly with increasing distance to the measurement antenna. Thus emissions at 3 m are assumed to be reduced by 3/10 if the antenna is moved out to a distance of 10 m. So, to translate Class A limits from a distance of 10 m to 3 m , we add $20\log_{10}(3/10) = 10.46$ dB to the Class A limits. This approximation is only valid, however, if the measurements are taken in the far field of the emitter. We can assume that the far field boundary is three wavelengths from the emitter, and with the radiated emissions frequency range defined as 30 MHz to 40 GHz, the maximum distance from the emitter that the measurements will be in the far field is 30 m. Thus, at 10 m not all measurements will be in the far field. At 10 m frequencies of 90 MHz and higher will be in the far zone. So, for the case of this plot, the inverse distance method can be assumed to be accurate for frequencies above 90 MHz, but begins to break down at lower frequencies. However, this comparison still nicely demonstrated how Class B limits tend to be roughly 10 dB more strict than Class A radiated emission requirements.

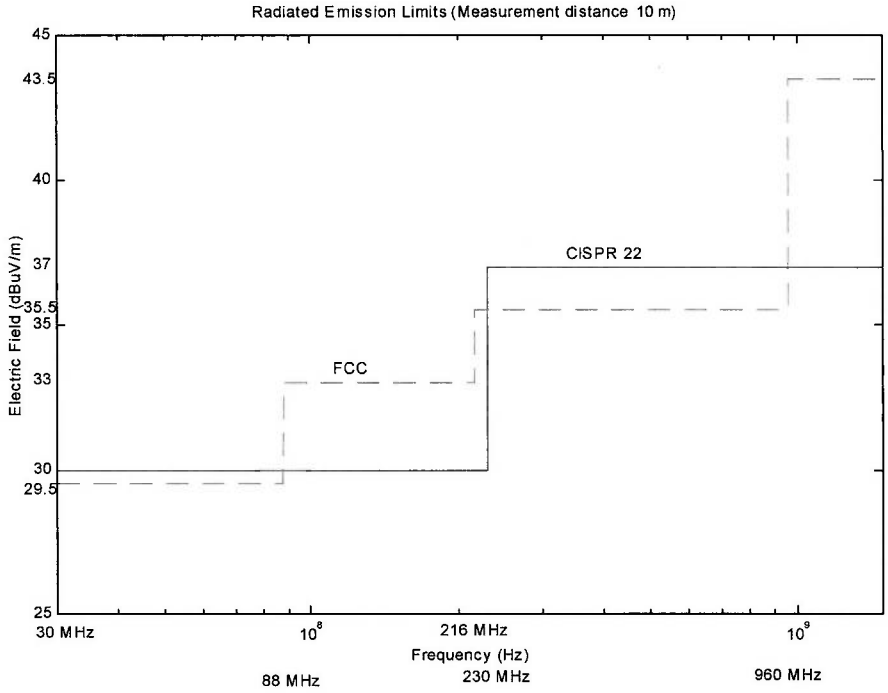


Internationally EMC requirements differ from those in the United States. As discussed earlier, each country is responsible for its own set of EMC regulations. Since the CISPR 22 regulations have been adopted by several countries we will examine them and compare them to the FCC regulations in the United States. CISPR 22 regulations require that radiated emissions measurements for Class A devices be measured at a distance of 30 m and Class B devices be measured at a distance of 10 m. Again using the inverse distance method, we can scale the measurement limits to a common distance and plot the CISPR 22 and FCC regulations together to compare them. As you can see, although the regulations vary slightly in different frequency ranges, there isn't much difference between the FCC and CISPR 22 regulations for radiated emissions.

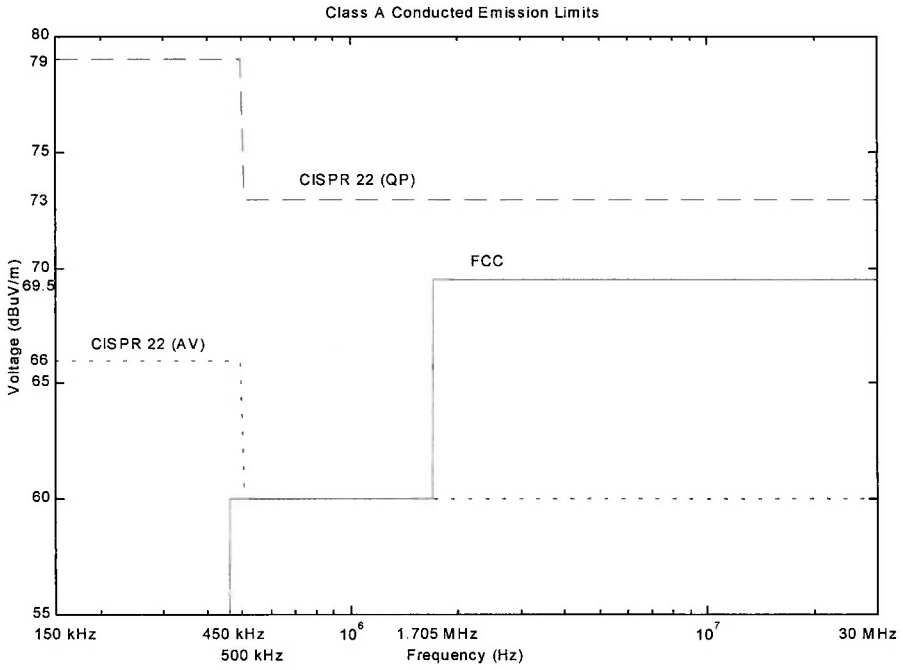
Radiated Emissions Limits for Class A Digital Devices

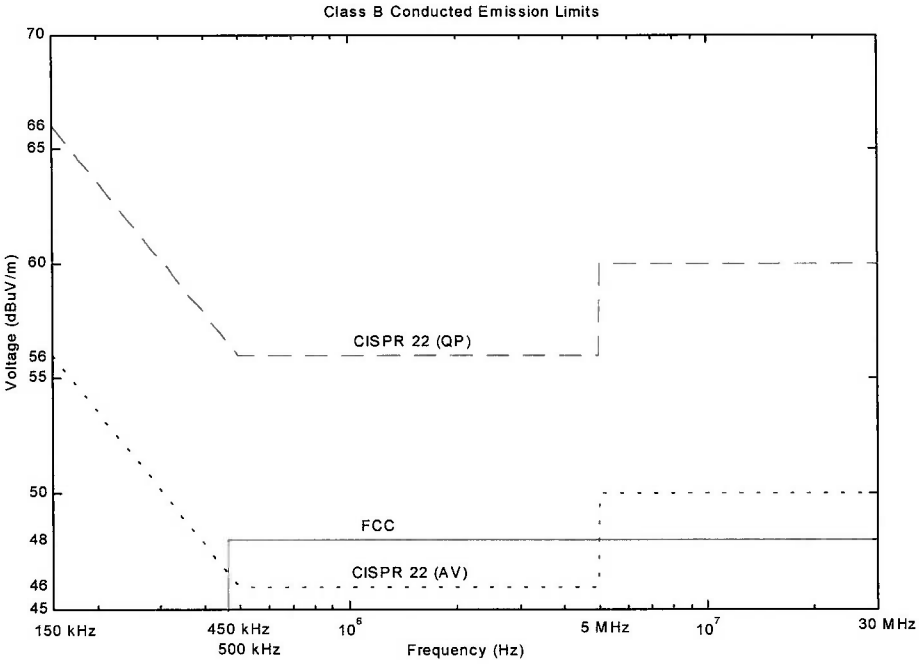


Radiated Emissions Limits for Class B Digital Devices



The differences in the FCC and CISPR 22 regulations become much more obvious when looking at the conducted emissions limits. The most notable difference is the frequency range that is regulated for conducted emissions. While they both have a maximum frequency of 30 MHz, the CISPR 22 regulations extend down to 150 kHz, while the FCC regulations only extend down to 450 kHz. You can see that the CISPR 22 limit for class B devices rises for frequencies below 500 kHz. This extension was put in place to cover the emissions of switching power supplies, which are growing in importance over linear power supplies due to their efficiency and light weight. Another difference is that the CISPR 22 regulations for conducted emissions are given for when the receiver uses a quasi-peak detector (QP) and when the receiver uses an average detector (AV). FCC conducted emissions limits and CISPR 22 and FCC conducted emissions limits all apply to the use of a quasi-peak detector.



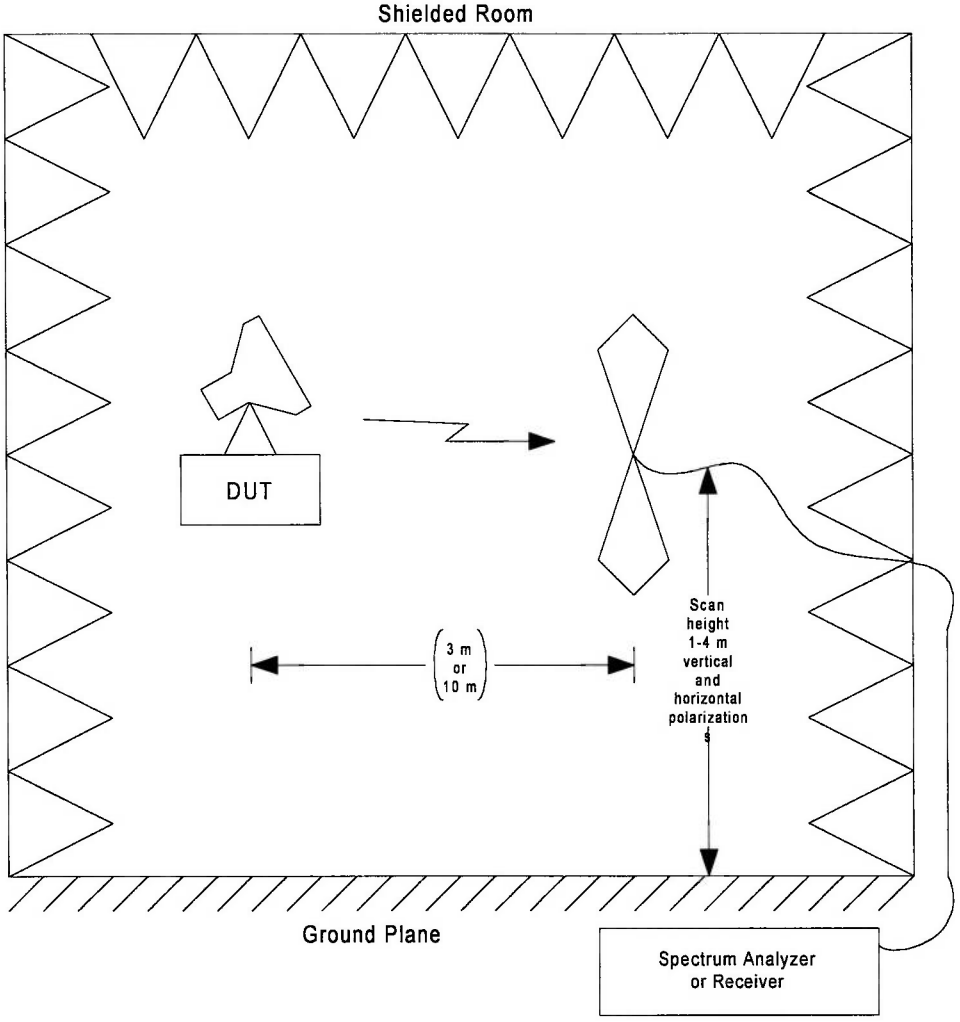


Military EMC regulations also exist. As you would expect, EMC issues are very important in military applications so that missions will not be compromised. Along with conducted and radiated emissions, the military also regulates susceptibility. This is very important in military applications, as it is vital that military equipment is immune to outside interference. The military is more strict in its regulations than the FCC or CISPR and it also has a much larger frequency range that is regulated and has several subdivisions within that frequency range. Additionally, the military may deem to have the EMC requirements waived for certain applications if it is judged that it is necessary to mission success. CISPR and FCC regulations cannot be waived for commercial products.

Measuring Radiated Emissions

In order to ensure that testing for radiated emissions are accurate, the FCC and CISPR have testing standards that explain how testing must be done. This ensures that the testing is accurate and repeatable. For radiated emissions the FCC specifies that the measurements of radiated and conducted emissions must be performed on the complete system. All interconnect cables to peripheral equipment must be connected and the system must be in a typical configuration. The cables and the system must also be configured in a representative way such that the emissions are maximized. For instance, a unit with interior wire harnesses must have the harnesses configured in such that for all possible ways the unit can be assembled with those wire harnesses, the way with the most radiated emissions must be tested. This ensures that for mass production of a unit, the worst case scenario is taken into consideration.

The testing standards set forth by the FCC for radiated emissions testing are very specific and difficult to automate. Radiated emissions are to be measured at a distance of 10 m for Class A devices and at a distance of 3 m for Class B devices. These measurements are to be made over a ground plane using a tuned dipole antenna at an open field test site. Additionally, the tests are to be made with the measurement antenna in both the vertical and horizontal positions. During development of products, however, most companies test their products in a semianechoic chamber, which is a shielded room with radio frequency absorbing cones on the walls and ceiling. This semianechoic chamber simulates an open field test site, and eliminates any ambientambient signals that may be present in an open field environment. An example of this setup can be seen in the following figure.



Another way that companies simplify the FCC test procedure is by using a broadband antenna such as a log-periodic or discone antenna. Such antennas are desireable since,

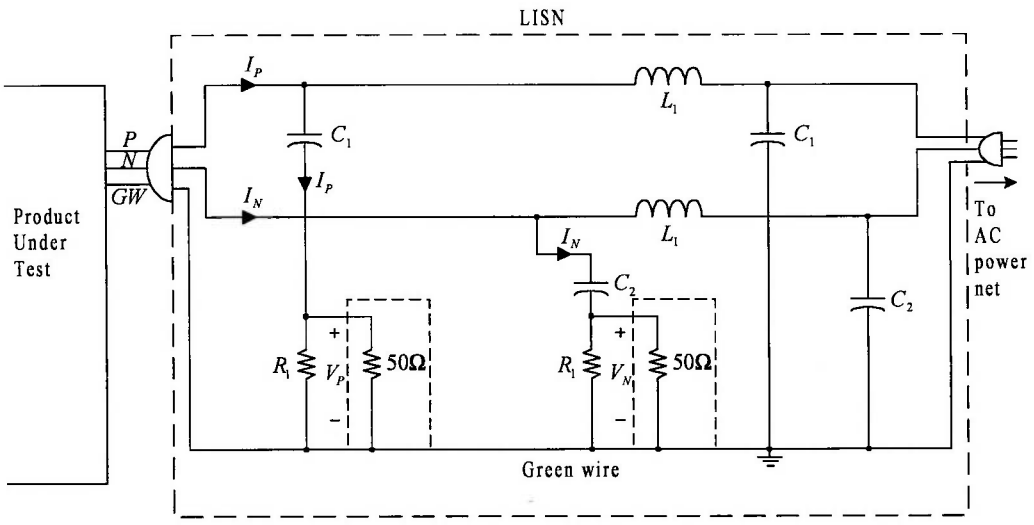
unlike a tuned dipole, their length does not need to be adjusted with each frequency change. This allows companies to test their products using a frequency sweep rather than having to do each frequency separately and adjusting the dipole lengths with each measurement.

One last test requirement for radiated emissions testing is the bandwidth of the receiver being used to measure the signal must be at least 100 kHz. By having such a large bandwidth, the test will not pick up intended narrowband signals such as clock signals, but it will detect emissions from broadband sources such as the arcing at the brushes of a dc motor. A related issue is the detector used in the output stage of the receiver. Although typical spectrum analyzers us peak detectors, the FCC and CISPR test procedures require that the receiver use a quasi-peak detector. This ensures that fast changing, momentary signals such as randomly occurring spikes will not charge up the quasi-peak detector to as high a level as periodic signals. After all, the FCC is not concerned with randomly occurring one time signals. Rather, they are concerned with more significant and frequent emissions that would cause interference with radio and wire communications.

Measurement Requirements for Conducted Emissions

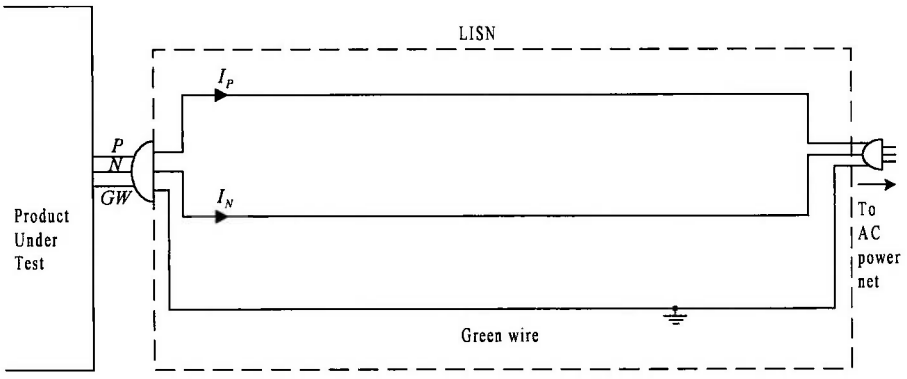
The intent of conducted emissions limits is to prevent noise currents from passing out through the AC power cord of the device onto the common power net of the installation. The common power net of an installation is an array of interconnected wires in the installation walls, and can be seen as a large antenna. Noise currents placed onto the common power net will consequently radiate very efficiently. An example of this is the interference that occurs on your television or radio when you use the blender. The arcing of the brushes of the dc motor in the blender causes noise currents that pass out through the power cord of the blender and into the common power net of your house. The wiring in the house acts as an antenna and radiates the noise, which is picked up as interference in your television and radio.

Therefore, conducted emissions are concerned with the current that is passed out through the power cord of the device. However, the FCC and CISPR 22 conducted emission limits are given in units of volts. This is because the LISN, which is used to measure conducted emissions converts the noise currents to voltage. In order to understand the function of the LISN it is important to understand the standard ac power distribution system. In the United States, AC voltage used in residential and business environments has a frequency of 60 Hz and an RMS voltage of 120 V. The power wires in a home consist of 3 wires, a phase wire, a neutral wire, and the green wire. Both the phase and neutral wires carry the 60 Hz power and the potential between each wire and ground is 120 V. The currents that need to be measured for conducted emissions tests are the currents that occur on the phase and neutral wires.

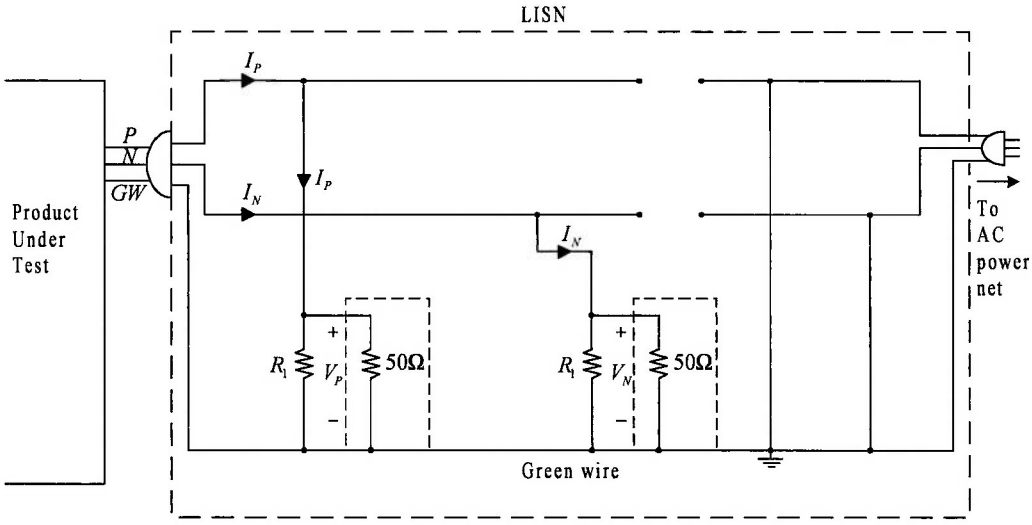


The above figure shows the LISN used for FCC conducted emissions tests. A similar LISN is used for CISPR 22 conducted emissions testing, but the component values are different due to the different frequency range defined by CISPR for conducted emissions testing. The LISN has two functions. The first function is to isolate external noise from the common ac net from contaminating the measurement. The second purpose of the LISN is to present a constant impedance in frequency from site to site to the product between phase and ground and between neutral and ground.

Following is an explanation of how the LISN works. First, one of the 50 Ω resistors represents the input impedance of the spectrum analyzer, and the other 50 Ω resistor is a dummy load. The capacitors C_1 =0.1 μF is in place to prevent any dc from overloading the test receiver and the resistors R_1=1kW are in place to provide a path an path for C_1 to discharge in the event the 50 Ω resistors are disconnected. The product under test should operate normally at 60 Hz power frequencies. Thus, at 60 Hz the capacitors will look like open circuits and the inductors will look like short circuits, and the equivalent circuit will look like this:



Thus the product under test will operate as if there were nothing between it and the ac power net at 60 Hz. In the frequency range of conducted emissions (450 kHz-30 MHz), however, the conductors will look like short circuits and the inductors will look like open circuits. The equivalent circuit will look like this:



Thus, the currents on the neutral and phase lines can be isolated and measured at the 50 Ω resistors. Notice that the currents on the phase and neutral lines have no path that they can get onto the ac power net with.

Additional Product Requirements

As stated earlier, the FCC and CISPR 22 regulations are requirements set forth by law to regulate digital devices. Individual companies, however, self impose their own set of regulations on their products, which are often much more stringent than the required regulations. The automobile industry, for example is exempt from FCC requirements, yet their self-imposed regulations far exceed those that the FCC sets forth for normal digital devices. This is because companies stand to lose far more money as a result of a faulty or poorly designed product, than they would by investing to make sure their product is safe and well designed. After all, people put their lives in the hands of auto manufacturers every time they drive a vehicle, and auto manufacturers cannot afford to have lax standards.

Aside from imposing stricter versions of government regulations on themselves, many companies also impose design constraints on their products that protect against, radiated immunity, conducted immunity, and electrostatic discharge (ESD). The FCC does not regulate these areas because they do not pose a threat to radio or wire communications, so individual manufacturers are left to create their own standards. Furthermore, as each of

these categories pertains to a products ability to function despite outside interference, they are of the utmost importance for manufacturers to guard against. Radiated immunity is a products ability to operate in the face of high power transmitters, such as AM and FM transmitters and airport surveillance radars. Manufacturers test their products by illuminating their product with typical waveforms and signal strengths that simulate worst case exposure that the product could encounter. Conducted immunity is the ability of a product to operate despite a variety of interferences that enter the device via the ac power cord. An obvious example of such interference would be a power surge caused by lightning strike. Manufacturers must design tests that would simulate the effect of lightning induced transients and design their product to resist such interference accordingly. Electrostatic discharge is when static charge builds up on the human body or furniture and is subsequently discharged to the product when the person or furniture comes in contact with the product. Such static voltage can approach 25 kV in magnitude. When the discharge through the product occurs, large currents momentarily coarse through the product. These currents can cause machines to reset, IC memories to clear, etc. Manufacturers test their products by subjecting them to controlled ESD events and design their product to operate successfully in the event of such ESD occurances.

References

1. Paul, C. Introduction to Electromagnetic Compatibility, John Wiley & Sons, 1992

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the application of CONSUMERS ENERGY COMPANY for authority to increase its rates for the generation and distribution of electricity and for other relief

Case No. **U-18322**

/

EXHIBIT RCG-10 (WSB-9)

TO

DIRECT TESTIMONY AND EXHIBIT OF WILLIAM S. BATHGATE

On Behalf of

Residential Customer Group

August 15, 2017

Design Practices for Military EMC and Environmental Compliance

BY MILITARY EMC STAFF, INTERTEK

The reliable operation of complex electronic communications, control and armament systems in extreme environments demands stringent design criteria and careful validation. Severe shock, vibration, heat, humidity and airborne contaminants are common in land, sea and air platforms.

Coupled with dense packaging, high-power radio and radar illumination, Hazards of Electromagnetic Radiation to Ordnance (HERO), and a possible electromagnetic pulse (EMP), the military equipment environmental requirements can be extreme indeed.

In order to expedite equipment availability and reduce cost, the acquisition of commercial-off-the-shelf (COTS) equipment for US military applications is an attractive consideration. But many types of commercial equipment are unlikely to meet all military environmental requirements as manufactured, so some modification or re-design is usually needed. Defining the gap between the commercial equipment's environmental performance and its military expectations is a first step in determining its potential suitability.

The full cycle of US military product development from environmental assessment, to definition of requirements, to test reports, is carefully spelled out in the relevant military standards or ancillary documents for the applicable physical and electromagnetic environments. These provide the design guidance, along with competent engineering practices, for a cost-effective and robust military product design.

THE ELECTROMAGNETIC ENVIRONMENT

Electromagnetic compatibility (EMC) requires the component, equipment or system to perform its designed functions without causing or suffering unacceptable degradation due to electromagnetic interference to or from other equipment. The starting point for EMC is self-compatibility, where the final product or system does not interfere with its own operation. This is a basic requirement in military EMC standards; for example, in MIL-STD-461F clause 4.2.3:

> *The operational performance of an equipment or subsystem shall not be degraded, nor shall it malfunction, when all of the units or devices in the equipment or subsystem are operating together at their designed levels of efficiency or their design capability.*

As we shall see, this is the modest starting point for military EMC, which extends to both lower and higher frequencies than most commercial EMC standards and to both lower emission limits and much higher susceptibility requirements. Test methods generally differ from their commercial counterparts in both setup and detail.

History of Military EMC

EMC problems in commercial applications were first noted worldwide in the 1930s, when early broadcast radios were being installed in automobiles. Reception was degraded by ignition noise and electrostatic buildup caused by non-conductive rubber tires.

The first US military specification on EMC also addressed this problem. It was published by the US Army Signal Corps in 1934 as SCL-49, "Electrical Shielding and Radio Power Supply in Vehicles". It required shielding of the vehicle ignition system, regulator and generator. With the increased use of mobile military radio communications, SCL-49 became inadequate. In 1942 it was superseded by specification 71-1303, "Vehicular Radio Noise Suppression."

In the period 1950 - 1965, each major military agency imposed its own EMC specifications. The Air Force used MIL-I-6181 and MIL-I-26600; the Navy used MIL-I-16910; the Army used MIL-I-11748 and MIL-E-55301(EL). These specifications limited the levels of conducted and radiated emissions, and they set susceptibility levels which systems and equipment must reject. These specifications also detailed the test configurations and methods for demonstrating compliance.

Unfortunately, over this period of time the various military EMC standards diverged from each other in test frequency ranges, limits and required test equipment. The differences made it quite expensive for a test lab or manufacturer to be fully equipped to test to all EMC specifications.

In 1960 the US Department of Defense enacted a comprehensive electromagnetic compatibility program that charged the military services to build EMC into all of their communications and electronics equipment. In 1966, EMC personnel of the three military departments jointly drafted standards addressing the overall EMC needs of the Department of Defense. That program resulted in 1967 in military standards 461 (requirements), 462 (methods) and 463 (definitions and acronyms). After revision, MIL-STD-461A was issued in August 1968. Subsequent revisions were designated B, C, and D. MIL-STD-463 was withdrawn after 1990.

In 1999 the 461D and 462D standards were merged into one document, MIL-STD-461E. The current version is MIL-STD-461F (2007), and updates to it are in the planning stage. Prior revision levels A-E may still be specified for testing.

USA: Supporting Documentation

The designer of military electronic equipment has an abundance of guidance available for successfully meeting the EMC demands of the intended operating environments.

Standards

Active military standards (Table 1) specify a variety of scopes, environmental sub-categories, limits and test methods clearly and in great detail.

The most commonly-used MIL standards are 461 (subsystems and equipment) and 464 (systems), and they apply to ground-based, shipboard and airborne applications. Other

Reference	Title
MIL-STD-188-124	Grounding, Bonding and Shielding for Common Long Haul/Tactical Communications Systems Including Ground Based Communication-Electronics Facilities and Equipments
MIL-STD-188-125-1	High-Altitude Electromagnetic Pulse (HEMP) Protection For Ground-Based C41 Facilities Performing Critical, Time-Urgent Missions - Part 1 - Fixed Facilities
MIL-STD-188-125-2	High-Altitude Electromagnetic Pulse (HEMP) Protection For Ground-Based C4I Facilities Performing Critical, Time-Urgent Missions - Part 2 - TransporTable Systems
MIL-STD-331C	Environmental and Performance Tests for Fuze and Fuze Components
MIL-STD-449D	Measurement of Radio Frequency Spectrum Characteristics
MIL-STD-461F	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
MIL-STD-464A	Electromagnetic Environmental Effects – Requirements for Systems
MIL-STD-704F	Aircraft electric Power Characteristics
MIL-STD-1310H	Shipboard Bonding, Grounding, and other Techniques for Electromagnetic Compatibility, Electromagnetic Pulse (EMP) Mitigation, and Safety
MIL-STD-1377	Measurement of effectiveness of cable, connector, and weapons enclosure shielding and filters in precluding Hazards of electromagnetic radiation to ordnance
DOD-STD-1399-70-1	Interface Standard for Shipboard Systems – Section 070 – Part 1 – DC Magnetic Field Environment
MIL-STD-1399-300B	Interface Standard for Shipboard Systems – Section 300 - Electric Power, Alternating Current
MIL-STD-1541A	Electromagnetic Compatibility Requirements for Space Systems
MIL-STD-1542B	Electromagnetic Compatibility and Grounding Requirements for Space System Facilities
MIL-STD-1576	Electroexplosive Subsystem Safety Requirements and Test Methods for Space Systems
MIL-STD-1605A	Procedures for Conducting a Shipboard Electromagnetic Interference (EMI) Survey (Surface Ship)
MIL-STD-2169B	High Altitude Electromagnetic Pulse (HEMP) Environment.

Table 1: Active US military EMC standards for equipment, systems and facilities

government documents may apply to a specific platform or application, and some of these are listed in the standards such as MIL-STD-461 and -464.

Handbooks

In addition to the EMC standards listed in Table 1, there are a number of handbooks available that provide procedural, EMC assessment and design guidance for specific military applications. These provide guidance only, and are not to be construed as requirements. A list of relevant handbooks is given in Table 2.

Generally these handbooks are tutorial in nature, clearly written, and with explanations of the underlying physical principles. They provide invaluable assistance to the equipment or systems designer.

Data Item Descriptions

Finally, there are very detailed documentation specifications associated with military EMC standards. In some cases the required documentation is described in separate Data Item Descriptions (DIDs) or Test Operational Procedures (TOPs). These Data Item Descriptions cover EMC design procedures, test and verification procedures, and test reports. Table 3 contains a list of Data Item Descriptions and TOPs and the military standards with which they are associated.

For example, the Data Item Description DI-EMCS-80199C associated with standard MIL-STD-461F is very explicit in the level of detail to be provided regarding equipment design procedures:

*3.2. **Design techniques and procedures.** The EMICP [Electromagnetic Interference Control Procedures] shall describe the specific design techniques and procedures used to meet each emission and susceptibility requirement, including the following:*

a. Spectrum management techniques.

b. EMI mechanical design, including the following:

Reference	Title
MIL-HDBK-235B	Electromagnetic (Radiated) Environment Considerations for Design and Procurement of Electrical and Electronic Equipment, Subsystems and systems
MIL-HDBK-237D	Electromagnetic Environmental Effects and Spectrum Supportability Guidance for the Acquisition Process
MIL-HDBK-240	Hazards of Electromagnetic Radiation to Ordnance (HERO) Test Guide
MIL-HDBK-274	Electrical Grounding for Aircraft safety
MIL-HDBK-419A	Grounding, Bonding and Shielding for Electronic Equipments and Facilities, Volume 1 of 2 Basic Theory
MIL-HDBK-423	High-Altitude Electromagnetic Pulse (HEMP) Protection for Fixed and TransporTable Ground-Based C4 1 Facilities – Volume 1 – Fixed Facilities
MIL-HDBK-454B	General Guidelines for Electronic Equipment
MIL-HDBK-83575	General Handbook for Space Vehicle Wiring Harness Design and Testing
MIL-HDBK-83578	Criteria for Explosive Systems and Devices used on Space Vehicles

Table 2: Active US military handbooks relating to EMC

Reference	Title	Associated with
DI-EMCS-80199C	Electromagnetic Interference Control Procedures (EMICP)	MIL-STD-461F
DI-EMCS-80200C	Electromagnetic Interference Test Report (EMITR)	MIL-STD-461F
DI-EMCS-80201C	Electromagnetic Interference Test Procedures (EMITP)	MIL-STD-461F
DI-EMCS-81295A	Electromagnetic Effects Verification Procedures (EMEVP)	Engineering/manufacturing development phase - any
DI-EMCS-81528	Electromagnetic Compatibility Program Procedures	Demo of life cycle EMC compliance - any
DI-EMCS-81540A	Electromagnetic Environmental Effects (E3) Integration and Analysis Report (E31AR)	MIL-STD-464A
DI-EMCS-81541A	Electromagnetic Environmental Effects (E3) Verification Procedures (E3VP)	MIL-STD-464A
DI-EMCS-81542A	Electromagnetic Environmental Effects (E3) Verification Report (E3VR)	MIL-STD-464A
DI-EMCS-81777	Electromagnetic Interference Survey (EMIS) Test Report	MIL-STD-1605A
DI-EMCS-81782	Electromagnetic Interference Survey (EMIS) Test Procedures	MIL-STD-1605A
TOP-1-2-511	Electromagnetic Environmental Effects System Testing	MIL-STD-464A
TOP 1-2-622	Vertical Electromagnetic Pulse (VEMP) Testing	MIL-STD-464A and MIL-STD-2169B

Table 3: EMC Data Item Descriptions and Test Operational Procedures

(1) *Type of metals, casting, finishes, and hardware employed in the design.*

(2) *Construction techniques, such as isolated compartments; filter mounting, isolation of other parts; treatment of openings (ventilation ports, access hatches, windows, metal faces and control shafts), and attenuation characteristics of Radio Frequency (RF) gaskets used on mating surfaces.*

(3) *Shielding provisions and techniques used for determining shielding effectiveness.*

(4) *Corrosion control procedures.*

(5) *Methods of bonding mating surfaces, such as surface preparation and gaskets.*

c. *Electrical wiring design, including cable types or characteristics, cable routing, cable separation, grounding philosophy, and cable shielding types and termination methods.*

d. *Electrical and electronic circuit design, including the following:*

(1) *Filtering techniques, technical reasons for selecting types of filters, and associated filter characteristics, including attenuation and line-to-ground capacitance values of AC and DC power line filters.*

(2) *Part location and separation for reducing EMI.*

(3) *Location, shielding, and isolation of critical circuits.*

MIL-STD-461A			MIL-STD-461B/C			
Test	**Description**	**Frequency**	**Test**	**Description**	**Frequency**	
CE01	Power Leads	30 Hz-20 kHz	CE01	Power / Signal Leads	30 Hz-15 kHz	
CE02	Control / Signal Leads	30 Hz-20 kHz	CE02	N/A		
CE03	Power Leads	20 kHz-50 MHz	CE03	Power/Signal Leads	15 kHz-50 MHz	
CE04	Control / Signal Leads	20 kHz-50 MHz	CE04	N/A		
CE05	Inverse Filter Method	30 Hz-50 MHz	CE05	N/A		
CE06	Antenna Terminal	10 kHz-10 GHz	CE06	Antenna Terminal	10 kHz-26 GHz	
CE07	N/A		CE07	Power Leads	Spikes / Time Domain	
CS01	Power Leads	20 Hz-50 kHz	CS01	Power Leads	30 Hz-50 kHz	
CS02	Power Leads	50 kHz-400 MHz	CS02	Power Leads	50 kHz-400 MHz	
CS03	Intermodulation	15 kHz-10 GHz	CS03	Intermodulation	15 kHz-10 GHz	
CS04	Undesired Signal Rejection	15 kHz-10 GHz	CS04	Undesired Sig. Rejection	30 kHz-20 GHz	
CS05	Cross Modulation	15 kHz - 10 GHz	CS05	Cross Modulation	30 kHz - 20 GHz	
CS06	Spikes, Power Leads		CS06	Spikes, Power Leads		
CS07	Squelch Circuits		CS07	Squelch Circuits		
CS08	Undesired Sig. Rejection	30 Hz-10 GHz	CS08	N/A		
CS09	N/A		CS09	Structure Common Mode Current	60 Hz-100 kHz	
CS10	N/A		CS10	Damped Sinusoidal Transients (terminals)	10 kHz-100 MHz	
RE01	Magnetic Field	30 Hz-50 kHz	RE01	Magnetic Field	30 Hz-50 kHz	
RE02	Electric Field	14 kHz-10 GHz	RE02	Electric Field	14 kHz-10 GHz	
RE03	Spurious & Harmonic	10 kHz-40 GHz	RE03	Spurious & Harmonic	10 kHz-40 GHz	
RE04	Magnetic Field	20 Hz-15 kHz	RE04	N/A		
RE05	Vehicle & Eng. Equipment	150 kHz-1 GHz	RE05	N/A		
RE06	Overhead Powerlines	14 kHz-1 GHz	RE06	N/A		
RS01	Magnetic Field	30 Hz-30 kHz	RS01	Magnetic Field, Equipment and Cables	30 Hz-50 kHz	
RS02	Magnetic Induction	Powerline & Spike	RS02	Magnetic Induction, Equipment and Cables	Powerline & Spike	
RS03	Electric Field	14 kHz-10 GHz	RS03	Electric Field, Equipment and Cables	14 kHz-40 GHz	
RS04	Parallel Line Fields	14 kHz-30 MHz	RS04	N/A		
RS05	N/A		RS05	Electromag Pulse Field	Transients	

Table 4: MIL-STD-461 requirement changes, versions A – E

This DID also requires, among other items, *analysis* (results demonstrating how each applicable requirement is going to be met) and *developmental testing* (testing to be performed during development such as evaluations of breadboards, prototypes, and engineering models). For the equipment designer, these points to be documented constitute a virtual punch list of EMC design attributes.

MIL-STD-461F – EMC for Subsystems and Equipment

This is no doubt the most widely-used standard for US military EMC assessment. Specific test requirements are grouped according to conducted (C) or radiated (R) coupling, and emissions (E) or susceptibility (S). Thus the tests are designated:

Conducted emissions: CE---
Radiated emissions: RE---
Conducted susceptibility: CS---
Radiated susceptibility: RS---

The dashes are replaced by the test reference number. Over time, the numerical test designations have transitioned from 01 to 101, 02 to 102, etc., but the prefixes have remained constant. Table 4 indicates the changes in MIL-STD-461 test requirements from versions A through E, and Table 5 (page 40) reflects the present version F requirements.

	MIL-STD-461D			MIL-STD-461E		
	Test	Description	Frequency	Test	Description	Frequency
	CE101	Power Leads	30 Hz-10 kHz	CE101	Power Leads	30 Hz-10 kHz
	CE102	Power Leads	10 kHz-10 MHz	CE102	Power Leads	10 kHz-10 MHz
	CE106	Antenna Terminal	10 kHz-40GHz	CE106	Antenna Terminal	10 kHz-40GHz
	CS101	Power Leads	30 Hz-50 kHz	CS101	Power Leads	30 Hz-150 kHz
	CS103	Antenna Port-Intermod	15 kHz-10 GHz	CS103	Antenna Port-Intermod	15 kHz-10 GHz
	CS104	Antenna Port-Rejection of Undesired Signals	30 Hz -20 GHz	CS104	Antenna Port-Rejection. of Undesired Signals	30 Hz -20 GHz
	CS105	Antenna Port-Cross Modulation	30 Hz-20 GHz	CS105	Antenna Port-Cross Mod.	30 Hz-20 GHz
	RE101	Magnetic Field	30 Hz-100 kHz	RE101	Magnetic Field	30 Hz-100 kHz
	RE102	Electric Field	10 kHz-18 GHz	RE102	Electric Field	10 kHz-18 GHz
	RE103	Antenna Spurious & Harmonics	10 kHz-40 GHz	RE103	Antenna Spurious & Harmonics	10 kHz-40 GHz
	RS101	Magnetic Field, Equipment and Cables	30 Hz-100 kHz	RS101	Magnetic Field, Equipment and Cables	30 Hz-100 kHz
	RS103	Electric Field, Equipment and Cables	10 kHz-40 GHz	RS103	Electric Field, Equipment and Cables	2 MHz-40 GHz
	RS105	Transient Electromagnetic Field	Transients	RS105	Transient Electromanetic Field	Transients
	CS109	Structure Current	60 Hz-100 kHz	CS109	Structure Current	60 Hz-100 kHz
	CS114	Bulk Cable Injection	10 kHz-400 MHz	CS114	Bulk Cable Injection	10 kHz-200 MHz
	CS115	Bulk Cable Injection	Impulse	CS115	Bulk Cable Injection	Impulse
	CS116	Sine Transients - Cables, and Power Leads	10 kHz-100 MHz	CS116	Sine Transients - Cables, and Power Leads	10 kHz-100 MHz

ESD and lightning effects are not included in MIL-STD-461F, although they are being discussed for inclusion in the next (G) version which is currently in draft to be released in 2014. ESD and lightning protection *are* covered in MIL-STD-464A, and in the current US standard for commercial aircraft equipment DO-160G, "Environmental Conditions and Test Procedures for Airborne Equipment." DO-160G contains a number of non-EMC environmental requirements, and equipment qualified to revisions C – F of RTCA DO-160 is often suitable for military aircraft applications. A summary of DO-160G test categories is given in Table 6.

The military electronic equipment designer needs to know the types of EMC tests that will be applied to the equipment, the magnitudes or limits of the tests, and the frequency ranges of the tests, in order to design for compliance. The designer also needs to know that, where the equipment will be used in more than one environment, the most stringent requirements apply. Generally of secondary importance to the designer are the test configuration details, which are amply documented in MIL-STD-461F. These test details are of course essential to the testing personnel.

What is important to the equipment designer, for the purpose of understanding the limits, are the radiated emissions test distances – which differ from the normal commercial separations of 3m or 10m. MIL-STD-461F is almost unique among EMC standards in requiring a 1m distance between the electric field antenna and the test setup boundary (RE102). Only DO-160G and CISPR 25 (Automotive) has a similar radiated

Test	Description	Lowest Emission or Highest Susceptibility	Changes from 461E version
CE101	Conducted Emissions, Power Leads, 30 Hz to 10 kHz	76 dBμA	-
CE102	Conducted Emissions, Power Leads, 10 kHz to 10 MHz	60 dBμV	-
CE106	Conducted Emissions, Antenna Terminal, 10 kHz to 40 GHz	34 dBμV	-
CS101	Conducted Susceptibility, Power Leads, 30 Hz to 150 kHz	136 dBμV	Applicability added for surface ships; setup modifications suggested.
CS103	Conducted Susceptibility, Antenna Port, Intermodulation, 15 kHz to 10 GHz	Per procurement specification	-
CS104	Conducted Susceptibility, Antenna Port, Rejection of Undesired Signals, 30 Hz to 20 GHz	Per procurement specification	-
CS105	Conducted Susceptibility, Antenna Port, Cross-Modulation, 30 Hz to 20 GHz	Per procurement specification	-
CS106	Conducted Susceptibility, Transients, Power Leads	400 V peak	CS06 absent from E, added back.
CS109	Conducted Susceptibility, Structure Current, 60 Hz to 100 kHz	120 dBμA	-
CS114	Conducted Susceptibility, Bulk Cable Injection, 10 kHz to 200 MHz	109 dBμA	Adds common mode test for some applications.
CS115	Conducted Susceptibility, Bulk Cable Injection, Impulse Excitation	5A x 30 ns	-
CS116	Conducted Susceptibility, Damped Sinusoidal Transients, Cables and Power Leads, 10 kHz to 100 MHz	10 A peak	Testing with power off is deleted; procedure allows reduction of calibrated test signal if necessary.
RE101	Radiated Emissions, Magnetic Field, 30 Hz to 100 kHz	76 dBpT @ 7 cm	Test procedure is modified to allow separations > 7cm where non-compliances are noted.
RE102	Radiated Emissions, Electric Field, 10 kHz to 18 GHz	24 dBμV/m @ 1m	Applicability and frequency ranges modified. Rod antenna methods modified.
RE103	Radiated Emissions, Antenna Spurious and Harmonic Outputs, 10 kHz to 40 GHz	-80 dBc, far field	Minor test procedure changes.
RS101	Radiated Susceptibility, Magnetic Field, 30 Hz to 100 kHz	180 dBpT	Scan rate is reduced.
RS103	Radiated Susceptibility, Electric Field, 2 MHz to 40 GHz	200 V/m	Sensor placement clarified; radiating antenna distance limited to ≥ 1m.
RS105	Radiated Susceptibility, Transient Electromagnetic Field	50 kV/m peak	-

Table 5: MIL-STD-461F requirement changes from versions E to F (2007).

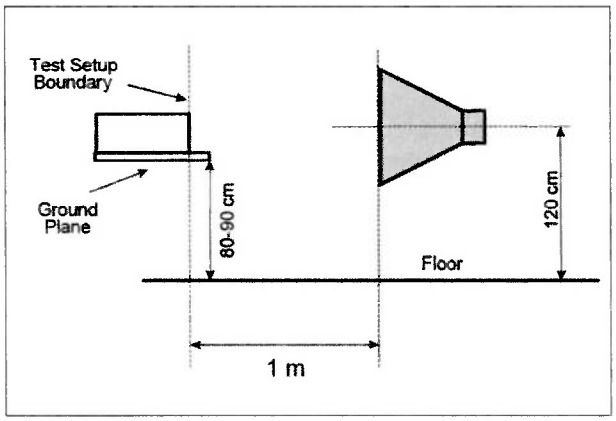


Figure 1: RE102 test setup showing 1m antenna distance, from MIL-STD-461F

emissions test distance. The magnetic field measurement distance in RE101 is 7 cm.

Radiated Susceptibility (RS 103) also has a 1m separation distance and typically requires a field strength of 200V/m in contrast to the 3V/m and 10V/m commonly encountered with commercial product standards such as EN61000-4-3. This higher field strength requirement can often be a hurdle for many designers involved with COTS or used to working on products intended for the commercial market.

In addition to the changes noted in Table 5, MIL-STD-461F addresses several topics of general applicability:

- The requirement to qualify "Line-Replaceable Modules (LRMs)" is added;
- Restricts the testing of shielded power cables;
- Includes software in the requirement to verify test procedures;
- Frequency step size above 1 GHz has been increased for susceptibility testing.

General	
Section 1.0	Purpose and Applicability
Section 2.0	Definition of Terms - General
Section 3.0	Conditions of Tests
Environmental Requirements	
Section 4.0	Temperature and Altitude
Section 5.0	Temperature Variation
Section 6.0	Humidity
Section 7.0	Operational Shocks and Crash Safety
Section 8.0	Vibration
Section 9.0	Explosion Proofness
Section 10.0	Waterproofness
Section 11.0	Fluids Susceptibility
Section 12.0	Sand and Dust
Section 13.0	Fungus Resistance
Section 14.0	Salt Spray
Section 24.0	Icing
Section 26.0	Fire, Flammability
EMC Requirements	
Section 15.0	Magnetic Effect
Section 16.0	Power Input
Section 17.0	Voltage Spike
Section 18.0	Audio Frequency Conducted Susceptibility – Power Inputs
Section 19.0	Induced Signal Susceptibility
Section 20.0	Radio Frequency Susceptibility (Radiated and Conducted)
Section 21.0	Emission of Radio Frequency Energy
Section 22.0	Lightning Induced Transient Susceptibility
Section 23.0	Lightning Direct Effects
Section 25.0	Electrostatic Discharge

Table 6: EMC and environmental requirements in RTCA DO-160G

Simultaneously with the publication of the F version of MIL-STD-461 (December 2007), the F version of RTCA DO-160 was published. DO-160F also included, for the first time, the CS106 test that was originally in MIL-STD-461 but later deleted only to be restored in the latest version. Since that time DO-160G has been released (December 2010), bringing more clarifications and updates.

RTCA DO-160F and G include the ESD and lightning requirements currently absent from MIL-STD-461F, and it includes the environmental requirements which are found in separate MIL documents discussed below. The European Union version of DO-160G is EUROCAE/ED-14G, which is identically worded.

MIL-STD-464A – EMC Requirements for Systems

This standard establishes electromagnetic environmental effects (E3), interface requirements and verification criteria for airborne, sea, space, and ground systems, including associated ordnance. MIL-STD-464A contains two sections, the main body

and an appendix. The main body of the standard specifies a baseline set of requirements. The appendix portion provides a detailed rationale and guidance, so that the baseline requirements can be tailored for a particular application.

Verification is intended to cover all life cycle aspects of the system. This includes (as applicable) normal in-service operation, checkout, storage, transportation, handling, packaging, loading, unloading, launch, and the normal operating procedures associated with each aspect.

The scope of E3 as used in this standard is very broad: all electromagnetic disciplines, including electromagnetic compatibility; electromagnetic interference; electromagnetic vulnerability; electromagnetic pulse; hazards of electromagnetic radiation to personnel, ordnance, and volatile materials; and natural phenomena effects of lightning and static.

Margin requirements apply to all EMC related tests performed in a 464A verification exercise. The intent is to account for manufacturing variations, aging and maintenance to assure that all equipment, not just test samples, will be compliant in the field over the equipment lifetime. Additional compliance margins to the limits specified in the standard are required for safety-critical, mission-critical and electrically-initiated devices (EIDs) such as electroexplosive devices and fusible links. The additional margins are:

- ≥ 6 dB for safety critical and mission critical system functions;
- ≥ 16.5 dB of maximum no-fire stimulus for safety assurances;

Clause	Parameter	Lowest Emission or Highest Susceptibility
5.2	Intra-system EMC (see also MIL-STD-461F clause 4.2.3)	Self-compatibility
5.2.1	Hull-generated intermodulation interference (IMI)	Not detecTable by onboard receivers
5.2.2	Shipboard internal electromagnetic environment (EME).	50 V/m
5.2.3	Multipaction, space applications, equipment and subsystems	No effect
5.3	External RF electromagnetic environment (EME) Flight deck, ships Weather deck, ships Main beam of transmitter, ships Space and launch vehicle systems Ground systems Army rotary wing aircraft Fixed wing aircraft, excluding shipboard	 2030 V/m peak, 200 V/m average 2030 V/m peak, 200 V/m average 27460 V/m peak, 2620 V/m average 200 V/m peak, 200 V/m average 2500 V/m peak, 50 V/m average 27460 V/m peak, 3120 V/m average 7200 V/m peak, 1050 V/m average
5.4	Lightning Severe stroke Near strike	 200kA strike, 100 kA restrike 2.2 x 10^9 A/m/s @ 10m
5.5	Electromagnetic pulse (EMP) per MIL-STD-2169B	classified
5.6	Subsystems and equipment EMI	Per MIL-STD-461F
5.6.1	Non-developmental items (NDI) and commercial items	System operational performance requirements shall be met.
5.6.2	Shipboard DC magnetic field environment.	See MIL-STD-1399, Section 070
5.7	Electrostatic charge control. Vertical lift and in-flight refueling. Precipitation static (p-static) control Ordnance subsystems.	 300 kV discharge Meet operational requirements 25 kV discharge
5.8	Electromagnetic radiation hazards (EMRADHAZ) Hazards of electromagnetic radiation to personnel (HERP). Hazards of electromagnetic radiation to fuel (HERF) Hazards of electromagnetic radiation to ordnance (HERO).	 See DoDI 6055.11 No inadvertent ignition 27460 V/m peak, 2620 V/m average
5.10.3	Mechanical interfaces – DC bonding levels	2.5 – 15 mΩ
5.11.1	Aircraft grounding jacks – resistance between the mating plug and the system ground reference.	≤ 1 Ω
5.13	Emissions control (EMCON)	≤ 105 dBm/m² @ 1 km, 500 kHz – 40 GHz

Table 7: Summary of MIL-STD-464A requirements. The high field strength susceptibility values occur in radar bands.

- ≥ 6dB of maximum no-fire stimulus for other purposes.

The worst-case (lowest emission limit or highest susceptibility requirement) for the environments categorized in MIL-STD-464A are summarized in Table 7. In many cases the requirements are frequency-dependent, and are much lower than worst-case over much of the frequency range. The standard should be consulted for details and definitions.

MIL-STD-1310H – Shipboard Bonding, Grounding and Other Techniques for EMC

This document specifies standard practices in wiring, bonding, grounding and shielding to facilitate achievement of the intra-ship and inter-ship electromagnetic compatibility (EMC), electromagnetic pulse (EMP), bonding, and intermodulation interference (IMI) requirements of MIL-STD-464A. It applies to metal and nonmetallic hull ships and is applicable during ship construction, overhaul, alteration, and repair. MIL-STD-1310H is not a typical EMC standard, but it provides the methods guidance appropriate to obtaining EMC in the shipboard environment.

This revision of MIL-STD-1310 has been expanded to include procedures for Electromagnetic Pulse (EMP) hardening. It also provides procedures and guidance to more easily address MIL-STD-464A requirements in relationship to intra- and inter-ship EMC, hull-generated IMI, lifecycle electromagnetic environmental effects (E3) hardness, EMP, and electrical bonding. A separate appendix is included, with procedures to identify whether commercial-off-the-shelf equipment (COTS) or non-developmental items (NDI) meets appropriate safety requirements before use, and to provide direction to bring them into conformance when necessary.

MIL-STD-1541A – Space Systems

The requirements covered by this standard apply to launch and space vehicles plus the associated grounds airborne, or spaceborne operational and support elements of the space system. It applies to new and modified or redesigned equipment or systems, and to existing equipment used in new applications.

MIL-STD-1541A establishes the electromagnetic compatibility requirements for space systems, including frequency management, and the related requirements for the electrical and electronic equipment used in space systems. It also includes requirements designed to establish an effective ground reference for the installed equipment and designed to inhibit adverse electrostatic effects. Bonding and prevention of electrostatic buildup are covered in detail.

As with MIL-STD-464A, this standard imposes additional compliance margin requirements in critical situations:

Category I: Serious injury or loss of life, damage to property, or major loss or delay of mission capability; 12 dB for qualification; 6 dB for acceptance

Category II: Degradation of mission capability, including any loss of autonomous operational capability; 6 dB

Category III: Loss of functions not essential to mission; 0 dB

Intersystem and intrasystem analysis is required by the standard, which also references all emission and susceptibility requirements in MIL-STD-461 (as modified by MIL-STD-1541A) for the relevant class of equipment. Some of the specific requirements of this standard not covered in MIL-STD-461 are summarized in Table 8. Thorough qualification testing is emphasized in the standard.

MIL-STD-1542B – Space System Facilities

This standard is intended for selected space system facilities. The requirements are applicable to all related facilities including, but not limited to, launch complexes, tracking stations, data processing rooms, satellite control centers, checkout stations, spacecraft or booster assembly buildings, and any associated stationary or mobile structures that house electrical and electronic equipment.

MIL-STD-1542B addresses in detail the appropriate bonding, shielding, electrical power and ground network for space system facilities. The facility ground network consists of the following electrically interconnected subsystems:

Section	Test	Limit
5.2.5	Lightning protection	200 kA peak
5.2.6	Outer surface resistivity of ESD control Grounded semiconductive coating over insulating material Painted surface over grounded semiconductive material-over dielectric Volume resistivity of a coating(t, cm) over a grounded metal conductor	 $\leq 10^8 \Omega$/square $\leq 4.6 \times 10^7 \Omega$/square $(2.5/t) \times 10^{10} \Omega$-cm
5.2.10	Electrical power quality Voltage ripple Spikes Surges Load switching and load faults Power subsystem faults – surge amplitude Vehicle power output ground isolation	 $\leq$ 500 mV peak-to-peak < 3 times nominal load, $< 0.14 \times 10^{-3}$ V-s Return to steady-state in 5 ms (+) and 100 ms (-) Remain within 65% to 130% of nominal Remain within 0% to 175% of nominal ≥ 1 MΩ
5.3.3	Performance criteria – MIL-STD-461 applies as noted CE01 applies CE06 and RE03 apply CS01 limit applies CS02 and RS03 apply CS06 limits	 Frequency extended to 30th harmonic or 100 GHz Test under maximum and minimum supply Susceptibility signals chosen for max. effect 200 V x 10µs pulse

Table 8: Some requirements in MIL-STD-1541A

Reference	Title
Def Stan 59-188-1 (2009)	High Altitude Electromagnetic Pulse (HEMP) Protection for Ground Based Communication Facilities Performing Critical, Time-Urgent Missions - Part No: 1: Fixed Facilities.
Def Stan 59-411-1 (2007)	Electromagnetic Compatibility - Part No: 1: Management & Planning
Def Stan 59-411-2 (2007)	Electromagnetic Compatibility - Part No: 2: The Electric, Magnetic and Electromagnetic Environment
Def Stan 59-411-3 (2007)	Electromagnetic Compatibility - Part No: 3: Test Methods and Limits for Equipment and Sub Systems
Def Stan 59-411-4 (2007)	Electromagnetic Compatibility - Part No: 4: Platform and System Tests and Trials
Def Stan 59-411-5 (2007)	Electromagnetic Compatibility - Part No: 5: Code of Practice for Tri-Service Design and Installation

Table 9: UK Ministry of Defence EMC standards

Reference	Title
STANAG 3516	Electromagnetic Interference and Test Methods for Aircraft
STANAG 3614	Electromagnetic Compatibility (EMC) of Aircraft Systems
STANAG 4234	Electromagnetic Radiation (Radio Frequency) - 200 kHz to 40 GHz Environment - Affecting the Design of Materiel for Use by NATO Forces
STANAG 4239	Electrostatic Discharge, Munitions Test Procedures
STANAG 4327	Lightning, Munition Assessment and Test Procedures
STANAG 4370	Environmental testing
STANAG 4416	Nuclear Electromagnetic Pulse Testing of Munitions Containing Electro-Explosive Devices
STANAG 4437	Electromagnetic Compatibility Testing Procedure and Requirements for Naval Electrical and Electronic Equipment (Submarines)

Table 10: Some NATO STANAGs relating to EMC.

a. The earth electrode subsystem.
b. The lightning protection subsystem.
c. The equipment fault protection subsystem.
d. The signal reference (technical ground) subsystem.

EMC performance for equipment installed in space system facilities is referenced to MIL-STD-461. COTS (commercial-off-the-shelf) equipment installed in these facilities shall also meet the requirements of MIL-STD-461.

As with the other military EMC standards discussed here, MIL-STD-1542B requires electromagnetic self-compatibility of equipment and systems. Clause 4.2 stipulates:

Facility electrical and electronic subsystems and equipment shall be compatible with each other as well as with the technical equipment installed in the facility for support of space system operations.

UK: DefStan Documents

Equipment procured for military purposes by the UK's Ministry of Defence must meet their defence standards (DefStan). Non-military equipment must meet the essential requirements of the EMC Directive 2004/108/EC. Ministry of Defence EMC standards are listed in Table 9.

Collectively the UK DefStan documents cover the same concerns as UK military standards. Specifically, DefStan 59-411-3 (Part 3) corresponds closely to MIL-STD-461F in methods, limits and frequency ranges. For example, Magnetic emissions are measured at 70 cm in both standards, and high-frequency radiated emissions are measured at 1m in both standards. However there are structural and content differences between the two standards:

- Individual EMC tests in 59-411-3 are denoted DCS---, DCE---, DRE---, DRS--- where the "D" denotes "Defence" and is absent from -461 test references.
- DefStan 59-411-3 uses susceptibility criteria A...D, which are familiar to users of commercial IEC and EU EMC standards. Default performance criteria are defined for each susceptibility test in terms of safety-critical or safety-related function, mission-critical function, or non-safety-critical or non-essential function.
- "Man worn" and "man portable" categories and test requirements are specified in detail in DefStan 59-411-3. Testing for man-worn applications requires the use of a non-conductive dummy approximating the shape

NATO: STANAG documents

The term "STANAG" stands for "Standardization Agreement" among the NATO member countries. There are literally hundreds of active agreements in place, usually drawing from one or more countries' existing standards. Some of the STANAG agreements relating to EMC are summarized in Table 10.

Both environmental considerations and EMC are covered under STANAG 4370. It references several separate documents termed "Allied

Design for EMC Compliance

Military product development follows well-defined program steps. MIL-HDBK-237D defines these steps clearly – including tailoring of requirements - as well as providing useful information on potentially applicable commercial standards plus standards from all branches of the US military, and NATO. An extensive list of acronyms is also included.

Definition and refinement of the product EMC environment occurs during the course of program progress. Initial EMC testing in the laboratory is only the first step toward full qualification. MIL-235B provides information on the likely levels of RF field exposure in various stages of deployment to land-based and shipboard locations.

Generally, EMC test requirements will have been fully defined before the product reaches the test laboratory, although modules or subsystems may have been previously tested. The relevant parts of MIL-STD-461F (typically) will be stipulated, and it will be up to the manufacturer to have used prudent design techniques to meet the designated requirements.

As the EMC requirements in MIL-STD-461F are generally more stringent than commercial standards, designing for successful compliance involves careful review of each level of product integration. Can the designer support each of the design criteria in Data Item Description DI-EMCS-80199C, and summarized in this review? These criteria include PC layout, wiring, shielding, filtering and enclosure design. Designers familiar largely with commercial environments will need to review and enhance the use of EMC control techniques to meet military EMC requirements. Later qualification tests may require control enhancements.

Environmental Conditions and Test Publication" (AECPT). We will explore the environmental aspects later, but we will look at EMC first.

STANAG 4370 references AECPT-500 (Edition 3, 2009), "Electromagnetic Environmental Effects Test and Verification." AECPT-500 draws for its tests and methods both from MIL-STD-461 and DefStan 59-411, as shown in Table 11. Individual EMC tests in AECPT-500 are denoted NCS---, NCE---, NRE---, NRS--- where the "N" denotes "NATO" and is absent from -461 test references.

AECPT-500 also contains a flow chart to guide the gap analysis between commercial and military EMC requirements, when COTS (commercial-off-the-shelf) or MOTS (military-off-the-shelf) acquisitions are being considered.

Look for Part 2 of this article in the April 2014 issue of In Compliance.

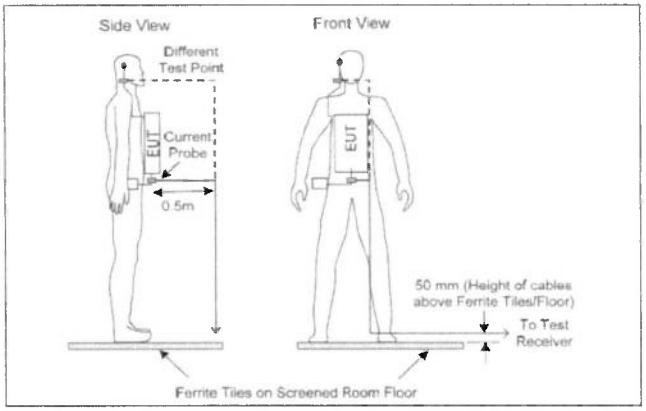


Figure 2: Man worn test configuration from DefStan 59-411-3, DCE02

This paper was authored by Intertek. Currently Intertek sits on more than 70 SAE standards committees to help draft the test and certifications necessary to keep people safe. Find more articles on EMC issues at www.interk.com. For more information on this topic or to find an Intertek EMC testing lab near you contact icenter@intertek.com or 1-800-WORLDLAB.

Reference	Description	Test Derived from
NCE01	Conducted Emissions, Power Leads, 30 Hz to 10 kHz	MIL-STD-461F
NCE02	Conducted Emissions, Power Leads, 10 kHz to 10 MHz	MIL-STD-461F
NCE03	Conducted Emissions, Antenna Terminal, 10 kHz to 40 GHz	MIL-STD-461F
NCE04	Conducted Emissions, Exported Transients on Power Leads	Def Stan 59-411
NCE05	Conducted Emissions, Power, Control & Signal Leads, 30 Hz to 150 MHz	Def Stan 59-411
NCS01	Conducted Susceptibility, Power Leads, 30 Hz to 150 kHz	MIL-STD-461F
NCS02	Conducted Susceptibility, Control & Signal Leads, 20 Hz to 50 kHz	Def Stan 59-411
NCS03	Conducted Susceptibility, Antenna Port, Intermodulation, 15 kHz to 10 GHz	MIL-STD-461F
NCS04	Conducted Susceptibility, Antenna Port, Rejection of Undesired Signals, 30 Hz to 20 GHz	MIL-STD-461F
NCS05	Conducted Susceptibility, Antenna Port, Cross Modulation, 30 Hz to 20 GHz	MIL-STD-461F
NCS06	Conducted Susceptibility, Structure Current, 60 Hz to 100 kHz	MIL-STD-461F
NCS07	Conducted Susceptibility, Bulk Cable Injection, 10 kHz to 200 MHz	MIL-STD-461F
NCS08	Conducted Susceptibility, Bulk Cable Injection, Impulse Excitation	MIL-STD-461F
NCS09	Conducted Susceptibility, Damped Sinusoidal Transients, Cables and Power Leads, 10 kHz to 100 MHz	MIL-STD-461F
NCS10	Conducted Susceptibility, Imported Lightning Transient (Aircraft/Weapons)	Def Stan 59-411
NCS11	Conducted Susceptibility, Imported Low Frequency on Power Leads (Ships)	Def Stan 59-411
NCS12	Conducted Susceptibility, Electrostatic Discharge	Def Stan 59-411
NCS13	Conducted Susceptibility, Transient Power Leads	MIL-STD-461F
NRE01	Radiated Emissions, Magnetic Field, 30 Hz to 100 kHz	MIL-STD-461F
NRE02	Radiated Emissions, Electric Field, 10 kHz to 18 GHz	MIL-STD-461F
NRE03	Radiated Emissions, Antenna Spurious and Harmonic Outputs, 10 kHz to 40 GHz	MIL-STD-461F
NRS01	Radiated Susceptibility, Magnetic Field, 30 Hz to 100 kHz	MIL-STD-461F
NRS02	Radiated Susceptibility, Electric Field, 50 kHz to 40 GHz	MIL-STD-461F / Def Stan 59-411
NRS03	Radiated Susceptibility, Transient Electromagnetic Field	MIL-STD-461F
NRS04	Radiated Susceptibility, Magnetic Field, (DC)	Def Stan 59-411

Table 11: Cross-reference between NATO EMC test references, MIL-STD-461 and DefStan 59-411

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the application of CONSUMERS ENERGY COMPANY for authority to increase its rates for the generation and distribution of electricity and for other relief

Case No. **U-18322**

/

EXHIBIT RCG-11 (WSB-10)

TO

DIRECT TESTIMONY AND EXHIBIT OF WILLIAM S. BATHGATE

On Behalf of

Residential Customer Group

August 15, 2017

Customer Name: _____

Service Address: _____

City/Town, Zip: _____

Telephone Number: _____

The following life-sustaining equipment is in my home:

- ☐ Tank-type Respirator (Iron Lung)
- ☐ Curaisse-type Respirator (Chest)
- ☐ Rocking Bed
- ☐ Electrically operated Respirator
- ☐ Suction Machine (Pump)
- ☐ Hemodialysis Equipment (Kidney Machine)
- ☐ Intermittent Positive Pressure Respirator
- ☐ Heart Rate Monitor
- ☐ PD APNEA Monitor
- ☐ Diaphragm Stimulator
- ☐ Oxygen Concentrator
- ☐ Medical Pump
- ☐ Press Respirator
- ☐ CPM Drum ventilator
- ☐ Special Air Conditioner *(Please explain why you need this)*

_____

- ☐ Other types of life-sustaining equipment or medical condition *(Please be specific)*

_____

If you would like to authorize someone that we may discuss your account with other than yourself, please provide that party's information below.

Third Party Name: _____

Third Party Address: _____

Third Party City, State, Zip: _____

Third Party Telephone: _____

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the application of
CONSUMERS ENERGY COMPANY
for authority to increase its rates for the generation and distribution of electricity and for other relief.

Case No. **U-18322**

_____/

PROOF OF SERVICE

On **August 15, 2017**, an electronic copy of the **Direct Testimony and Exhibits of William S. Bathgate on behalf of the Residential Customer Group** was served on the following:

Name/Party	E-mail Address
Administrative Law Judge Hon. Sharon Feldman	feldmans@michigan.gov
Consumers Energy Company Kelly Hall Bret A. Totoraitis Gary Gensch, Jr. H. Richard Chambers Robert Beach Anne Uitvlugt	mpscfilings@cmsenergy.com kelly.hall@cmsenergy.com bret.totoraitis@cmsenergy.com gary.genschjr@cmsenergy.com rick.chambers@cmsenergy.com robert.beach@cmsenergy.com anne.uitvlugt@cmsenergy.com
Michigan Environmental Council and Sierra Club Christopher M. Bzdok Tracy J. Andrews	chris@envlaw.com tjandrews@envlaw.com
MPSC Staff Spencer Sattler	sattlers@michigan.gov
Attorney General Bill Schuette John Janiszewski Joel B. King	janiszewskij2@michigan.gov kingj38@michigan.gov

Michigan Cable Telecommunications Association David E. S. Marvin Michael Ashton	 dmarvin@fraserlawfirm.com mashton@fraserlawfirm.com
The Kroger Company Kurt Boehm Jody Kyler Cohn Michael L. Kurtz	 KBoehm@BKLlawfirm.com JKylerCohn@BKLlawfirm.com mkurtz@BKLlawfirm.com
Wal-Mart Stores East, LP and Sam's East, Inc. Melissa M. Horne	 mhorne@hcc-law.com
Energy Michigan Timothy J. Lundgren Laura A. Chappelle Toni Newell	 tjlundgren@varnumlaw.com lachappelle@varnumlaw.com tlnewell@varnumlaw.com
Hemlock Semiconductor Operations and Constellation NewEnergy, Inc. Jennifer U. Heston	 jheston@fraserlawfirm.com
Environmental Law & Policy Center Meredith Kearney	 mkearney@elpc.org
Michigan State Utility Workers Council, Utility Workers Union of America, AFL-CIO John A. Canzano Patrick J. Rorai	 jcanzano@michworkerlaw.com prorai@michworkerlaw.com
Association of Businesses Advocating Tariff Equity and Gerdau Macsteel Sean P. Gallagher Michael Pattwell	 sgallagher@clarkhill.com mpattwell@clarkhill.com
Midland Cogeneration Venture Limited Partnership Richard Aaron Jason Hanselman	 raaron@dykema.com jhanselman@dykema.com

Midwest Cogeneration Assn John R. Liskey Patricia F. Sharkey	 john@liskeypllc.com psharkey@e-lawcounsel.com

The statements above are true to the best of my knowledge, information and belief.

PUBLIC LAW RESOURCE CENTER PLLC

Carol Ann Dane

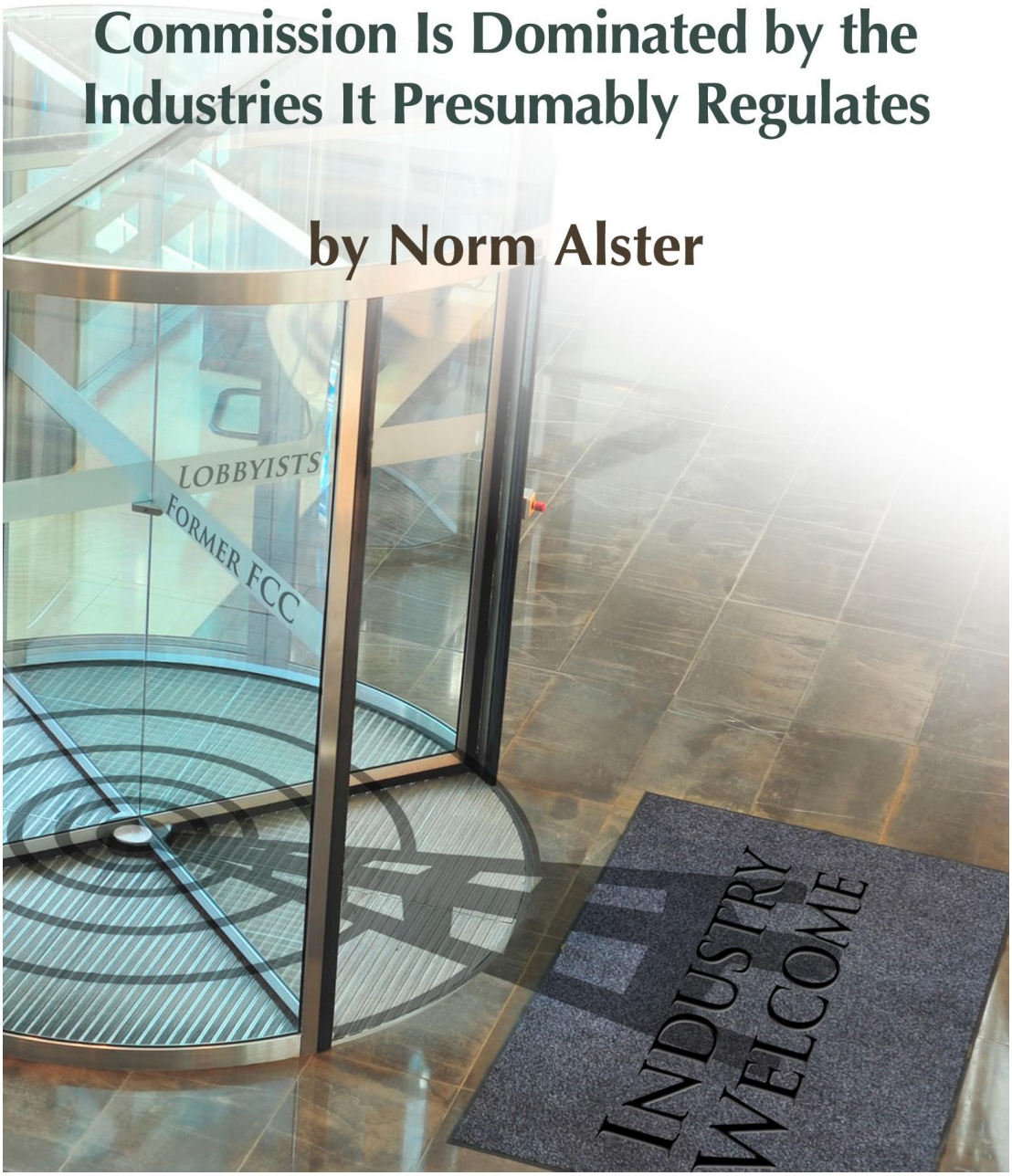
Carol A. Dane
Public Law Resource Center PLLC
University Office Place
333 Albert Avenue, Suite 425
East Lansing, MI 48823
Telephone: (517) 999-3782
E-mail: adminasst@publiclawresourcecenter.com

Dated: August 15, 2017

Captured Agency:

How the Federal Communications Commission Is Dominated by the Industries It Presumably Regulates

by Norm Alster



www.ethics.harvard.edu

Captured Agency

How the Federal Communications Commission Is Dominated by the Industries It Presumably Regulates

By Norm Alster

--

Published by:
Edmond J. Safra Center for Ethics
Harvard University
124 Mount Auburn Street, Suite 520N
Cambridge, MA 02138 USA
http://www.ethics.harvard.edu/

HARVARD UNIVERSITY
Edmond J. Safra
Center for Ethics

CONTENTS

Chapter One: The Corrupted Network

Renee Sharp seemed proud to discuss her spring 2014 meeting with the Federal Communications Commission.

As research director for the non-profit Environmental Working Group, Sharp doesn't get many chances to visit with the FCC. But on this occasion she was able to express her concerns that lax FCC standards on radiation from wireless technologies were especially hazardous for children.

The FCC, however, should have little trouble dismissing those concerns.

Arguing that current standards are more than sufficient and that children are at no elevated risk from microwave radiation, wireless industry lobbyists don't generally have to set up appointments months in advance. They are at the FCC's door night and day.

Indeed, a former executive with the Cellular Telecommunications Industry Association (CTIA), the industry's main lobbying group, has boasted that the CTIA meets with FCC officials "500 times a year."[1]

Sharp does not seem surprised. "There's no question that the government has been under the influence of industry. The FCC is a captured agency," she said.[2]

Captured agency.

That's a term that comes up time and time again with the FCC. Captured agencies are essentially controlled by the industries they are supposed to regulate. A detailed look at FCC actions—and non-actions—shows that over the years the FCC has granted the wireless industry pretty much what it has wanted. Until very recently it has also granted cable what it wants. More broadly, the FCC has again and again echoed the lobbying points of major technology interests.

Money—and lots of it—has played a part. The National Cable and Telecommunications Association (NCTA) and CTIA have annually been among Washington's top lobbying spenders. CTIA alone lobbied on at least 35 different Congressional bills through the first half of 2014. Wireless market leaders AT&T and Verizon work through CTIA. But they also do their own lobbying, spending nearly $15 million through June of 2014, according to data from the Center for Responsive Politics (CRP). In all, CTIA, Verizon, AT&T, T-Mobile USA, and Sprint spent roughly $45 million lobbying in 2013. Overall, the Communications/Electronics sector is one of Washington's super heavyweight lobbyists, spending nearly $800 million in 2013-2014, according to CRP data.

But direct lobbying by industry is just one of many worms in a rotting apple. The FCC sits at the core of a network that has allowed powerful moneyed interests with limitless access a variety of ways to shape its policies, often at the expense of fundamental public interests.

As a result, consumer safety, health, and privacy, along with consumer wallets, have all been overlooked, sacrificed, or raided due to unchecked industry influence. The cable industry has consolidated into giant local monopolies that control pricing while leaving consumers little choice over content selection. Though the FCC has only partial responsibility, federal regulators have allowed the Internet to grow into a vast hunting grounds for criminals and commercial interests: the go-to destination for the surrender of personal information, privacy and identity. Most insidious of all, the wireless industry has been allowed to grow unchecked and virtually unregulated, with fundamental questions on public health impact routinely ignored.

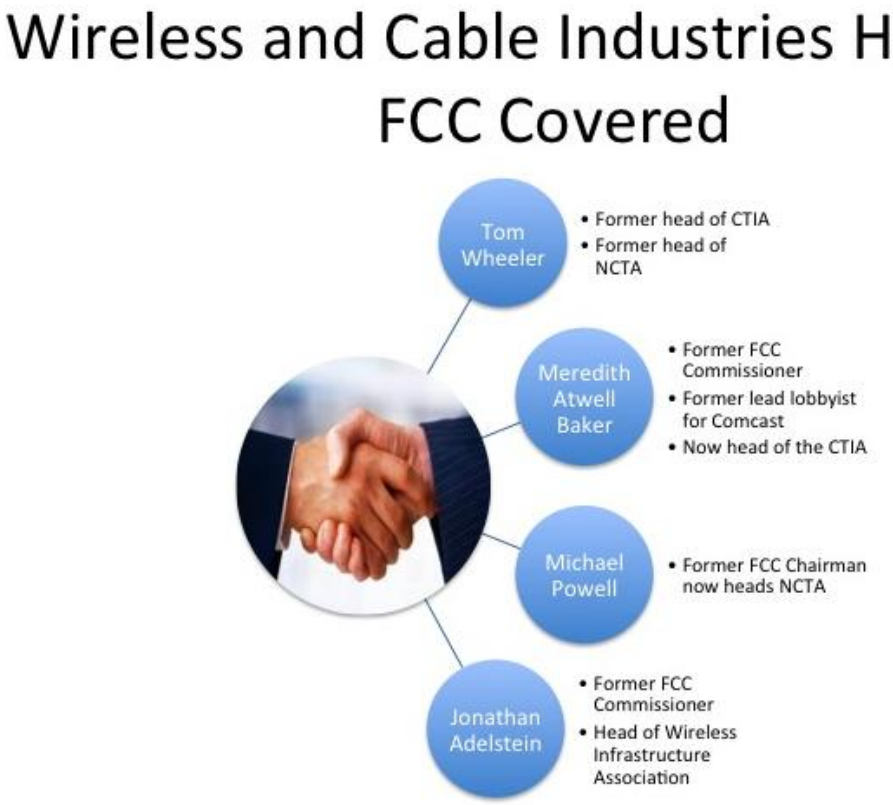
Industry controls the FCC through a soup-to-nuts stranglehold that extends from its well-placed campaign spending in Congress through its control of the FCC's Congressional oversight committees to its persistent agency lobbying. "If you're on a committee that regulates industry you'll be a major target for industry," said Twaun Samuel, chief of staff for Congresswoman Maxine Waters.[3] Samuel several years ago helped write a bill aimed at slowing the revolving door. But with Congress getting its marching orders from industry, the bill never gained any traction.

Industry control, in the case of wireless health issues, extends beyond Congress and regulators to basic scientific research. And in an obvious echo of the hardball tactics of the tobacco industry, the wireless industry has backed up its economic and political power by stonewalling on public relations and bullying potential threats into submission with its huge standing army of lawyers. In this way, a coddled wireless industry intimidated and silenced the City of San Francisco, while running roughshod over local opponents of its expansionary infrastructure.

On a personal level, the entire system is greased by the free flow of executive leadership between the FCC and the industries it presumably oversees. Currently presiding over the FCC is Tom Wheeler, a man who has led the two most powerful industry lobbying groups: CTIA and NCTA. It is Wheeler who once supervised a $25 million industry-funded research effort on wireless health effects. But when handpicked research leader George Carlo concluded that wireless radiation did raise the risk of brain tumors, Wheeler's CTIA allegedly rushed to muffle the message. "You do the science. I'll take care of the politics," Carlo recalls Wheeler saying.[4]

Wheeler over time has proved a masterful politician. President Obama overlooked Wheeler's lobbyist past to nominate him as FCC chairman in 2013. He had, after all, raised more than $700,000 for Obama's presidential campaigns. Wheeler had little trouble earning confirmation from a Senate whose Democrats toed the Presidential line and whose Republicans understood Wheeler was as industry-friendly a nominee as they could get. And while Wheeler, at the behest of his Presidential sponsor, has taken on cable giants with his plans for net neutrality and shown some openness on other issues, he has dug in his heels on wireless.

Newly ensconced as chairman of the agency he once blitzed with partisan pitches, Wheeler sees familiar faces heading the industry lobbying groups that ceaselessly petition the FCC. At CTIA, which now calls itself CTIA - The Wireless Association, former FCC commissioner Meredith Atwell Baker is in charge.



And while cell phone manufacturers like Apple and Samsung, along with wireless service behemoths like Verizon and AT&T, are prominent CTIA members, the infrastructure of 300,000 or more cellular base stations and antenna sites has its own lobbying group: PCIA, the Wireless Infrastructure Association. The President and CEO of PCIA is Jonathan Adelstein, another former FCC commissioner. Meanwhile, the cable industry's NCTA employs former FCC chairman Michael Powell as its president and CEO. Cozy, isn't it?

FCC commissioners in 2014 received invitations to the Wireless Foundation's May 19th Achievement Awards Dinner. Sounds harmless, but for the fact that the chief honoree at the dinner was none other than former wireless lobbyist but current FCC Chairman Tom Wheeler. Is this the man who will act to look impartially at the growing body of evidence pointing to health and safety issues?

The revolving door also reinforces the clout at another node on the industry-controlled influence network. Members of congressional oversight committees are prime targets of

industry. The cable industry, for example, knows that key legislation must move through the Communications and Technology Subcommittee of the House Energy and Commerce Committee. Little wonder then that subcommittee chairman Greg Walden was the second leading recipient (after Speaker John Boehner) of cable industry contributions in the last six years (through June 30, 2014). In all, Walden, an Oregon Republican, has taken over $108,000 from cable and satellite production and distribution companies.[5] But he is not alone. Six of the top ten recipients of cable and satellite contributions sit on the industry's House oversight committee. The same is true of senators on the cable oversight committee. Committee members were six of the ten top recipients of campaign cash from the industry.[6]

Cable & Satellite Campaign Contributions

Top House Recipients Funded

Recipient	Amount
John A. Boehner	$135,425
Greg Walden	$108,750
Bob Goodlatte	$93,200
John Conyers Jr.	$84,000
Mike Coffman	$82,137
Fred Upton	**$73,500**
Lee Terry	**$65,916**
Henry A. Waxman	**$65,000**
Cory Gardner	**$64,500**
Anna G. Eshoo	**$60,500**

Cellular Industry Campaign Contributions

Top House Recipients Funded

Recipient	Amount
Henry A. Waxman	**$41,500**
Scott H. Peters	$40,300
Greg Walden	**$35,750**
Fred Upton	**$32,250**
Bob Goodlatte	$31,250
Lee Terry	**$29,600**
Anna G. Eshoo	**$27,000**
Doris O. Matsui	**$25,500**
John Shimkus	**$24,000**
Peter J. Roskam	$21,100

Cable & Satellite Campaign Contributions

Top Senate Recipients Funded

Recipient	Amount
Edward J. Markey	**$320,500**
Kirsten E. Gillibrand	$194,125
Mitch McConnell	$177,125
Harry Reid	$175,600
Charles E. Schumer	$175,450
Mark L. Pryor	**$172,950**
Michael F. Bennet	$159,000
Richard Blumenthal	**$148,800**
Claire McCaskill	**$138,185**
Mark Udall	$136,625

Cellular Industry Campaign Contributions

Top Senate Recipients Funded

Recipient	Amount
Edward J. Markey	**$155,150**
Mark R. Warner	$74,800
Harry Reid	$73,600
Mark L. Pryor	**$71,900**
Roy Blunt	**$57,400**
John McCain	$56,261
Charles E. Schumer	$53,300
Roger F. Wicker	$51,300
Barbara Boxer	$49,578
Kelly Ayotte	$43,333

The compromised FCC network goes well beyond the revolving door and congressional oversight committees. The Washington social scene is one where money sets the tone and throws the parties. A look at the recent calendar of one current FCC commissioner shows it would take very disciplined and almost saintly behavior on the part of government officials to resist the lure of lavishly catered dinners and cocktail events. To paraphrase iconic investigative journalist I.F. Stone, if you're going to work in Washington, bring your chastity belt.

All that free liquor, food and conviviality translates into the lobbyist's ultimate goal: access. "They have disproportionate access," notes former FCC commissioner Michael Copps. "When you are in a town where most people you see socially are in industry, you don't have to ascribe malevolent behavior to it," he added.[7]

Not malevolent in motive. But the results can be toxic. And blame does not lie solely at the feet of current commissioners. The FCC's problems predate Tom Wheeler and go back a long way.

Indeed, former Chairman Newton Minow, enduringly famous for his 1961 description of television as a "vast wasteland," recalls that industry manipulation of regulators was an issue even back then. "When I arrived, the FCC and the communications industry were both regarded as cesspools. Part of my job was to try to clean it up."[8]

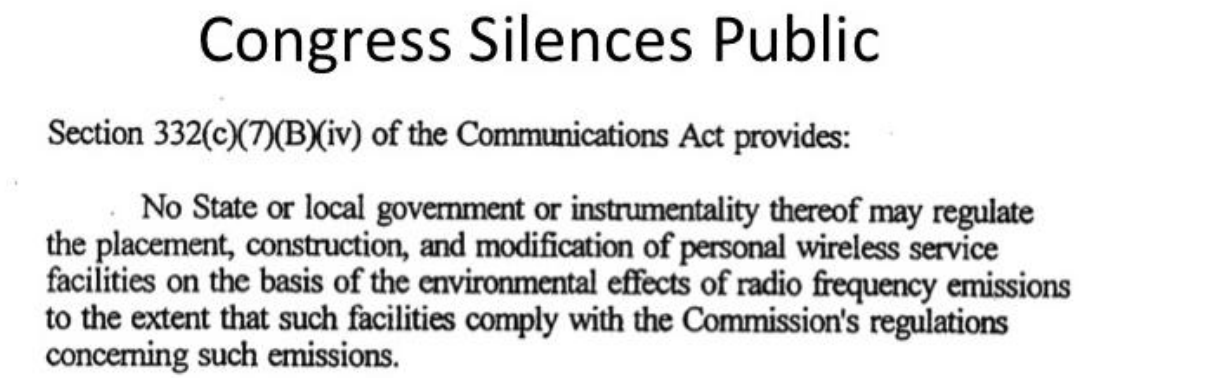
More than 50 years later, the mess continues to pile up.

Chapter Two: Just Don't Bring Up Health

Perhaps the best example of how the FCC is tangled in a chain of corruption is the cell tower and antenna infrastructure that lies at the heart of the phenomenally successful wireless industry.

It all begins with passage of the Telecommunications Act of 1996, legislation once described by South Dakota Republican senator Larry Pressler as "the most lobbied bill in history." Late lobbying won the wireless industry enormous concessions from lawmakers, many of them major recipients of industry hard and soft dollar contributions. Congressional staffers who helped lobbyists write the new law did not go unrewarded. Thirteen of fifteen staffers later became lobbyists themselves.[9]

Section 332(c)(7)(B)(iv) of the Act remarkably—and that adverb seems inescapably best here—wrests zoning authority from local governments. Specifically, they cannot cite health concerns about the effects of tower radiation to deny tower licenses so long as the towers comply with FCC regulations.



In preempting local zoning authority—along with the public's right to guard its own safety and health— Congress unleashed an orgy of infrastructure build-out. Emboldened by the government green light and the vast consumer appetite for wireless technology, industry has had a free hand in installing more than 300,000 sites. Church steeples, schoolyards, school rooftops, even trees can house these facilities.

Is there any reason to believe that the relatively low level radiofrequency emissions of these facilities constitute a public health threat? Certainly, cell phones themselves, held close to the head, have been the focus of most concern on RF emissions. Since the impact of RF diminishes with distance, industry advocates and many scientists dismiss the possibility that such structures pose health risks.

But it's not really that simple. A troubling body of evidence suggests exposure to even low emission levels at typical cellular frequencies between 300 MHz and 3 GHz can have a wide range of negative effects.

In a 2010 review of research on the biological effects of exposure to radiation from cell tower base stations, B. Blake Levitt and Henry Lai found that "some research does exist to warrant caution in infrastructure siting."[10] They summarized the results on one 2002 study that compared the health of 530 people living at various distances within 300 meters of cell towers with a control group living more than 300 meters away. "Results indicated increased symptoms and complaints the closer a person lived to a tower. At <10 m, symptoms included nausea, loss of appetite, visual disruptions, and difficulties in moving. Significant differences were observed up through 100 m for irritability, depressive tendencies, concentration difficulties, memory loss, dizziness, and lower libido."[11]

A 2007 study conducted in Egypt found similar results. Levitt and Lai report, "Headaches, memory changes, dizziness, tremors, depressive symptoms, and sleep disturbance were significantly higher among exposed inhabitants than controls."[12]

Beyond epidemiological studies, research on a wide range of living things raises further red flags. A 2013 study by the Indian scientists S. Sivani and D. Sudarsanam reports: "Based on current available literature, it is justified to conclude that RF-EMF [electro magnetic fields] radiation exposure can change neurotransmitter functions, blood-brain barrier, morphology, electrophysiology, cellular metabolism, calcium efflux, and gene and protein expression in certain types of cells even at lower intensities."[13]

The article goes on to detail the effects of mobile tower emissions on a wide range of living organisms: "Tops of trees tend to dry up when they directly face the cell tower antennas. . . . A study by the Centre for Environment and Vocational Studies of Punjab University noted that embryos of 50 eggs of house sparrows were damaged after being exposed to mobile tower radiation for 5-30 minutes. . . . In a study on cows and calves on the effects of exposure from mobile phone base stations, it was noted that 32% of calves developed nuclear cataracts, 3.6% severely."[14]

Does any of this constitute the conclusive evidence that would mandate much tighter control of the wireless infrastructure? Not in the estimation of industry and its captured agency. Citing other studies—often industry-funded—that fail to establish health effects, the wireless industry has dismissed such concerns. The FCC has typically echoed that position.

Keep in mind that light regulation has been one factor in the extraordinary growth of wireless—CTIA says exactly that in a Web post that credits the Clinton Administrations light regulatory touch.

July 25, 2013

CTIA BLOG

CTIA is an international nonprofit trade association that has represented the wireless communications industry since 1984.

But our position as the world's leader was no accident. It started with the Clinton Administration that had the foresight to place a "light regulatory touch" on the wireless industry, which was in its infancy at the time. That light touch has continued through multiple Administrations.

Obviously, cellular technology is wildly popular because it offers many benefits to consumers. But even allowing for that popularity and for the incomplete state of science, don't some of these findings raise enough concern to warrant some backtracking on the ham-fisted federal preemption of local zoning rights?

In reality, since the passage of the 1996 law, the very opposite has occurred. Again and again both Congress and the FCC have opted to stiffen—rather than loosen—federal preemption over local zoning authority. In 2009, for example, the wireless industry convinced the FCC to impose a "shot clock" that requires action within 90 days on many zoning applications. "My sense is that it was an industry request," said Robert Weller, who headed up the FCC's Office of Engineering and Technology when the shot clock was considered and imposed.[15]

And just last November, the FCC voted to further curb the rights of local zoning officials to control the expansion of antenna sites Again and again, Congress and the FCC have extended the wireless industry carte blanche to build out infrastructure no matter the consequences to local communities.

The question that hangs over all this: would consumers' embrace of cell phones and Wi-Fi be quite so ardent if the wireless industry, enabled by its Washington errand boys, hadn't so consistently stonewalled on evidence and substituted legal intimidation for honest inquiry? (See Appendix for online study of consumer attitudes on wireless health and safety.)

Document searches under the Freedom of Information Act reveal the central role of Tom Wheeler and the FCC in the tower siting issue. As both lobbyist and FCC chairman, Wheeler has proved himself a good friend of the wireless industry.

In January of 1997, CTIA chieftain Wheeler wrote FCC Wireless Telecommunications Bureau Chief Michele C. Farquhar citing several municipal efforts to assert control over siting. Wheeler, for example, asserted that one New England state had enacted a law requiring its Public Service Commissioner to issue a report on health risks posed by wireless facilities.[16] He

questions whether such a study—and regulations based on its results—would infringe on FCC preemption authority.

FCC bureau chief Farquhar hastily reassured Wheeler that no such study could be consulted in zoning decisions. "Therefore, based on the facts as you have presented them, that portion of the statute that directs the State Commissioner to recommend regulations based upon the study's findings would appear to be preempted,"[17] the FCC official wrote to Wheeler. She emphasized that the state had the right to do the study. It just couldn't deny a siting application based on anything it might learn.

The FCC in 1997 sent the message it has implicitly endorsed and conveyed ever since: study health effects all you want. It doesn't matter what you find. The build-out of wireless cannot be blocked or slowed by health issues.

Now let's fast forward to see Wheeler on the other side of the revolving door, interacting as FCC chairman with a former FCC commissioner who is now an industry lobbyist.

A March 14, 2014 letter[18] reveals the chummy relationship between Wheeler and former commissioner Jonathan Adelstein, now head of PCIA, the cellular infrastructure lobbying group. It also references FCC Chairman Wheeler seeking policy counsel from lobbyist Adelstein:

Wheeler Still Willing to Help

From: Jonathan Adelstein [mailto:adelstein@pcia.com]
Sent: Friday, March 14, 2014 12:24 PM
To: [redacted]
Cc: Renee Gregory; Jonathan Campbell
Subject: How to Spur Wireless Broadband Deployment

Tom – It was great to see you the other night at the FCBA event, and wonderful to see how much fun you're having (if that's the right word). I know I enjoyed my time there (thanks to your help with Daschle in getting me that role in the first place!).

Thanks for asking how we think the FCC can help spur wireless broadband deployment. The infrastructure proceeding perfectly tees up many of the top issues the FCC needs to address. As you requested, I've summarized briefly in the attached letter some of the key steps you can take now.

"Tom – It was great to see you the other night at the FCBA event, and wonderful to see how much fun you're having (if that's the right word). I know I enjoyed my time there (thanks to your help with Daschle in getting me that role in the first place!)."

"Thanks for asking how we think the FCC can help spur wireless broadband deployment," the wireless lobbyist writes to the ex-wireless lobbyist, now running the FCC.

Adelstein's first recommendation for FCC action: *"Amend its rules to categorically exclude DAS and small deployments* [Ed. note: these are compact tower add-ons currently being widely deployed] *from environmental and historic review."* Adelstein outlined other suggestions for further limiting local antenna zoning authority and the FCC soon did its part. Late last year, the agency proposed new rules that largely (though not entirely) complied with the antenna industry's wish list.

James R. Hobson is an attorney who has represented municipalities in zoning issues involving the FCC. He is also a former FCC official, who is now of counsel at Best, Best and Krieger, a Washington-based municipal law practice. "The FCC has been the ally of industry," says Hobson. Lobbyist pressure at the FCC was intense even back in the 70s, when he was a bureau chief there. "When I was at the FCC, a lot of my day was taken up with appointments with industry lobbyists." He says of the CTIA that Wheeler once headed: "Their reason for being is promoting the wireless industry. And they've been successful at it."[19]

The FCC's deferential compliance has allowed industry to regularly bypass and if necessary steamroll local authorities. Violation of the FCC-imposed "shot clock," for example, allows the wireless license applicant to sue.

The FCC's service to the industry it is supposed to regulate is evidently appreciated. The CTIA web site, typically overflowing with self-congratulation, spreads the praise around in acknowledging the enabling contributions of a cooperative FCC. In one brief summation of its own glorious accomplishments, CTIA twice uses the word "thankfully" in describing favorable FCC actions.

In advancing the industry agenda, the FCC can claim that it is merely reflecting the will of Congress. But the agency may not be doing even that.

Remember the key clause in the 96 Telecom Act that disallowed denial of zoning permits based on health concerns? Well, federal preemption is granted to pretty much any wireless outfit on just one simple condition: its installations must comply with FCC radiation emission standards. In view of this generous carte blanche to move radiation equipment into neighborhoods, schoolyards and home rooftops, one would think the FCC would at the very least diligently enforce its own emission standards. But that does not appear to be the case.

Indeed, one RF engineer who has worked on more than 3,000 rooftop sites found vast evidence of non-compliance. Marvin Wessel estimates that "10 to 20% exceed allowed radiation standards."[20] With 30,000 rooftop antenna sites across the U.S. that would mean that as many as 6,000 are emitting radiation in violation of FCC standards. Often, these emissions can be 600% or more of allowed exposure levels, according to Wessel.

Antenna standards allow for higher exposure to workers. In the case of rooftop sites, such workers could be roofers, painters, testers and installers of heating and air conditioning

equipment, to cite just a few examples. But many sites, according to Wessel, emit radiation at much higher levels than those permitted in occupational standards. This is especially true of sites where service providers keep adding new antenna units to expand their coverage. "Some of these new sites will exceed ten times the allowable occupational radiation level," said Wessel.[21] Essentially, he adds, this means that nobody should be stepping on the roof.

"The FCC is not enforcing its own standard," noted Janet Newton, who runs the EMF Policy Institute, a Vermont-based non-profit. That group several years ago filed 101 complaints on specific rooftop sites where radiation emissions exceeded allowable levels. "We did this as an exercise to hold the FCC's feet to the fire," she said. But the 101 complaints resulted in few responsive actions, according to Newton.[22]

Former FCC official Bob Weller confirms the lax—perhaps negligible is the more appropriate word—FCC activity in enforcing antenna standards. "To my knowledge, the enforcement bureau has never done a targeted inspection effort around RF exposure," he said.[23] Budget cuts at the agency have hurt, limiting the FCC's ability to perform field inspections, he added. But enforcement, he adds, would do wonders to insure industry compliance with its limited regulatory compliance requirements. "If there were targeted enforcement and fines issued the industry would pay greater attention to ensuring compliance and self-regulation," he allowed.

Insurance is where the rubber hits the road on risk. So it is interesting to note that the rating agency A.M. Best, which advises insurers on risk, in 2013 topped its list of "emerging technology-based risks" with RF Radiation:

> *"The risks associated with long-term use of cell phones, although much studied over the past 10 years, remain unclear. Dangers to the estimated 250,000 workers per year who come in close contact with cell phone antennas, however, are now more clearly established. Thermal effects of the cellular antennas, which act at close range essentially as open microwave ovens can include eye damage, sterility and cognitive impairments. While workers of cellular companies are well trained on the potential dangers, other workers exposed to the antennas are often unaware of the health risks. The continued exponential growth of cellular towers will significantly increase exposure of these workers and others coming into close contact with high-energy cell phone antenna radiation,"* A.M. Best wrote.[24]

So what has the FCC done to tighten enforcement? Apparently, not very much. Though it does follow up on many of the complaints filed against sites alleged to be in violation of standards it takes punitive actions very rarely. (The FCC did not provide answers to written questions on details of its tower enforcement policies.)

The best ally of industry and the FCC on this (and other) issues may be public ignorance.

An online poll conducted for this project asked 202 respondents to rate the likelihood of a series of statements.[25] Most of the statements were subject to dispute. Cell phones raise the risk of certain health effects and brain cancer, two said. There is no proof that cell phones are harmful, another declared. But among the six statements there was one statement of indisputable fact: "The U.S. Congress forbids local communities from considering health effects when deciding whether to issue zoning permits for wireless antennae," the statement said.

Though this is a stone cold fact that the wireless industry, the FCC and the courts have all turned into hard and inescapable reality for local authorities, just 1.5% of all poll respondents replied that it was "definitely true."

Public ignorance didn't take much cultivation by the wireless industry on the issue of local zoning. And maybe it doesn't matter much, considering the enormous popularity of wireless devices. But let's see how public ignorance has been cultivated and secured—with the FCC's passive support—on the potentially more disruptive issue of mobile phone health effects.

Chapter Three: Wireless Bullies and the Tobacco Analogy

Issues of cable and net neutrality have recently attracted wide public attention (more on that in Chapter Six). Still, the bet here remains that future judgment of the FCC will hinge on its handling of wireless health and safety issues.

And while the tower siting issue is an egregious example of an industry-dominated political process run amuck, the stronger health risks appear to reside in the phones themselves. This is an issue that has flared up several times in recent years. Each time, industry has managed to beat back such concerns. But it's worth noting that the scientific roots of concern have not disappeared. If anything, they've thickened as new research substantiates older concerns.

The story of an FCC passively echoing an industry determined to play hardball with its critics is worth a further look. The CTIA's own website acknowledges the helpful hand of government's "light regulatory touch" in allowing the industry to grow.[26]

Former congressman Dennis Kucinich ventures one explanation for the wireless industry's success in dodging regulation: "The industry has grown so fast its growth has overtaken any health concerns that may have gained attention in a slow growth environment. The proliferation of technology has overwhelmed all institutions that would have attempted safety testing and standards," Kucinich said.[27]

But the core questions remain: Is there really credible evidence that cell phones emit harmful radiation that can cause human health problems and disease? Has the FCC done an adequate job in protecting consumers from health risks? Or has it simply aped industry stonewalling on health and safety issues?

Before wading into these questions, some perspective is in order.

First, there's simply no denying the usefulness and immense popularity of wireless technology. People depend on it for safety, information, entertainment and communication. It doesn't take a keen social observer to know that wireless has thoroughly insinuated itself into daily life and culture.

The unanswered question, though, is whether consumers would embrace the technology quite so fervently if health and safety information was not spun, filtered and clouded by a variety of industry tactics.

To gain some insight into this question, we conducted an online survey of 202 respondents, nearly all of whom own cell phones, on Amazon's Mechanical Turk Web platform (see Appendix). One striking set of findings: many respondents claim they would change behavior—reduce wireless use, restore landline service, protect their children—if claims on health dangers of wireless are true.

It is not the purpose of this reporter to establish that heavy cell phone usage is dangerous. This remains an extremely controversial scientific issue with new findings and revised scientific conclusions repeatedly popping up. Just months ago, a German scientist who had been outspoken in denouncing the view that cell phones pose health risks reversed course. In an April 2015 publication, Alexander Lerchl reported results confirming previous research on the tumor-promoting effects of electromagnetic fields well below human exposure limits for mobile phones. "Our findings may help to understand the repeatedly reported increased incidences of brain tumors in heavy users of mobile phones," the Lerchl team concluded.[28] And in May 2015, more than 200 scientists boasting over 2,000 publications on wireless effects called on global institutions to address the health risks posed by this technology.

But the National Cancer Institute still contends that no cell phone dangers have been established. A representative of NCI was the sole known dissenter among the 30 members of the World Health Organization's International Agency for Research on Cancer (IARC) when it voted to declare wireless RF "possibly carcinogenic."[29] If leading scientists still can't agree, I will not presume to reach a scientific conclusion on my own.

IARC RF working group: Official press release

International Agency for Research on Cancer

World Health Organization

PRESS RELEASE
N° 208

31 May 2011

IARC CLASSIFIES RADIOFREQUENCY ELECTROMAGNETIC FIELDS AS POSSIBLY CARCINOGENIC TO HUMANS

Lyon, France, May 31, 2011 -- The WHO/International Agency for Research on Cancer (IARC) has classified radiofrequency electromagnetic fields as **possibly carcinogenic to humans (Group 2B)**, based on an increased risk for **glioma**, a malignant type of brain cancer, associated with wireless phone use.

But let's at least look at some of the incriminating clues that health and biology research has revealed to date. And let's look at the responses of both industry and the FCC.

The most widely cited evidence implicating wireless phones concerns gliomas, a very serious type of brain tumor. The evidence of elevated risk for such tumors among heavy cell phone users comes from several sources.

Gliomas account for roughly half of all malignant brain tumors, which are relatively rare. The annual incidence of primary malignant brain tumors in the U.S. is only 8.2 per 100,000 people, according to the International Radio Surgery Association.

Still, when projected over the entire U.S. population, the public health impact is potentially very significant.

Assuming roughly four new glioma cases annually in the U.S. per 100,000 people, yields over 13,000 new cases per year over a total U.S. population of 330 million. Even a doubling of that rate would mean 13,000 new gliomas, often deadly, per year. A tripling, as some studies have found, could mean as many as 26,000 more new cases annually. Indeed, the respected online site Medscape in January 2015 reported results of Swedish research under the headline: *Risk for Glioma Triples With Long-Term Cell Phone Use*.[30]

And here's some eye-opening quantitative perspective: the wars in Iraq and Afghanistan, waged now for more than a decade each, have together resulted in roughly 7,000 U.S. deaths.

Preliminary—though still inconclusive—research has suggested other potential negative health effects. Swedish, Danish and Israeli scientists have all found elevated risk of salivary gland tumors. One Israeli studied suggested elevated thyroid cancer risk. Some research has found that men who carry their phones in their pockets may suffer sperm count damage. One small study even suggests that young women who carry wireless devices in their bras are unusually vulnerable to breast cancer.

And while industry and government have never accepted that some portion of the population is unusually sensitive to electromagnetic fields, many people continue to complain of a broad range of symptoms that include general weakness, headaches, nausea and dizziness from exposure to wireless.

Some have suggested that the health situation with wireless is analogous to that of tobacco before court decisions finally forced Big Tobacco to admit guilt and pay up. In some ways, the analogy is unfair. Wireless research is not as conclusively incriminating as tobacco research was. And the identified health risks with wireless, significant as they are, still pale compared with those of tobacco.

But let's not dismiss the analogy outright. There is actually a very significant sense in which the tobacco-wireless analogy is uncannily valid.

People tend to forget that the tobacco industry—like the wireless industry—also adopted a policy of tone-deaf denial. As recently as 1998, even as evidence of tobacco toxicity grew overwhelming, cigarette maker Phillip Morris was writing newspaper advertorials insisting there was no proof smoking caused cancer.

It seems significant that the responses of wireless and its captured agency—the FCC—feature the same obtuse refusal to examine the evidence. The wireless industry reaction features stonewalling public relations and hyper aggressive legal action. It can also involve undermining the credibility and cutting off the funding for researchers who do not endorse cellular safety. It is these hardball tactics that look a lot like 20th century Big Tobacco tactics. It is these hardball tactics—along with consistently supportive FCC policies—that heighten suspicion the wireless industry does indeed have something to hide.

Begin with some simple facts issuing from meta-analysis of cellular research. Dr. Henry Lai, emeritus professor of bioengineering at the University of Washington, has reviewed hundreds of published scientific papers on the subject. He wanted to see how many studies demonstrated that non-ionizing radiation produces biological effects beyond the heating of tissue. This is critical since the FCC emission standards protect only against heating. The assumption behind these standards is that there are no biological effects beyond heating.

But Dr. Lai found that just over half—actually 56%—of 326 studies identified biological effects. And the results were far more striking when Dr. Lai divided the studies between those that were industry-funded and those that were independently funded. Industry-funded research identified biological effects in just 28% of studies. But fully 67% of non-industry funded studies found biological effects (Insert Slide—Cell Phone Biological Studies).

A study conducted by Swiss and British scientists also looked at how funding sources affected scientific conclusions on the possible health effects of cell phone usage. They found that of studies privately funded, publicly funded and funded with mixed sponsorship, industry-funded studies were "least likely to report a statistically significant result."[31] "The interpretation of results from studies of health effects of radiofrequency radiation should take sponsorship into account," the scientists concluded.[32]

So how does the FCC handle a scientific split that seems to suggest bias in industry-sponsored research?

In a posting on its Web site that reads like it was written by wireless lobbyists, the FCC chooses strikingly patronizing language to slight and trivialize the many scientists and health and safety experts who've found cause for concern. In a two page Web post titled "Wireless Devices and Health Concerns," the FCC four times refers to either "some health and safety interest groups," "some parties," or "some consumers" before in each case rebutting their presumably groundless concerns about wireless risk.[33] Additionally, the FCC site references the World Health Organization as among those organizations who've found that "the weight of scientific

evidence" has not linked exposure to radiofrequency from mobile devices with "any known health problems."

Yes, it's true that the World Health organization remains bitterly divided on the subject. But it's also true that a 30 member unit of the WHO called the International Agency for Research on Cancer (IARC) was near unanimous in pronouncing cell phones "possibly carcinogenic" in 2011. How can the FCC omit any reference to such a pronouncement? Even if it finds reason to side with pro-industry scientists, shouldn't this government agency also mention that cell phones are currently in the same potential carcinogen class as lead paint?

Now let's look a bit more closely at the troublesome but presumably clueless crowd of "some parties" that the FCC so cavalierly hastens to dismiss? Let's begin with **Lennart Hardell**, professor of Oncology and Cancer Epidemiology at the University Hospital in Oreboro, Sweden.

Until recently it was impossible to gain any real sense of brain tumor risk from wireless since brain tumors often take 20 or more years to develop. But the cohort of long-term users has been growing. In a study published in the International Journal of Oncology in 2013, Dr. Hardell and Dr. Michael Carlberg found that the risk of glioma—the most deadly type of brain cancer—rose with cell phone usage. The risk was highest among heavy cell phone users and those who began to use cell phones before the age of 20.[34]

Indeed, those who used their phones at least 1640 hours (which would be roughly 30 minutes a day for nine years) had nearly three times the glioma incidence. Drs. Hardell and Carlberg also found that gliomas tend to be more deadly among heavy wireless callers.[35]

Perhaps of greatest long-term relevance, glioma risk was found to be four times higher among those who began to use mobile phones as teenagers or earlier. These findings, along with the established fact that it generally takes decades for tumors induced by environmental agents to appear, suggest that the worst consequences of omnipresent wireless devices have yet to be seen.

In a 2013 paper published in *Reviews on Environmental Health*, Drs. Hardell and Carlberg argued that the 2011 finding of the IARC that identified cell phones as a "possibly carcinogenic" needs to be revised. The conclusion on radiofrequency electromagnetic fields from cell phones should now be "cell phones are not just a possible carcinogen." They can now be "regarded as carcinogenic to humans" and the direct cause of gliomas (as well as acoustic neuromas, a less serious type of tumor).[36] Of course, these views are not universally accepted.

The usual spin among industry supporters when presented with research that produces troubling results is along the lines of: "We might pay attention if the results are duplicated." In fact, the Hardell results were echoed in the French CERENAT study, reported in May of 2014. The CERENAT study also found higher risk among heavy users, defined as those using their phones at least 896 hours (just 30 minutes a day for five years). "These additional data support

previous findings concerning a possible association between heavy mobile phone use and brain tumors," the study concluded.[37]

Cell phones are not the only wireless suspects. Asked what he would do if he had policy-making authority, Dr. Hardell swiftly replied that he would "ban wireless use in schools and pre-schools. You don't need Wi-Fi," he noted.[38] This is especially interesting in view of the FCC's sharply hiked spending to promote and extend Wi-Fi usage, as well as its consistent refusal to set more stringent standards for children (more on all this later). But for now let's further fill out the roster of the FCC's unnamed "some parties."

Martin Blank is a Special Lecturer in Physiology and Cellular Biophysics at Columbia University. Unlike Dr. Hardell, who looks at broad epidemiological effects over time, Dr. Blank sees cause for concern in research showing there is biological response at the cellular level to the type of radiation emitted by wireless devices. "The biology tells you unequivocally that the cell treats radiation as a potentially damaging influence," Dr. Blank said in a late 2014 interview.[39]

"The biology tells you it's dangerous at a low level," he added. Though some results have been difficult to replicate, researchers have identified a wide range of cellular responses including genetic damage and penetration of the blood brain barrier. Dr. Blank specifically cited the "cellular stress response" in which cells exposed to radiation start to make proteins.

It is still not clear whether biological responses at the cellular level translate into human health effects. But the research seems to invalidate the basic premise of FCC standards that the only biological effect of the type of radiation produced by wireless devices is tissue heating at very high power levels. But the standards-setting agencies "ignore the biology," according to Dr. Blank. He describes the FCC as being "in industry's pocket."[40]

Sweden's Lund University is annually ranked among the top 100 universities in the world. **Leif Salford** has been chairman of the Department of Neurosurgery at Lund since 1996. He is also a former president of the European Association for Neuro-Oncology. In the spring of 2000, Professor Salford told me that wireless usage constituted "the world's largest biological experiment ever."[41]

He has conducted numerous experiments exposing rats to cellular-type radiation. Individual experiments have shown the radiation to penetrate the blood-brain barrier, essential to protecting the brain from bloodstream toxins. Professor Salford also found that rats exposed to radiation suffered loss of brain cells. "A rat's brain is very much the same as a human's. They have the same blood-brain barrier and neurons. We have good reason to believe that what happens in rat's brains also happens in humans," he told the BBC in 2003. Dr. Salford has also speculated that mobile radiation could trigger Alzheimer's disease in some cases but emphasized that much more research would be needed to establish any such causal relationship. Does this man deserve to be dismissed as one of a nameless and discredited group of "some parties?"

And what about the **American Academy of Pediatrics (AAP),** which represents 60,000 American doctors who care for children? In a December 12, 2012 letter to former Ohio Congressman Dennis Kucinich, AAP President Dr. Thomas McInerny writes: "Children are disproportionately affected by environmental exposures, including cell phone radiation. The differences in bone density and the amount of fluid in a child's brain compared to an adult's brain could allow children to absorb greater quantities of RF energy deeper into their brains than adults."[42]

In a subsequent letter to FCC officials dated August 29, 2013, Dr. McInerny points out that "children, however, are not little adults and are disproportionately impacted by all environmental exposures, including cell phone radiation." Current FCC exposure standards, set back in 1996, "do not account for the unique vulnerability and use patterns specific to pregnant women and children," he wrote. (Insert slide: A Plea from Pediatricians). Does an organization representing 60,000 practitioners who care for children deserve to be brushed off along with "some health and safety interest groups?"

So what is the FCC doing in response to what at the very least is a troubling chain of clues to cellular danger? As it has done with wireless infrastructure, the FCC has to this point largely relied on industry "self-regulation." Though it set standards for device radiation emissions back in 1996, the agency doesn't generally test devices itself. Despite its responsibility for the safety of cell phones, the FCC relies on manufacturers' good-faith efforts to test them. Critics contend that this has allowed manufacturers undue latitude in testing their devices.

Critics further contend that current standards, in place since cell phones were barely in use, are far too lax and do not reflect the heavy usage patterns that have evolved. Worse still, industry is allowed to test its own devices using an imprecise system that makes no special provision for protecting children and pregnant women. One 2012 study noted that the procedure widely used by manufacturers to test their phones "substantially underestimates" the amount of RF energy absorbed by 97% of the population, "especially children." A child's head can absorb over two times as much RF energy. Other persons with smaller heads, including women, are also more vulnerable. The authors recommend an alternative computer simulation technique that would provide greater insight into the impact of cellular radiation on children and on to the specific RF absorption rates of different tissues, which vary greatly.[43]

Acting on recommendations of the General Accounting Office, the FCC is now reconsidering its standards for wireless testing and allowed emissions. On the surface, this may seem to represent an effort to tighten standards to promote consumer health and safety. But many believe the FCC's eventual new standard will actually be weaker, intensifying any health risk from industry's self-reported emission levels. "They're under great pressure from industry to loosen the criteria," notes Joel Moskowitz, director of the Center for Family and Community Health at UC Berkeley's School of Public Health.[44] One fear is that the FCC could measure the allowed radiation absorption level (SAR) over a wider sample of tissue, effectively loosening the

standard allowable energy absorption. One FCC official, who asked that his name not be used, contended that a decision had not yet been made to loosen the standard.

But to this point, there is little evidence the FCC is listening to anyone beyond its familiar friends in the wireless industry. Carl Blackman, a scientist at the Environmental Protection agency until retiring in 2014, notes that the FCC does rely to some degree on an inter-agency governmental group for advice on health matters. The group includes, for example, representatives from the EPA and the FDA.

Blackman served on that advisory group and he says that it has been divided. Though some government advisers to the FCC find evidence of wireless health risks convincing, others remain skeptical, said Blackman. Root of the skepticism: even though numerous researchers have found biological and health effects, the mechanism for action by non-ionizing radiation on the human body has still not been identified. "I don't think there's enough of a consensus within the Radio Frequency Inter-agency Working Group for them to come out with stricter standards," he says.[45]

But political pressures also figure mightily in all this. The EPA, notably, was once a hub of research on RF effects, employing as many as 35 scientists. However, the research program was cut off in the late 80s during the Regan presidency. Blackman says he was personally "forbidden" to study health effects by his "supervisory structure."[46] He termed it "a political decision" but recognized that if he wanted to continue to work at the EPA he would have to do research in another area.

Blackman is cautious in imputing motives to the high government officials who wanted his work at EPA stopped. But he does say that political pressure has been a factor at both the EPA and FCC: "The FCC people were quite responsive to the biological point of view. But there are also pressures on the FCC from industry." The FCC, he suggests, may not just be looking at the scientific evidence "The FCC's position—like the EPA's—is influenced by political considerations as well."[47]

Still, the FCC has ultimate regulatory responsibility and cannot indefinitely pass the buck on an issue of fundamental public health. Remarkably, it has not changed course despite the IARC classification of cell phones as possibly carcinogenic, despite the recent studies showing triple the glioma risk for heavy users, despite the floodtide of research showing biological effects, and despite even the recent defection of core industry booster Alex Lerchl. It is the refusal of both industry and the FCC to even acknowledge this cascade of warning signs that seems most incriminating.

Of course, industry behavior goes well beyond pushing for the FCC's willful ignorance and inaction. Industry behavior also includes self-serving public relations and hyper aggressive legal action. It can also involve undermining the credibility of and cutting off the funding for researchers who do not endorse cellular safety. It is these hardball tactics that recall 20th century Big Tobacco tactics. It is these tactics that heighten suspicion that the wireless industry does

indeed have a dirty secret. And it is those tactics that intensify the spotlight on an FCC that so timidly follows the script of the fabulously wealthy, bullying, billion-dollar beneficiaries of wireless.

Chapter Four: You Don't Need Wires To Tie People Up

So let's look a little more deeply at some of the actions of an industry group that boasts of 500 meetings a year with the FCC. Lobbying is one thing. Intimidation is another. CTIA has shown its skill at—and willingness to use—both.

Outright legal bullying is a favored tactic. The City of San Francisco passed an ordinance in 2010 that required cell phone manufacturers to display more prominently information on the emissions from their devices. This information was already disclosed—but often buried—in operator manuals and on manufacturer websites. The idea was to ensure that consumers saw information already mandated and provided.

Seeing this as a threat to its floodtide of business, the industry sued the City of San Francisco. The City, fearing a prolonged legal fight with an industry that generates hundreds of billions of dollars in annual revenue, backed down.

On May 12, 2015, Berkeley, California's City Council unanimously passed a similar ordinance. Joel Moskowitz, director of the Center for Family and Community Health at the University of California-Berkeley's School of Public Health, has been involved in the effort. Berkeley, he says, didn't want to run into the same legal threats that paralyzed San Francisco. So it tried to draft the most inoffensive and mild language possible. The proposed Cell Phone Right to Know ordinance: "To assure safety, the Federal Government requires that cell phones meet radio frequency (RF) exposure guidelines. If you carry or use your phone in a pants or shirt pocket or tucked into a bra when the phone is ON and connected to a wireless network, you may exceed the federal guidelines for exposure to RF radiation. This potential risk is greater for children. Refer to the instructions in your phone or user manual for information about how to use your phone safely."[48]

Sounds pretty inoffensive, no? Not to the CTIA, which indicated that it was prepared to sue, according to Berkeley City Attorney Zach Cowan.[49] (On June 8th, CTIA did indeed sue the City of Berkeley.)

Well, from the industry point of view, why not throw around your weight? Smash mouth legal tactics have been highly successful thus far as industry has managed to throttle several efforts to implicate manufacturers in cases where heavy users suffered brain tumors.

But one current case has advanced in district court in Washington to the point where the judge allowed plaintiffs to present expert witness testimony. The industry response: file a legal action seeking to invalidate long-held court methods for qualifying expert witnesses.

This is a very rich industry that does not hesitate to outspend and bully challengers into submission. Meanwhile, amidst the legal smoke and medical confusion, the industry has

managed to make the entire world dependent on its products. Even tobacco never had so many hooked users.

Such sustained success in the face of medical doubt has required industry to keep a lid on critics and detractors. Many scientists who've found real or potential risk from the sort of microwave radiation emanating from wireless devices have learned there is a price to be paid for standing up to the industry juggernaut. A few prominent examples:

--

In 1994, University of Washington researchers Henry Lai and N.P. Singh found that rats exposed to microwave radiation suffered DNA damage to their brain cells. This was a scary finding since DNA damage can lead to mutations and possibly cancer.

The reaction from industry was swift. Motorola was at that time the U.S. market leader in cell phones. In a memorandum obtained by the journal Microwave News, Motorola PR honcho Norm Sandler outlined how the company could "downplay the significance of the Lai study." One step: "We have developed a list of independent experts in this field and are in the process of recruiting individuals willing and able to reassure the public on these matters," Sandler wrote. After outlining such measures, he concluded that Motorola had "sufficiently war-gamed" the issue. The practices of lining up industry-friendly testimony and "war-gaming" researchers who come up with unfavorable results have been persistent themes with this industry.

--

After Lai's results were published, Motorola decided to sponsor further research on microwaves and DNA damage. Oftentimes, lab results cannot be reproduced by other

researchers, particularly if experiments are tweaked and performed a bit differently. Non-confirming studies raise doubt, of course, on the original work.

Motorola lined up Jerry Phillips, a scientist at the Veteran's Administration Medical Center in Loma Linda, California, and Phillips tested the effect of radiation at different frequencies from those tested by Lai and Singh. Nevertheless, Phillips found that at some levels of exposure, DNA damage increased, while at other levels it decreased. Such findings were "consistent" with the sorts of effects produced by chemical agents, Phillips said in an interview.[50] In some cases, the radiation may have activated DNA repair mechanisms, reducing the overall microwave effect. But what was important, Phillips explained, is that there were *any* biological effects at all. The wireless industry has long contended—and the FCC has agreed—that there is no evidence that non-ionizing radiation at the frequencies and power levels used by cell phones is biologically active.

Understanding the potential impact of "biological effect" findings, Motorola again turned to damage control, said Phillips. He recalls receiving a phone call from a Motorola R&D executive. "I don't think you've done enough research,'" Phillips recalls being told. The study wasn't ready for publication, according to the Motorola executive. Phillips was offered more money to do further research without publishing the results of what he'd done.

But Phillips felt he'd done enough. Despite warnings for his own boss to "give Motorola what it wants," Phillips went ahead and published his findings in 1998. Since then, Phillips' industry funding has dried up. Meanwhile, as many other researchers report, government funding to do independent research on microwave radiation has dried up, leaving the field at least in the U.S. to industry-funded scientists. "There is no money to do the research," Said Phillips. "It's not going to come from government because government is controlled by industry."[51]

--

Om P. Gandhi is Professor of Electrical and Computer Engineering at the University of Utah and a leading expert in dosimetry—measurement of non-ionizing radiation absorbed by the human body. Even before cell phones were in wide use, Professor Gandhi had concluded that children absorb more emitted microwave radiation. "The concentration of absorbed energy is 50 to 80% greater," he explained.[52]

These conclusions were not acceptable to Professor Gandhi's industrial sponsors. In 1998, he recalls, an executive from a cell phone manufacturer—which he did not want to identify—told him directly that if he did not discontinue his research on children his funding would be cut off. Professor Gandhi recalled replying: "I will not stop. I am a tenured professor at the University of Utah and I will not reject my academic freedom." Professor Gandhi also recalled some of his thought process: "I wasn't going to order my students to alter their results so that I can get funding." His industry sponsors cancelled his contract and asked for a return of funds.

Professor Gandhi believes that some cell phone users require extra protection because their heads are smaller and more absorptive. “Children, as well as women and other individuals with smaller heads absorb more concentrated energy because of the proximity of the radiating antenna to the brain tissue,” he said. And yet the FCC has not acted to provide special protection for these groups. Asked why not, Professor Gandhi conceded that he doesn’t know. He does note, however, that recent standards-setting has been dominated by industry representatives.[53]

--

While the mobile industry refuses to admit to even the possibility that there is danger in RF radiation, giant insurance companies see things differently. Several insurers have in recent years issued reports highlighting product liability risk with cell phones. This is important because it is evidence that where money is on the line professionals outside the industry see the risk of legal liability.

Legal exposure could be one reason—perhaps the central one—the industry continues to stonewall. Should legal liability be established, one key question will be how much wireless executives knew—and at what point in time. Meanwhile, the combination of public relations denials, legal intimidation and the selective application of pressure on research follows a familiar pattern. “The industry is basically using the tobacco industry playbook,” UC Berkeley’s Moskowitz said in a recent radio interview.[54]

That playbook has thus far been highly successful in warding off attention, regulation and legal incrimination.

Chapter Five: $270 Billion . . . and Looking for Handouts

The FCC's network of corruption doesn't just shield industry from needed scrutiny and regulation on matters of public health and safety. Sometimes it just puts its hand directly into the public pocket and redistributes that cash to industry supplicants.

Such is arguably the case with the Universal Service Fund. Originally established to extend telephone service to rural and urban areas that industry would find difficult or uneconomical to wire, the USF is now shifting from subsidizing landline phone service to subsidizing the extension of broadband Internet. USF monies also support the Lifeline program, which subsidizes cell phone service to low-income consumers, and the E-Rate program, which subsidizes Internet infrastructure and service to schools and libraries.

Since 1998, more than $110 billion has been allocated to Universal Service programs, notes Charles Davidson, director of the Advanced Communications Law & Policy Institute at New York Law School. The FCC has allocated over $40 billion to the E-Rate program alone.

Who pays the freight for these high-cost programs? You do.

Technically, landline and wireless phone companies are assessed for the Universal Service fund's expenditures. But the FCC also allows those companies to pass on such charges to their subscribers, which they do. Both landline and wireless subscribers pay a monthly Universal Service charge that is tacked on to their phone bills. That charge has been rising and recently amounted to a 16% surcharge on interstate calls.

Consumers who pay for these programs might be interested to learn that both the E-Rate and Lifeline programs have been riddled with fraud. Government watchdogs have repeatedly found the programs to be inefficient and prone to inflated and fraudulent claims. But the programs have been a windfall for tech and telecom industry beneficiaries. Wherever the FCC presides, it seems, these industries reap a windfall.

The General Accounting Office (GAO) has issued several reports citing fraud, waste and mismanagement, along with inadequate FCC oversight of the subsidy program. Bribery, kickbacks and false documentation can perhaps be expected in a handout program mandated by Congress and only indirectly supervised by the FCC.

But the scope of fraud has been impressive. The most striking corruption has marred the E-Rate program, which subsidizes Internet hardware, software and service for schools and libraries, and the Lifeline cell phone subsidies.

In recent years, several school districts have paid fines to settle fraud cases involving bribery, kickbacks, non-competitive bidding of contracts and false documentation in the E-Rate

program. More eye opening perhaps are the settlements of fraud claims by tech giants like IBM, Hewlett Packard and AT&T. The HP case, for example, involved some colorful bribery allegations, including gifts of yachts and Super Bowl tickets. HP settled for $16 million. An HP official and a Dallas Independent School District official both received jail sentences.

The Lifeline program has also been riddled with fraud. A Wall Street Journal investigation of the five top corporate beneficiaries of Lifeline showed that 41% of more than 6 million subsidy claimants "couldn't demonstrate their eligibility or didn't respond to requests for certification."[55] AT&T, Verizon, and Sprint Nextel were three of the major Lifeline beneficiaries.

The FCC has initiated several efforts to clean up USF programs and seems honestly determined to bring greater accountability and efficiency to its subsidy efforts. Nevertheless, problems with fraud persist, as reported recently by the FCC's own top investigator.

Congress established the FCC's Office of Inspector General in 1989 to "provide objective and independent investigations, audits and reviews of the FCC's programs and operations." Here's what the FCC's internal investigative unit said in a September 30, 2014 report to Congress about its Office of Investigation (OI): "*The bulk of the work of OI involves investigating and supporting civil and criminal investigations/prosecutions of fraud in the FCC's federal universal service program*."[56]

Fraud—as pervasive and troubling as it has been—is just one of the problems with the programs of universal service. It may not even be the fundamental problem. More fundamental issues concern the very aim, logic and efficiency of programs to extend broadband and wireless technology at public expense. Though the aims of extending service to distant impoverished areas seem worthy on the surface, there are many reasons to think the major beneficiaries of these programs are the technology companies that win the contracts.

Lobbyists have long swarmed over the FCC looking to get an ever-growing piece of the USF honeypot. An FCC report on meetings with registered lobbyists details a 2010 meeting with representatives of the International Society for Technology in Education and other education lobbyists. Topics discussed, according to the FCC report, included "the need to raise the E-Rate's annual cap."[57]

The CTIA, leaving no stone unturned in its efforts to pump up member revenues, last year responded to a House hearing on the USF by grousing that "current USF-supported programs skew heavily toward support of wireline services. . . . The concentration of USF monies to support wireline services is inconsistent with technological neutrality principles and demonstrated consumer preferences," CTIA wrote..[58] An industry that generates hundreds of billions of dollars in equipment and service revenues annually bellies up for a bigger slice of the $8 billion a year USF.

The grousing has paid off. The FCC recently announced that it will raise spending on E-Rate from what had been a cap of $2.4 billion a year to $3.9 billion. A significant portion of new outlays will go to Wi-Fi—yet another wireless industry victory at the FCC. But the CTIA is by no means the only industry group pressing the FCC.

Leading the roster of active lobbyists on E-Rate issues is the Software and Information Industry Association. Beginning in 2006, SIAA led all lobbyists with 54 mentions of E-Rate in its filings, according to the Center for Responsive Politics. SIAA board members include executives from tech heavyweights Google, Oracle and Adobe Systems.

Tech business leaders—many of them direct beneficiaries of FCC programs—made a direct pitch to FCC Chairman Wheeler last year to hike E-Rate funding. "The FCC must act boldly to modernize the E-Rate program to provide the capital needed to upgrade our K-12 broadband connectivity and Wi-Fi infrastructure within the next five years," the executives wrote.[59]

There were dozens of corporate executive signees to this letter, including the CEOs of many Fortune 500 giants. But let's just consider the participation of three: top executives of Microsoft, Google and HP all joined the call to expand E-Rate subsidies. Consider the simple fact that these three tech giants alone had revenues of $270 billion—more than a quarter of a trillion dollars—in a recent four-quarter period. Together, they produced nearly $40 billion in net income. And yet their top executives still thought it necessary to dun the FCC—and really, they were surreptitiously hitting up the public—for ramped-up spending on what was then a $2.4 billion a year program.

Is that greed? Arrogance? Or is it simply behavior conditioned by success in repeatedly getting what they want at the public trough? Almost never mentioned in these pleas for higher subsidies is the fact that ordinary American phone subscribers are the ones footing the bill for the E-Rate program—not the FCC or the telecom industry.

Much of the added spending, as noted, will go towards the installation of wireless networks. And yet Wi-Fi does not have a clean bill of health. When Lennart Hardell, professor of Oncology and Cancer Epidemiology at the University Hospital in Orebro, Sweden, was asked what he would do if given policy authority over wireless health issues, he replied swiftly that he would "ban wireless use in schools and pre-school." Noting that there are wired alternatives, Professor Hardell flatly stated: "You don't need Wi-Fi."[60] And yet the FCC, prodded by an industry ever on the lookout for incremental growth opportunities, is ignoring the health of youngsters to promote expanded Wi-Fi subsidies in schools across the U.S.

And what about the merit of the program itself? Overlooking the fraud and lobbying and Wi-Fi safety issues for a moment, shouldn't schools and libraries across the country be equipped with the best electronic gear, accessing the Internet at the fastest speeds? Doesn't the government owe that to its younger citizens, especially those disadvantaged by the long-referenced digital divide?

Well, maybe. But answers to these questions hinge on even more fundamental question: Do students actually learn more or better with access to the latest high-speed electronic gadgetry?

It would be foolish to argue that nobody benefits from access to high-speed Internet. But the benefits are nowhere near as broad or rich as corporate beneficiaries claim. Some researchers, for example, have concluded that computers don't seem to have positive educational impact—they may even have negative impact—when introduced into the home or freely distributed to kids from low income backgrounds.

Duke University researchers Jacob Vigdor and Helen Ladd studied the introduction of computers into North Carolina homes. They found that the academic performance of youngsters given computers actually declined. *"The introduction of home computer technology is associated with modest but statistically significant and persistent negative impacts on student math and reading test scores,"* the authors wrote in a National Bureau of Economic Research Working Paper.[61] The impact was actually most negative on the poorer students.

A study in the Journal of International Affairs examined the impact of the global One Laptop Per Child Program (OLPC), which has distributed millions of computers to children around the world. Researchers Mark Warschauer and Morgan Ames conclude: *"The analysis reveals that provision of individual laptops is a utopian vision for the children in the poorest countries, whose educational and social futures could be more effectively improved if the same investments were instead made on more proven and sustainable interventions. Middle- and high-income countries may have a stronger rationale for providing individual laptops to children, but will still want to eschew OLPC's technocratic vision. In summary, OLPC represents the latest in a long line of technologically utopian schemes that have unsuccessfully attempted to solve complex social problems with overly simplistic solutions*."[62]

Access to computers in the home may not work educational magic. But what about computers in the classroom? Don't they have educational value there?

The anecdotal evidence is mixed at best. Consider how students in Los Angeles, newly equipped with flashy iPads at a mind-boggling taxpayer cost of more than $1 billion, went about using the new tools to improve their educational performance. "Instead of solving math problems or doing English homework, as administrators envisioned, more than 300 Los Angeles Unified School District students promptly cracked the security setting and started tweeting, posting to Facebook and playing video games."[63]

But let's cut through the self-serving corporate claims and the troubling anecdotes to hear from someone who actually has had extensive and unique field experience. Kentaro Toyama was co-founder of Microsoft's research lab in India. Over more than five years he oversaw at least a dozen projects that sought to address educational problems with the introduction of computer technology. His conclusion: "The value of technology has been over-hyped and over-sold."

The most important factor in improving schools, says Toyama, now the W.K Kellogg Associate Professor of Community Information at the University of Michigan, is good teachers. Without good, well-trained teachers, adequate budgets and solid school administration, technology does little good. "Technology by itself never has any kind of positive impact," he said.[64]

The only schools in his experience that benefited from increased technology investment were those where "the teachers were very good, the budgets adequate." The richer schools, in essence. But as both Vigdor and Warschauer found, the introduction of technology has by itself little if any positive effect. For a public conditioned to believe in the virtues of new technology, such testimony is a bracing dose of cold reality.

But what about cost? Doesn't technology in the schools more efficiently replace alternative investments? Cost reductions are often the most persuasive argument for technology, Toyama agrees. But even these have been overstated. The costs of introducing new technology run far beyond initial hardware and software investments, said Toyama. In reality, the total costs of ownership—including maintenance, training, and repair—typically run to five or ten times the initial cost, according to Toyama. He said of the investment in technology for cost benefits: "I would say that in the long run—and even in the medium run and the short-run—that's probably the worst and most misguided conclusion to come to."[65]

He adds: "The inescapable conclusion is that significant investments in computers, mobile phones and other electronic gadgets in education are neither necessary nor warranted for most school systems. In particular, the attempt to use technology to fix underperforming class rooms . . . is futile. And for all but wealthy, well-run schools, one-to-one computer programs cannot be recommended in good conscience."[66]

But that doesn't keep industry lobbyists from recommending them. And it hasn't kept the FCC for spending scores of billions subsidizing technology to the very groups least likely to benefit from it.

Unmoved by the arguments of researchers and educators like Vigdor, Warschauer, and Toyama, the FCC keeps moving to increase technology subsidies. Ignoring research that disputes the value of technology in closing the so-called "digital divide," the FCC has even pioneered a new slogan: "the Wi-Fi gap."

In announcing that it was lifting E-Rate's annual budget from $2.4 billion to $3.9 billion and stepping up investment in wireless networking, FCC chairman Wheeler exulted that "10 million students are going to experience new and better opportunities."[67] The impact on consumer pocketbooks (and potentially on youngsters' health from daily Wi-Fi exposure) were not mentioned.

The two Republican members of the FCC did at least recognize the pocketbook impact. "It always seems easier for some people to take more money from the American people via higher taxes and fees rather than do the hard work," said Commissioner Michael O'Reilly.[68]

The subsidized provision of high-speed Internet service is yet another pet project of the FCC. Julius Genachowski, chairman from 2009 to 2013, championed the transition of the USF from landline phone service to broadband. Universal broadband Internet connections would begin to absorb the monies collected from consumers to extend basic phone service.

As with government subsidies for cell phone service, classroom technology, and Wi-Fi, there are basic questions about the wisdom of subsidizing broadband. Charles Davidson and Michael Santorelli of the New York Law School found that spending billions to extend broadband is a flawed approach since there are many largely ignored reasons people choose not to adopt

broadband. “Everybody is pushing broadband non-stop,” noted Davidson, director of the Law School’s Advanced Communications Law and Policy Institute. “I think the FCC is focused on the wrong set of issues,” he said.[69]

Already, he explained, over 98% of Americans have access to wired or wireless broadband. The issue is not one of supply. It’s one of demand. Many people—for a variety of reasons—don’t really care about broadband, he contends. Price is one issue. Also powerful factors—but given almost no attention—are privacy and security concerns. “In our view, they should be focused on barriers to meaningful broadband utilization: privacy and security,” said Davidson.[70]

But consumer privacy (more on this subject in Chapter Seven) has no well-funded lobby with limitless access to the FCC.

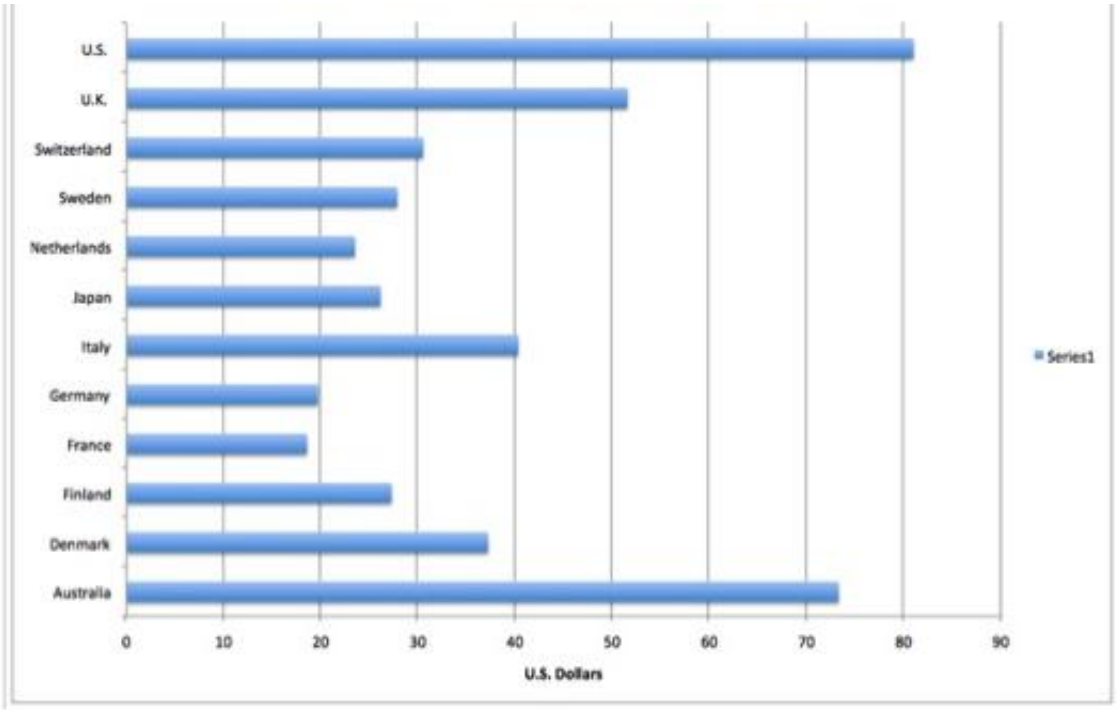
Chapter Six: The Cable Connection

The network has also been active in diluting FCC control of the cable television industry. Over the years, cable has devolved into major de facto local monopolies. Comcast and Time Warner Cable, whose merger proposal was dropped in April, are dominant forces in both cable television and broadband Internet subscriptions. Somehow, though, they have managed to steer clear of one another in specific markets, giving each pricing power where it faces little local competition.

It's interesting that cable companies annually rank in consumer polls among the "most hated" or "most disliked" American corporations. Indeed, Comcast and Time Warner Cable often top the "most hated" list.[71] Why would these companies—providers of the TV programming that has so expanded consumer options in recent decades—be so widely scorned? After all, the U.S. has been a leader in developing both cable technology and diverse television programming.

The problem is that it hasn't been anything close to a leader in bringing down subscriber prices. Industry consultants typically measure pricing by the metric of average revenue per subscriber. Industry trackers at IHS compared the price of U.S. pay television (which includes satellite services) to those in more than 60 other countries. U.S. prices were the highest, with only Australia even coming close. The average revenue per subscriber in the U.S. in 2013 was $81. But in France it was just $18.55. In Germany it was $19.68. In Japan it was just over $26.

Pay TV Monthly Revenue Per Person:



And U.S. cable prices have risen in recent years at rates three or more times the rate of inflation. This has been going on for some time. From 1995 to 2013 cable rates increased at a 6.1% annual clip. The Consumer Price Index, by contrast, rose by just 2.4% annually. Former FCC commissioner Michael Copps says the FCC shares a major part of the blame. "The FCC is as culpable for allowing that as much as the companies for imposing it," he said.[72]

One area where the FCC has contributed to the problem is in its traditional rubber-stamping of merger agreements. The proposed Comcast/Time Warner Cable deal has been shelved, largely because of Justice Department reservations. But a long run of earlier FCC-sanctioned deals allowed Comcast and Time Warner Cable to grow to the market dominance—and attendant pricing power—they currently command.

Lofty monthly cable bills pinch consumers. But it's more than that. Subscribers paying $80 a month are often paying for a lot of channels they don't watch and don't want. The FCC has never required cable operators to charge for what consumers actually want to watch. Kevin Martin, who chaired the FCC from 2005 to 2009, pushed to "debundle" programming in hopes of lowering bills. But the issue was never resolved. Only recently have viable competitive alternatives to cable's "bundled" packages become available. The satellite service Dish, for example, months ago introduced its Sling offering that enables consumers to opt for smaller and cheaper packages.

In fairness to cable operators, it should be pointed that programmers often require operators to take unwanted or fledgling channels along with their stars. New York cable operator Cablevision Systems filed suit against Viacom in 2013, charging that in order to get popular channels like MTV and Nickelodeon it was also forced to take low-rated channels like Nicktoons and VH1 Soul. But the simple truth is that no matter who is to blame, the cable consumer pays high prices, typically for some programming he doesn't want. As it often does when powerful interests pursue dubious practices, the FCC has for the most part idly stood by.

Still, the FCC isn't entirely to blame. Some factors in the growth of the cable giants cannot be laid at its doorstep. Local municipalities often granted monopoly or duopoly status in granting franchises to cable network builders. With the huge capital investments required to cable metropolitan areas, this once seemed to make sense.

And over the years, the cable giants have used a variety of tactics to weaken what little local competition they may have had. Active lobbyists on the local level, the cable giants have managed to convince a growing number of states to outlaw municipal systems that could threaten private corporate incumbents. The FCC for many years declined to tangle with the states in this matter, partly due to the opposition of Republican commissioners. But the Wheeler-led Commission did vote recently to override state laws that limit the build-out of municipal cable systems.

Still, many years of industry subservience will be difficult to swiftly undo. One linchpin merger shows how FCC decision-making has been thoroughly undermined by the revolving door, lobbying, and carefully targeted campaign contributions. All conspired in Comcast's pivotal 2011 buyout of NBC Universal, a deal which reinforced Comcast's domination of both cable and broadband access. This deal also set the stage for the recent headline-grabbing acrimony over the issue of net neutrality.

In 2011, mighty Comcast proposed to acquire NBC Universal. A series of mergers including the 1986 acquisition of Group W assets and the 2002 acquisition of AT&T's cable assets had already vaulted Comcast into cable market leadership. In bidding for NBC Universal, a huge step towards vertical integration, Comcast was once again raising the stakes. NBC Universal would give Comcast a treasure trove of programming, including valued sports content like NFL football and the Olympics.

Suddenly, the issue was not just cable subscriber base size—where Comcast had already bought its way to dominance. NBC Universal would also allow Comcast to consolidate its growing power as a broadband Internet provider. And with NBC Universal's programming assets, Comcast would gain new leverage when negotiating prices to carry the competing programming content of rivals. This would prompt a new round of debate over net neutrality. Couldn't a programming-rich Comcast slow down rival services—or charge them more to carry their programming?

To short-circuit any potential opposition to the merger, Comcast assembled a superstar cast of lobbyists. As Susan Crawford reports in her 2013 book, "Comcast hired almost eighty former government employees to help lobby for approval of the merger, including several former chiefs of staff for key legislators on congressional antitrust committees, former FCC staffers and Antitrust Division lawyers, and at least four former members of Congress.[73] Such "profligate hiring," Crawford observes, pretty much silenced the opposition to the deal. If Comcast had already retained one member of a lobbying firm, the firm could not under conflict of interest rules object to the deal. And Comcast had locked up key lobbying shops. Money was both weapon and silencer.

Of course, Comcast had always been a big spender on lobbying, with outlays exceeding $12 million every year since 2008. Lobbying costs peaked in 2011 at $19.6 million, according to the Center for Responsive Politics.

For its part, the FCC had a long history of approving most media mergers. So it was hardly a great surprise when the agency, after exacting some relatively minor concessions from Comcast, rubber-stamped the deal. Comcast would thus broaden its footprint as local monopoly distributor of cable. And with its new programming assets, it would enhance its leverage in negotiating deals to carry its rivals' programming. It would also fortify its position of growing strength as broadband Internet gatekeeper.

The most telling footnote to the deal would come just four months later. FCC Commissioner Meredith Atwell Baker, who voted to approve the merger in January 2011, left the FCC to become a top-tier Comcast lobbyist in May. It was the ultimate—and perhaps most telling—glide of the revolving door.

Baker's was a high-profile defection. But it was neither the first nor the last. Comcast had successfully convinced other FCC officials to take their expertise and government contacts to the cable giant. Comcast has long been a master at spinning the revolving door to its own advantage. "Comcast has been very good at hiring everyone who is very smart," said Crawford.[74]

Approval of the NBC Universal deal was another in the long string of FCC merger approvals that made Comcast a nationwide monopolist that could dictate both pricing and viewer programming choice.

But the deal may have had another unintended consequence. It set the stage for Comcast's subsequent battles on net neutrality. "Those mergers gave additional oomph to the issue of net neutrality," noted former commissioner Copps. Speaking specifically of Comcast's buyout of NBC Universal, IHS senior analyst Eric Brannon agreed. "That merger laid the grounds for net neutrality."

In allowing Comcast to acquire major programming assets, the deal would sharpen questions about the power of gatekeepers like Comcast to control the flow of traffic from rival Web services. So in bowing to lobbyist pressure, the FCC would bring on itself a whole new set of pressures by focusing public attention on the issue of net neutrality.

With activists rounding up comments from the public and hip TV personalities like HBO's John Oliver also beating the drums, net neutrality quickly grew into a popular issue that won the support of President Obama, and by proxy, his hand-picked appointee Tom Wheeler. When the FCC ruled in February of 2015 that it would seek Title II authority to regulate the Internet and presumably block any favoritism by broadband gatekeepers, it seemed to finally cast its lot with the public against steamrolling corporate interests

The issue had simmered for years but reached full boil when movie purveyor Netflix, which had argued that its service was slowed down by Comcast, signed a side deal ensuring better download speeds for its wares. This triggered an outburst of public concern that Comcast was now in position to operate "fast" and "slow" lanes, depending on whether a rival programmer could afford to ensure that Comcast provide adequate download speed.

With nearly 4 million comments—many supplied or encouraged by public interest groups—filed to the FCC, net neutrality was a bankable political issue. And there's no question, net neutrality attracted public interest because it gave cable viewers—long furious at the treatment by the monopolists who send them monthly bills—issues of both viewing pleasure and economics.

But it also fed into the longstanding sentimental but increasingly unrealistic view of the Internet as the last bastion of intellectual freedom. Internet romanticists have long seen the Web as a place that somehow deserves special rules for breaking the stranglehold of traditional media and offering exciting new communications, information retrieval and shopping efficiencies.

Yes, the Internet is a modern marvel. This is beyond dispute. But some of the favors it has won from government over the years have had unfortunate unintended consequences.

In the 1990s, for example, net access providers were repeatedly exempted as an "infant industry" from paying access charges to the Baby Bells even though they had to connect users through local phone networks. The long distance companies were then paying as much as $30 billion a year for the privilege. But the Internet was exempted.

As the late 90s approached, the Internet was no longer an infant industry. Still, the exemption from access charges was extended. That exemption essentially allowed AOL in the late 90s to offer unlimited unmetered online time, a key factor in boosting usage and siphoning advertisers from print media. Why buy an ad in print that might get viewed with the transitory flip of a page when you can get round-the-clock attention online?[75] FCC decisions to grant the Internet access-charge exemptions arguably accelerated the decline of print media and much of the quality journalism print advertising could once support.

Meanwhile, retailers on the Internet were making inroads into brick and mortar retail business with the help of a Supreme Court-sanctioned exemption from collecting sales tax.[76] This judicial coddling of the Internet was the death knell for many smaller mom and pop local businesses, already challenged to match online pricing. And that's not all. The special favors continue virtually every year, as Congress proposes and/or passes legislation to extend special tax exemptions to Internet services.

Well, maybe tax breaks aren't such a bad idea for such an innovative and transformational emerging technology. For all its faults, the Internet—gateway to all goods, repository of all things, wizardly guide to all knowledge, enabler of universal self-expression—is undeniably cool.

But let's not deny that the combination of tax advantages and deregulation was toxic. Allow an industry to emerge with advantages over useful existing industries that largely play by the rules—well, maybe that can be rationalized. But then fail to hold the upstart industry to the same rules, allowing it more leeway to trample fundamental rights because it has the technical capacity to do so. Well, then you have a cruel Faustian bargain.

With the see-no-evil deregulatory gospel loosing all constraints, the Web would devolve into a playground for corporate snoops and criminals. For all its wonders, the Internet comes at a cost: the loss of control over personal data, the surrender of personal privacy, sometimes even the confiscation of identity.

Perhaps the most favorable consequence of net neutrality—and one that has gotten surprisingly little attention—is that it could set the stage for privacy reform. (More on this in Chapter Seven). The FCC can now choose to exercise its Title II powers to enforce privacy standards over broadband Internet. Privacy is one area where the FCC has done a pretty good job in the past.

Worth remembering, though, is that the hard-fought public victory over Net Neutrality may be transitory. AT&T and others have threatened to go to court to upend the FCC rules. And there's a fair chance a Republican Congress will legislate against Title II.

Meanwhile, though, one supreme irony has begun to unfold in the marketplace.

Modern-day laissez fair ideologues love to invoke the wisdom of markets as represented by the "mysterious hand" of Adam Smith. Unfortunately, in the absence of effective regulation, the putatively wise "mysterious hand" generally seems to work its magic for those with huge financial resources and the political access it buys.

In the current cable situation, however, the mysterious hand may actually be working in consumer-friendly ways. Years of regulation that favored the cable companies have now backfired as the market reacts to monopolistic pricing and content control.

Whereas cable giants have commanded premium monthly subscriber prices to deliver packages of largely unwatched channels, the market is now beginning to burst with new "debundled" options that are whittling away at cable's vast subscriber base.

Satellite service Direct TV, as noted, now offers its streaming video Sling TV package of popular networks that includes live sports and news. Amazon, Apple, CBS, HBO, Netflix, Sony, and others offer a variety of streaming video options that allow viewers to cut the cable cord. Suddenly, consumers have the cherry-picking capability that bundled—and expensive—cable packages have never allowed.

In this case, at least, the unintended consequences of the FCC's pro-industry policies may be producing an unexpected pro-consumer twist.

Chapter Seven: What about Privacy?

Has any issue gotten as much lip service—and as little meaningful action?

For all the various congressional bills, corporate self-regulatory schemes and presidential Privacy Bill of Rights proposals, the simple truth remains that no personal information is safe on the Internet. Data brokers have built a multi-billion dollar business exchanging information used to build profiles of Net users. Your shopping and surfing habits, your health history, your banking data, your network of social ties, perhaps even your tax filings are all potentially exposed online. Both legal and criminal enterprises amass this information. And it doesn't go away.

At any given moment people you don't know somehow know where you are. They may very well know when you made your last bank deposit, when you had your last asthma attack or menstrual period. Corporations encourage and pay for every bit of information they can use or sell. Creepy? Perhaps, but as Jeff Chester, president of the Center for Digital Democracy points out: "The basic business model that drives online is advertising."[77]

The FCC largely escapes blame on this one. It is the Federal Trade Commission that has had primary responsibility for protecting Internet privacy. The FCC does have some limited authority, which, some critics say, could have been exercised more vigorously. But for the most part the FCC is not to blame for the rampant online abuse of personal privacy and identity.

The FCC does however have privacy authority over the phone, cable and satellite industries. Until recently, at least, the FCC has kept privacy issues at bay among the companies in these industries. "The FCC has generally taken privacy very seriously," noted Harold Feld, a senior vice president at the non-profit Public Knowledge.[78]

But dynamics now in place suggest that privacy may be the next great testing ground for the FCC. A new chance, perhaps, to champion public interest. Even before the opportunity for privacy enforcement under Title II regulatory powers, the FCC faces new challenges from phone companies, now itching to monetize their vast consumer data stashes the way Net companies have. The commonly used term is "Google envy."

"Until now, ISPs (Internet Service Providers) have mostly not gotten into hot water on privacy—but that's changing," observed Jonathan Mayer, a fellow at the Center for Internet and Society.[79] Verizon and AT&T, major providers of mobile Internet access, have each introduced "super cookies" that track consumer behavior even if they try to delete older, less powerful, forms of cookies. AT&T is actually charging its customers an extra $30 a month *not* to be tracked.

Showdowns loom.

In adopting Title II to enforce net neutrality, the FCC has made broadband Internet access a telecom service subject to regulation as a "common carrier." This reclassification means that the FCC could choose to invoke privacy authority under Title II's Section 222. That section, previously applied to phone and cable companies, mandates the protection of consumer information. Such information—called CPNI for Customer Proprietary Network Information—has kept phone companies from selling data on whom you call, from where you call and how long you spend on the phone. Consumers may have taken such protection for granted on their phone calls. But they have no such protection on their Internet activity—which, as noted, has been a multi-billion dollar safe house hideaway for corporate and criminal abusers of personal privacy.

Now, though, the FCC could put broadband Internet communications under Section 222 protection. To Scott Cleland, a telecom industry consultant who has often been ahead of the analytic pack, this would be a momentous decision.

When the smoke clears—and it hasn't yet—the FCC could make consumer identifiers like IP addresses the equivalent of phone numbers. Suddenly, the Internet companies that have trafficked in all that personal data would be subject to the same controls as the phone and cable companies.

Cleland argues that the risk for privacy abuses extends beyond broadband access providers like Comcast and Verizon to Internet giants like Google and Facebook that have until now flourished with all that personal data. "They are at risk and they are going to live under the uncertainty their business model could be ruled illegal by the FCC," Cleland said.[80]

Much has been written about the legal challenges broadband access providers intend to mount against the FCC's new rules. But Cleland argues that a very different type of legal action could engulf companies that have benefited from the use and sale of private data. Trial lawyers, he argues, will see opportunity in rounding up massive class action suits of Internet users whose privacy has been violated. What sorts of privacy abusers face legal action? Anyone who has "collected CPNI via some type of cookie," according to Cleland.

"Right now, edge providers like Google, Facebook and Twitter are at risk of being sued by trial lawyers," he said.[81]

Sounds great for consumers who care about privacy on the Internet and how it has been abused. But the FCC, Cleland was reminded, has never been a consumer advocate. "Bingo," replied Cleland. That's what makes the FCC's potential move into privacy protection so important and so surprising, he suggests.

There are other signs that the FCC under Tom Wheeler might actually become more consumer-friendly on the issue of data privacy. While Wheeler has brought some former associates from lobbying groups to the FCC, he has also peppered his staff with respected

privacy advocates. Indeed, he named Gigi Sohn, longtime president of the non-profit Public Knowledge, as Counsellor to the Chairman in April.

Another appointee with a privacy background is Travis LeBlanc, head of the FCC's Enforcement Bureau. In previous employment in California's Office of the Attorney General, LeBlanc was active in enforcing online privacy. LeBlanc has stated an interest in privacy and has already taken action against two firms that exposed personal information—including social security numbers—on unprotected Internet servers.

But many aspects of LeBlanc's approach to regulating Internet privacy under Title II remain unclear. Unfortunately, the FCC declined repeated requests to make LeBlanc available for an interview. (It also declined to answer written questions on its enforcement intentions in both privacy and cell tower infrastructure emissions.)

It remains to be seen if LeBlanc and his superiors at the FCC are really willing to take on privacy enforcement. Such a stance would require great courage as the entire Internet infrastructure is built around privacy abuse. It is also questionable whether the FCC would have the courage to challenge Google—a rare corporate ally in the battles over Net Neutrality.

Chapter Eight: Dependencies Power the Network of Corruption

As a captured agency, the FCC is a prime example of institutional corruption. Officials in such institutions do not need to receive envelopes bulging with cash. But even their most well-intentioned efforts are often overwhelmed by a system that favors powerful private influences, typically at the expense of public interest.

Where there is institutional corruption, there are often underlying dependencies that undermine the autonomy and integrity of that institution. Such is the case with the FCC and its broader network of institutional corruption.

As noted earlier, the FCC is a single node on a corrupt network that embraces Congress, congressional oversight committees and Washington social life. The network ties the public sector to the private through a frictionless revolving door—really no door at all.

Temptation is everywhere in Washington, where moneyed lobbyists and industry representatives throw the best parties and dinners. Money also allows industry to control other important factors, like the research agenda. All of this works together to industry's advantage because—as with other instances of institutional corruption—there are compromising dependencies. Policy makers, political candidates and legislators, as well as scientific researchers are all compromised by their dependence on industry money.

Dependency #1 – So much of the trouble here comes back to the core issue of campaign finance. Cable, cellular and educational tech interests know where to target their funds for maximum policy impact. And the contributions work, seemingly buying the silence of key committee congressmen—even those with past records as progressives. Key recipients of industry dollars include Massachusetts Senator Ed Markey and, until he retired, California Democrat Henry Waxman. Though they have intermittently raised their voices on such issues as data privacy and cellular health and safety, neither has shown any great inclination to follow through and take up what would have to be a long and tough fight on these issues.

Dependency #2 – Democrats might be expected to challenge industry now and then. They traditionally have done so, after all. But this is the post-*Citizens United* era where the Supreme Court has turned government into a giant auction house.

Bid the highest price and you walk home with the prize—your personal congressman, legislative loophole, even an entire political party.

Such is the case with technology industries and the Democrats. The communications/electronics industry is the third largest industry group in both lobbying and campaign contributions, according to the Center for Responsive Politics. In just 2013 and 2014, this industry sector spent well over $750 million on lobbying.[82]

Only the finance/insurance/real estate and health industries outspend the tech sector on lobbying. But those industry groups lean Republican. Over 62% of the finance/insurance/real estate campaign contributions go to the GOP. Health contributions lean Republican 57% to 43%. But the technology group leans sharply to Democrats, who got 60% of contributions in the 2013-2014 election cycle.[83] The two next largest industry groups—energy/natural resources and agribusiness—also lean heavily Republican. So of the top five industry groups whose money fuels and often tilts elections four are strongly Republican. The Democrats need the tech industry—and they show that dependence with consistent support, rarely raising such public interest issues as wireless health and safety and Internet privacy.

Dependency #3 – Spectrum auctions give the wireless industry a money-making aura. In recent Congressional testimony, an FCC official reminded legislators that the FCC has over the years been a budget-balancing revenue-making force.[84] Indeed, the auctions of electromagnetic spectrum, used by all wireless communications companies to send their signals, have yielded nearly $100 billion in recent years. The most recent auction to wireless providers produced the unexpectedly high total of $43 billion. No matter that the sale of spectrum is contributing to a pea soup of electromagnetic "smog" whose health consequences are largely unknown. The government needs money and Congress shows its appreciation with consistently pro-wireless policies.

Dependency #4 – Science is often the catalyst for meaningful regulation. But what happens when scientists are dependent on industry for research funding? Under pressure from budget cutters and deregulators, government funding for research on RF health effects has dried up. The EPA, which once had 35 investigators in the area, has long since abandoned its efforts.[85] Numerous scientists have told me there's simply no independent research funding in the U.S. They are left with a simple choice: work on industry-sponsored research or abandon the field.

Chapter Nine: A Modest Agenda for the FCC

Nobody is proposing that cell phones be banned. Nor does anyone propose the elimination of the Universal Service program or other radical reforms. But there are some steps—and most are modest—that the FCC can take now to right some of the wrongs that result from long years of inordinate industry access and influence:

1. Acknowledge that there may be health risks in wireless communications. Take down the dismissive language. Maturely and independently discuss the research and ongoing debate on the safety of this technology.

2. In recognition of this scientific uncertainty, adopt a precautionary view on use of wireless technology. Require prominent point-of-sale notices suggesting that users who want to reduce health risks can adopt a variety of measures, including headphones, more limited usage and storage away from at-risk body parts.

3. Back off the promotion of Wi-Fi. As Professor Lennart Hardell has noted, there are wired alternatives that do not expose children to wireless risk.

4. Petition Congress for the budgetary additions needed to expand testing of emissions on antenna sites. It was Congress after all that gave industry carte blanche for tower expansion so long as they comply with FCC standards. But there is evidence of vast non-compliance and Congress needs to ensure that tower infrastructure is operating within the law.

5. Acknowledge that children and pregnant women may be more vulnerable to the effects of RF emissions and require special protection.

6. Promote cable debundling as a way to lighten consumer cable bills, especially for those customers who don’t care about high-cost sports programming.

7. Apply more rigorous analysis to properly assess the value of technology in education. Evidence continues to pile up that technology in education is not as valuable as tech companies claim. Pay less attention to tech CEOs—pay more attention to the researchers who’ve actually studied the impact of trendy technology fixes on learning

8. Take over enforcement of personal privacy rights on the Internet. Of all the basic suggestions here, this would require the most courage as it would involve challenging many of the entrenched powers of the Internet.

Chapter Ten: Stray Thoughts

Some concluding thoughts:

Why do so many of the most dubious FCC policies involve technology?

In large part, of course, because the FCC has authority over communications and that is a sector that has been radically transformed—along with so many others—by technology.

Let's be clear, though. The problem is not technology, which unarguably brings countless benefits to modern life. The problem is with the over-extension of claims for technology's usefulness and the worshipful adulation of technology even where it has fearful consequences. Most fundamentally, the problem is the willingness in Washington—for reasons of both venality and naïveté—to give technology a free pass.

Personally, I don't believe that just because something can be done it should heedlessly be allowed. Murder, rape and Ponzi schemes are all doable—but subject to prohibition and regulation. Government regulators have the responsibility to examine the consequences of new technologies and act to at least contain some of the worst. Beyond legislators and regulators, public outrage and the courts can also play a role—but these can be muffled indefinitely by misinformation and bullying.

There are precedents for industries (belatedly perhaps) acting to offset the most onerous consequences of their products. In responding to a mix of litigation, public demand and regulatory requirement, the auto industry, for example, has in the last 50 years substantially improved the safety and environmental footprint of its products.

Padded instrument panels, seat belts, air bags, and crumple zones have all addressed safety issues. Environmental concerns have been addressed with tightened emissions and fuel consumption standards. The response to new safety challenges is ongoing. Before side air bags were widely deployed, sedan drivers side-swiped by much larger SUVs were at vastly disproportionate risk of death and dismemberment.[86] But the deployment of side air bags has "substantially" reduced the risk of collision deaths.[87] Overall, auto fatality rates per 100,000 persons have dropped by nearly 60% in the U.S. since 1966.[88] Today, automakers continue to work on advanced safety features like collision avoidance.

It can be argued that most of these safety improvements came decades after autos were in wide usage and only in response to outrage at Ralph Nader's 1965 revelations on the auto industry.[89] No matter the catalysts. The simple truth remains that the auto industry—and its regulators—have for the last half-century been addressing safety and environmental issues.

But with the overwhelming application of money and influence, information and communications technologies have almost totally escaped political scrutiny, regulatory control, and legal discipline.

Should the Internet have been allowed to develop into an ultra-efficient tool for lifting personal information that includes financial records, health histories and social security numbers? Should wireless communications be blindly promoted even as new clues keep suggesting there may be toxic effects? Should local zoning authorities and American citizens be stripped of the right to protect their own health? Should education be digitized and imposed just because technology companies want to develop a new market and lock in a younger customer base?

All these questions can perhaps be rolled up in one: do we all just play dead for the corporate lobbyists and spinners who promote the unexamined and unregulated application of their products?

Finally, a word about the structure of the FCC. With five commissioners—no more than three from the same party—the structure seems to make some kind of sense.

But in practice, it works out poorly. The identification of commissioners by party tends to bring out the worst in both Republicans and Democrats. Instead of examining issues with clear-sighted independence, the commissioners seem to retreat into the worst caricatures of their parties. The Republicans spout free market and deregulatory ideology that is most often a transparent cover for support of business interests. The Democrats seems satisfied if they can implement their pet spending programs—extension of broadband wireless to depressed urban and rural schools, cell phone subsidies for low income clients. The result is a Commission that fulminates about ideology and spends heavily to subsidize powerful interests.

Perhaps one solution would be to expand the Commission to seven by adding two public interest Commissioners. The public interest only rarely prevails at the FCC. So it would represent vast improvement if both Republican and Democrat commissioners had to vie for support of public interest representatives in order to forge a majority. The public interest, in other words, would sometimes carry the swing votes.

It's very hard to believe, though, that Congress would ever approve such a plan. It simply represents too much of a threat to the entrenched political power of the two parties. Why would they ever agree to a plan that dilutes that power?

It's also worth noting that the public interest is not always easy to define. Sometimes there are arguably conflicting definitions. Still, an FCC with public interest commissioners is an idea worth consideration. It would at least require party apologists to defend how they so consistently champion the moneyed interests that have purchased disproportionate access and power in Washington.

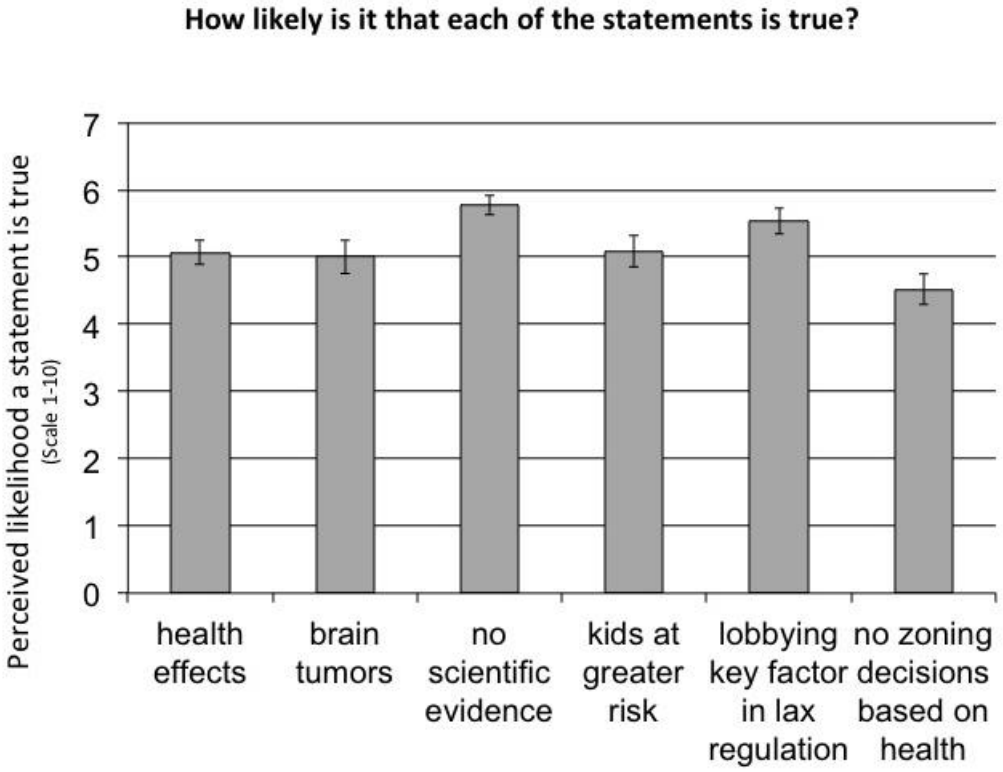
Appendix—Survey of Consumer Attitudes

What does the public believe about the science and politics of wireless health research? Under what conditions would people change wireless usage patterns? Is the FCC currently trusted to protect public health? How would confirmation of health risks affect trust in the FCC?

These are some of the questions Ann-Christin Posten[90] and Norm Alster[91] hoped to answer with an April 2015 online survey of 202 respondents. Participants were recruited through Amazon's Mechanical Turk online platform. All were U.S. residents and had achieved qualifying approval rates in prior Mechanical Turk surveys.

Participants were asked how likely they believed the following statements to be true:

> Statement 1. Prolonged and heavy cell phone use can have a variety of damaging effects on health.
>
> Statement 2. Prolonged and heavy cell phone use triples the risk of brain tumors.
>
> Statement 3. There is no scientific evidence that proves that wireless phone usage can lead to cancer or a variety of other problems.
>
> Statement 4. Children and pregnant women are especially vulnerable to radiation from wireless phones, cell towers and Wi-Fi
>
> Statement 5. Lobbying and campaign contributions have been key factors in keeping the government from acknowledging wireless hazards and adopting more stringent regulation.
>
> Statement 6. The U.S. Congress forbids local communities from considering health concerns when deciding whether to issue zoning permits for wireless antennae.

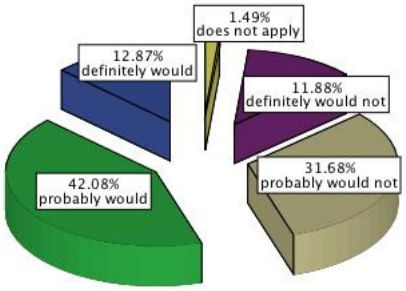


Two findings seem especially interesting:

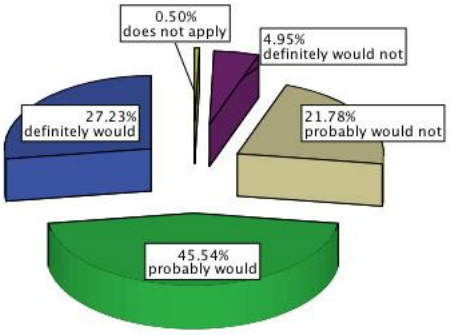
1. Statement 3 received a higher credibility rating than Statements 1 and 2. The different credibility levels are statistically significant. Respondents are more likely to trust in wireless safety than to believe there are general or specific health risks.

2. The only statement that is a matter of uncontested fact is Statement 6 on the outlawing of opposition to antenna sites on health grounds. (All other statements have been both proclaimed and denied.) And yet Statement 6 was least likely to be believed. Just 1.5% of respondents recognized this as an "absolutely true" statement. Over 14% thought this statement was "not true at all." Answers to this question would seem to reflect public ignorance on the political background to wireless health issues.

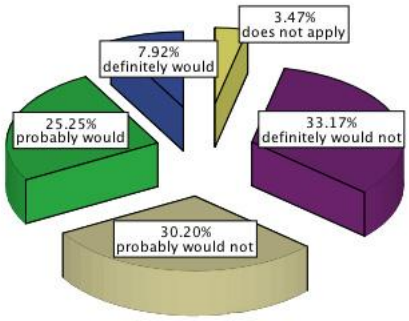
Participants were also asked how they would change behavior if claims of wireless health risks were established as true:



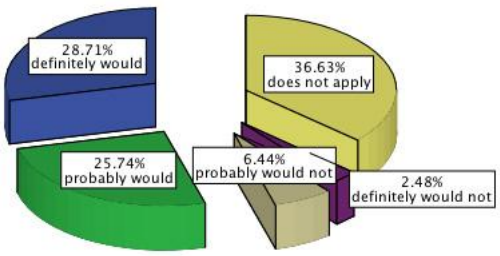
**If statement 1 was true,
I would start using headphones.**



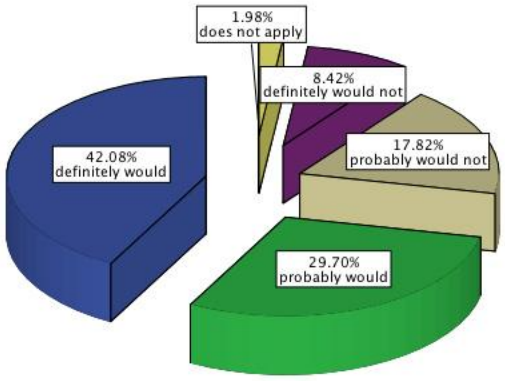
**If statement 1 was true,
I would restrict the amount of time
I spend on the phone.**



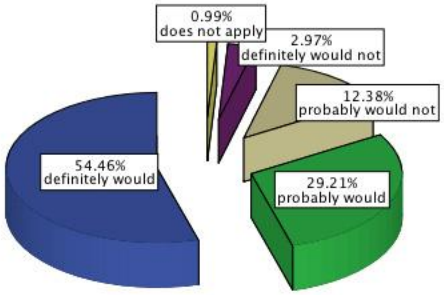
**If statement 1 was true,
I would start up a new land line
account for home use.**



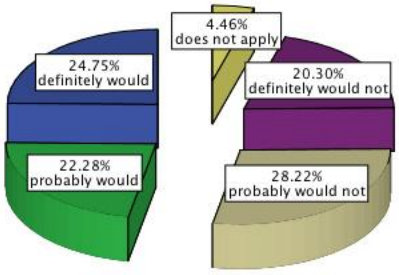
**If statement 1 was true,
I would restrict my children's cell phone use.**



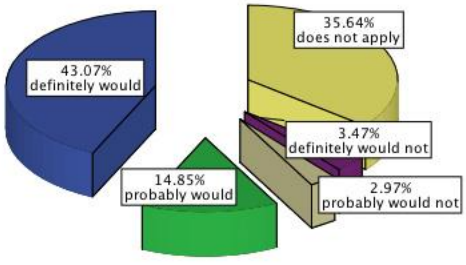
If statement 2 was true,
I would start using headphones.



If statement 2 was true,
I would restrict the amount of time
I spend on the phone.



If statement 2 was true,
I would start up a new land line
account for home use.



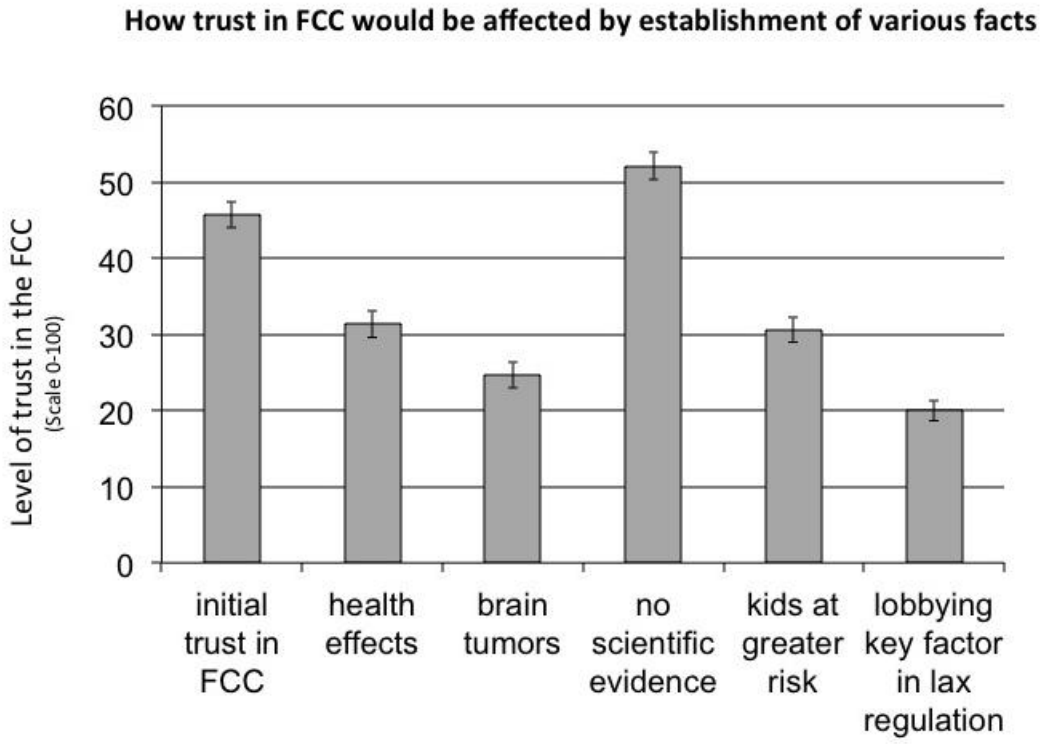
If statement 2 was true,
I would restrict my children's cell phone use.

The greatest impact on behavior came when respondents were asked to assume it is true that prolonged and heavy cell phone use triples the risk of brain tumors. More than half said they would "definitely" restrict the amount of time spent on the phone. Just over 43% would "definitely" restrict their children's phone use. Perhaps most surprisingly, close to 25% would "definitely" start up a new landline phone account. (This last response suggests it may be foolishly premature for the phone giants to exit the landline business just yet.)

The inclination of consumers to change behavior should negative health effects be confirmed suggests the stakes are enormous for all companies that derive revenue from wireless usage.

This survey points to—but cannot answer—some critical questions: Do wireless companies better protect themselves legally by continuing to deny the validity of all troublesome research? Or should they instead be positioning themselves to maintain consumer trust? Perhaps there is greater financial wisdom in listening to the lawyers right now and denying all chance of harm. If so, however, why would anyone seriously concerned about health listen to the industry—or to its captured agency? That's a question the FCC will eventually need to answer.

Trust could eventually become a central issue. Respondents were initially asked to describe their level of trust in the wireless industry and in the FCC as its regulator. Not surprisingly, establishment of any of the presumed health risks—or confirmation of inordinate industry pressure—resulted in statistically significant diminution of trust in both the industry and the FCC.



On a scale of 1 to 100, the FCC had a mean baseline trust level of 45.66. But if the tripling of brain tumor risk is established as definitely true, that number falls all the way to 24.68. If "lobbying and campaign contributions" have been "key factors" in keeping the government from acknowledging wireless hazards, the trust level in the FCC plummets to 20.02. All results were statistically significant.

It's clear that at this point confirmation of health dangers—or even of behind-the-scenes political pressures—from wireless will substantially diminish public trust in the FCC. Skeptics might argue that this gives the FCC motive to continue to downplay and dismiss further evidence of biological and human health effects. Those of a more optimistic bent might see in these findings reason to encourage an FCC concerned about public trust to shake itself loose from special interests.

Endnotes

[1] Former CTIA vice president John Walls in Kevin Kunze's documentary film *Mobilize*, introduced in 2014 at the California Independent Film Festival.

[2] November 2014 interview with Renee Sharp.

[3] December 2014 interview with Twaun Samuel.

[4] Dr. George Carlo and Martin Schram, *Cell Phones, Invisible Hazards In The Wireless Age* (Carroll & Graf, 2001), 18.

[5] Center for Responsive Politics.

[6] Id.

[7] November 2014 interview with Michael Copps.

[8] January 2015 interview with Newton Minow.

[9] Daniel Lathrop, "From Government Service to Private Practice: Writers of Telecom Law Move to K Street," Center for Public Integrity, October 28, 2004, http://www.publicintegrity.org/2004/10/28/6597/government-service-private-practice.

[10] B. Blake Levitt and Henry Lai, "Biological Effects from Exposure to Electromagnetic Radiation Emitted By Cell Tower Base Stations and Other Antenna Arrays," NRC Research Press Web site, November 5, 2010.

[11] Id., 381.

[12] Id.

[13] S. Sivani and D. Sudarsanam, "Impacts of Radio-Frequency Electromagnetic Field (RF_EMF) from Cell Phone Towers and Wireless Devices on Biosystem and Ecosystem – A Review," *Biology and Medicine* 4.4 (2013): 202.

[14] Id., 206-208.

[15] January 2015 interview with Robert Weller.

[16] Letter from Michelle C. Farquhar, Chief of the FCC's Wireless Telecommunications Bureau, to Thomas Wheeler, President and CEO of the Cellular Telecommunications Industry Association, January 13, 1997.

[17] Id.

[18] Letter from FCC Chairman Thomas Wheeler to former FCC Commissioner Jonathan Adelstein, President and CEO, PCIA-The Wireless Infrastructure Association, March 14, 2014.

[19] December 2014 interview with James R. Hobson.

[20] January 2015 interview with Marvin Wessel.

[21] Id.

[22] January 2015 interview with Janet Newton.

[23] Robert Weller interview.

[24] Best's Briefing, "Emerging Technologies Pose Significant Risks with Possible Long-Tail Losses," February 11, 2013, http://www.ambest.com/directories/bestconnect/EmergingRisks.pd.

[25] Online survey conducted in April 2015 on Amazon's Mechanical Turk platform.

[26] CTIA, "Policy & Initiatives: Innovation," http://www.ctia.org/policy-initiatives/policy-topics/innovation.

[27] February 2015 interview with Dennis Kucinich.

[28] Alexander Lerchl, Melanie Klose, and Karen Grote et al., "Tumor Promotion by Exposure to Radiofrequency Electromagnetic Fields below Exposure Limits for Humans," *Biochemical and Biophysical Research Communications* 459.4 (2015): 585-590.

[29] WHO/International Agency for Research on Cancer (IARC), "IARC Classifies Radiofrequency Electromagnetic Fields As Possibly Carcinogenic To Humans," Press Release No. 208, May 31, 2011.

[30] Medscape, "Brain Cancer CME Learning Center," http://www.medscape.org/resource/brain-cancer/cme.

[31] Anke Huss, Matthias Egger, Kerstin Hug, Karin Huwiler-Muntener, and Martin Roosli, "Source of Funding and Results of Studies of Health Effects of Mobile Phone Use: Systemic Review of Experimental Studies," *Environmental Health Perspectives* 115.1 (2007): 1-4, 1.

[32] Id.

[33] Federal Communications Commission, "Wireless Devices and Health Concerns," http://www.fcc.gov/guides/wireless-devices-and-health-concerns.

[34] Lennart Hardell, Michael Carlberg, Fredrik Soderqvist, and Kjell Hansson Mild, "Case-Control Study of the Association between Malignant Brain Tumours Diagnosed between 2007 and 2009 and Mobile and Cordless Phone Use," *International Journal of Oncology* 43.6 (2013): 1833-1845.

[35] Lennart Hardell and Michael Carlberg, "Use of Mobile and Cordless Phones and Survival of Patients with Glioma," *Neuroepidemiology* 40.2 (2012): 101-108.

[36] Lennart Hardell and Michael Carlberg, 'Using the Hill Viewpoints from 1965 for Evaluating Strengths of Evidence of the Risk for Brain Tumors Associated with Use of Mobile and Cordless Phones," *Reviews on Environmental Health* 28.2-3 (2013): 97-106.

[37] Gaelle Coureau, Ghislaine Bouvier, and Pierre Lebailly, et al., "Mobile Phone Use and Brain Tumors in the CERENAT Case-Control Study," *Occupational and Environmental Medicine* 71.7 (2014): 514-522, doi:10.1136/oemed-2013-101754.

[38] October 2014 interview with Lennart Hardell.

[39] December 2014 interview with Martin Blank.

[40] Id.

[41] Norm Alster, "Cell Phones: We Need More Testing," *BusinessWeek,* August 14, 2000, 39.

[42] Quoted in American Academy of Pediatrics, "American Academy of Pediatrics Endorses Cell Phone Safety Bill," Press Release, December 20, 2012, http://www.ewg.org/release/american-academy-pediatrics-endorses-cell-phone-safety-bil.

[43] Om P. Gandhi, L. Lloyd Morgan, Alvaro Augusto de Salles, Yueh-Ying Han, Ronald B. Herberman, and Devra Lee Davis, "Exposure Limits: The Underestimation of Absorbed Cell Phone Radiation, Especially in Children," *Electromagnetic Biology and Medicine* 31.1 (2012): 34-51.

[44] November 2014 interview with Joel Moskowitz.

[45] February 2015 interview with Carl Blackman.

[46] Id.

[47] Id.

[48] Lawrence Lessig, Roy L. Furman Professor of Law and Leadership at Harvard Law School, helped to draft the Right to Know ordinance and has offered pro bono legal representation to the city of Berkeley. Professor Lessig was director of the Lab at Harvard's Safra Center for Ethics, from which the Project on Public Narrative was spun off in November of 2014.

[49] May 2015 interview with Berkeley City Attorney Zach Cowan

[50] December 2014 interview with Jerry Phillips.

[51] Id.

[52] February 2015 interview with Om P. Gandhi.

[53] Id.

[54] Radio interview on WBAI-FM, "Wireless Radiation: What Scientists Know and You Don't, With Dr. Joel Moskowitz," March 10, 2015.

[55] Spencer Ante, "Millions Improperly Claimed U.S. Phone Subsidies," *Wall Street Journal*, February 11, 2013, http://allthingsd.com/201330212/millions-improperly-claimed-u-s-phone-subsidies/.

[56] Federal Communications Commission Office of Inspector General, "Semiannual Report to Congress for the Period April 1, 2014 - September 30, 2014," 20, http://transition.fcc.gov/oig/FCC_OIG_SAR_09302014a.pdf.

[57] Federal Communications Commission, "Reports on Meetings and Telephone Calls with Registered Lobbyists Regarding General Recovery Act Policy Issues," March 2, 2010.

[58] CTIA - The Wireless Association, "Response to White House Paper on Universal Service Policy," September 19, 2014, http://www.ctia.org/docs/default-source/Legislative-Activity/ctia-usf-response-to-house-white-paper-091914.pdf?sfvrsn=0.

[59] Open Letter from Executives of 50 Leading Companies to Tom Wheeler, Chairman of the FCC, January 30, 2014, http://erate2.educationsuperhighway.org/#ceos-letter. See also David Nagel, "50 Top Execs Urge E-Rate Modernization To Propel Broadband in Schools," *The Journal*, January 30, 2014.

[60] October 2014 interview with Lennart Hardell.

[61] Jacob L. Vigdor and Helen F. Ladd, "Scaling the Digital Divide: Home Computer Technology and Student Achievement," Calder Urban Institute Working Paper, No. 48, June 2010.

[62] Mark Warschauer and Morgan Ames, "Can One Laptop Per Child Save the World's Poor?" *Journal of International Affairs* 64.1 (2010): 33-51.

[63] John Rogers, "L.A. Students Get iPads, Crack Firewall, Play Games," *Associated Press,* October 5, 2013, http://bigstory.ap.org/article/la-students-get-ipads-start-playing-video-games.

[64] April 2015 interview with Kentaro Toyama.

[65] Id.

[66] Id.

[67] FCC Chairman Tom Wheeler, quoted in Grant Gross, "FCC Approves Plan to Spend $1B a Year on School Wi-Fi," IDG News Service, July 11, 2014.

[68] Michael O'Rielly, "Dissenting Statement by Commissioner Michael O'Rielly," 2, http://e-ratecentral.com/files/fcc/DOC-328172A7.pdf, after FCC in July of 2014 voted to increase Wi-Fi spending.

[69] February 2015 interview with Charles Davidson and Michael Santorelli.

[70] Id.

[71] The University of Michigan's American Customer Satisfaction Index, http://www.theacsi.org/the-american-customer-satisfaction-index.

[72] September 2014 interview with Michael Copps.

[73] Susan Crawford, *Captive Audience: The Telecom Industry and Monopoly Power in the New Gilded Age* (Yale University Press, 2013), 212.

[74] October 2014 interview with Susan Crawford.

[75] Norm Alster, "A Little Help from the Feds," *BusinessWeek,* January 24, 2000, 42.

[76] 1992 Supreme Court decision in *Quill Corp. v. North Dakota,* 504 U.S. 298 (1992).

[77] February 2015 conversation with Jeff Chester**.**

[78] April 2015 interview with Harold Feld.

[79] March 2015 interview with Jonathan Mayer.

[80] April 2015 interview with Scott Cleland.

[81] Id.

[82] Center for Responsive Politics.

[83] Id.

[84] "Testimony of Jon Wilkins, Managing Director, Federal Communications Commission," Before the Committee on Energy and Commerce, Subcommittee on Communications and Technology, U.S. House of Representatives, March 4, 2015.

[85] Alster, "Cell Phones: We Need More Testing," 39.

[86] Danny Hakim and Norm Alster, "Lawsuits: This Year's Model," *New York Times,* May 30, 2004, http://www.nytimes.com/2004/05/30/business/lawsuits-this-year-s-model.html.

[87] A.T. McCartt and S.Y. Kyrychenko, "Efficacy of Side Airbags in Reducing Driver Deaths in Driver-Side Car and SUV Collisions," *Traffic Injury Prevention* 8.2 (2007): 162-170.

[88] National Highway Traffic Safety Administration, "Traffic Safety Facts 2012," 18, http://www-nrd.nhtsa.dot.gov/Pubs/812032.pdf.

[89] Ralph Nader, *Unsafe At Any Speed: The Designed-In Dangers of the American Automobile* (Grossman Publishers, 1965).

[90] Lab Fellow, Edmond J. Safra Center for Ethics, Harvard University.

[91] Investigative Journalism Fellow, Project on Public Narrative at Harvard Law School.

Smart Meter Data: Privacy and Cybersecurity

Brandon J. Murrill
Legislative Attorney

Edward C. Liu
Legislative Attorney

Richard M. Thompson II
Legislative Attorney

February 3, 2012

Congressional Research Service
7-5700
www.crs.gov
R42338

CRS Report for Congress
Prepared for Members and Committees of Congress

Summary

Fueled by stimulus funding in the American Recovery and Reinvestment Act of 2009 (ARRA), electric utilities have accelerated their deployment of smart meters to millions of homes across the United States with help from the Department of Energy's Smart Grid Investment Grant program. As the meters multiply, so do issues concerning the privacy and security of the data collected by the new technology. This Advanced Metering Infrastructure (AMI) promises to increase energy efficiency, bolster electric power grid reliability, and facilitate demand response, among other benefits. However, to fulfill these ends, smart meters must record near-real time data on consumer electricity usage and transmit the data to utilities over great distances via communications networks that serve the smart grid. Detailed electricity usage data offers a window into the lives of people inside of a home by revealing what individual appliances they are using, and the transmission of the data potentially subjects this information to interception or theft by unauthorized third parties or hackers.

Unforeseen consequences under federal law may result from the installation of smart meters and the communications technologies that accompany them. This report examines federal privacy and cybersecurity laws that may apply to consumer data collected by residential smart meters. It begins with an examination of the constitutional provisions in the Fourth Amendment that may apply to the data. As we progress into the 21st century, access to personal data, including information generated from smart meters, is a new frontier for police investigations. The Fourth Amendment generally requires police to have probable cause to search an area in which a person has a reasonable expectation of privacy. However, courts have used the third-party doctrine to deny protection to information a customer gives to a business as part of their commercial relationship. This rule is used by police to access bank records, telephone records, and traditional utility records. Nevertheless, there are several core differences between smart meters and the general third-party cases that may cause concerns about its application. These include concerns expressed by the courts and Congress about the ability of technology to potentially erode individuals' privacy.

If smart meter data and transmissions fall outside of the protection of the Fourth Amendment, they may still be protected from unauthorized disclosure or access under the Stored Communications Act (SCA), the Computer Fraud and Abuse Act (CFAA), and the Electronic Communications Privacy Act (ECPA). These statutes, however, would appear to permit law enforcement to access smart meter data for investigative purposes under procedures provided in the SCA, ECPA, and the Foreign Intelligence Surveillance Act (FISA), subject to certain conditions. Additionally, an electric utility's privacy and security practices with regard to consumer data may be subject to Section 5 of the Federal Trade Commission Act (FTC Act). The Federal Trade Commission (FTC) has recently focused its consumer protection enforcement on entities that violate their privacy policies or fail to protect data from unauthorized access. This authority could apply to electric utilities in possession of smart meter data, provided that the FTC has statutory jurisdiction over them. General federal privacy safeguards provided under the Federal Privacy Act of 1974 (FPA) protect smart meter data maintained by federal agencies, including data held by federally owned electric utilities.

A companion report from CRS focusing on policy issues associated with smart grid cybersecurity, CRS Report R41886, *The Smart Grid and Cybersecurity—Regulatory Policy and Issues*, by Richard J. Campbell, is also available.

Contents

Figures

Contacts

Overview

Smart meter technology is a key component of the Advanced Metering Infrastructure (AMI)[1] that will help the smart grid[2] link the "two-way flow of electricity with the two-way flow of information."[3] Privacy and security concerns surrounding smart meter technology arise from the meters' essential functions, which include (1) recording near-real time data on consumer electricity usage; (2) transmitting this data to the smart grid using a variety of communications technologies;[4] and (3) receiving communications from the smart grid, such as real-time energy prices or remote commands that can alter a consumer's electricity usage to facilitate demand response.[5]

Beneficial uses of AMI are developing rapidly, and like the early Internet, many applications remain unforeseen.[6] At a basic level, smart meters will permit utilities to "collect, measure, and analyze energy consumption data for grid management, outage notification, and billing purposes."[7] The meters may increase energy efficiency by giving consumers greater control over their use of electricity,[8] as well as permitting better integration of plug-in electric vehicles and renewable energy sources.[9] They may also aid in the development of a more reliable electricity grid that is better equipped to withstand cyber attacks and natural disasters, and help to decrease peak demand for electricity.[10] To be useful for these purposes, and many others, data recorded by

[1] AMI includes the meters at the consumer's residence or business, the communications networks that send data between the consumer and utility, and the data management systems that store and process data for the utility. ELECTRIC POWER RESEARCH INST., ADVANCED METERING INFRASTRUCTURE (AMI) (2007), *available at* http://www.ferc.gov/eventcalendar/Files/20070423091846-EPRI%20-%20Advanced%20Metering.pdf. The primary function of AMI is to "combine interval data measurement with continuously available remote communications" to increase energy efficiency and grid reliability, and decrease expenses borne by the utility and consumer. *Id.*

[2] The Energy Independence and Security Act of 2007 (EISA) lists ten characteristics of a smart grid. These include "[i]ncreased use of digital information and controls technology to improve reliability, security, and efficiency of the electric grid"; "[d]evelopment and incorporation of demand response, demand-side resources, and energy-efficiency resources"; and "[d]eployment of "smart" technologies (real-time, automated, interactive technologies that optimize the physical operation of appliances and consumer devices) for metering, communications concerning grid operations and status, and distribution automation." EISA, P.L. 110-140, §1301, 121 Stat. 1492, 1783-84 (2007) (to be codified at 42 U.S.C. §17381).

[3] DEP'T OF ENERGY, COMMUNICATIONS REQUIREMENTS OF SMART GRID TECHNOLOGIES 1 (2010) [hereinafter DEP'T OF ENERGY COMMUNICATIONS REPORT], *available at* http://energy.gov/sites/prod/files/gcprod/documents/Smart_Grid_Communications_Requirements_Report_10-05-2010.pdf.

[4] *Id.* at 3, 5. These technologies include fiber optics, wireless networks, satellite, and broadband over power line. *Id.*

[5] *Id.* at 20. "Demand response is the reduction of the consumption of electric energy by customers in response to an increase in the price of electricity or heavy burdens on the system." *Id.*

[6] DEP'T OF ENERGY, DATA ACCESS AND PRIVACY ISSUES RELATED TO SMART GRID TECHNOLOGIES 5, 9 (2010) [hereinafter DEP'T OF ENERGY PRIVACY REPORT], *available at* http://energy.gov/sites/prod/files/gcprod/documents/Broadband_Report_Data_Privacy_10_5.pdf; *see also* ELIAS LEAKE QUINN, SMART METERING & PRIVACY: EXISTING LAW AND COMPETING POLICIES: A REPORT FOR THE COLORADO PUBLIC UTILITIES COMMISSION 1, 12 (2009) [hereinafter COLORADO PRIVACY REPORT], *available at* http://www.dora.state.co.us/puc/docketsdecisions/DocketFilings/09I-593EG/09I-593EG_Spring2009Report-SmartGridPrivacy.pdf.

[7] DEP'T OF ENERGY COMMUNICATIONS REPORT, *supra* note 3, at 12.

[8] Companies are developing several new applications that use smart meter data to offer consumers and utilities better control over energy usage, for example by determining the energy efficiency of specific appliances within the household. DEP'T OF ENERGY PRIVACY REPORT, *supra* note 6, at 5, 9; *see also* COLORADO PRIVACY REPORT, *supra* note 6, at 1, 12.

[9] DEP'T OF ENERGY COMMUNICATIONS REPORT, *supra* note 3, at 1.

[10] *Id.* at 3.

smart meters must be highly detailed, and, consequently, it may show what individual appliances a consumer is using.[11] The data must also be transmitted to electric utilities—and possibly to third parties outside of the smart grid—subjecting it to potential interception or theft as it travels over communications networks and is stored in a variety of physical locations.[12]

These characteristics of smart meter data present privacy and security concerns that are likely to become more prevalent as government-backed initiatives expand deployment of the meters to millions of homes across the country. In the American Recovery and Reinvestment Act of 2009 (ARRA), Congress appropriated funds for the implementation of the Smart Grid Investment Grant (SGIG) program administered by the Department of Energy.[13] This program now permits the federal government to reimburse up to 50% of eligible smart grid investments, which include the cost to electric utilities of buying and installing smart meters.[14] In its annual report on smart meter deployment, the Federal Energy Regulatory Commission cited statistics showing that the SGIG program has helped fund the deployment of about 7.2 million meters as of September 2011.[15] At completion, the program will have partially funded the installation of 15.5 million meters.[16] By 2015, the Institute for Electric Efficiency expects that a total of 65 million smart meters will be in operation throughout the United States.[17]

Installation of smart meters and the communications technologies that accompany them may have unforeseen legal consequences for those who generate, seek, or use the data recorded by the meters. These consequences may arise under existing federal laws or constitutional provisions governing the privacy of electronic communications, data retention, computer misuse, foreign surveillance, and consumer protection. This report examines federal privacy and cybersecurity laws that may apply to consumer data collected by residential smart meters. It examines the legal implications of smart meter technology for consumers who generate the data, law enforcement officers who seek smart meter data from utilities, utilities that store the data, and hackers who access smart grid technology to steal consumer data or interfere with it. This report looks at federal laws that may pertain to the data when it is (1) stored in a utility-owned smart meter at a consumer's residence; (2) in transit between the meter and the smart grid by way of various communications technologies; and (3) stored on computers in the grid. This report does not address state or local laws, such as regulations by state Public Utilities Commissions, that may establish additional responsibilities for some electric utilities with regard to smart meter data. It also does not discuss the mandatory cybersecurity and reliability standards enforced by the North

[11] *See* NAT'L INST. OF STANDARDS AND TECH., GUIDELINES FOR SMART GRID CYBER SECURITY: VOL. 2, PRIVACY AND THE SMART GRID 14 (2010) [hereinafter NIST PRIVACY REPORT], *available at* http://csrc.nist.gov/publications/nistir/ir7628/nistir-7628_vol2.pdf.

[12] *Id.* at 3-4, 23-24, 29.

[13] The act provides $4.5 billion for "electricity delivery and energy reliability," which includes "activities to modernize the electric grid, to include demand responsive equipment," as well as "programs authorized under title XIII of the Energy Independence and Security Act of 2007." ARRA, P.L. 111-5, 123 Stat. 115, 138-39.

[14] ARRA §405(5), (8), 123 Stat. 115, 143-44 (amendment to be codified at 42 U.S.C. §17386) (amending the Energy Independence and Security Act of 2007 (EISA) to allow for the reimbursement of up to 50% of qualifying smart grid investments instead of only 20%); *see also* EISA, P.L. 110-140, §1306, 121 Stat. 1492, 1789-91 (to be codified as amended at 42 U.S.C. §17386) (initially establishing the SGIG program).

[15] FED. ENERGY REGULATORY COMM'N, ASSESSMENT OF DEMAND RESPONSE & ADVANCED METERING 3 (2011), *available at* http://www.ferc.gov/legal/staff-reports/11-07-11-demand-response.pdf.

[16] *Id.*

[17] INST. FOR ELECTRIC EFFICIENCY, UTILITY-SCALE SMART METER DEPLOYMENTS, PLANS & PROPOSALS 1 (2011), *available at* http://www.edisonfoundation.net/iee/issuebriefs/SmartMeter_Rollouts_0911.pdf.

American Electric Reliability Corporation, which impose obligations on utilities that participate in the generation or transmission of electricity.[18]

General federal privacy safeguards provided under the Federal Privacy Act of 1974 (FPA) protect smart meter data maintained by federal agencies, including data held by federally owned electric utilities. Section 5 of the Federal Trade Commission Act (FTC Act) allows the Federal Trade Commission (FTC) to bring enforcement proceedings against electric utilities that violate their privacy policies or fail to protect meter data from unauthorized access, provided that the FTC has statutory jurisdiction over the utilities.

It is unclear how Fourth Amendment protection from unreasonable search and seizures would apply to smart meter data, due to the lack of cases on this issue. However, depending upon the manner in which smart meter services are presented to consumers, smart meter data may be protected from unauthorized disclosure or unauthorized access under the Stored Communications Act (SCA), the Computer Fraud and Abuse Act (CFAA), and the Electronic Communications Privacy Act (ECPA). If smart meter data is protected by these statutes, law enforcement would still appear to have the ability to access it for investigative purposes under procedures provided in the SCA, ECPA, and the Foreign Intelligence Surveillance Act (FISA).

Smart Meter Data: Privacy and Security Concerns

Residential smart meters present privacy and cybersecurity issues[19] that are likely to evolve with the technology.[20] In 2010, the National Institute of Standards and Technology (NIST) published a report identifying some of these issues, which fall into two main categories: (1) privacy concerns that smart meters will reveal the activities of people inside of a home by measuring their electricity usage frequently over time;[21] and (2) fears that inadequate cybersecurity measures surrounding the digital transmission of smart meter data will expose it to misuse by authorized and unauthorized users of the data.[22]

Detailed Information on Household Activities

Smart meters offer a significantly more detailed illustration of a consumer's energy usage than regular meters. Traditional meters display data on a consumer's *total* electricity usage and are typically read manually once per month.[23] In contrast, smart meters can provide *near real-time* usage data by measuring usage electronically at a much greater frequency, such as once every 15

[18] For additional information on the development of mandatory national smart grid privacy and cybersecurity standards by federal agencies, see MASS. INST. OF TECH., THE FUTURE OF THE ELECTRIC GRID 197-234 (2011) [hereinafter MIT GRID STUDY]; *see also* CRS Report R41886, *The Smart Grid and Cybersecurity—Regulatory Policy and Issues*, by Richard J. Campbell.

[19] According to the authors of the MIT study, cybersecurity "refers to all the approaches taken to protect data, systems, and networks from deliberate attack as well as accidental compromise, ranging from preparedness to recovery." MIT GRID STUDY, *supra* note 18, at 208. Closely related is the concept of "information privacy," which "deals with policy issues ranging from identification and collection to storage, access, and use of information." *Id.* at 219 n.viii.

[20] *See* NIST PRIVACY REPORT, *supra* note 11, at 1.

[21] *Id.* at 4, 11. Data that offers a high degree of detail is said to be "granular." *Id.*

[22] *See id.* at 4, 23-24, 29.

[23] *Id.* at 2, 9.

minutes.[24] Current smart meter technology allows utilities to measure usage as frequently as once every minute.[25] By examining smart meter data, it is possible to identify which appliances a consumer is using and at what times of the day, because each type of appliance generates a unique electric load "signature."[26] NIST wrote in 2010 that "research shows that analyzing 15-minute interval aggregate household energy consumption data can by itself pinpoint the use of most major home appliances."[27] A report for the Colorado Public Utilities Commission discussed an Italian study that used "artificial neural networks" to identify individual "heavy-load appliance uses" with 90% accuracy using 15-minute interval data from a smart meter.[28] Similarly, software-based algorithms would likely allow a person to extract the unique signatures of individual appliances from meter data that has been collected less frequently and is therefore less detailed.[29]

By combining appliance usage patterns, an observer could discern the behavior of occupants in a home over a period of time.[30] For example, the data could show whether a residence is occupied, how many people live in it, and whether it is "occupied by more people than usual."[31] According to the Department of Energy, smart meters may be able to reveal occupants' "daily schedules (including times when they are at or away from home or asleep), whether their homes are equipped with alarm systems, whether they own expensive electronic equipment such as plasma TVs, and whether they use certain types of medical equipment."[32] **Figure 1**, which appears in NIST's report on smart grid cybersecurity, shows how smart meter data could be used to decipher the activities of a home's occupants by matching data on their electricity usage with known appliance load signatures.

[24] *Id.* at 13.

[25] COLORADO PRIVACY REPORT, *supra* note 6, at 2. Some utilities may elect to receive data at less frequent intervals because "backhauling real-time or near real-time data from the billions of devices that may eventually be connected to the Smart Grid would require not only tremendous bandwidth" but also greater data storage capacities that could make the effort "economically infeasible." DEP'T OF ENERGY COMMUNICATIONS REPORT, *supra* note 3, at 20. However, the "trend" is for utilities to collect data more frequently. *See* COLORADO PRIVACY REPORT, *supra* note 6, at A-1 n.111.

[26] NIST PRIVACY REPORT, *supra* note 11, at 2, 14.

[27] *Id.* at 14. *But see* DEP'T OF ENERGY PRIVACY REPORT, *supra* note 6, at 9 (claiming, in 2010, that smart meter technology "cannot yet identify individual appliances and devices in the home in detail, but this will certainly be within the capabilities of subsequent generations of Smart Grid technologies").

[28] COLORADO PRIVACY REPORT, *supra* note 6, at 3 n.7, A-8.

[29] *Id.* at A-9.

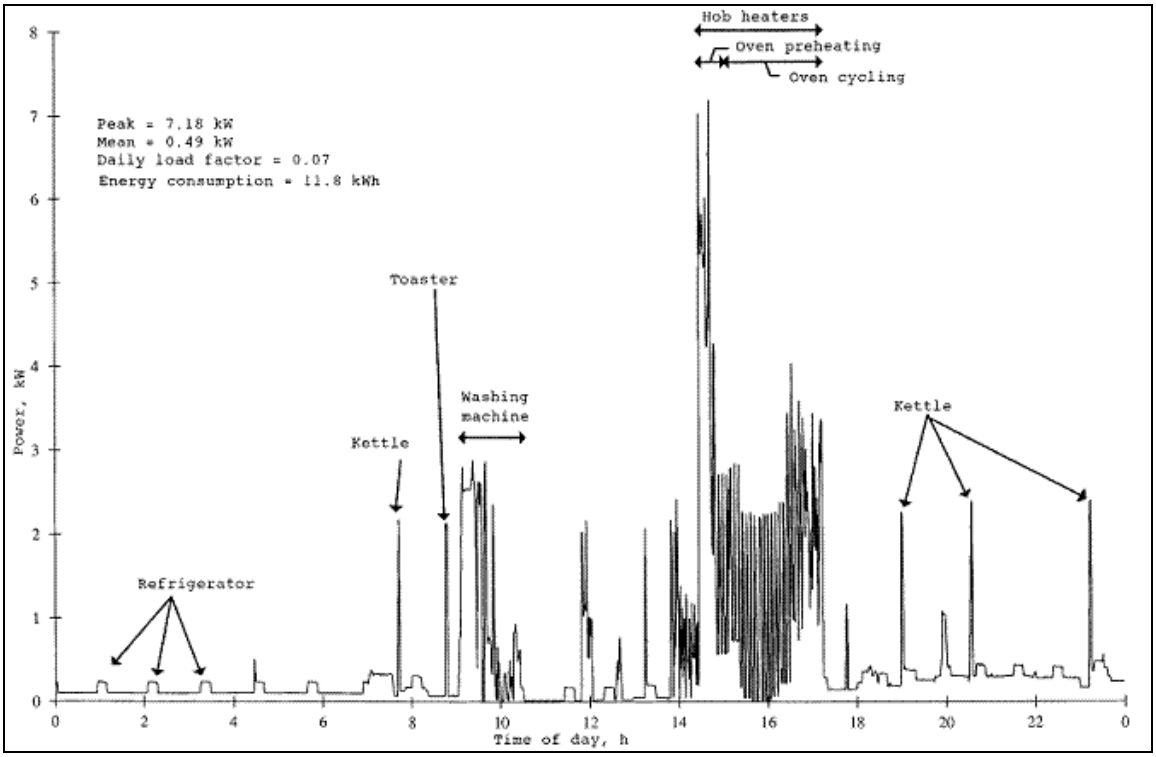
[30] NIST PRIVACY REPORT, *supra* note 11, at 6 & n.9.

[31] *Id.* at 11.

[32] DEP'T OF ENERGY PRIVACY REPORT, *supra* note 6, at 2.

Figure 1. Identification of Household Activities from Electricity Usage Data

Unique Electric Load Signatures of Common Household Appliances



Source: NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST), GUIDELINES FOR SMART GRID CYBER SECURITY: VOL. 2, PRIVACY AND THE SMART GRID 13 (2010), *available at* http://csrc.nist.gov/publications/nistir/ir7628/nistir-7628_vol2.pdf.

Note: Researchers constructed this picture from electricity usage data collected at one-minute intervals using a nonintrusive appliance load monitoring (NALM) device, which is similar to a smart meter in the way that it records usage data. For a comparison of the technologies, see COLORADO PRIVACY REPORT, *supra* note 6, at A-1 to A-9.

Smart meter data that reveals which appliances a consumer is using has potential value for third parties, including the government. In the past, law enforcement agents have examined *monthly* electricity usage data from *traditional* meters in investigations of people they suspected of illegally growing marijuana.[33] For example, in *United States v. Kyllo*, a federal agent subpoenaed the suspect's electricity usage records from the utility and "compared the records to a spreadsheet for estimating average electrical use and concluded that Kyllo's electrical usage was abnormally high, indicating a possible indoor marijuana grow operation."[34] If law enforcement officers obtained near-real time data on a consumer's electricity usage from the utility company, their ability to monitor household activities would be amplified significantly.[35] For example, by observing when occupants use the most electricity, it may be possible to discern their daily schedules.[36]

[33] NIST PRIVACY REPORT, *supra* note 11, at 11, 29; *see also* United States v. Kyllo, 190 F.3d 1041, 1043 (9th Cir. 1999), *rev'd on other grounds*, 533 U.S. 27 (2001).

[34] *Kyllo*, 190 F.3d at 1043.

[35] *See supra* notes 26-32 and accompanying text.

[36] *See supra* note 32 and accompanying text.

As smart meter technology develops and usage data grows more detailed, it could also become more valuable to private third parties outside of the grid.[37] Data that reveals which appliances a person is using could permit health insurance companies to determine whether a household uses certain medical devices, and appliance manufacturers to establish whether a warranty has been violated.[38] Marketers could use it to make targeted advertisements.[39] Criminals could use it to time a burglary and figure out which appliances they would like to steal.[40] If a consumer owned a plug-in electric vehicle, data about where the vehicle has been charged could permit someone to identify a person's location and travel history.[41]

Even privacy safeguards, such as "anonymizing" data so that it does not reflect identity, are not foolproof.[42] By comparing anonymous data with information available in the public domain, it is sometimes possible to identify an individual—or, in the context of smart meter data, a particular household.[43] Moreover, a smart grid will collect more than just electricity usage data. It will also store data on the account holder's name, service address, billing information, networked appliances in the home, and meter IP address, among other information.[44] Many smart meters will also provide transactional records as they send data to the grid, which would show the time that the meter transmitted the data and the location or identity of the transmitter.[45]

Increased Potential for Theft or Breach of Data

Smart grid technology relies heavily on two-way communication to increase energy efficiency and reliability, including communication between smart meters and the utility (or other entity) that stores data for the grid.[46] Many different technologies will transmit data to the grid, including "traditional twisted-copper phone lines, cable lines, fiber optic cable, cellular, satellite, microwave, WiMAX, power line carrier, and broadband over power line."[47] Of these communications platforms, wireless technologies are likely to play a "prominent role" because they present fewer safety concerns and cost less to implement than wireline technologies.[48] According to the Department of Energy, a typical utility network has four "tiers" that collect and transmit data from the consumer to the utility.[49] These include "(1) the core backbone—the primary path to the utility data center; (2) backhaul distribution—the aggregation point for

[37] NIST PRIVACY REPORT, *supra* note 11, at 14, 35-36.

[38] *Id.* at 27-28.

[39] *Id.* at 28.

[40] *Id.* at 31.

[41] *Id.*

[42] *Id.* at 13.

[43] *See id.* at 13, 25.

[44] *Id.* at 26-27.

[45] *Id.* at 12 (drawing a comparison to telecommunications providers' "call detail records").

[46] *Id.* at 3; DEP'T OF ENERGY COMMUNICATIONS REPORT, *supra* note 3, at 3 (stating that "integrated two-way communications ... allows for dynamic monitoring of electricity use as well as the potential for automated electricity use scheduling."). As more consumers become generators of electricity through the use of "fuel cells, wind turbines, solar roofs, and the like," the importance of two-way communication will increase. MIT GRID STUDY, *supra* note 18, at 201.

[47] DEP'T OF ENERGY COMMUNICATIONS REPORT, *supra* note 3, at 3.

[48] *Id.* at 5, 51 n.215.

[49] *Id.* at 16.

neighborhood data; (3) the access point—typically the smart meter; and, (4) the HAN—the home network."[50] Energy usage data moves from the smart meter,[51] and then to an "aggregation point" outside of the residence such as "a substation, a utility pole-mounted device, or a communications tower."[52] The aggregation points gather data from multiple meters and "backhaul" it to the utility using fiber, T1, microwave, or wireless technology.[53] Utilities typically rely on their own private networks to communicate with smart meters because they have found these networks to be more reliable and less expensive than commercial networks.[54]

As NIST explains, consumer data moving through a smart grid becomes stored in many locations both within the grid and within the physical world.[55] Thus, because it is widely dispersed, it becomes more vulnerable to interception by unauthorized parties[56] and to accidental breach.[57] The movement of data also increases the potential for it to be stolen by unauthorized third parties while it is in transit, particularly when it travels over a wireless network[58]—or through communications components that may be incompatible with one another or possess outdated security protections.[59]

Smart Meters and the Fourth Amendment

The use of smart meters presents the recurring conflict between law enforcement's need to effectively investigate and combat crime and our desire for privacy while in our homes. With smart meters, police will have access to data that might be used to track residents' daily lives and routines while in their homes, including their eating, sleeping, and showering habits, what appliances they use and when, and whether they prefer the television to the treadmill, among a host of other details.[60] Though a potential boon to police, access to this data is not limitless. The Fourth Amendment, which establishes the constitutional parameters for government investigations, may restrict access to smart meter data or establish rules by which it can be obtained.[61] The Fourth Amendment ensures that the "right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated...."[62] This section discusses whether the collection and use of smart meter data may

[50] *Id.*

[51] The home network will be used to provide *consumers* with near real-time data on their energy usage. *Id.* at 13-15.

[52] *Id.* Many urban installations use wireless mesh networks to carry data from the meters to the aggregation point. These networks are more reliable because each smart meter can serve as a router in the network, providing redundant network coverage. *Id.* at 18.

[53] *Id.* at 16, 19.

[54] *Id.* at 4, 19, 44.

[55] NIST PRIVACY REPORT, *supra* note 11, at 23.

[56] *Id.* at 23-24.

[57] *Id.* at 29.

[58] *See id.* at 9, 12, 33, and 36.

[59] MIT GRID STUDY, *supra* note 18, at 209, 213-16.

[60] Jack I. Lerner & Deirdre K. Mulligan, *Taking the "Long View" on the Fourth Amendment: Stored Records and the Sanctity of the Home*, 2008 STAN. TECH. L. REV. 3, ¶ 3 (2008).

[61] Additionally, as described below, there are federal statutory protections that may pertain to this data. State constitutional and statutory safeguards may also apply, but these are beyond the scope of this report.

[62] U.S. CONST. amend IV.

contravene this protection. Although there is no Fourth Amendment case on point, analogous cases may provide guidance.[63]

To assess whether there has been a Fourth Amendment violation, two primary questions must be asked: (1) whether there was state action; that is, was there sufficient government involvement in the alleged wrongdoing to trigger the Fourth Amendment; and (2) whether the person had an expectation of privacy that society is prepared to deem reasonable.[64] If the first question is answered in the affirmative, then the analysis moves to the second question. But if no state action is found, the analysis ends there and the Fourth Amendment does not apply. This subpart will first determine whether access to smart meter data by police, or by privately and publicly owned utilities, satisfies the state action doctrine, thereby warranting further Fourth Amendment review.

State Action: Privately Versus Publicly Owned Utilities

Most of the safeguards for civil liberties and individual rights contained in the U.S. Constitution apply only to actions by state and federal governments.[65] This rule, known as the state action doctrine, arises when a victim claims his constitutional rights have been violated, and therefore must prove the wrongdoer had sufficient connections with the government to warrant a remedy.[66] Applying the state action test is intended to determine whether a utility's collection and dissemination of smart meter data is governed by the Fourth Amendment, and if so, to what extent. Although there are many variations in the governance and ownership of utilities—some are privately owned, others publicly owned, some federally operated, and still others nonprofit cooperatives—they generally fall into two broad categories: public and private.[67] This section will analyze the constitutional differences between privately and publicly owned utilities under the state action doctrine and a public records theory.

Privately Owned and Operated Utilities

It is broadly said that the Fourth Amendment applies only to acts by the government.[68] But there are at least two exceptions to this rule. First, if a utility performs a function traditionally exercised by the government, it may be considered a state actor under the public function exception. Second, the Fourth Amendment may apply when a private utility acts as an instrument or agent of the police.[69]

---

[63] For additional analyses of smart meters under the Fourth Amendment, see Cheryl Dancey Balough, *Privacy Implications of Smart Meters*, 86 CHI.-KENT L. REV. 161 (2011); *see also* QUINN, *supra* note 6, at 28 ("[I]nterval data of electricity consumption appears to be in something of a no-man's-land under Supreme Court Fourth Amendment jurisprudence.").

[64] California v. Ciraolo, 476 U.S. 207, 211 (1986) (citing Katz v. United States, 389 U.S. 347, 360 (1967) (Harlan, J., concurring)).

[65] Civil Rights Cases, 109 U.S. 3, 11 (1883) ("It is State action of a particular character that is prohibited. Individual invasion of individual rights is not the subject-matter of the [Fourteenth] amendment."); *see* JOHN E. NOWAK & RONALD D. ROTUNDA, CONSTITUTIONAL LAW §12.1(a)(i) (8th ed. 2010).

[66] NOWAK & ROTUNDA, *supra* note 65.

[67] Determining whether a private actor is sufficiently "public" is not clear-cut. Then Justice Rehnquist noted, "[t]he true nature of the State's involvement may not be immediately obvious, and detailed inquiry may be required in order to determine whether the test is met." Jackson v. Metropolitan Edison Co., 419 U.S. 345, 351 (1974).

[68] Burdeau v. McDowell, 256 U.S. 465, 475 (1921).

[69] *See* United States v. Jacobsen, 466 U.S. 109, 113 (1984).

Under the public function exception, a nominally private entity is treated as a state actor when it assumes a role traditionally played by the government.[70] Determining when this exception applies has not proved easy,[71] but it is reasonably clear that private utilities do not, in most instances, satisfy it. In *Jackson v. Metropolitan Edison Co.*, a customer sued a privately owned utility under the Civil Rights Act of 1871 for improperly shutting off her service without providing her notice or a hearing.[72] The Supreme Court asked whether there was a close enough nexus between the state and the utility for the acts of the latter to be treated as those of the former.[73] Although the utility was heavily regulated by the state, it was held not to be a state actor.[74] The Court reasoned that the provision of utility service is not generally an "exclusive prerogative of the State."[75] Also absent was the symbiotic relationship between the utility and the state found in previous cases.[76] Though its holding was broad, the Court did not foreclose the possibility that a privately owned utility could be a state actor under different circumstances.[77] This possibility, however, appears narrow.

The Fourth Amendment may also apply to a private utility if its acts were directed by the government. Generally, searches performed by private actors without police participation or encouragement are not governed by the Fourth Amendment.[78] A search by a private insurance investigator, for instance, was not a "search" in the constitutional sense, though the evidence was ultimately used by the government at trial.[79] This result differs, however, if there is sufficient government involvement. If the search has been ordered or requested by the government, the private actor will become an "instrument or agent of the state" and must abide by Fourth Amendment strictures.[80] For example, the Fourth Amendment does not apply when a telephone company installs a pen register on its own initiative.[81] The same action constitutes a search, however, if requested by the government.[82]

This theory applies not only to direct instigation, but also on a broad, programmatic level. In the 1960s and 1970s the federal government required privately owned and operated airlines to institute new security measures to combat airline hijacking.[83] In *United States v. Davis*, the airline

[70] Marsh v. Alabama, 326 U.S. 501 (1946) (holding that privately owned property was equivalent to "community shopping center" thus private party was subject to the First and Fourteenth Amendments).

[71] *See* NOWAK & ROTUNDA, *supra* note 65, §12.2.

[72] *Jackson*, 419 U.S. at 347; *see also* Mays v. Buckeye Rural Elec. Coop., Inc., 277 F.3d 873, 880-81 (6th Cir. 2002) (holding that nonprofit cooperative utility was not a state actor under the federal constitution); Spickler v. Lee, No. 02-1954, 2003 U.S. App. LEXIS 6227, at *2 (1st Cir. March 31, 2003) (holding that private electric utility company was not a state actor).

[73] *Jackson*, 419 U.S. at 351.

[74] *Id.* at 358-59.

[75] *Id.* at 353.

[76] *Id.* at 357.

[77] *Id.* at 351.

[78] 1 WAYNE R. LAFAVE, SEARCH AND SEIZURE §1.8, at 255 (4th ed. 2004).

[79] United States v. Howard, 752 F.2d 220, 227-28 (6th Cir. 1985).

[80] Coolidge v. New Hampshire, 403 U.S. 443, 487 (1971) (internal quotation marks omitted); *see* LAFAVE, *supra* note 78, §1.8(b).

[81] United States v. Manning, 542 F.2d 685, 686 (6th Cir. 1976).

[82] People of Dearborn Heights v. Hayes, 82 Mich. App. 253, 258 (1978).

[83] United States v. Davis, 482 F.2d 893, 897-903 (9th Cir. 1973).

searched a passenger based on these requirements and found a loaded gun.[84] The Ninth Circuit held that it made no difference whether the search was conducted by a private or public official: "the search was part of the overall, nation-wide anti-hijacking effort, and constituted 'state action' for purposes of the Fourth Amendment."[85] Thus, if a private party is required to perform a search or collect data under federal or state laws or regulations, there will be sufficient state action for the Fourth Amendment to apply. Or, put another way, the government cannot circumvent the Fourth Amendment by requiring a private party to initiate a search or implement an investigative program.

This agency theory might apply to the collection of smart meter data. If the utility is accessing this information "independent of the government's intent to collect evidence for use in a criminal prosecution,"[86] the utility will not be considered an agent of the government for Fourth Amendment purposes. But there might be instances when government instigation will trigger further analysis. If, for example, the government requested the utility to record larger quantities of data than was customary (e.g., increasing the intervals from sub-15 minute intervals to sub-five minute or sub-one minute intervals), this would likely warrant Fourth Amendment scrutiny. Also, if the police requested the utility to hand over customer data, say, for spikes in energy commensurate with a marijuana growing operation, this would likely be a sufficient instigation to trigger further constitutional review. Other situations may arise where the government establishes a dragnet-type law enforcement scheme in which all smart meter data is filtered through police computers. This could also implicate the agency theory and warrant a finding of state action.

Publicly Owned and Operated Utilities

Although the Fourth Amendment (with its warrant and probable cause requirement) typically applies to public actors, in certain instances their collection of information may not fall under the Fourth Amendment or may prompt a lower evidentiary standard. The Supreme Court has infrequently considered the scope of the Fourth Amendment "on the conduct of government officials in noncriminal investigations,"[87] and even less frequently as to "noncriminal *noninvestigatory* governmental conduct."[88] Nonetheless, there are two lines of cases that may apply to smart meters in which the Fourth Amendment may not apply at all (noncriminal noninvestigatory conduct) or may be reduced (noncriminal investigations). The key to this analysis is the government's purpose in collecting the data.

The Supreme Court has developed a line of cases dubbed the "special needs" doctrine that permits the government to perform suspicionless searches if the special needs supporting the program outweigh the intrusion on the individual's privacy.[89] It is premised on the notion that "'special needs,' beyond the normal need for law enforcement, make the warrant and probable-cause requirement impracticable."[90] If, on the one hand, the objective of the search is not for law

[84] *Id.* at 895.

[85] *Id.* at 904.

[86] United States v. Howard, 752 F.2d 220, 228 (6th Cir. 1985).

[87] *The Supreme Court, 1986-Term—Leading Cases*, 101 HARV. L. REV. 119, 230 (1987).

[88] United States v. Attson, 900 F.2d 1427, 1430 (9th Cir. 1990) (emphasis in original).

[89] Ferguson v. City of Charleston, 532 U.S. 67, 77-78 (2001).

[90] Skinner v. Ry. Labor Executives' Ass'n, 489 U.S. 602, 620 (1989) (quoting Griffin v. Wisconsin, 483 U.S. 868, 873 (1987)).

enforcement purposes but for other reasons such as public safety[91] or ensuring the integrity of sensitive government positions,[92] then the doctrine will apply. If, however, the "primary purpose" or "immediate objective" was "to generate evidence *for law enforcement purposes*," then application of the special needs doctrine is not appropriate, and the government must adhere to general Fourth Amendment principles.[93] Again, the primary inquiry is the purpose of the search.

Some circuit courts of appeal have extended the special needs theory, holding that the Fourth Amendment does not apply (in contrast to a reduced standard of suspicion as with the special needs cases) unless the "conduct has as its purpose the intention to elicit a benefit for the government in either its investigative or administrative capacities."[94] In *United States v. Attson*, the Ninth Circuit held that the collection of blood by a government-employed physician, which was subsequently used by the police in a drunk driving prosecution, was not within the scope of Fourth Amendment protection.[95] The panel reasoned that the doctor drew the blood for medical purposes, not to further a governmental purpose in obtaining evidence against the defendant in its criminal investigation, so the Fourth Amendment did not apply.[96]

Applying these two theories to smart meters, a court would focus on the publicly owned utility's purpose in collecting the data. If it were for ordinary business purposes such as billing, informing the customer of its usage patterns, or aiding the utility in making the grid more energy-efficient, then it would not violate the Fourth Amendment. If, however, the public utility began aggregating data at the request of a law enforcement agency, with the purpose of aiding a criminal investigation or other administrative purpose, the Fourth Amendment would seemingly apply. As with private utilities, if the government requested that the public utility report any suspicious electricity usage, or created a program where certain data was regularly transmitted to the police, this might become investigatory and warrant Fourth Amendment protections. It appears law enforcement cannot evade Fourth Amendment restrictions by requesting a publicly owned utility to collect data for it.

Law enforcement might also request smart meter data under a public records theory. It is generally accepted that public records are not accorded Fourth Amendment protection.[97] Unless there is a state or federal statute prohibiting disclosure, "law enforcement access to state public records is unrestricted."[98] Thus the inquiry hinges on whether a document is a public record.

---

[91] *Id.*

[92] Nat'l Treasury Employees Union v. Von Raab, 489 U.S. 656, 670 (1989).

[93] *Ferguson*, 532 U.S. at 83 (emphasis in original).

[94] *See* United States v. Attson, 900 F.2d 1427, 1431 (9th Cir. 1990); Poe v. Leonard, 282 F.3d 123, 137 (2d Cir. 2002); United States v. Elliot, 676 F. Supp. 2d 431, 435-36 (D. Md. 2009).

[95] *Attson*, 900 F.2d at 1433.

[96] *Id.*

[97] *See* Nilson v. Layton City, 45 F.3d 369, 372 (10th Cir. 1995) ("Information readily available to the public is not protected by the constitutional right to privacy."); Doe v. City of New York, 15 F.3d 264, 268 (2d Cir. 1994) ("Certainly, there is no question that an individual cannot expect to have a constitutionally protected privacy interest in matters of public record."); United States v. Ellison, 462 F.3d 557, 562 (6th Cir. 2006) (accessing license plate number from computer database held not an intrusion of a constitutionally protected area, thus not a Fourth Amendment "search"); United States v. Baxter, 492 F.2d 150, 167 (9th Cir. 1973) (holding that Fourth Amendment protections do not extend to telephone company toll and billing records); *see also* Christopher Slobogin, *The Search and Seizure of Computers and Electronic Evidence: Transaction Surveillance by the Government*, 75 MISS. L. J. 139, 156 (2005).

[98] Slobogin, *supra* note 97.

Whether a person's utility records are public records differs from state to state.[99] Some states deem records of a municipally owned and operated electric utility as public records open for public inspection, while others have accorded these records statutory and constitutional protections.

In Florida, for example, records kept in connection with the operation of a city-operated utility are considered public records.[100] A similar policy applies in Georgia, where all records of a government agency, including utility records, must be open for inspection.[101] South Carolina, too, takes a similar approach.[102] It is not clear, however, from the reported cases whether these statutes permit access to personally identifiable information or simply operating records of the utility. Oklahoma is more explicit, permitting access to "records of the address, rate paid for services, charges, consumption rates, adjustments to the bill, reasons for adjustment, the name of the person that authorized the adjustment, and payment for each customer."[103] Oklahoma does protect some confidentiality, including "credit information, credit card numbers, telephone numbers, social security numbers, [and] bank account information for individual customers."[104] Other states, like Washington, specifically protect personally identifiable utility records. Washington does not require a showing of probable cause, but instead "a reasonable belief" that the record will help establish the customer committed a crime.[105] North Carolina likewise states that any "[b]illing information compiled and maintained by a city or county or other public entity providing utility services in connection with the ownership or operation of a public enterprise" is not a public record.[106]

---

[99] Because the focus of this report is federal law and the Fourth Amendment, a full treatment of state privacy law is beyond its scope.

[100] *In re* Public Records—Records of Municipally Operated Utility, Op. Att'y Gen. Fla. 74-35 (1974), *available at* http://www.myfloridalegal.com/ago.nsf/Opinions/B4AED736C2272860852566B30067371A; *see* FLA. STAT. §119.01(1) (2008) ("It is the policy of this state that all state, county, and municipal records are open for personal inspection by any person.").

[101] *See* GA. CODE ANN. §50-18-70(b) (2011); Op. Att'y Gen. Ga. 2000-4 (2000) (requiring personal utility records of certain public employees to be disclosed under public records law). Georgia defines a "public record" as "all documents, papers, letters, maps, books, tapes, photographs, computer based or generated information, or similar material prepared and maintained or received in the course of the operation of a public office or agency." GA. CODE ANN. §50-18-70(a).

[102] In South Carolina, public records include "information in or taken from any account, voucher, or contract dealing with the receipt or expenditure of public or other funds by public bodies." S.C. CODE ANN. §30-4-50 (2011). *See* Kelsey M. Swanson, *The Right to Know: An Approach to Gun Licenses and Public Access to Government Records*, 56 UCLA L. REV. 1579, 1601 (2009).

[103] OKLA. STAT. tit. 51, §24A.10 (2011).

[104] *Id.*

[105] WASH. REV. CODE §42.56.335 (2011). In Washington, the following rule applies to public utility districts and municipally owned electrical utilities:

> A law enforcement authority may not request inspection or copying of records of any person who belongs to a public utility district or a municipally owned electrical utility unless the authority provides the public utility district or municipally owned electrical utility with a written statement in which the authority states that it suspects that the particular person to whom the records pertain has committed a crime and the authority has a reasonable belief that the records could determine or help determine whether the suspicion might be true. Information obtained in violation of this section is inadmissible in any criminal proceeding.

WASH. REV. CODE §42.56.335. The Washington Supreme Court has raised this protection to state constitutional status in *In re* Personal Restraint of Maxfield, 133 Wash. 2d 332, 344 (1997).

[106] However, the North Carolina public records law declares that "[n]othing contained herein is intended to limit public disclosure by a city or county of bill information: ... that is necessary to assist law enforcement, public safety, fire (continued...)

Determining whether a utility is a state actor or whether smart meter data is a public record are merely threshold matters. A finding that an entity is a state actor or data is public does not foreclose law enforcement's ability to retrieve customer smart meter data, but instead activates the next step of Fourth Amendment analysis: whether the government invaded a reasonable expectation of privacy.

Reasonable Expectation of Privacy in Smart Meter Data

Under the modern conception of the Fourth Amendment, the government may not intrude into an area in which a person has an actual expectation of privacy that society would consider reasonable.[107] In the case of smart meter data, the government presumably seeks records in the custody of third-party utilities on the energy use at a specific home. However, a significant body of cases has refused to recognize constitutionally protected privacy interests in information provided by customers to businesses as part of their commercial relationships.[108] This theory, the third-party doctrine, permits police access to the telephone numbers a person dials[109] and to a person's bank documents,[110] free from Fourth Amendment constraints.

There are two relevant differences, however, between smart meters and the traditional third-party cases that may warrant a shift in approach. First is the possible judicial unease with the notion that advancement of technology threatens to erode further the constitutional protection of privacy.[111] From that perspective, as technology progresses, society faces an ever-increasing risk that an individual's activities will be monitored by the government. This is coupled with the concern that the breadth and granularity of personal information that new technology affords provide a far more intimate picture of an individual than the more limited snapshots available through prior technologies. Do the richness and scope of new information technologies warrant increased constitutional scrutiny?

Second, smart meters can convey information about the activities that occur inside the home, an area singled out for specific textual protection in the Fourth Amendment and one deeply ingrained in Anglo-Saxon law.[112] Even when the Court declared that "the Fourth Amendment protects people, not places,"[113] ostensibly shifting away from a property-based conception of the Fourth Amendment, it has still carved out special protections for the home.[114] However, concomitant with the increased use of technology in our private lives is increased exposure of our private activities, including those conducted in the home. Commonly, we share more personal

(...continued)

protection, rescue, emergency management, or judicial officers in the performance of their duties." N.C. GEN. STAT. §132-1.1(c)(3).

[107] Katz v. United States, 389 U.S. 347, 361 (1967) (Harlan, J., concurring).

[108] *See* Smith v. Maryland, 442 U.S. 735 (1979).

[109] *Id.*

[110] United States v. Miller, 425 U.S. 435 (1976).

[111] Kyllo v. United States, 533 U.S. 27, 33-4 (2001) ("It would be foolish to contend that the degree of privacy secured to citizens by the Fourth Amendment has been entirely unaffected by the advance of technology.").

[112] *See* Entick v. Carrington, 19 How. St. Tr. 1029 (C.P. 1765).

[113] Katz v. United States, 389 U.S. 347, 351 (1967).

[114] *See* Orin S. Kerr, *The Fourth Amendment and New Technologies: Constitutional Myths and the Case for Caution*, 102 MICH. L. REV. 801, 809-10 (2004) [hereinafter Kerr, *Fourth Amendment and New Technologies*].

information, even as our concerns grow that more individuals, businesses, and others can glean more information about our personal lives as a matter of course. As with technology generally, does the fact that more of our lives are becoming "public" call for lesser or greater constitutional protection, and how does a "reasonable expectation"-based model continue to apply in a technologically intensive society?

This subpart will first look at the third-party doctrine as it is commonly conceived by the courts. Then it will discuss whether there are sufficient differences between the use of smart meters and traditional third-party cases to counsel against its application.

Third-Party Doctrine

Traditionally, there has been no Fourth Amendment protection for information a consumer gives to business as part of their business dealings.[115] This doctrine dates back to the secret agent cases, in which any words uttered to another person, including a government agent or informant, were not covered by the Fourth Amendment.[116] It was later extended to business records, giving police access to documents such as telephone records,[117] bank records,[118] motel registration records,[119] and cell phone records.[120] The Supreme Court has reasoned that the customers assume the risk that the information could be handed over to government authorities,[121] and also that they consent to such access.[122] Some lower courts have applied this theory to traditional analog utility meters.[123] This section discusses the possible application of the third-party doctrine to smart meters.

In *Miller v. United States*, agents of the Bureau of Alcohol, Tobacco, and Firearms (ATF) subpoenaed several banks for records pertaining to the defendant, including copies of the defendant's checks, deposit slips, and financial statements.[124] The defendant moved to suppress the records at trial, arguing that a warrantless retrieval of the bank records (his "private papers")[125] was an intrusion into an area protected by the Fourth Amendment. The Court

[115] Orin S. Kerr, *The Case for a Third-Party Doctrine*, 107 MICH. L. REV. 561, 563 (2009) [hereinafter Kerr, *Third-Party Doctrine*]. While the third-party doctrine has supporters like Professor Kerr, this group is overshadowed by its vocal detractors. Professor LaFave described its underpinnings as "dead wrong" and that the "Court's woefully inadequate reasoning does great violence to the theory of Fourth Amendment protection which the Court developed in *Katz*." LAFAVE, *supra* note 78, §2.7(c). Justice Sotomayor lent credence to this sentiment in *United States v. Jones*, where she posited that it "may be necessary to reconsider the premise that an individual has no reasonable expectation of privacy in information voluntarily disclosed to third parties." United States v. Jones, 565 U.S. ___, 5 (Sotomayor, J., concurring in the judgment and the opinion).

[116] United States v. White, 401 U.S. 745, 750 (1971) (holding that the Fourth Amendment "affords no protection to a wrongdoer's misplaced belief that a person to whom he voluntarily confides his wrongdoing will not reveal it.") (internal quotation marks omitted).

[117] Smith v. Maryland, 442 U.S. 735 (1979).

[118] United States v. Miller, 425 U.S. 435 (1976).

[119] United States v. Willis, 759 F.2d 1486, 1498 (11th Cir. 1985).

[120] United States v. Hynson, No. 05-576, 2007 WL 2692327, at *6 (E.D. Pa. Sept. 11, 2007).

[121] *Smith*, 442 U.S. at 744.

[122] Kerr, *Third-Party Doctrine*, *supra* note 115.

[123] United States v. McIntyre, 646 F.3d 1107 (8th Cir. 2011).

[124] *Miller*, 425 U.S. at 437-438.

[125] Brief for Respondent at 4, *Miller*, 425 U.S. 435 (No. 74-1179), 1975 WL 173642, at *4 ("The Fourth Amendment is historically rooted in a concern for control over personal and private information in the face of governmental demands (continued...)

disagreed, broadly declaring "the Fourth Amendment does not prohibit the obtaining of information revealed to a third-party and conveyed by him to Government authorities, even if it is revealed on the assumption that it will be used only for a limited purpose and the confidence placed in the third-party will not be betrayed."[126] The Court further noted that "the depositor takes the risk, in revealing his affairs to another, that the information will be conveyed by that person to the Government."[127]

Three years later, the Court extended the third-party doctrine to outgoing numbers dialed from a person's telephone.[128] In *Smith v. Maryland*, the defendant robbed a woman and began making obscene phone calls to her.[129] Suspecting Smith placed the calls, the police used a pen register to track the telephone numbers dialed from his phone.[130] The police failed to obtain a warrant or subpoena before installing the pen register.[131] The register revealed that Smith was in fact making the phone calls to the woman. In denying Smith's motion to suppress, the Court relied on the third-party doctrine, stating that "this Court consistently has held that a person has no legitimate expectation of privacy in information he voluntarily turns over to third parties."[132] As applied to the telephone context, the Court found that "[w]hen he used his phone, [Smith] voluntarily conveyed numerical information to the telephone company and 'exposed' that information to its equipment in the ordinary course of business. In so doing, [Smith] assumed the risk that the company would reveal to police the numbers he dialed."[133]

Traditionally, utility records have been handled similarly to bank records and telephone records. Several lower federal courts have held that customers do not have a reasonable expectation of privacy in their utility records, thereby permitting warrantless access to these records. In *United States v. Starkweather*, the Ninth Circuit held that a person does not have a reasonable expectation of privacy in his utility records.[134] The panel reasoned that (1) these records were no different from phone records, and thus did not justify a different constitutional result; and (2) the public was aware that such records were regularly maintained, thereby negating any expectation of privacy.[135] The Eighth Circuit has also upheld warrantless police access to utility records in *United States v. McIntyre*.[136] The Eighth Circuit panel distinguished *Kyllo*, declaring that the means of obtaining the information in *Kyllo* (a thermal-imaging device) was significantly more intrusive than simply subpoenaing the records from the utility company.[137] The court held that "the means to obtaining the information is legally significant."[138] Likewise, the court in *United*

(...continued)

for access and use.") (citing Entick v. Carrington, 19 How. St. Tr. 1029 (C.P. 1765)).

[126] *Miller*, 425 U.S. at 443.

[127] *Id.*

[128] Smith v. Maryland, 442 U.S. 735 (1979).

[129] *Id.* at 737.

[130] *Id.*

[131] *Id.*

[132] *Id.* at 743-44.

[133] *Id.* at 744.

[134] United States v. Starkweather, No. 91-30354, 1992 WL 204005, at *2 (9th Cir. Aug. 24, 1992).

[135] *Id.*

[136] United States v. McIntyre, 646 F.3d 1107 (8th Cir. 2011).

[137] *Id.* at 1111.

[138] *Id.*

States v. Hamilton held that the means of obtaining power records from a third-party by way of administrative subpoena as opposed to "intrusion on the home by 'sense enhancing technology'" is "legally significant," removing this type of situation from the *Kyllo*-home privacy line of cases into the *Miller*-third-party line.[139]

It is difficult to predict whether a court would extend this traditional third-party analysis to smart meters. The courts may seek to ensure the predictability and stability of the third-party doctrine generally and administration of utility services specifically, thus requiring a bright-line rule for all third-party circumstances.[140] There is an advantage to a rule that is easy to apply, that allows utilities to better govern their affairs, and does not permit "savvy wrongdoers [to] use third-party services in a tactical way to enshroud the entirety of their crimes in zones of Fourth Amendment protection."[141] However, there are three overarching considerations embodied in the use of smart meters that might weigh against the application of traditional third-party analysis. These include (a) a person's expectation of privacy while at home; (b) the breadth and granularity of private information conveyed by smart meters; (c) the lack of a voluntary assumption of the risk or consent to release of this data.

Privacy in the Home

The location of the search mattered little in the traditional third-party cases, but it may take on constitutional significance with smart meters.[142] In the case of smart meters, the information is generated in the home, an area accorded specific textual protection in the Fourth Amendment, and one the Supreme Court has persistently safeguarded.[143] In no uncertain terms the Court has asserted that "[a]t the very core [of the Fourth Amendment] stands the right of a man to retreat into his own home and there be free from unreasonable government intrusion."[144] Even as technology advances—whether a tracking or thermal-imaging device or something new—the Court has maintained this bulwark. Because of the significance of the home, access to smart

[139] United States v. Hamilton, 434 F. Supp. 2d 974, 980 (D. Or. 2006); Booker v. Dominion Va. Power, No. 3:09-759, 2010 U.S. Dist. LEXIS 44960, at *17 (E.D. Va. May 7, 2010); *see also* Samson v. State, 919 P.2d 171, 173 (Ala. App. 1996) (holding under state constitution that "utility records are maintained by the utility and do not constitute information in which society is prepared to recognize a reasonable expectation of privacy"); People v. Stanley, 86 Cal. Rptr. 2d 89, 94 (Cal. App. 1999) (same).

[140] *See* Duncan Kennedy, *Form and Substance in Private Law Adjudication*, 89 HARV. L. REV. 1687, 1710 (1976).

[141] Kerr, *Third-Party Doctrine*, *supra* note 115, at 564.

[142] In *Smith*, the "site of the call was immaterial for purposes of analysis" of that case. Smith v. Maryland, 442 U.S. 735, 743 (1979). Whether a person dials a telephone number from his home, a telephone booth, or any other location does not alter the nature of the activity, and thus does not affect the Fourth Amendment analysis. The privacy interests implicated are the same no matter where the call is placed. The same theory applies to bank records. It matters not where someone writes a check, or fills out a deposit slip—the privacy interest is the same.

[143] Payton v. New York, 445 U.S. 573, 589 ("The Fourth Amendment protects the individual's privacy in a variety of settings. In none is the zone of privacy more clearly defined than when bounded by the unambiguous physical dimensions of an individual's home—a zone that finds its roots in clear and specific constitutional terms: 'The right of the people to be secure in their ... houses ... shall not be violated.'") (quoting U.S. CONST. amend IV); Minnesota v. Carter, 525 U.S. 83, 99 (1998) (Kennedy, J., concurring) ("[I]t is beyond dispute that the home is entitled to special protection as the center of the private lives of our people. Security of the home must be guarded by law in a world where privacy is diminished by enhanced surveillance and sophisticated communication systems.").

[144] Silverman v. United States, 365 U.S. 505, 511 (1961).

meter data may prompt a doctrinal shift away from the third-party doctrine. Several home privacy cases shed light on this possible approach.[145]

In *Kyllo v. United States*, the Court had to decide whether the use of a thermal-imaging device from the outside of a home that detected the amount of heat coming from inside the home was a violation of the Fourth Amendment.[146] In *Kyllo*, an agent of the Department of the Interior suspected Danny Kyllo was growing marijuana in his home with the use of high-intensity lamps.[147] The agent used a thermal imager to scan the outside of Kyllo's apartment to determine if he was using these "grow" lamps.[148] Thermal imagers can detect energy emitting from the outside surface of an object.[149] When scanning the home, the thermal imager produced an image with various shades of black, white, or gray—the shades darker or lighter depending on the warmth of the area being scanned.[150] From the passenger seat of his car, the agent scanned Kyllo's home for several minutes.[151] From his scan, he determined that the area over the garage and one side of his home were relatively hot compared to neighboring homes.[152] Based on utility bills, informant tips, and the results of thermal imaging, the agents obtained a warrant to search Kyllo's home.[153] As suspected, inside the home the agents found a marijuana growing operation, including over 100 plants.[154]

Justice Scalia first posited that "with very few exceptions, the question whether a warrantless search of the home is reasonable must be answered no."[155] Searches of the home were historically analyzed under the common law doctrine of trespass,[156] but during the mid-20th century the Court instead anchored the Fourth Amendment to a conception of privacy.[157] While this test may be difficult to apply in the context of automobiles, telephone booths, or other public areas, it is made easier when concerning the home:

> In the case of the search of the interior of homes—the prototypical and hence most commonly litigated area of protected privacy—there is a ready criterion, with deep roots in the common law, of the minimal expectation of privacy that *exists*, and that is acknowledged

[145] In April 2012, the Supreme Court will hear oral arguments in its most recent home privacy case, Jardines v. Florida, 73 So. 3d 34 (Fla. 2011), *cert granted*, 2012 U.S. LEXIS 7 (Jan. 6, 2012) (No. 11-564), where it will decide whether a drug sniff at the front door of a suspect's house by a trained narcotics dog is a Fourth Amendment search requiring probable cause. This case should shed further light on the parameters of privacy surrounding the home.

[146] Kyllo v. United States, 533 U.S. 27, 29 (2001).

[147] *Id.*

[148] *Id.*

[149] *Id.*

[150] *Id.* at 29-30.

[151] *Id.* at 30.

[152] *Id.*

[153] *Id.*

[154] *Id.* The Ninth Circuit held that Kyllo had not exhibited a subjective expectation of privacy in the home because he did not attempt to prevent the heat emitting from the lamps from escaping his home. United States v. Kyllo, 190 F.3d 1041, 1046 (9th Cir. 1999). Further, the panel held that even if he had a subjective expectation of privacy, it was not a reasonable one since the imager "did not expose any intimate details of Kyllo's life." *Id.* at 1047.

[155] *Kyllo*, 533 U.S. at 31.

[156] *See* Olmstead v. United States, 277 U.S. 438 (1928).

[157] Katz v. United States, 389 U.S. 347, 361 (1967) (Harlan, J., concurring). The modern formulation of the reasonable expectation of privacy test derives not from the majority opinion but from Justice Harlan's concurrence.

> to be reasonable. To withdraw protection of this minimum expectation would be to permit police technology to erode the privacy guaranteed by the Fourth Amendment.[158]

The Court ultimately held that "obtaining by sense-enhancing technology any information regarding the interior of the home that could not otherwise have been obtained without physical intrusion into a constitutionally protected area constitutes a search—at least where (as here) the technology in question is not in general public use."[159] *Kyllo* affirmed the notion that "an expectation of privacy in activities taking place inside the home is presumptively reasonable."[160]

The Court also protected home privacy by prohibiting the monitoring of the location of a beeper while inside a residence.[161] In *United States v. Karo*, with the consent of a government informant the police attached a beeper to the false bottom of a can of ether, which was sold to Karo.[162] The can of ether was transported between several residences and storage facilities.[163] The police used the beeper to monitor the location of the can several times while it was located inside of the residences.[164] The Court was asked to determine "whether the monitoring of a beeper in a private residence, a location not open to visual surveillance, violates Fourth Amendment rights of those who have a justifiable interest in the privacy of the residence."[165] The Court answered in the affirmative.

The Court reiterated the long-standing notion that "private residences are places in which the individual normally expects privacy free of governmental intrusion not authorized by a warrant, and that expectation is plainly one that society is prepared to recognize as justifiable."[166] Unless there are exigent circumstances, "searches and seizures inside a home without a warrant are presumptively unreasonable...."[167] The Court ultimately held that the warrantless monitoring of the beeper in the home was a Fourth Amendment violation.[168]

Kyllo and *Karo* demonstrate that the Supreme Court "has defended the home as a sacred site at the 'core of the Fourth Amendment.'"[169] Although neither the Supreme Court nor any lower federal court has ruled on the use of smart meters, a few propositions can be deduced from *Kyllo* and *Karo* bearing on this question.

Because smart meters allow law enforcement to access information regarding intimate details occurring inside the home, a highly invasive investigation that could not otherwise be performed without intrusion into the home, a court may require a warrant to access this data. In *Kyllo*, the

---

[158] *Kyllo*, 533 U.S. at 34.

[159] *Id.* (internal quotation marks omitted).

[160] Lerner & Mulligan, *supra* note 60, ¶ 18.

[161] United States v. Karo, 468 U.S. 705 (1984).

[162] *Id.* at 708.

[163] *Id.*

[164] *Id.* at 709-10.

[165] *Id.*

[166] *Id.* at 714.

[167] *Id.* at 714-15.

[168] *Id.* at 718.

[169] Stephanie M. Stern, *The Inviolate Home: Housing Exceptionalism in the Fourth Amendment*, 95 CORNELL L. REV. 905, 913 (2010) (citing Wilson v. Layne, 526 U.S. 603, 612 (1999)).

police merely obtained the relative temperatures of a house,[170] and in *Karo* the police only generally located the beeper in the house.[171] Although this information was limited, the Court nonetheless prohibited such investigatory techniques. Smart meters have the potential to produce significantly more information than that derived in *Kyllo* and *Karo*, including what individual appliances we are using; whether our house is empty or occupied; and when we take our daily shower or bath.[172] Further, a look at **Figure 1**, *supra*, makes it clear that this level of information is much more intimate than prior technologies used by law enforcement. This depth of intrusion suggests that customers may have a reasonable expectation of privacy in smart meter data.

There is also a question whether smart meters are in "general public use." (The police must use technology not in general public use for *Kyllo* to apply.)[173] Unfortunately, the Court provided no criterion for making this determination.[174] Several courts applying this test have held that night vision goggles were in general public use.[175] One federal district court reasoned that the goggles were regularly used by the military and police and could be found on the Internet, so were considered in general public use.[176] In 2009, the Department of Energy estimated that 4.75% of all electric meters were smart meters.[177] The department projects that by 2012 approximately 52 million more meters will be installed.[178] With little guidance on this issue, it is uncertain whether this jump in numbers would elevate smart meters into the general public use category.

The means by which data is gathered also differentiates the thermal-imaging in *Kyllo* from smart meters. In *Kyllo*, the police independently gathered the information using the thermal imager; an agent went outside Kyllo's house and used the thermal imager himself.[179] With smart meters, the utility company compiles the information and the police subpoena the company for the data. This difference in means was material in one lower court analyzing access to traditional utility data.[180] It is not clear whether this difference advises against application of *Kyllo* here.

Mosaic and Dragnet Theories

The second factor guiding against the application of the third-party doctrine is composed of two interconnected theories: the mosaic and dragnet theories. The mosaic theory is grounded in the idea that surveillance of the whole of one's activities over a prolonged period is substantially

[170] United States v. Kyllo, 533 U.S. 27, 30 (2001).

[171] *Karo*, 468 U.S. at 705, 709-10.

[172] NIST PRIVACY REPORT, *supra* note 11, at 14 & n.35. It is unclear whether the specificity of the data from the smart meter will directly affect the constitutional analysis. *Kyllo*, 533 U.S. at 37 ("The *Fourth Amendment's* protection of the home has never been tied to measurement of the quality or quantity of information obtained."). With that said, the NIST report maintains that sufficient information about the activities inside of the home are presented to implicate a *Kyllo*, home search analysis.

[173] *Kyllo*, 533 U.S. at 34.

[174] *See* Douglas Adkins, *The Supreme Court Announces a Fourth Amendment "General Public Use" Standard for Emerging Technologies but Fails to Define It:* Kyllo v. United States, 27 DAYTON L. REV. 245 (2002).

[175] *See* United States v. Dellas, 355 F. Supp. 2d 1095, 1107 (N.D. Cal. 2005).

[176] United States v. Vela, 486 F. Supp. 2d 587, 590 (W.D. Tex. 2005).

[177] DEP'T OF ENERGY, SMART GRID SYSTEM REPORT vi (2009), *available at* http://energy.gov/sites/prod/files/oeprod/DocumentsandMedia/SGSRMain_090707_lowres.pdf.

[178] *Id.*

[179] United States v. Kyllo, 533 U.S. 27, 29 (2001).

[180] United States v. McIntyre, 646 F.3d 1107, 1111-12 (8th Cir. 2011).

more invasive than a look at each item in isolation.[181] In the case of smart meters, this is the difference between knowing a person's monthly energy usage, and being able to discern a person's daily activities with considerable accuracy. This theory intersects with dragnet-styled law enforcement techniques in which the police cast a wide surveillance net, taking in a wealth of personal information with the goal of finding criminal activity among the stream of data.

Although the Supreme Court has never formally adopted the mosaic theory, there seems to be a ready-made majority potentially willing to consider it.[182] In *United States v. Jones*, the police used a GPS tracking device to track Jones's movements for almost a month.[183] The majority, led by Justice Scalia, held that attaching a GPS device on a vehicle for the purpose of collecting information constituted a "search" under the Fourth Amendment.[184] The physical intrusion, rather than a *Katz*-type invasion of privacy, was the lynchpin of the decision.[185] Justices Alito and Sotomayor both agreed that this was a search, but on different grounds. Both discussed an adaptation of the mosaic theory as prohibiting police from tracking a person for an extended period of time. Justice Alito, joined by Justices Breyer, Ginsburg, and Kagan, assumed that a short-term search would not violate the Fourth Amendment, but that "the use of longer term GPS monitoring in investigations of most offenses impinges on expectations of privacy."[186] Likewise, Justice Sotomayor agreed with this "incisive" observation, noting that "GPS monitoring generates a precise, comprehensive record of a person's public movements that reflects a wealth of detail about familial, political, professional, religious, and sexual associations."[187] Both of these comments closely mirror those of the opinion below, which relied on the mosaic theory: "A person who knows all of another's travels can deduce whether he is a weekly church goer, a heavy drinker, a regular at the gym, an unfaithful husband, an outpatient receiving medical treatment, an associate of particular individuals or political groups—and not just one such fact about a person, but all such facts."[188]

Although the *Jones* majority did not embrace the mosaic theory, the concurrences demonstrate that five justices are flirting with the idea. These arguments resemble those made against the unfettered use of smart meter data. With smart meters, police would have a rich source of personal data that reveals far more about a person than traditional analog meters. Understanding a person's daily activities, including what appliances he is using, is a far leap from knowing his monthly energy usage. This is the difference between knowing about a single trip a person took and monitoring his movements over a month-long period. The breadth and granularity of the smart meter data may be seen as warranting application of the mosaic theory and may perhaps find receptive ears on the Court.

Additionally, the dragnet theory may apply to collection of energy usage data. This theory states that surveillance normally permitted under the Fourth Amendment—such as monitoring a person's movements on a public street—becomes an impermissible invasion of privacy when

[181] *See* Cent. Intelligence Agency v. Sims, 471 U.S. 159, 178 (1985).

[182] *See* Orin Kerr, VOLOKH CONSPIRACY, What's the Status of the Mosaic Theory After Jones?, http://volokh.com/2012/01/23/whats-the-status-of-the-mosaic-theory-after-jones/.

[183] United States v. Jones, 565 U.S. ___, 2 (2012).

[184] *Id.* at 3.

[185] *Id.* at 4.

[186] *Id.* at 13 (Alito, J., concurring in the judgment).

[187] *Id.* at 3 (Sotomayor, J., concurring in the judgment and the opinion).

[188] United States v. Maynard, 615 F.3d 544, 562 (D.C. Cir. 2010).

conducted on a prolonged, 24-hour basis.[189] "If such dragnet-type law enforcement practices as respondent envisions should eventually occur," Justice Rehnquist asserted earlier in *United States v. Knotts*, "there will be time enough then to determine whether different constitutional principles may be applicable."[190] Twenty-four hour access to our intimate daily activities, including what appliances we use, when we take our daily shower or bath, eat, and sleep, may push smart meters into the dragnet category.

Coinciding with the mosaic and dragnet theories is the difference in sophistication and the quantity of the data revealed between traditional third-party cases and smart meters. Comparing *Smith* with *Katz* provides insight into this distinction. Pen registers, as used in *Smith*, have "limited capabilities"—they can only record the numbers dialed from a phone.[191] In comparison, in *Katz* the police listened to the contents of Katz's phone call—the actual words spoken.[192] In noting this distinction, it seems the *Smith* Court, in permitting the use of pen registers, intentionally limited its holding to the discrete set of data conveyed—the telephone numbers dialed. Smart meters, to the contrary, have the potential to collect and aggregate precise detail about the activities inside the home. It is more than one packet of data, but reveals minute-by-minute activity, something far more revealing, and arguably more like *Katz* than *Smith*.

Assumption of the Risk—Consent

The third difference between traditional third-party cases and smart meters is the nature of services involved and whether the customer actually assumes the risk or consents to this information being shared with others. Assumption of the risk and consent are the two leading theories supporting the third-party doctrine. In *United States v. Miller*, the customer "assumed the risk" that the bank would turn over the bank records to government authorities.[193] That was a risk he took in doing business with the bank. As to the consent theory, one commentator asked and answered the question as follows: "When does a person's choice to disclose information to a third-party constitute consent to a search? So long as a person knows that they are disclosing information to a third-party, their choice to do so is voluntary and the consent valid."[194]

With banking or telephone services, a customer has the option of transferring his business to another bank or another telephone carrier.[195] To the contrary, because electric utilities are essentially monopolies, the customer cannot simply switch services. The only way to avoid the recordation of his electric usage is to terminate his utility service altogether, an impracticable option in modern society. As one state court has noted:

> Electricity, even more than telephone service, is a "necessary component" of modern life, pervading every aspect of an individual's business and personal life: it heats our homes,

[189] *Id.* at 558.

[190] United States v. Knotts, 460 U.S. 276, 283-84 (1983). Because this statement was not essential to the holding, it was dictum: persuasive, but not binding.

[191] *Smith*, 442 U.S at 741 (citing Katz v. United States, 389 U.S. 347 (1967)).

[192] *Katz*, 389 U.S. at 348.

[193] *Smith*, 442 U.S. at 744 (citing United States v. Miller, 425 U.S. 435 (1976)).

[194] Kerr, *Third-Party Doctrine*, *supra* note 115, at 588.

[195] *Contra Smith*, 442 U.S. at 750 (Marshall, J., dissenting) ("[U]nless a person is prepared to forgo use of what for many has become a personal or professional necessity, he cannot help but accept the risk of surveillance. It is idle to speak of "assuming" the risk in contexts where, as a practical matter, individuals have no realistic alternative.").

> powers our appliances, and lights our nights. A requirement of receiving this service is the disclosure to the power company (and in this case an agent of the state) of one's identity and the amount of electricity being used. The nature of electrical service requires the disclosure of this information, but that disclosure is only for the limited business purpose of obtaining the service.[196]

It is not clear whether assumption of the risk or consent should apply to smart meters. It is reasonable to assume that customers understand utility companies must collect usage data to bill the customer for that usage. Customers receive their statement each month demonstrating this fact. However, most customers are probably not familiar with the sophistication of smart meters and the detailed data sets that can be derived from them. Even if customers are aware their utility usage can be recorded in sub-fifteen minute intervals, a reasonable customer would probably be surprised, if not shocked, to know that data from smart meters can potentially be used to pinpoint the usage of specific appliances. If knowledge of the sophistication of the data is a prerequisite to assumption of the risk or consent, it is difficult to say whether a reasonable customer would understand the privacy implications with this new technology.[197]

Because smart meters are an emerging technology not yet judicially tested, it is difficult to conclude with certainty how they would be handled under the Fourth Amendment. Further, beyond the possible constitutional implications of smart meters, federal communication and privacy statutes may also apply. As noted by Professor Kerr, "in recent decades, legislative privacy rules governing new technologies have proven roughly as privacy protective, and quite often more protective than, parallel Fourth Amendment rules."[198]

Statutory Protection of Smart Meter Data

This section discusses federal statutory protections that may be applicable to the contents of communications sent by a smart meter, independent of the Fourth Amendment, while they are either stored within the smart meter prior to transmission, during transmission, or after they have been delivered to the utility. Three federal laws, the Electronic Communications Privacy Act (ECPA),[199] the Stored Communications Act (SCA),[200] and the Computer Fraud and Abuse Act (CFAA)[201] may be applicable to these situations and are discussed in more detail below.

[196] *In re* Restraint of Maxfield, 133 Wn.2d 332, 341 (Wash. 1997); *see also* Balough, *supra* note 63, at 185.

[197] *Cf.* United States v. Warshak, 631 F.3d 266, 288 (6th Cir. 2010) ("*Miller* involved simple business records, as opposed to the potentially unlimited variety of 'confidential communications' at issue here.").

[198] Kerr, *Fourth Amendment and New Technologies*, *supra* note 114, at 806.

[199] For more detailed information on ECPA, *see* CRS Report R41733, *Privacy: An Overview of the Electronic Communications Privacy Act*, by Charles Doyle.

[200] For a more detailed discussion of the SCA, *see* CRS Report R41733, *Privacy: An Overview of the Electronic Communications Privacy Act*, by Charles Doyle.

[201] For more detailed information on the CFAA, *see* CRS Report 97-1025, *Cybercrime: An Overview of the Federal Computer Fraud and Abuse Statute and Related Federal Criminal Laws*, by Charles Doyle.

The Electronic Communications Privacy Act (ECPA)

ECPA, enacted in 1986, "addresses the interception of wire, oral and electronic communications."[202] The statute defines electronic communications as "any transfer of signs, signals, writing, images, sounds, data, or intelligence of any nature transmitted in whole or in part by a wire, radio, electromagnetic, photoelectronic or photooptical system that affects interstate or foreign commerce...."[203] Based on the description of the smart meter network provided above,[204] the envisioned transmission of customers' energy usage data by smart meters would seem to fall squarely within the definition of electronic communications under ECPA.

ECPA generally prohibits the interception of electronic communications, but also provides a mechanism for government entities to conduct such surveillance, and a number of other exceptions.[205] Additionally, the statute provides that interception under the procedures and exceptions set forth in ECPA, or pursuant to the Foreign Intelligence Surveillance Act, are the exclusive means for intercepting electronic communications.[206] The unlawful interception of electronic communications in violation of ECPA is generally punishable by imprisonment for not more than five years and/or a fine of not more than $250,000 for individuals and not more than $500,000 for organizations.[207]

Of particular relevance to the immediate discussion is the fact that ECPA permits interception of an electronic communication where a party to the communication has consented to such interception.[208] In the context of a smart meter network that is the subject of this report, it appears that the utility would be a party to all of the communication sent by the smart meters, since it is primarily receiving that information for its own billing purposes. Therefore, if the utility consents to law enforcement's interception of the traffic which is addressed to it, that surveillance would not appear to violate the prohibitions in ECPA.

ECPA also provides a procedural mechanism for law enforcement to conduct surveillance activities for investigative purposes without the consent of any party to the communication. The statute limits the types of criminal cases in which electronic surveillance may be used[209] and requires court orders authorizing electronic surveillance to be supported by probable cause to believe that the target is engaged in criminal activities, that normal investigative techniques are

[202] S.Rept. 99-541 at 3.

[203] 18 U.S.C. §2510(12).

[204] *See supra* note 47 and accompanying text (noting that smart meters may use a variety of communications technologies, including fiber optics, wireless networks, satellite, and broadband over power line).

[205] 18 U.S.C. §2516. Exceptions cover things such as interception with the consent of a party to the communication and interception by communication service providers as an incident to providing service.

[206] 18 U.S.C. §2511(2)(f). FISA defines electronic surveillance to include more than the interception of wire, oral, or electronic communications, 50 U.S.C. §1801(f), but places limitations on its definition based upon the location or identity of some or all of the parties to the communications involved.

[207] "Except as provided in (b) of this subsection or in subsection (5), whoever violates subsection (1) of this section shall be fined under this title or imprisoned not more than five years, or both." 18 U.S.C. §2511(4)(a).

[208] 18 U.S.C. §2511(2)(c).

[209] The list of covered criminal provisions can be found at 18 U.S.C. §2516(1), and includes offenses such as violence at international airports; animal enterprise terrorism; arson; bribery of public officials and witnesses; unlawful use of explosives; fraud by wire, radio, or television; terrorist attacks against mass transportation; sexual exploitation of children; narcotics production and trafficking; and many others.

insufficient, and that the facilities that are the subject of surveillance will be used by the target.[210] It also limits the use and dissemination of information intercepted.[211] In addition, when an interception order expires, authorities must notify those whose communications have been intercepted.[212] Law enforcement may also conduct electronic surveillance when acting in an emergency situation pending issuance of a court order.[213]

The government may also conduct electronic surveillance under the authority of the Foreign Intelligence Surveillance Act (FISA). FISA governs the gathering of information about foreign powers, including international terrorist organizations, and agents of foreign powers.[214] Although it is often discussed in relation to the prevention of terrorism, it applies to the gathering of foreign intelligence information for other purposes.[215] Although some exceptions apply, such as for emergency situations,[216] the government typically must obtain a court order, supported by probable cause, from the Foreign Intelligence Surveillance Court (FISC), a neutral judicial decision maker, in order to conduct electronic surveillance pursuant to FISA.[217]

The Stored Communications Act (SCA)

The SCA was enacted in 1986 as Title II of the Electronic Communications Privacy Act (ECPA),[218] to "address[] access to stored wire and electronic communications and transactional records."[219] The SCA prohibits unauthorized persons from accessing a facility through which an *electronic communication service* (ECS) is provided; or obtaining, altering, or preventing access to an electronic communication while it is in *electronic storage* in an ECS.[220] The SCA also limits the circumstances in which providers of ECS or a *remote computing service* (RCS) may disclose information that they carry or maintain.[221] The SCA also provides a mechanism by which law enforcement may compel the disclosure of stored communications.[222]

The terms "electronic communication service," "remote computing services," and "electronic storage" are all specifically defined by the SCA. As described above, the SCA applies only to providers of either an ECS or an RCS; stored communications held by other types of entities are not protected by the SCA. Therefore, in order to determine whether the SCA would protect stored information collected by a smart meter, this report will first examine whether a utility's deployment of a smart meter network falls within the definition of an ECS or an RCS and then

[210] 18 U.S.C. §§2516, 2518(3).

[211] 18 U.S.C. §2517.

[212] 18 U.S.C. §2518(8).

[213] 18 U.S.C. §2518(7).

[214] *See* 50 U.S.C. §1801(a) (definition of "foreign power").

[215] For example, it extends to the collection of information necessary for the conduct of foreign affairs. *See* 50 U.S.C. §1801(e) (definition of "foreign intelligence information").

[216] 50 U.S.C. §1805(e).

[217] 50 U.S.C. §§1801-1808. FISA authorizes electronic surveillance without a FISA order in specified instances involving communications between foreign powers. 50 U.S.C. §1802.

[218] P.L. 99-508.

[219] S.Rept. 99-541 at 3.

[220] 18 U.S.C. §2701(a). Unauthorized access includes exceeding an authorization to use the facility. *Id.*

[221] 18 U.S.C. §2702.

[222] 18 U.S.C. §2703.

discuss the protections and disclosure restrictions that might apply to any smart meter network that qualifies as an ECS or RCS.

Electronic Communication Services

An ECS is defined by the SCA as any service which provides users "the ability to send or receive wire or electronic communications."[223] The statute also defines an "electronic communication" as "any transfer of signs, signals, writing, images, sounds, data, or intelligence of any nature transmitted in whole or in part by a wire, radio, electromagnetic, photoelectronic or photooptical system that affects interstate or foreign commerce."[224] As described above, one of the essential functions of a smart meter would appear to be the capability to transmit consumer electricity usage data to the smart grid using a variety of communications technologies.[225] These transmissions would seem to fall neatly within the SCA's definition of an electronic communication. Therefore, whether a smart meter network would qualify as an ECS would likely depend on whether the deployed smart meters could be said to be providing this ability to users.

It is not clear whether it would be accurate to categorically describe smart meters as providing customers with "the ability to send or receive" communications. It could be argued that a utility customer would use the smart meter to transmit usage information to the utility, in the same way that the same customer uses a traditional meter to record household electricity usage over a billing period. However, the Ninth Circuit has suggested that an ECS should not include situations in which electronic communications are used only "as an incident to providing some other service, as is the case with a street-front shop that requires potential customers to speak into an intercom device before permitting entry, or a 'drive-thru' restaurant that allows customers to place orders via a two-way intercom located beside the drive-up lane."[226] On one hand, it may not be accurate to describe utility customers as users of smart meters at all, particularly if the deployment of such smart meters is intended principally for the benefit of the utility and does not change the experience of utility customers. On the other hand, some of the proposed uses of deployed smart meters may include using collected data for the benefit of the customers, for example by determining the energy efficiency of specific household appliances.[227] As a result, the ultimate classification of a particular smart meter network as an ECS may depend largely on the specific facts present, such as the manner in which it is marketed, or the ostensible purposes for which the transmissions are intended to be used.

If a smart meter network qualifies as an ECS, then transmissions containing smart meter data would be protected under the SCA only while such transmissions are in electronic storage, as that term is defined by the statute.[228] Therefore, one must first determine whether, and under what circumstances, the data collected by a smart meter network is in electronic storage in order to determine what protections apply.

---

[223] 18 U.S.C. §2510(15).

[224] 18 U.S.C. §2510(12). Wire communications are defined as communications containing the human voice and are not implicated here. 18 U.S.C. §2510(1).

[225] *See supra* note 47 and accompanying text.

[226] Company v. United States (*In re* United States), 349 F.3d 1132, 1141 (9th Cir. 2003) (holding that definition of ECS includes service that provides drivers with the ability to make phone calls from their car for directory assistance, driving directions, or roadside assistance because those activities are intrinsically communicative).

[227] *See supra* note 8.

[228] 18 U.S.C. §2701.

For purposes of the SCA, a communication is in electronic storage at an ECS if it is in temporary, intermediate storage incidental to electronic transmission or in storage for backup protection.[229] As applied to the smart meter network, data residing on the smart meter itself prior to being sent to the utility would appear to be in electronic storage, as such storage is likely temporary and undertaken solely in anticipation of some eventual transmission to the utility. In contrast, once the data has arrived at the utility and resides on its servers, it may no longer be in temporary or intermediate storage. However, some form of the communications may still be being held for backup purposes, and in such a case might be considered in electronic storage under the statute. To the extent that the data would be considered in electronic storage, either while on the meter or on the utility's computers, the data would appear to be subject to the SCA's provisions applicable to providers of ECS.

The SCA prohibits intentionally accessing without authorization, a facility through which an ECS is provided and obtaining, altering, or preventing access to an electronic communication while it is in electronic storage.[230] Criminal penalties for violating the SCA's prohibitions on unauthorized access start at imprisonment for not more than one year (not more than five years for a subsequent conviction) and/or a fine of not more than $100,000.[231] However, violations committed for malicious, mercenary, tortious or criminal purposes are subject to higher penalties and may be punished by imprisonment for not more than five years (not more than 10 years for a subsequent conviction) and/or a fine of not more than $250,000 (not more than $500,000 for organizations).[232] Victims of a violation of the SCA also have a civil cause of action for equitable relief, reasonable attorneys' fees and costs, and damages equal to the loss and gain associated with the offense but not less than $1,000.[233]

The SCA generally restricts the ability of providers of ECS to disclose the contents of communications in electronic storage, if the ECS is offering those services to the public.[234] However, the statute also permits certain disclosures to law enforcement. Such permitted disclosures by a provider of electronic communication services to law enforcement can be either voluntary or compelled. Normally, voluntary disclosure to law enforcement is authorized only if the contents of the communication were inadvertently obtained by the service provider and appear to pertain to the commission of a crime.[235] However, it should be noted that the utility in this case appears to be the intended recipient of all communications sent over the smart meter network, and the SCA's restrictions on disclosures of electronically stored information held by ECS or RCS providers may generally be overcome if an intended recipient of the communication consents to the disclosure.[236] Consequently, the utility may have more latitude to share communications in electronic storage with law enforcement than a traditional provider of ECS, such as a telephone company, would have.

[229] 18 U.S.C. §2510(17).

[230] 18 U.S.C. §2701(a). Unauthorized access includes exceeding an authorization to use the facility. *Id.*

[231] 18 U.S.C. §2701(b)(2).

[232] 18 U.S.C. §2701(b)(1).

[233] 18 U.S.C. §2707.

[234] 18 U.S.C. §2702(a)(1) ("a person or entity providing an electronic communication service to the public shall not knowingly divulge to any person or entity the contents of a communication while in electronic storage by that service").

[235] 18 U.S.C. §2702(b)(7).

[236] *See* 18 U.S.C. §2702(b)(3).

For purposes of compelled disclosures to law enforcement, the SCA distinguishes between recent communications and those that have been in electronic storage for more than 180 days. A search warrant is required to compel providers to disclose communications held in electronic storage for 180 days or less.[237] However, communications held for more than 180 days may be obtained by law enforcement through a warrant, subpoena, or a court order supported by specific and articulable facts sufficient to establish reasonable grounds to believe that the contents are relevant and material to an ongoing criminal investigation.[238] Customers whose communications have been disclosed are generally required to be given notice of such disclosure, but such disclosure may be delayed if notification might result in endangering the life or physical safety of an individual; flight from prosecution; destruction of or tampering with evidence; intimidation of potential witnesses; or otherwise seriously jeopardizing an investigation or unduly delaying a trial.[239]

Remote Computing Services

It is likely that the classification of a smart meter network as an RCS would similarly be fact-dependent. The SCA defines an RCS as a service in which computer storage or processing services by means of an ECS are provided to the public.[240] It is conceivable that the data collected by smart meters may in fact be stored or processed by the utility, but there is no indication that such storage or processing would be categorically provided as a service to the public, rather than solely for the utility's internal benefit.[241] If such service is not provided to the public, then it would likely be inaccurate to classify the smart meter network as an RCS. However, if one of the features of a particular smart meter deployment is to give customers the ability to store or process their usage data, then it would appear to qualify as an RCS.

For those smart meter networks which qualify as an RCS, the SCA generally protects the contents of electronically transmitted communications "carried or maintained on that service" for customers of the service. Disclosures of such information are generally prohibited,[242] but the SCA also provides a means for law enforcement to obtain access to the contents of such communications. The government may obtain a warrant supported by probable cause, or use a subpoena or a court order supported by specific and articulable facts sufficient to establish reasonable grounds to believe that the contents are relevant and material to an ongoing criminal investigation.[243] However, use of a subpoena or court order supported by specific and articulable facts also requires the government to give prior notice to the customer whose information is sought, unless particular circumstances warrant delayed notice.[244] RCS customers whose

[237] 18 U.S.C. §2703(a).

[238] 18 U.S.C. §2703(d). Some courts have held that this "reasonable grounds" standard is a less demanding standard than "probable cause." *See In re* Application of the United States, 620 F.3d 304, 313 (3d Cir. 2010) ("We also conclude that this [§2703(d)] standard is a lesser one than probable cause.").

[239] 18 U.S.C. §2705(a).

[240] 18 U.S.C. §2711(2).

[241] However, if some other service provided by the utility allows the data collected by a smart meter to be stored or manipulated for the benefit of the utility's customers, it is possible that this system would fall within the definition of an RCS.

[242] The SCA allows providers of an RCS to disclose stored communications with the consent of the subscriber of an RCS. 18 U.S.C. §2702(b)(3).

[243] 18 U.S.C. §2703(b)(1).

[244] 18 U.S.C. §2703(b)(1)(B).

communications have been disclosed in violation of the SCA may pursue a civil cause of action for equitable relief, reasonable attorneys' fees and costs, and damages equal to the loss and gain associated with the offense but not less than $1,000.[245]

The Computer Fraud and Abuse Act (CFAA)

The Computer Fraud and Abuse Act (CFAA) prohibits intentionally accessing and obtaining information from a computer used in or affecting interstate commerce, without authorization or in excess of a granted authorization.[246] The definition of a computer for purposes of the CFAA is "an electronic, magnetic, optical, electrochemical, or other high speed data processing device performing logical, arithmetic, or storage functions, and includes any data storage facility or communications facility directly related to or operating in conjunction with such device" excluding "an automated typewriter or typesetter, a portable hand held calculator, or other similar device...."[247]

The servers on a utility's network would likely fall squarely within the definition of a computer under the CFAA. Similarly, smart meters themselves also appear to meet the definition of a computer, insofar as they store customers' energy usage data and also perform logical operations by routing transmissions across the utility's network. Additionally, in light of the significant role that energy utilities play in the modern economy, the smart meter network would also likely be considered to have an effect on interstate commerce, even if they operate entirely within one state. Therefore, intentionally gaining access to the utility's servers or smart meters to obtain customer data would likely constitute a violation of the CFAA if done without the utility's authorization or in excess of an authorization granted by the utility.

The criminal penalties for violating the unauthorized access provisions of the CFAA have a three tier sentencing structure. Simple violations are punished as misdemeanors, imprisonment for not more than one year and/or a fine of not more than $100,000 ($200,000 for organizations).[248] At the next level, cases in which: "(i) the offense was committed for purposes of commercial advantage or private financial gain; (ii) the offense was committed in furtherance of any criminal or tortious act in violation of the Constitution or laws of the United States or of any State; or (iii) the value of the information obtained exceeds $5,000" may be punished by imprisonment for not more than five years and/or a fine of not more $250,000 ($500,000 for organizations).[249] The third tier is for repeat offenders whose punishment is increased to imprisonment of not more than 10 years and/or a fine of not more than $250,000 ($500,000 for organizations) for a second or subsequent conviction.[250]

[245] 18 U.S.C. §2707.

[246] 18 U.S.C. §1030(a)(2). For more detailed information on the CFAA, *see* CRS Report 97-1025, *Cybercrime: An Overview of the Federal Computer Fraud and Abuse Statute and Related Federal Criminal Laws*, by Charles Doyle.

[247] 18 U.S.C. §1030(e)(1).

[248] 18 U.S.C. §1030(c)(2)(A).

[249] 18 U.S.C. §1030(c)(2)(B).

[250] 18 U.S.C. §§1030(c), 3571.

The Federal Trade Commission Act (FTC Act)

Section 5 of the FTC Act prohibits "unfair or deceptive acts or practices in or affecting commerce"[251] and gives the Federal Trade Commission (FTC) jurisdiction to bring enforcement actions against "persons, partnerships, or corporations" that engage in these practices.[252] In the past, the FTC has used its authority under Section 5 to take action against businesses that violate their own privacy policies or that fail to adequately safeguard a consumer's personal information.[253] Although there do not appear to be any cases in which the FTC has taken action against an electric utility for failing to protect consumer smart meter data, the Commission would have authority to enforce Section 5 against a utility that fell within its statutory jurisdiction.

Covered Electric Utilities

This section considers whether the FTC would have Section 5 jurisdiction over each of the four types of electric utilities identified by the Energy Information Administration (EIA): investor-owned, publicly owned, federally owned, and cooperative.[254] It finds that the FTC clearly has jurisdiction over investor-owned utilities. It is unclear whether the Commission has jurisdiction over publicly owned utilities or federally owned utilities. The FTC could enforce Section 5 against for-profit electric cooperatives, and case law suggests that nonprofit electric cooperatives may also be subject to the act's requirements.

The FTC has jurisdiction to enforce Section 5 against "persons, partnerships, or corporations," with exceptions not applicable here.[255] Utilities that are "persons" or "partnerships" would be subject to the FTC's enforcement powers automatically,[256] as the statute does not provide any additional jurisdictional requirements for these entities. Most electric utilities, however, are organized as legal entities that would potentially fit within the definition of "corporation." The FTC Act states that, for the purposes of Section 5, the term "corporation":

> shall be deemed to include any company, trust, so-called Massachusetts trust, or association, incorporated or unincorporated, which is organized to carry on business for its own profit or that of its members, and has shares of capital or capital stock or certificates of interest, and any company, trust, so-called Massachusetts trust, or association, incorporated or unincorporated, without shares of capital or capital stock or certificates of interest, except partnerships, which is organized to carry on business for its own profit or that of its members.[257]

[251] 15 U.S.C. §45(a)(1).

[252] 15 U.S.C. §45(a)(2).

[253] *See* "Enforcement of Data Privacy and Security," *infra* p. 41; *see also* NIST PRIVACY REPORT, *supra* note 11, at 23 n.48.

[254] ENERGY INFO. ADMIN., ELECTRIC POWER INDUSTRY OVERVIEW (2007) [hereinafter EIA ELECTRIC POWER OVERVIEW], *available at* http://www.eia.gov/cneaf/electricity/page/prim2/toc2.html.

[255] 15 U.S.C. §45(a)(2).

[256] The FTC Act does not further define "persons" or "partnerships" or impose any additional jurisdictional requirements on these entities in the way that it does for "corporations." *See* 15 U.S.C. §44.

[257] 15 U.S.C. §44.

This definition, particularly in its use of the words "shall be deemed to include," suggests that a wide variety of legal entities could potentially constitute "corporations." Moreover, in *California Dental Ass'n v. FTC*, the Supreme Court remarked that the "FTC Act directs the Commission to prevent the *broad set of entities* under its jurisdiction" from violating Section 5.[258] In that case, the Court found that the term "corporation" also included *nonprofit* entities, so long as they imparted significant economic benefit to their members.[259] Thus, as the Court's opinion demonstrates, the key question when determining whether an entity is a "corporation" for the purposes of Section 5 jurisdiction is not what legal form the entity takes, but rather whether the entity is "organized to carry on business for its own profit or that of its members."

Investor-Owned Utilities

Investor-owned utilities are clearly subject to the FTC's Section 5 jurisdiction as "corporations." The EIA defines investor-owned electric utilities as those that "have the fundamental objective of producing a profit for their investors" and distributing these profits as dividends or reinvesting them in the business.[260] These utilities satisfy the definition of "corporation" under the statute because they are companies organized to carry on business for the profit of their investors.[261]

Publicly Owned Utilities

It is unclear whether the FTC has Section 5 jurisdiction over publicly owned utilities. The agency probably lacks jurisdiction over these utilities if it characterizes them as "corporations," but it is possible that it may have jurisdiction over them if it characterizes them as "persons." Publicly owned utilities include "municipals, public utility districts and public power districts, State authorities, irrigation districts, and joint municipal action agencies."[262] The EIA describes these as "nonprofit government entities that are organized at either the local or State level," are exempt from state and federal income taxes, and "provide service to their communities and nearby consumers at cost."[263] In contrast to investor-owned utilities or cooperatively owned utilities, publicly owned utilities obtain capital by issuing debt rather than selling an ownership interest in the utility to investors or members.[264]

As "Corporations"

Publicly owned utilities probably do not fall within the FTC's Section 5 jurisdiction over "corporations" because they are not organized to carry on business for profit. Rather, governments form these utilities for the sole purpose of distributing electricity to consumers at

[258] Cal. Dental Ass'n v. FTC, 526 U.S. 756, 768 (1999) (emphasis added) (internal quotation marks omitted).

[259] *Id.* at 766-69.

[260] EIA ELECTRIC POWER OVERVIEW, *supra* note 254.

[261] Indeed, the FTC has asserted Section 5 jurisdiction over holding companies with investor-owned electric utility subsidiaries in the past. *See, e.g.*, *DTE Energy Co.*, 131 F.T.C. 962 (May 15, 2001) (complaint); *CMS Energy Corp.*, 127 F.T.C. 827 (June 2, 1999) (complaint). *See also In re* DTE Energy Co., FTC File No. 001 0067 (May 15, 2001) (consent order); *In re* CMS Energy Corp., FTC File No. 991 0046 (June 2, 1999) (consent order).

[262] EIA ELECTRIC POWER OVERVIEW, *supra* note 254.

[263] *Id.*

[264] DAVID E. MCNABB, PUBLIC UTILITIES: MANAGEMENT CHALLENGES FOR THE 21ST CENTURY 165 (2005).

cost.[265] Significantly, when publicly owned utilities realize net income—that is, revenues they earn in excess of their expenses—they either (1) use it to finance their operations in lieu of issuing more debt,[266] or (2) transfer it to the general fund of the political subdivision that they serve.[267] These utilities typically lack investors or members to which they could distribute net income as dividends.[268] Thus, publicly owned utilities are probably not "organized to carry on business" for profit and are probably exempt from the FTC's Section 5 jurisdiction if characterized as "corporations."

As "Persons"

It is unclear whether a court would find that the FTC has Section 5 jurisdiction over publicly owned utilities as "persons," as a court could employ several different canons of statutory interpretation when deciding whether "persons" includes state or local government entities.[269] In the 1980s, the FTC attempted to assert Section 5 jurisdiction over two state-chartered municipal corporations—the cities of New Orleans and Minneapolis—as "persons," alleging that the cities engaged in unfair methods of competition by assisting taxicab companies in maintaining high prices and stifling competition.[270] The Commission later withdrew both complaints, and thus no court considered whether jurisdiction was proper. More recently, the Commission has asserted jurisdiction over state government agencies that regulate certain professions such as dentistry,[271] optometry,[272] and funeral services.[273]

There appears to be only one court case that engages in a full discussion and interpretation of the meaning of "persons" under Section 5. In *California State Board of Optometry v. FTC*, the D.C. Circuit Court of Appeals considered "whether a State acting in its sovereign capacity is a 'person' within the FTC's enforcement jurisdiction."[274] The FTC had issued a rule declaring "certain state laws restricting the practice of optometry to be unfair acts or practices."[275] Petitioners, which were state boards of optometry and professional associations, argued that the court should strike down the rule because it went beyond the FTC's statutory authority.[276] In vacating the rule, the court found nothing in the relevant provisions of the FTC Act "to indicate that Congress intended to authorize the FTC to reach the 'acts or practices' of States acting in their sovereign capacities."[277]

---

[265] EIA ELECTRIC POWER OVERVIEW, *supra* note 254.

[266] MCNABB, *supra* note 264, at 165.

[267] EIA ELECTRIC POWER OVERVIEW, *supra* note 254.

[268] MCNABB, *supra* note 264, at 165.

[269] In contrast to entities that are "corporations," the FTC does not have to show that entities qualifying as "persons" are organized for profit. *See* 15 U.S.C. §44.

[270] *In re* City of Minneapolis, 105 F.T.C. 304 (May 7, 1985) (order withdrawing complaint); *In re* City of New Orleans, 105 F.T.C. 1 (Jan. 3, 1985) (order withdrawing complaint).

[271] *In re* N.C. State Bd. of Dental Exam'rs, 151 F.T.C. 607 (Feb. 3, 2011) (state action opinion); *In re* South Carolina State Bd. of Dentistry, 138 F.T.C. 229 (Sept. 12, 2003) (complaint).

[272] *In re* Mass. Board of Registration in Optometry, 110 F.T.C. 549 (June 13, 1988) (decision).

[273] *In re* Va. Bd. of Funeral Dirs. & Embalmers, 138 F.T.C. 645 (Oct. 1, 2004) (complaint).

[274] 910 F.2d 976, 979 (D.C. Cir. 1990).

[275] *Id.* at 978.

[276] *Id.* at 978-79.

[277] *Id.* at 980, 982.

A court approaching the question of whether "persons" includes publicly owned utilities would start with the language of the statute. Courts traditionally give broad deference to an agency when the agency interprets the extent of its own jurisdiction unless the reach of its jurisdiction is clear from reading the statute "under ordinary principles of construction."[278] Attempting to discern the Commission's jurisdiction under Section 5 of the FTC Act is difficult, as the statute does not define the term "persons" for the purposes of that provision. Title 1, Section 1 of the United States Code (the Dictionary Act) provides: "In determining the meaning of any Act of Congress, *unless the context indicates otherwise* ... the words 'person' and 'whoever' include corporations, companies, associations, firms, partnerships, societies, and joint stock companies, as well as individuals."[279]

However, the context in which "persons" appears in Section 5 probably forecloses the use of the default definition of "person" in the Dictionary Act. In Section 5, Congress listed the terms "persons," "partnerships," and "corporations" separately, which indicates that it intended to give each term independent significance. The terms "corporations" and "partnerships" would not have independent meaning in Section 5 if the term "persons" in Section 5 included the entities listed in the Dictionary Act. Furthermore, the FTC Act requires that "corporations" be organized for their own profit or the profit of their members in order for the FTC to exercise jurisdiction over them—a requirement it does not impose on the other entities.[280] By reading the term "persons" to include the entities listed in the Dictionary Act, the FTC could evade this additional requirement simply by bringing its complaint against an entity as a "person" rather than a "corporation"—a result that Congress probably did not intend. Thus, a court that ended its analysis here could find that the meaning of "persons" remains ambiguous. The court could then choose to defer to the FTC's broad interpretation of its own jurisdiction under the Supreme Court's decision in *Chevron U.S.A., Inc. v. NRDC, Inc.*[281]

The *California Optometry* court, however, declined to defer to the FTC's interpretation of its own jurisdiction because it found that principles of federalism outweighed *Chevron* deference.[282] Quoting the Supreme Court's decision in *Will v. Michigan Department of State Police*,[283] the

[278] *See* Cal. Dental Ass'n v. FTC, 526 U.S. 756, 765-66 (1999) ("Respondent urges deference to this interpretation of the Commission's jurisdiction as reasonable. But we have no occasion to review the call for deference here, the interpretation urged in respondent's brief being clearly the better reading of the statute under ordinary principles of construction.") (internal citations omitted); *see also* Chevron U.S.A., Inc. v. NRDC, Inc., 467 U.S. 837, 842-43 (1984).

[279] 1 U.S.C. §1 (emphasis added).

[280] *See* 15 U.S.C. §44.

[281] *Chevron*, 467 U.S. at 842-43. In that case, the Court held that

> When a court reviews an agency's construction of the statute which it administers, it is confronted with two questions. First, always, is the question whether Congress has directly spoken to the precise question at issue. If the intent of Congress is clear, that is the end of the matter; for the court, as well as the agency, must give effect to the unambiguously expressed intent of Congress. If, however, the court determines Congress has not directly addressed the precise question at issue, the court does not simply impose its own construction on the statute, as would be necessary in the absence of an administrative interpretation. Rather, if the statute is silent or ambiguous with respect to the specific issue, the question for the court is whether the agency's answer is based on a permissible construction of the statute. *Id.*

[282] Todd H. Cohen, *Double Vision: The FTC, State Regulation, and Deciding What's Best for Consumers*, 59 GEO. WASH. L. REV. 1249, 1267 (1991) ("In sum, the *California State Board of Optometry* court relied on federalism principles to justify protecting state interests. The court extended the judicially-created *Parker* state action doctrine to cover FTC trade regulation rules and applied the clear statement doctrine to prevent the FTC from invalidating a state law as unfair without additional congressional action.").

[283] 491 U.S. 58 (1989).

California Optometry court stated that "in common usage, the term person does not include the sovereign, and statutes employing the word are ordinarily construed to exclude it."[284] In the *Will* case, the Court considered whether the term "person" as it appeared in 42 U.S.C. §1983 included a state.[285] The Court held that it did not, invoking the principles of federalism when it wrote that "[t]his approach is particularly applicable where it is claimed that Congress has subjected the States to liability to which they had not been subject before."[286] The Court found that the statute's language fell "far short of satisfying the ordinary rule of statutory construction that if Congress intends to alter the 'usual constitutional balance between the States and Federal Government,' it must make its intention to do so 'unmistakably clear in the language of the statute.'"[287]

The Court's decision in *Will*, as interpreted by the D.C. Circuit in *California Optometry*, suggests that Congress must clearly indicate in a particular statute when it wishes to subject states to a new form of liability, particularly when this would change the balance between state and federal authority by intruding on the actions a state takes in its sovereign capacity. There does not appear to be a clear indication that Congress intended the word "persons" in the FTC Act to subject publicly owned utilities to FTC enforcement actions.[288] Thus, if the FTC's enforcement of Section 5 against a publicly owned utility would alter the balance between the state and federal governments, a court might read "persons" to exclude these utilities. As the *California Optometry* court indicated, whether the balance is altered may depend on whether the operation of the utility amounts to the state acting in its sovereign capacity (balance altered) or merely engaging in a proprietary function (balance not altered).[289] The *California Optometry* court suggested that whether a state is acting in its sovereign capacity or engaging in a proprietary function may vary according to the antitrust laws' state action doctrine, a multi-pronged analysis that is beyond the scope of this report.[290] If a court found that the state was acting in its sovereign capacity when the state (or one of its subdivisions) operated an electric utility, the court could hold that the FTC does not have Section 5 jurisdiction because of the federalism principles and clear statement rule that guided the interpretation of the statute in *Will* and were adopted by the court in *California Optometry*.[291]

A third possible choice for a court would be to adopt the reasoning of the FTC and find that Congress clearly intended "persons" to include government entities, because under the other antitrust laws, the term "persons" includes state and local government entities, and the antitrust

[284] *California Optometry*, 910 F.2d 976, 980 (D.C. Cir. 1990) (internal quotation marks omitted).

[285] *Will*, 491 U.S. at 60.

[286] *Id.* at 64.

[287] *Id.* at 65 (citations omitted).

[288] Representative Covington, the sponsor of the act, explained during floor debate on the measure that Section 5 "embraces within the scope of that section every kind of person, natural or artificial, who may be engaged in interstate commerce."51 CONG. REC. 14,928 (1914). Despite this remark, courts have not taken such a broad view of the FTC's jurisdiction under the act. Even the Supreme Court has held that there are some limits on the entities covered by Section 5. *See* Cal. Dental Ass'n v. FTC, 526 U.S. 756, 766-67 (1999) (requiring, for jurisdiction, that a "proximate relation" must exist between the activities of a nonprofit and the benefit it provides to its members, and implying that the activities must confer "more than *de minimis* or merely presumed economic benefits" on the members).

[289] *See California Optometry*, 910 F.2d at 980-81 ("This rule of statutory construction serves to ensure that the States' sovereignty interests are adequately protected by the political process.").

[290] *Id.* at 980. For more information on the factors that courts consider when making this determination, see FED. TRADE COMM'N, REPORT OF THE STATE ACTION TASK FORCE (2003), *available at* http://www.ftc.gov/os/2003/09/stateactionreport.pdf.

[291] *See* Cohen, *supra* note 282, at 1267.

laws, including the FTC Act,[292] should be read together.[293] The *California Optometry* court acknowledged this argument, writing that "several Supreme Court decisions hold that a State *is* a person for purposes of the antitrust laws."[294] The court ultimately rejected the argument, however, because it found that "when a State acts in a sovereign rather than a proprietary capacity, it is exempt from the antitrust laws even though those actions may restrain trade," and that this state action doctrine may "limit the reach of the FTC's enforcement jurisdiction."[295] Thus, if a court found that a state acted in its *proprietary* capacity when the state (or one of its subdivisions) operated a public utility, then the state action doctrine would not apply, and it would be possible for a court to find jurisdiction even under the *California Optometry* case. The FTC has advanced this reasoning, arguing that the state boards over which it asserts jurisdiction do not amount to the states acting in their sovereign capacities.[296] Whether the operation of a particular publicly owned utility consists of the state acting in its sovereign capacity or engaging in a proprietary function may vary according to the antitrust laws' state action doctrine, a multi-pronged analysis that is beyond the scope of this report.[297]

Thus, whether a court would find that the word "persons" in Section 5 includes certain government entities such as publicly owned utilities is unclear because it may depend on which, if any, of several principles of statutory construction the court adopts. A court could, among other options: (1) find that the meaning of "persons" in Section 5 is ambiguous, and thus defer to the FTC's broad interpretation of its own jurisdiction because of the *Chevron* doctrine; (2) find that the statute is ambiguous, but that principles of federalism outweigh the court's usual *Chevron* deference to the Commission's interpretation of its own jurisdiction—a determination that may require a court to find that the state is acting in its sovereign capacity when the state (or one of its subdivisions) operates an electric utility; or (3) find that Congress clearly intended "persons" to include government entities because Section 5 should be read together with the other antitrust laws, under which the term "person" includes state and local government entities—a determination that may require a court to find that the state is performing a proprietary function when the state (or one of its subdivisions) operates a utility.

Federally Owned Utilities

It is unclear whether the FTC could enforce Section 5 against a federally owned utility. Indeed, there does not appear to be any case in which the FTC has sought to enforce Section 5 against a federal agency.[298] The FTC probably lacks Section 5 jurisdiction over the nine federally owned

[292] Although this report focuses on the FTC's consumer law cases under Section 5 ("unfair or deceptive acts or practices"), and not its antitrust cases ("unfair methods of competition"), both types of prohibited activities share the same phrase for the purposes of determining the agency's jurisdiction: "persons, partnerships, or corporations." *See* 15 U.S.C. §45(a)(2).

[293] *See In re* Mass. Board of Registration in Optometry, 110 F.T.C. 549 (June 13, 1988) (decision) (citations omitted).

[294] *California Optometry*, 910 F.2d at 980 (citations omitted).

[295] *Id.* at 980 (citation omitted).

[296] *See, e.g.*, *In re* N.C. State Bd. of Dental Exam'rs, 151 F.T.C. 607 (Feb. 3, 2011) (state action opinion); *In re* Mass. Board of Registration in Optometry, 110 F.T.C. 549 (June 13, 1988) (decision).

[297] For more information on the factors that courts consider when making this determination, see FED. TRADE COMM'N, REPORT OF THE STATE ACTION TASK FORCE (2003), *available at* http://www.ftc.gov/os/2003/09/stateactionreport.pdf.

[298] This report does not consider whether any constitutional implications would result if the FTC, an independent executive branch agency, brought an enforcement proceeding against another executive branch agency. *See generally* Michael Eric Herz, *When Can the Federal Government Sue Itself?*, 32 WM. & MARY L. REV. 893 (1991).

utilities operating in the United States[299] if it characterizes them as "corporations." Like publicly owned utilities, federally owned utilities are not organized for profit. As the EIA notes, "federal power is not sold for profit, but to recover the costs of operations and repay the Treasury for funds borrowed to construct generation and transmission facilities."[300] If the Commission characterizes these utilities as "persons," it is unclear whether a court would find that this term includes government entities.[301]

As a practical matter, FTC enforcement of Section 5 against federally owned utilities is probably unnecessary in the context of smart meter data because of other federal laws, such as the Privacy Act,[302] that would likely protect this data when it is stored in records systems maintained by federal agencies, including federally owned utilities.[303]

Cooperatively Owned Utilities

For-profit electric cooperatives would clearly fall within the Commission's Section 5 jurisdiction over "corporations" operated for their own profit or that of their members.[304] Indeed, the FTC has maintained jurisdiction over for-profit cooperatives as "corporations" in the past, including a rural healthcare cooperative[305] and a wine maker.[306] However, it appears that most electric cooperatives—and particularly the cooperatives that will receive funds under the Department of Energy's Smart Grid Investment Grant program—are nonprofits.[307]

It is possible that the FTC would have Section 5 jurisdiction over these nonprofit electric cooperatives as "corporations" organized for profit. These distribution utilities are owned by the "consumers they serve," and those that are tax-exempt must "provide electric service to their members at cost, as that term is defined by the Internal Revenue Service."[308] However, when the activities of a cooperative result in revenues that exceed the cooperative's costs, these "net margins ... are considered a contribution of equity by the members that are required to be returned to the members consistent with the organization's bylaws and lender limitations imposed as a condition of loans."[309] Thus, in contrast to publicly owned utilities, which typically transfer any net income to the general fund of the government that they serve, electric cooperatives return net margins to their members as equity, and when that equity is retired by the board of directors, members receive cash payments.[310] Although it does not appear that a court has considered

[299] EIA ELECTRIC POWER OVERVIEW, *supra* note 254. Among these utilities are the Tennessee Valley Authority, the four power marketing administrations in the Department of Energy, and the Army Corps of Engineers. *Id.*

[300] *Id.*

[301] *See supra* notes 269-97 and accompanying text.

[302] 5 U.S.C. §552a.

[303] *See* "The Federal Privacy Act of 1974," *infra* p. 45.

[304] 15 U.S.C. §44.

[305] *In re* Minn. Rural Health Coop., FTC File No. 051 0199 (Dec. 28, 2010) (decision and order).

[306] *In re* Heublein, Inc., 96 F.T.C. 385 (Oct. 7, 1980) (final order).

[307] *See* DEP'T OF ENERGY, CASE STUDY – NATIONAL RURAL ELECTRIC COOPERATIVE ASSOCIATION SMART GRID INVESTMENT GRANT 1, *available at* http://energy.gov/sites/prod/files/oeprod/DocumentsandMedia/NRECA_case_study.pdf.

[308] EIA ELECTRIC POWER OVERVIEW, *supra* note 254.

[309] *Id.* "Net margins" is the term given to "revenues in excess of the cost of providing service." *Id.*

[310] *See, e.g.*, Cent. Rural Electric Coop., Patronage Capital, http://www.crec.coop/CRECAdvantage/PatronageCapital/tabid/711/Default.aspx ("Allocated patronage capital appears as an entry on the permanent financial records of the (continued...)

whether the FTC has Section 5 jurisdiction over a nonprofit electric cooperative that returns its net margins to its consumer-members in addition to providing them with electricity service, the Supreme Court, as well as lower federal courts, have issued guidance on factors that a court may consider in answering this question.

Applicable Law

Under Section 5, the FTC Act requires that a "corporation" be "organized to carry on business for its own profit *or that of its members*."[311] In *California Dental Ass'n v. FTC*, the Court considered whether the FTC could enforce Section 5 against a "voluntary nonprofit association of local dental societies" that was exempt from paying federal income tax and furnished its members with "advantageous insurance and preferential financing arrangements" in addition to lobbying, litigating, and advertising on their behalf.[312] The Court found that the FTC had jurisdiction over the California Dental Association as a "corporation," stating that

> the FTC Act is at pains to include not only an entity "organized to carry on business for its own profit," but also one that carries on business for the profit "of its members." While such a supportive organization may be devoted to helping its members in ways beyond immediate enhancement of profit, no one here has claimed that such an entity must devote itself single-mindedly to the profit of others. It could, indeed, hardly be supposed that Congress intended such a restricted notion of covered supporting organizations, with the opportunity this would bring with it for avoiding jurisdiction where the purposes of the FTC Act would obviously call for asserting it.[313]

The Court declined to specify the percentage of a nonprofit entity's activities that must be "aimed at its members' pecuniary benefit" to subject it to FTC jurisdiction.[314] However, the Court wrote that a "proximate relation" must exist between the activities of the entity and the profits of its members, and implied that the activities must confer "more than *de minimis* or merely presumed economic benefits" on the members.[315] The Court's justification for this result was that "nonprofit entities organized on behalf of for-profit members have the same capacity and derivatively, at

(...continued)

cooperative and reflect [sic] your equity or ownership in CREC. When patronage capital is retired, a check or bill credit is issued to you and your equity in the cooperative is reduced. ... When considering a retirement, the board analyzes the financial health of the cooperative and will not authorize a retirement that will adversely affect the financial integrity of the cooperative."); Fall River Rural Electric Coop., Patronage Capital, http://www.frrec.com/myAccount/patronageCapital.aspx ("The Cooperative's Board of Directors retires patronage capital when finances allow, often on an annual basis. The oldest patronage capital is retired first. Fall River currently retires patronage capital on a rotation of approximately 20 years."); Kauai Island Util. Coop., Member Patronage Capital Information, http://www.kiuc.coop/member_patcap-qa.htm ("A portion of Patronage Capital may be periodically paid to the members upon approval of the Board of Directors and our lenders."); Sulphur Springs Valley Electric Coop., Inc., Patronage Capital Credits, http://www.ssvec.org/?page_id=583 ("Capital credits represent your share of the Cooperative's margins – margins are the operating revenue remaining after operating expenses. The amount assigned in your name depends on your energy purchases. To calculate this, we divide your annual energy purchase by the Cooperative's operating income for the year. The more electricity you buy, the more capital credits you earn.").

[311] 15 U.S.C. §44 (emphasis added).

[312] 526 U.S. 756, 759-60, 767 (1999).

[313] *Id.* at 766 (internal citations omitted).

[314] *Id.*

[315] *Id.* at 766-67.

least, the same incentives as for-profit organizations to engage in unfair methods of competition or unfair and deceptive acts."[316]

It is clear that the FTC may still have Section 5 jurisdiction even when the benefits that a nonprofit provides to its members are secondary to its charitable functions. In *American Medical Ass'n v. FTC*, the Second Circuit considered whether the FTC could enforce Section 5 against three medical professional associations, including the American Medical Association (AMA), a nonprofit corporation composed of "physicians, osteopaths, and medical students."[317] The court, acknowledging that the associations served "both the business and non-business interests of their member physicians," found jurisdiction because the "business aspects" of their activities, including lobbying for members and offering business advice to them, subjected them to the FTC's jurisdiction despite the fact that the business aspects "were considered secondary to the charitable and social aspects of their work."[318]

When determining whether jurisdiction exists, a court may consider other factors in addition to the benefits that the nonprofit provides to its members. In *Community Blood Bank v. FTC*, the Eighth Circuit considered whether a "corporation" included all nonprofit corporations.[319] The appeals court held that the FTC lacked Section 5 jurisdiction over nonprofit blood banks because the banks' activities did not result in "profit" in the sense of "gain from business or investment over and above expenditures."[320] The blood banks, the court observed, lacked shares of capital, capital stock, or certificates, and were "organized for and actually engaged in business for only charitable purposes."[321] One bank's articles of incorporation touted the entity's charitable purposes, and all of the banks were exempt from paying federal income taxes.[322] Upon dissolution, the corporations would transfer their assets to other charitable or nonprofit organizations.[323] In addition, none of the funds collected by the blood banks had "ever been distributed or inured to the benefit of any of their members, directors or officers."[324] The court found that these factors made the blood banks "charitable organizations" both "in law and in fact," exempting them from the FTC's Section 5 jurisdiction.[325]

Analysis

The case law suggests several factors that a court may weigh when determining whether a private, nonprofit entity composed of members, such as an electric cooperative, is subject to the FTC's Section 5 jurisdiction as a "corporation."[326] The most significant factor is whether the nonprofit

[316] *Id.* at 768.

[317] 638 F.2d 443, 446 (1980).

[318] *Id.* at 448. The court noted in passing that the AMA's articles of incorporation stated that one purpose of the organization was to "safeguard the material interests of the medical profession." *Id.*

[319] 405 F.2d 1011, 1015 (8th Cir. 1969).

[320] *See id.* at 1017. The court also remarked that at least one case had established that "even though a corporation's income exceeds its disbursements its nonprofit character is not necessarily destroyed." *Id.*

[321] *Id.* at 1020, 1022.

[322] *Id.* at 1020.

[323] *Id.*

[324] *Id.*

[325] *Id.* at 1019.

[326] This analysis assumes that a court would extend the holdings of the applicable case law, which covered entities organized as nonprofit corporations and professional associations, to include entities organized as nonprofit electric (continued...)

provides an economic benefit to its members that is more than *de minimis* and that is proximately related to the nonprofit's activities. This benefit need not be the sole—or even primary—function of the nonprofit. Additional factors that the case law suggests weigh in favor of a finding of jurisdiction include that the nonprofit: (1) has gain from its business or investments that exceeds its expenditures; (2) has shares of capital or capital stock or certificates; (3) is not organized solely for charitable purposes or does not engage only in charitable work; (4) has articles of incorporation that list profit-seeking objectives; (5) is subject to federal income tax liability; (6) would distribute its assets to profit-seeking entities upon dissolution; and (7) distributes any of the funds it collects to its members, directors, or officers.

It is possible that the FTC has Section 5 jurisdiction over nonprofit electric cooperatives, although the outcome in any particular case may depend on the characteristics of the individual utility. A court could find that the typical nonprofit electric cooperative provides "economic benefit" to its members in at least two ways: (a) by providing electricity service to members;[327] and (b) by returning net margins to members in the form of patronage capital, which is an ownership interest in the cooperative that is later converted to cash payments to members when that capital is retired.[328] With regard to (a), it is likely that a court would find that electricity service is an "economic benefit" as defined in the case law. In *California Dental Ass'n*, the nonprofit professional association provided "advantageous insurance and preferential financing arrangements," as well as lobbying, litigation, and advertising services to its members.[329] In *American Medical Ass'n*, the nonprofit lobbied on behalf of its members and offered business advice to members.[330] These benefits, it is assumed, enabled the members to more easily conduct business profitably. Electricity service allows people to conduct activities at all times of the day, and thus provides a similar and clearly significant economic benefit to those who use it, whether for business or recreational purposes. As the primary objective of an electric cooperative is to provide electricity service to members, the necessary proximate relation between the activities of the nonprofit and the benefit to its members clearly exists.

Despite its pecuniary nature, there are a few problems with considering benefit (b), patronage capital, to be an "economic benefit" as defined by the Court. First, it is not clear that patronage capital actually is a benefit. A court could view patronage capital as a no-interest *loan* from the consumer-member to the utility,[331] or, because it is typically allocated to member accounts in a manner proportional to members' spending on electricity, simply a *refund* of money collected from the members that reflects the actual cost of providing service in a particular year.[332] If

(...continued)

cooperatives.

[327] Many cooperatives provide other services to their communities that could constitute "economic benefits." The National Rural Electric Cooperative Association notes that, "In addition to electric service, many electric co-ops are involved in community development and revitalization projects" that include "small business development and jobs creation, improvement of water and sewer systems, and assistance in delivery of health care and educational services." Nat'l Rural Electric Coop. Ass'n, Member Directory, http://www.nreca.coop/members/MemberDirectory/Pages/default.aspx.

[328] *See* sources cited *supra* note 310.

[329] Cal. Dental Ass'n v. FTC, 526 U.S. 756, 759-60, 767 (1999).

[330] Am. Med. Ass'n v. FTC, 638 F.2d 443, 448 (1980).

[331] *See, e.g.*, Cent. Rural Electric Coop., Patronage Capital, http://www.crec.coop/CRECAdvantage/PatronageCapital/tabid/711/Default.aspx ("These margins represent an interest-free loan of operating capital by the membership to the cooperative.").

[332] *See, e.g.*, Kauai Island Util. Coop., Member Patronage Capital Information, http://www.kiuc.coop/member_patcap-(continued...)

adopted by a court, neither of these characterizations would appear to be consistent with the "profit" that the statute describes[333] or the "economic benefit" that the Supreme Court requires for a nonprofit to be a "corporation."

Second, even if a court found patronage capital to be an economic benefit, it is not clear that it is more than *de minimis*. Patronage capital must be "retired" before members receive cash payments for it.[334] Retirements are made at the discretion of the cooperative's board of directors because the capital is needed to finance the cooperative's ongoing expenses, and thus retirement of a class of capital typically occurs after a long rotation period, such as 20 years.[335] Although the Supreme Court did not hold that an "economic benefit" must produce *immediate* advantage to the members of a nonprofit, a court could potentially view the decades-long delay in cash payments as significantly decreasing the degree of economic benefit that the capital provides. In addition, patronage capital would probably be considered *de minimis* if the cooperative's net margins were small, as this would mean that little capital would be issued to members. It is thus difficult to discern whether a court would find that an economic benefit accrues to members as a result of their receipt of patronage capital, which nevertheless probably bears the requisite "proximate relation" to the activities of the cooperative that produce any net margins distributed as capital.

With regard to the additional factors, those favoring jurisdiction include (2) cooperatives typically have shares of capital stock, including patronage capital;[336] (3) cooperatives do not operate solely for the benefit of the people outside of the organization like the nonprofits in *Community Blood Bank* did because cooperatives provide electricity service and patronage capital to their members;[337] and (7) an electric cooperative typically returns any net margins to members in the form of patronage capital, an ownership interest refunded to consumer-members as cash when the capital is retired.[338] Factors that cannot be evaluated because they are specific to each individual cooperative include (1) whether the revenues of the cooperative exceed its expenditures; (4) the particular objectives listed in a cooperative's articles of incorporation or other foundational document; (5) whether a nonprofit electric cooperative is exempt from federal income tax liability, which depends on whether it meets the requirements under Section 501(c)(12) of the Internal Revenue Code;[339] and (6) whether a cooperative would distribute its assets to profit-seeking entities upon dissolution—a factor that also may depend on state laws.[340]

It is likely that a court would find that nonprofit electric cooperatives impart economic benefits to their members by distributing electricity to them or, possibly, by issuing patronage capital to them. However, because many of the other factors that courts consider may differ for each

(...continued)

qa.htm (characterizing the retirement of patronage capital as a "refund").

[333] 15 U.S.C. §44.

[334] *See* sources cited *supra* note 310.

[335] *See id*.

[336] *See* Nat'l Rural Electric Coop. Ass'n, Seven Cooperative Principles, http://www.nreca.coop/members/SevenCoopPrinciples/Pages/default.aspx (describing "Members' Economic Participation").

[337] Whether electricity service and patronage capital, which are clearly benefits, constitute "economic benefits" within the meaning of the Supreme Court's holding in *California Dental Ass'n* is a separate question.

[338] *See* sources cited *supra* note 310.

[339] I.R.C. §501(c)(12).

[340] *See* Cmty. Blood Bank v. FTC, 405 F.2d 1011, 1020 (8th Cir. 1969).

particular cooperative, it is not possible to draw any general conclusions about whether the FTC would have Section 5 jurisdiction over these entities as "corporations."

Enforcement of Data Privacy and Security

If the FTC has Section 5 jurisdiction over a particular electric utility, it may bring an enforcement action against the utility if its privacy or security practices with regard to consumer smart meter data constitute "unfair or deceptive acts or practices in or affecting commerce."[341] The FTC Act defines an "unfair" act or practice as one that "causes or is likely to cause substantial injury to consumers which is not reasonably avoidable by consumers themselves and not outweighed by countervailing benefits to consumers or to competition."[342] According to the FTC, an act or practice is "deceptive" if it is a material "representation, omission or practice" that is likely to mislead a consumer acting reasonably in the circumstances.[343] The history of the Commission's enforcement of consumer data privacy and security practices shows that the agency has brought complaints against entities that (1) engage in "deceptive" acts or practices by failing to comply with their stated privacy policies; or (2) employ "unfair" practices by failing to adequately secure consumer data from unauthorized parties.[344] Often, conduct constituting a violation could fall under either category, as a failure to protect consumer data may be an unfair practice because of the unavoidable injury it causes, as well as a deceptive practice because it renders an entity's privacy policy materially misleading.

"Deceptive" Privacy Statements

A utility that fails to comply with its own privacy policy may engage in a "deceptive" act or practice under Section 5 of the FTC Act. In *Facebook, Inc.*, the FTC alleged, among other things, that the social networking site violated promises contained in its privacy policy when it made users' personal information accessible to third parties without users' consent.[345] Facebook had claimed that users could limit third-party access to their personal information on the site. Despite this promise, applications run by users' Facebook friends were able to access the users' personal information. The Commission also charged that Facebook altered its privacy practices without users' consent, causing personal information that had been restricted by users to be available to third parties. This change, which allegedly "caused harm to users, including, but not limited to, threats to their health and safety, and unauthorized revelation of their affiliations" constituted both a "deceptive" and an "unfair" practice in the view of the Commission.[346] Finally, the Commission alleged that Facebook had represented to users that it would not share their personal information with advertisers but had done so anyway.

---

[341] 15 U.S.C. §45(a)(1). For more details on FTC enforcement of consumer data privacy and security under Section 5, see CRS Report RL34120, *Federal Information Security and Data Breach Notification Laws*, by Gina Stevens.

[342] 15 U.S.C. §45(n).

[343] *In re* Cliffdale Assocs., Inc., 103 F.T.C. 110, 174 (1984) (policy statement at end of opinion).

[344] *See Consumer Privacy: Hearing Before the S. Comm. on Commerce, Sci., and Transp.*, 11th Cong. (2010) (statement of Jon D. Leibowitz, Chairman, Fed. Trade Comm'n) (describing the FTC's enforcement activity in the areas of consumer data privacy and security), *available at* http://www.ftc.gov/os/testimony/100727consumerprivacy.pdf. The FTC recently released a preliminary report on the consumer privacy implications of new technologies. FED. TRADE COMM'N, PROTECTING CONSUMER PRIVACY IN AN ERA OF RAPID CHANGE: A PROPOSED FRAMEWORK FOR BUSINESSES AND POLICYMAKERS (2010), *available at* http://www.ftc.gov/os/2010/12/101201privacyreport.pdf.

[345] FTC File No. 092 3184 (Nov. 29, 2011) (complaint).

[346] *Id.*

In *Twitter, Inc.*, the FTC alleged that the social networking site engaged in "deceptive" acts when it violated claims made in its privacy policy about the security of consumer data by failing to "use reasonable and appropriate security measures to prevent unauthorized access to nonpublic user information."[347] The Commission found that Twitter had permitted its administrators to access the site with easy-to-guess passwords and failed to limit the extent of administrators' access according to the requirements of their jobs. In a consent order, the company agreed not to misrepresent its privacy controls and to implement a comprehensive information security program that would be assessed by an independent third party.[348]

As smart meter data becomes valuable to third parties,[349] utilities may be tempted to sell or share this information with others to increase revenues and provide new services to their customers. If prohibited by the terms of the utility's privacy policy, it may be a "deceptive" act or practice for the utility to share a consumer's personal information with third parties without a consumer's consent.[350] The FTC could also find deception when a utility represents that its privacy controls are capable of protecting smart meter data when, in fact, they are not.

"Unfair" Failure to Secure Consumer Data

Failure to Protect Against Common Technology Threats or Unauthorized Access

The FTC may consider it an "unfair" practice when an electric utility fails to safeguard smart meter data from well-known technology threats as the data travels across the utility's communications networks. For example, in *DSW Inc.*, the FTC brought enforcement proceedings against the respondent, the owner of several shoe stores.[351] The agency alleged that the respondent failed to protect customers' credit card and check information as it was transmitted to the issuing bank for authorization. The information collected at the register traveled wirelessly to the store's computer network, and from there to the bank or check processor, which communicated its response back to the store through the same channels. The agency charged that

> [a]mong other things, respondent (1) created unnecessary risks to the information by storing it in multiple files when it no longer had a business need to keep the information; (2) did not use readily available security measures to limit access to its computer networks through wireless access points on the networks; (3) stored the information in unencrypted files that could be accessed easily by using a commonly known user ID and password; (4) did not limit sufficiently the ability of computers on one in-store network to connect to computers on other in-store and corporate networks; and (5) failed to employ sufficient measures to detect unauthorized access. As a result, a hacker could use the wireless access points on one in-store computer network to connect to, and access personal information, on the other in-store and corporate networks.[352]

[347] FTC File No. 092 3093 (Mar. 2, 2011) (complaint).

[348] FTC File No. 092 3093 (Mar. 2, 2011) (decision and order)

[349] NIST PRIVACY REPORT, *supra* note 11, at 14, 35-36.

[350] As suggested below, it may also be an "unfair" practice, regardless of whether the utility has a privacy policy.

[351] FTC File No. 052 3096 (Mar. 7, 2006) (complaint).

[352] *Id.*

Similarly, in *Cardsystems Solutions, Inc.*, the Commission brought a complaint against a credit and debit card authorization processor.[353] The FTC alleged that the respondent failed to protect its systems by neglecting to guard its network against "commonly known or reasonably foreseeable attacks" that could be avoided using low-cost methods.[354] As part of settlement agreements in *DSW* and *Cardsystems*, the respondents had to create "a comprehensive information security program" to protect consumer information that would be assessed periodically by an independent third party.[355]

Smart meters also transmit personal consumer information, often wirelessly, across several different communications networks located in various physical places.[356] Thus, it is possible that the FTC would view a utility's failure to protect smart meter data against common technology threats as an "unfair" practice if the utility could have avoided the threats by using low-cost methods such as encrypting the data; storing it in fewer places and for no longer than needed; implementing basic wireless network security; and taking other reasonable measures suggested by the agency in *DSW Inc.*

Failure to Dispose of Data Safely

A utility's failure to dispose of smart meter data safely may also constitute an "unfair" practice under Section 5. For example, in *Rite Aid Corp.*, the respondent, the owner of retail pharmacy stores, purportedly failed to safely dispose of personal information in its possession when it neglected to: "(1) implement policies and procedures to dispose securely of such information," including rendering "the information unreadable in the course of disposal; (2) adequately train employees to dispose securely of such information; (3) use reasonable measures to assess compliance with its established policies and procedures for the disposal of such information; and (4) employ a reasonable process for discovering and remedying risks to such information."[357] The information was later found in various publicly accessible garbage dumpsters in readable form. This suggests that utilities holding smart meter data and other personal information, whether on electronic or physical media, must ensure that the methods used to destroy this data render it unreadable to third parties.

Penalties

There is no private right of action in the FTC Act. If the Commission has "reason to believe" that a violation has occurred, it may, after notice to the respondent and an opportunity for a hearing, issue an order directing the respondent to cease and desist from acts or practices that the agency finds violate the act.[358] If the respondent disobeys an order that has become final, the U.S. Attorney General may bring an action in district court seeking the imposition of civil monetary

[353] FTC File No. 052 3148 (Sept. 5, 2006) (complaint).

[354] *Id.*

[355] *See, e.g.*, *In re* Cardsystems Solutions, Inc., FTC File No. 052 3148 (Sept. 5, 2006) (decision and order).

[356] NIST PRIVACY REPORT, *supra* note 11, at 23.

[357] FTC File No. 072 3121 (Nov. 12, 2010) (complaint).

[358] 15 U.S.C. §45(b). The Commission may seek a preliminary injunction in district court if it "has reason to believe" that an entity subject to the Commission's jurisdiction "is violating, or is about to violate, any provision of law enforced" by the FTC, and such an injunction would be in the public interest. 15 U.S.C. §53(b). In "proper cases the Commission may seek, and after proper proof, the court may issue, a permanent injunction." *Id.*

penalties of up to $16,000 per violation ($16,000 per day for continuing violations), as well as further injunctive and equitable relief that the court deems appropriate.[359]

After a party becomes subject to a final cease and desist order under the act, the Commission may seek redress for consumers by bringing suit in state or federal court against the party if the Commission "satisfies the court that the act or practice to which the cease and desist order relates is one which a reasonable man would have known under the circumstances was dishonest or fraudulent."[360] "Such relief may include, but shall not be limited to, rescission or reformation of contracts, the refund of money or return of property, the payment of damages," and public notification of the violation, "except nothing in [15 U.S.C. §57b(b)] is intended to authorize the imposition of any exemplary or punitive damages."[361] Once the Commission has issued a final cease and desist order (not a consent order) finding an act or practice to be deceptive, then it may bring suit in district court to obtain a civil penalty against an entity that engages in that act or practice: (1) after the order became final ("whether or not such person, partnership, or corporation was subject to such cease and desist order"); and (2) "with actual knowledge that such act or practice is unfair or deceptive and is unlawful" under Section 5 of the FTC Act.[362]

The Federal Privacy Act of 1974 (FPA)

Smart meter electricity usage data pertaining to U.S. citizens or permanent residents that is retrievable by personal identifier from a system of records maintained by any federal "agency," including federally owned utilities, is subject to the protections contained in the Privacy Act[363] when it is maintained, collected, used, or disseminated by the agency.

Federally Owned Utilities as "Agencies"

All nine of the federally owned utilities are federal agencies covered by the Privacy Act. For the purposes of the act, the term "agency" includes, but is not limited to, "any executive department, military department, Government corporation, Government controlled corporation, or other establishment in the executive branch of the Government (including the Executive Office of the President), or any independent regulatory agency."[364] According to EIA, utilities that are part of an executive department include the four power marketing administrations in the Department of Energy (Bonneville, Southeastern, Southwestern, and Western), the International Boundary and Water Commission in the Department of State, and the Bureau of Indian Affairs and the Bureau

[359] 15 U.S.C. §45(l). The size of the civil monetary penalty was last adjusted for inflation in 2009. 16 C.F.R. §1.98.

[360] 15 U.S.C. §57b(a)(2).

[361] 15 U.S.C. §57b(b).

[362] 15 U.S.C. §45(m)(1)(B).

[363] 5 U.S.C. §552a. The federally owned utilities primarily sell electricity to nonprofit electric utilities on the wholesale markets rather than distribute electricity directly to consumers. EIA ELECTRIC POWER OVERVIEW, *supra* note 254. As these utilities provide only about 1% of total sales of electricity to end user consumers, *id.*, they may be unlikely to acquire consumer smart meter data, which is typically transmitted to distribution utilities. However, as the smart grid becomes more interconnected, more utilities at different points in the smart grid may come into possession of this data. NIST PRIVACY REPORT, *supra* note 11, at 23.

[364] *See* 5 U.S.C. §552(f)(1). The act also covers data in a "system of records" operated by a government contractor on behalf of a federal agency. *See* 5 U.S.C. §552a(m).

of Reclamation in the Department of the Interior.[365] The U.S. Army Corps of Engineers resides in the Department of Defense, which is an executive department.[366] The Tennessee Valley Authority is a government-owned corporation.[367]

Smart Meter Data as a Protected "Record"

The Privacy Act protects the type of electricity usage data gathered by smart meters, provided that the data pertains to U.S. citizens or permanent residents, is personally identifiable, and is retrievable by the individual's name or another personal identifier. The Privacy Act "governs the collection, use, and dissemination of a 'record' about an 'individual' maintained by federal agencies in a 'system of records.'"[368] Under the statute, a "record" is "any item, collection, or grouping of information about an individual that is maintained by an agency ... that contains his name, or the identifying number, symbol, or other identifying particular assigned to the individual, such as a finger or voice print or a photograph."[369]

An "individual" is defined as "a citizen of the United States or an alien lawfully admitted for permanent residence."[370] A "system of records" is "a group of any records under the control of any agency from which information is retrieved by the name of the individual" or other personal identifier "assigned to the individual."[371]

Smart meter data held by an agency certainly fits within the broad definition of a "record" because it is a grouping of information about an individual, namely, data on that individual's electricity usage. The data is typically stored along with a consumer's account information, which usually includes a consumer's name, social security number, or other "identifying particular."[372] Thus, smart meter data would constitute a protected "record" under the Privacy Act, assuming that it pertains to a citizen of the United States or lawful permanent resident and is retrievable by a personal identifier such as a consumer's name or account number.

Requirements

For information on the general safeguards that the Privacy Act provides for data that is maintained by a federal agency and meets the other requirements for a covered record under the act, see CRS Report RL34120, *Federal Information Security and Data Breach Notification Laws*, by Gina Stevens.

---

[365] EIA ELECTRIC POWER OVERVIEW, *supra* note 254.

[366] DEP'T OF THE ARMY CORPS OF ENG'RS, CIVIL WORKS STRATEGIC PLAN 1 (2004), *available at* http://www.corpsresults.us/pdfs/cw_strat.pdf. It is also a "Major Command within the Army." *Id.*

[367] Tenn. Valley Auth., About TVA, http://www.tva.com/abouttva/index.htm.

[368] *See* CRS Report RL34120, *Federal Information Security and Data Breach Notification Laws*, by Gina Stevens (citations omitted).

[369] 5 U.S.C. §552(a)(4).

[370] 5 U.S.C. §552a(a)(2).

[371] 5 U.S.C. §552a(a)(5).

[372] NIST PRIVACY REPORT, *supra* note 11, at 26-27.

Author Contact Information

Brandon J. Murrill
Legislative Attorney
bmurrill@crs.loc.gov, 7-8440

Edward C. Liu
Legislative Attorney
eliu@crs.loc.gov, 7-9166

Richard M. Thompson II
Legislative Attorney
rthompson@crs.loc.gov, 7-8449

Massachusetts for safe TECHNOLOGY

EMF Points of Confusion vs. Fact

Many are surprised to learn the **electromagnetic fields (EMFs)** emitted by wireless technology are biologically hazardous, and one often gets push-back when they open the conversation. This fact sheet provides information to help sort fact from disinformation and identifies solutions for safer technology use. For those reading this in print format, please see https://sites.google.com/site/understandingemfs/massachusetts-emf-bills-2025-26?authuser=0 for an electronic copy to investigate the links below.

Point of Confusion	**FACT**
The FCC says wi-fi is fine.	The Federal Communication Commission's 1996 guidelines are outdated. The FCC ignored 11,000 pages of scientific evidence of harm and was sued for not protecting the public. FCC is a captured agency and has yet to respond to the court order. See Harvard's *Captured Agency: How the Federal Communications Commission is Dominated by the Industries it Presumably Regulates*. See also the Mobile Communications and Health study by T-Mobil showing the industry knew early on of the serious harm. New Hampshire is the only U.S. government to do an independent investigation, see their final commission report documenting conflicts of interest, science, harm and 15 recommendations for responsibly deploying technology.
The manufacturers make it look like all wi-fi all the time is the way to go.	Most consumers, and even many who work in the industry, are unaware of the manufacturers' fine print that comes with each device indicating one should never keep an active device on one's body or radiation exposure may exceed even the FCC's outdated non-protective guidelines. Additionally, science indicates we should have invoked the Precautionary Principle decades ago when evidence of harm was first found, and not exposed the public until proven safe. We have not done this in the U.S. but other countries have. Physicians for Safe Technology illustrate the disparity in allowable public radiation exposure levels.
There are studies showing no evidence of harm.	No evidence of harm is not the same as safe. This technology was brought to market with no safety testing and a safe level of microwave radiation has never been identified. The telecommunications industry produces its own scientific studies designed to show no evidence of harm. This creates doubt among consumers so they will continue to purchase wireless products. Dr. Henry Lai provides insights here. In 2018 the U.S. National Institutes of Health found clear evidence of cancer, as did a large Italian study at the Ramazzini Institute. Pittsfield, MA Board of Health documented their findings of harm too.
There are not many studies done on wi-fi.	There didn't used to be, but there are now. See this 2018 meta-study on Wi-Fi by Dr. Martin Pall. Cell phones came first so that is why the majority of studies, which can take years to complete, use cell phones. However, all wireless operates in the biologically hazardous microwave segment of the electromagnetic radiation spectrum. So, what cell phone studies reveal holds true for 2G, 3G, 4G, 5G, wi-Fi and the Internet of Things too. We have thousands of studies showing man-made EMFs are hazardous to all biological species– humans, plants, animals, and insects -- including the pollinators needed to grow our food.

Point of Confusion	FACT
Surely we would know if this were an issue.	Advertising dollars influence media content, and telecommunications, energy and technology companies are among the top advertisers. Media executives will not allow true investigative journalism into this issue or their revenues will drop so we rarely hear of wi-fi harm in mainstream media. When there is coverage, they typically say more research is needed, which appeases industry advertisers and keeps consumers buying their toxic products. Industry influence on public servants can also be a factor. In 2017, it took a lawsuit for the California Department of Public Health to finally release a long-suppressed fact sheet on cell phone radiation.
Our education agencies do not see this as an issue.	Few agencies have investigated because the industry has been so effective at suppressing evidence of harm while offering financial incentives to adopt EMF products and infrastructure. In our top-down education system, local schools often do not feel empowered to act. However, legal precedents are being set that leave schools, public agencies and companies at risk. The insurance industry has identified EMFs as one of the top emerging hazards. Lloyds of London and other insurers do not cover EMF damages so schools and businesses can be held directly responsible for harm. Workers compensation cases have also been awarded for EMF damages in the workplace, and teachers unions are beginning to request hard-wired work environments. Click here for additional information. Ashland Public Schools, MA became the first in the nation to adopt Best Practices for Mobile Devices and Maryland is the first state to recommend hard-wiring in schools with wi-fi off and offer Guidelines to Reduce Electromagnetic Field Radiation.
We need wireless for the 21st century classroom.	The industry identified children as an untapped market and began their 21st Century Classroom campaign to put a wireless device in the hands of every child. In addition to biological harm from wi-fi, studies show excessive screen time is harming brain development causing impaired social and emotional skills, digital addiction and poorer educational outcomes. Silicon Valley executives send their children to schools with NO tech. TechSafe Schools will send information to your schools with health, legal and remediation information.
Some say electrosensitivity doesn't exist.	The United States Access Board's IEQ Indoor Environmental Quality Project indicates electromagnetic sensitivities may be considered disabilities under the ADA and recommends accommodations. Just as Lyme Disease was dismissed by medical practitioners before it was widely understood, today's doctors, nurses, psychologists and social workers in many countries have yet to be trained. They can now attend the EMF Medical Conference on-line at no cost. School nursing records often indicate an increase in one or more common symptoms among students and staff following the installation of wireless systems: headaches, tachycardia, bloody noses, ear bleeds, skin rashes, nausea, tinnitus (loud ringing in the ears), vertigo, inability to concentrate, depression, anxiety, insomnia. See also the *EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses*.

Point of Confusion	FACT
The radiation drops off with distance.	This is true, in physics the inverse-square law states the intensity is inversely proportional to the square of the distance from the source of that physical quantity. However, it is the pulsed, spiked, erratic signal that causes biological damage. Many routers and cell antennas send and receive data at long distances, and those erratic pulses, though spread out with distance, hit our bodies as they go through buildings, walls, ceilings, etc. Further, if not stopped through protective town zoning code, the industry is installing cell antennas right in our neighborhoods every 2-12 houses for 5G and the Internet of Things. These pulse close range toxic radiation at us, our children, pets and pollinators 24x7.
Respected engineers, physicists, medical professionals and technologists in our community want our children to have wi-fi in schools.	Most professionals were taught in school and in their work that there must be enough heat from a wireless device to raise the temperature of skin tissue in order to cause harm. Non-industry funded science has now proven this thermal effect premise is false. Thousands of studies show biological effects at the non-thermal, non-ionizing level; the U.S. National Toxicology Program study found DNA damage as well as brain and heart tumors. Professionals in all sectors will benefit from updated education on EMFs.
There is nothing we can do, wi-fi is everywhere.	Leading non-industry funded EMF scientists from around the world have already sent a formal appeal to the World Health Organization and United Nations to address this "emerging public health crisis". They succinctly outline specific measures to solve this problem, the first of which is to protect children and pregnant women. The retired President of Microsoft Canada indicates wireless is no longer advanced technology: fiber-optics is. Until public policy catches up with science and biologically safe technology is brought to market: • Use hard-wired connections with antennas turned off (cell, data, Bluetooth, wi-fi, hotspot) to access the internet safely and avoid legal exposure. Hard-wired is not only safer, it is faster, more reliable and more secure than wireless. Use Ethernet cables and adapters to hard-wire routers, laptops, tablets, etc. Clear sleeping areas of EMFs, and never give to or use an active device near a child. • Choose corded baby monitors, gaming devices, entertainment systems; turn off any wi-fi antennas. • Use corded landline phones, they are safer and more reliable, especially during power outages. Avoid DECT cordless phones, they have high EMF emissions. Cell phones can be forwarded to landlines. • Keep analog utility meters, they do not emit the electromagnetic radiation that "smart" meters do. • Work with public servants to keep wireless infrastructure away from where we live, work, learn, play. The U.S. Collaborative for High Performance Schools provides Low-EMF Best Practices to establish a hard-wired school environment and prohibit use of personal wi-fi devices in school, except during emergencies. See SaferScreentime.org, a non-profit charity that distills the science and medical recommendations into easy-to-learn concepts in a quick (@ 1-hr.) affordable e-learning course for families, schools, and workplaces.

Are your symptoms caused by your wireless devices?

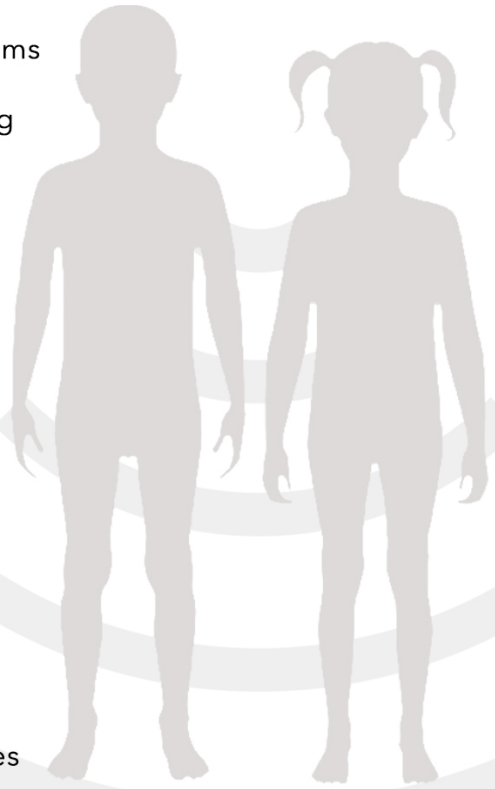
Common Symptoms of Microwave Sickness/Electro-Sensitivity

Brain
Headaches
Insomnia/Sleep Problems
Dizziness
Difficulty Concentrating
Memory Problems
Brain Fog
Fatigue

Ears
Tinnitus
Humming
Sharp Pain
Noise Sensitivity

Skin
Skin Rash
Itching
Burning
Facial Flushing

Eye
Pressure In/Behind Eyes
Eye Twitching
Deteriorating Vision
Vision Disturbances
Cataract



Children are more susceptible to biological effects from wireless radio frequency radiation

Heart
Palpitations
Arrhythmia
Chest Pain/Pressure
Difficulty Breathing
Low/High Blood Pressure

Mood
Irritability
Depression

Other
Adrenal Problems
Digestive Problems
Weight Loss/Gain
Tingling
Dehydration
Hair Loss
Flu Like Symptms

Longterm
Cancer
ADD/ADHD
Autism
Alzheimer's
Oxidative Stress
DNA Damage

To: FCC From: Patricia Burke Date: April 9, 2025 Re: 25-133 Delete, Delete, Delete

The FCC asked: *"Are there existing rules that could give rise to a risk of regulatory capture?"*

"We also invite more general comment on rules that should be considered for elimination on other grounds."

This testimony pertains to the demand to address Accessibility and Accommodation, especially including Fair Housing, including references to smart meters and proximal infrastructure (cell towers).

> [Sic]"Lastly, the Board received multiple comments from individuals or entities addressing various types of electromagnetic sensitivities. These commenters requested that the final rule require accommodations for people with electromagnetic intolerances, so that they might use Federal buildings and Federally-funded facilities. The Board acknowledges the challenges faced by mstockstill on DSK3G9T082PROD with RULES3 VerDate Sep<11>2014 21:45 Jan 17, 2017 Jkt 241001 PO 00000 Frm 00007 Fmt 4701 Sfmt 4700 E:\FR\FM\18JAR3.SGM 18JAR3 5796 Federal Register / Vol. 82, No. 11 / Wednesday, January 18, 2017 / Rules and Regulations 1Subsequently, in 2015, the three European standards bodies issued an updated version of EN 301 549, which contained minor editorial changes only relative to the 2014 version. See ETSI/CEN/ CENELEC, EN 301 549 V1.1.2 (2015–04), Accessibility Requirements Suitable for Public Procurement of ICT Products and Services in Europe (Apr. 2015), available at http:// www.etsi.org/deliver/etsi_en/301500_301599/ 301549/01.01.02_60/en_301549v010102p.pdf. individuals with electromagnetic sensitivities, and notes that electromagnetic sensitivities may be considered a disability under the ADA if the sensitivity so severely impairs the neurological, respiratory, or other functions of an individual that it substantially limits one or more of the individual's major life activities. However, most of the accommodations suggested by these commenters are beyond the scope of this rulemaking or our statutory jurisdiction. Moreover, none of our prior rulemaking notices (i.e., 2010 ANPRM, 2011 ANPRM, and NPRM) proposed technical specifications relating to electromagnetic sensitivities. Thus, were the Board to address electromagnetic sensitivity issues posed by ITC, this complex area would require thorough research and notice-andcomment rulemaking before being addressed through rulemaking."

(Access Board)

The FCC: For the Purpose of National Defense

The 2008 Federal Communications Commission Fiscal Year 2008 Performance and Accountability Report states, *"Furthermore, the Act provides that* ***the FCC was created, "for the purpose of the national defense,"*** *and,* ***"for the purpose of promoting safety of life and property through the use of wire and radio communications.****"[4] As specified in Section 1 of the Communications Act of 1934 and amended by the Telecommunications Act of 1996 (amendment to 47 U.S.C. §151), the mandate of the FCC is, "to make available so far as possible, to all the people of the United States, without discrimination on the*

basis of race, color, religion, national origin, or sex, rapid, efficient, nationwide, and world-wide wire and radio communication services with adequate facilities at reasonable charges." SOURCE

Promoting safety has translated into the authorization for successive installations of First Responder infrastructure that doubles as ubiquitous citizen surveillance, most recently invoking justification for 5G. https://www.verizon.com/business/solutions/public-sector/public-safety/

The FEDERAL COMMUNICATIONS COMMISSION Fiscal Year 2024 Annual Performance Report (October 1, 2023 – September 30, 2024) states,

"FCC's Strategic Plan for FY's 2022 - 2026 [ ]include: Pursue a 100% Broadband Policy; Promote Diversity, Inclusion, Equity and Accessibility; Empower Consumers; Enhance Public Safety and National Security; Advance America's Global Competitiveness; and Foster Operational Excellence."

"The FCC is an independent regulatory agency of the United States Government. The FCC is charged with regulating interstate and international communications by radio, television, wire, satellite, and cable."

"In the very first sentence of the Communications Act, Congress directs the FCC to help make communications services available to "all the people of the United States … without discrimination on the basis of race, color, religion, national origin, or sex." The Commission remains resolute in fulfilling this mandate and assuring the benefits of modern communications provide equal access to everyone, everywhere. In service of this statutory mandate, the FCC has made extraordinary progress to **strengthen consumer protection, universal service, broadband access, competition, space innovation, national security, and public safety, while keeping pace with dynamic and advancing technologies."**

The FCC Bureaus and Offices are: The Consumer & Governmental Affairs Bureau, The Enforcement Bureau, The Media Bureau, The Space Bureau, The Wireless Telecommunications Bureau, The Wireline Competition Bureau, The Office of Administrative Law Judges, The Office of Communications Business Opportunities, The Office of Economics and Analytics, The Office of Engineering and Technology, The Office of the General Counsel, The Office of the Inspector General, The Office of International Affairs, The Office of Legislative Affairs, The Office of the Managing Director, The Office of Media Relations, and two more.

FCC Workplace Diversity

The Office of Workplace Diversity *develops, coordinates, evaluates, and recommends to the Commission policies, programs, and practices that foster a diverse workforce, and promotes and ensures equal employment opportunity (EEO) for all employees and applicants without regard to race, color, religion,* ***sex (including pregnancy and gender identity)****, sexual orientation, national origin,* ***age, disability (mental, intellectual, or physical),*** *marital status, parental status, political affiliation,* ***genetic information (including medical history),*** *or any other basis protected by law.*

While the FCC has updated its Workplace Diversity, its mission *"to make available so far as possible, to all the people of the United States, without* ***discrimination on the basis of race, color, religion, national origin, or sex****, rapid, efficient, nationwide, and world-wide wire and radio communication services with adequate facilities at reasonable charges*" has not been updated to include pregnancy, age, disability (mental, intellectual, or physical), or genetic information.

In fact, the FCC's interpretation of "safety" has resulted in an unacknowledged wave of symptom onset, acute disability, and sky-rocketing rates of neurological deaths, especially for older women.

Epidemiology: Neurological Harm

In 2015, Bournemouth University (U.K) researchers Colin Pritchard and Emily Rosenorn-Lanng published their study, Neurological deaths of American adults (55–74) and the over 75's by sex compared with 20 Western countries 1989–2010: Cause for concern

The researchers showed that deaths due to neurological diseases like Alzheimer's and dementia were, in fact, rising in the twenty-one Western countries, with especially alarming increases for women in the United States. In August of 2015, the Washington Post reported," The study [] found that the disease is now being regularly diagnosed in people in their late 40s and that death rates are soaring. [] The problem was particularly acute in the United States, where neurological deaths in men aged over 75 have nearly tripled and in women risen more than fivefold."

"Total Neurological Deaths include such disparate conditions as Parkinson's disease, motor neuron disease (MND), hereditary neuromuscular conditions, prion disorders, degenerative diseases, including Creutzfeldt Jacob's disease (CJD), and new variant CJD[50] though the incidence of the later appears to have relatively stabilized, returning close to pre-2000 levels.[9,30,41] Earlier research found that dementia morbidity was occurring earlier and had disproportionately increased in some Western countries in people aged 45–74 years, with relatively larger increases in women[26,38,40] as women's TND rates had risen relatively more than male rates in every country."

" [] apart from Portugal, over the 20 years the USA had statistically significant greater rises in Total Neurological Deaths than 16 other countries, indicating disproportionate changes in neurological morbidity and mortality in American adults (55–74) and the over 75's"

"Moreover, the extent of "early dementias," often seen in people under 60, was virtually unknown 30 or more years ago and the more than doubling of the over 75's Total neurological Deaths in the US within just 20 years, suggests that interactive multiple environmental and lifestyle factors are operating."

These are expensive and emotionally devastating diseases, which may be occurring in individuals who may have lead healthy and enjoyable lives throughout the lifespan, without neurological damage, if they were not being exposed to unsafe juxtapositions of wireless exposures promoted as safe by the FCC and its military/industrial partners.

"Neurological diseases are considered to be "diseases of the elderly"[37] and that possibly the rises are essentially due to the "Gompertzian effect" -that is, that as people live longer, they have diseases that previously they would not have lived long enough to develop.[7,14,43] This appears to have some validity, but the question is whether such substantial changes, occurring over a relatively short period, are mainly due to the Gompertzian effect? However, international changes in regard to cancer deaths[41,42] do not accord with a Gompertzian prediction, nor does this explanation account for changes between countries and gender especially in the USA, as other studies, while acknowledging an element of Gompertzian process, have suggested that environmental factors play a larger part.[2,24,25,"

"CONCLUSIONS The Gompertzian explanation appears limited, not least because it does not explain the USA position, but we avoid the temptation to speculate but point toward a number of studies indicating possible epigenetic factors influencing neurological morbidity,[3-5,15,22,24-26,32,36,44] suggesting that possible nongenetic influences on gene expression, may be entertained.[4-6,10,12,13,16,20,32,41] The nature of any environmental factors are uncertain but there have been major environmental changes; including increased population, economic activity, substantial rises in road and air travel; increased home technology involving background electromagnetic fields (mobile phones, microwave ovens, computers), which are unique to these later years and these possible environmental factors cannot be ignored, especially as they probably interact.[6,10,27,28,33] This list of possible features might be described as "modern living" and the USA is the epitome of "modern living.""

In the study, death rates for cancer and cardio-vascular diseases were used as controls and compared with neurological deaths. (Note: Unfortunately, the World Health Organization modified their data categories to 20-year cohorts, instead of the previous practice of sorting by decades, further obscuring patterns of earlier neurological damage. There is a difference between dying of dementia at 55 vs. 74. He who controls the data controls the narrative.)

Public 'Safety'

The Public Safety and Homeland Security Bureau develops and implements policies and programs to strengthen public safety communications and interoperability, homeland security, national security, emergency management and preparedness, disaster management, and network reliability and resiliency. These efforts include rulemaking proceedings that promote more efficient use of public safety spectrum, improve public alerting mechanisms, enhance the nation's 911 emergency calling system, and establish frameworks for communications prioritization during crises. The Bureau also maintains 24/7 operations capability and promotes Commission preparedness to assist the public, first responders, the communications industry, and all levels of government in responding to emergencies and major disasters where reliable public safety communications are essential. Finally, the Bureau coordinates the Commission's national security mission and consults with the Defense Commissioner pursuant to 47 CFR § 0.181 of the Commission's rules.

The FCC's practice of promoting and authorizing the safety testing cell phones by

taking the internal temperature of an inanimate model

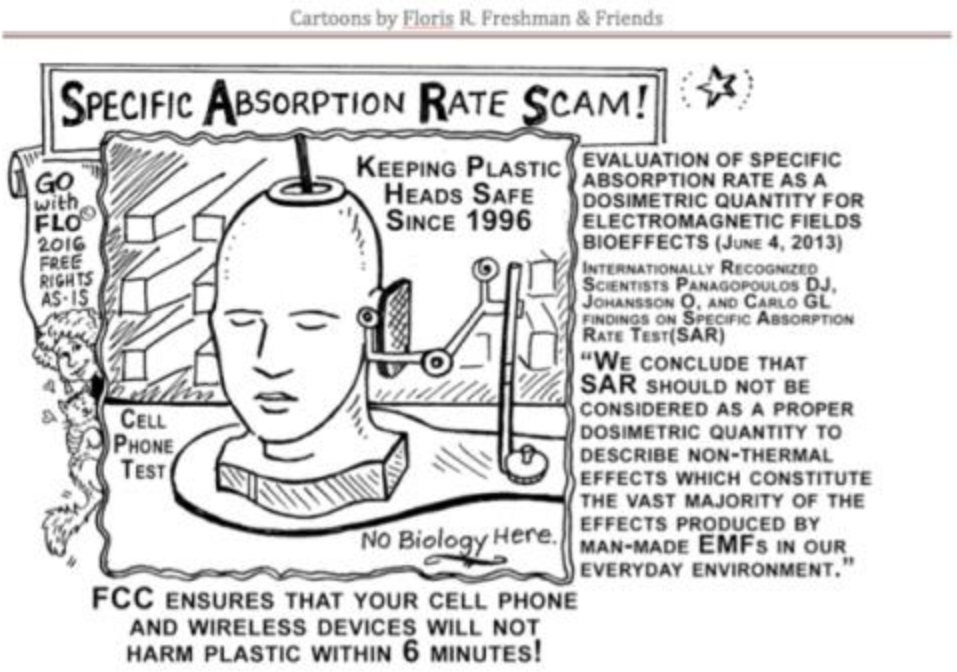
filled with the equivalent of Jell-o

that represents "average tissue,

based the dimensions of a 220 pound male military recruit's head

for 6 minutes

is evidence of the fact that the FCC is only evaluating the thermal effects of non-ionizing radiation, and has not responded to either historical or emerging science regarding the non-thermal effects of non-ionizing radiation.



Regarding "Public Safety," no bureau within the FCC is accountable for responding to emerging science and reported harm, and for insuring that technology choices are "safe," including both consumer products and imposed technologies, including smart grid/smart meter devices and telecommunication infrastructure.

In particular, the installation of a smart meter has been associated with the acute onset of suffering and neurological harm resulting in loss of safe and secure housing for some individuals.

The FCC has no expertise in the area of health, and is not incentivized to investigate or respond to evidence of damage to human health. The FCC actively engages in regulating the process of preventing other agencies from responding appropriately to unsafe exposures.

2. Legal Authority for 255 Guidelines Section 255 of the Communications Act (hereafter, ''Section 255''), requires telecommunications equipment and services to be accessible to, and usable by, individuals with disabilities, where readily achievable. 47 U.S.C. 255. ''Readily achievable'' is defined in the statute as ''easily accomplishable and able to be carried out without much difficulty or expense.'' Id. In determining whether an access feature is readily achievable, **the Federal Communications Commission (FCC), which has exclusive implementation and enforcement authority under Section 255**, has directed telecommunications equipment manufacturers and service providers to weigh the nature and cost of that feature against the individual company's overall financial resources, taking into account such factors as the type, size, and nature of its business operation. **Section 255 tasks the Access Board, in conjunction with the FCC, with the development of guidelines for the accessibility** of telecommunications equipment and customer premises equipment, as well as their periodic review and update. The FCC, however, has exclusive authority under Section 255 to issue implementing regulations and carry out enforcement activities. Moreover, when issuing implementing regulations, the FCC is not bound to adopt the Access Board's guidelines as its own or to use them as minimum requirements

If appropriate safety standards were in effect, the burdens being created by unsafe exposures would not be shifted other agencies that are check-mated from taking appropriate actions by the FCC, including HUD.

The public is routinely misled about efforts to "address the digital divide" (for example promoting Wi-Fi on school buses so that rural students can do their homework, while ignoring the physiological stressor of reading in a moving vehicle.)

In addition, not adequately investigating so-called "Havana Syndrome" and its similarities to EMR-S/EHS, as identified by environmental researcher Beatrice Golomb, presents a very real risk to U.S. security interests.

The issue of access as escalated to the point where individuals have either been isolated, or have been driven from their homes, community, and former lives, and deprived of livelihood, and access to health care itself.

Health: The Cities of Boston and Philadelphia Reference to the 1999-2000 Judicial Review That Was Never Resolved: ADA vs FCC

The cities of Boston and Philadelphia in their joint submission to the FCC on November 18 accused the FCC and Federal health agencies of negligence for failing to investigate whether electrosensitive persons are harmed by cell phone radiation, dating back to 1999.

"The FCC admits its own lack of expertise in the field. But the overlap of federal agency responsibilities for RF radiation protection and the merely advisory status of the Radiofrequency Interagency Work Group often leaves leadership unclear and encourages a pass-the-buck attitude ...

The 1999-2000 judicial challenge to the FCC's 1996 rules never reached the issue of "electrosensitivity" as a cognizable disability under the Americans with Disabilities Act. ("ADA") Here again, an agency responsible for ADA implementation acknowledges that the impairment may be disabling but has promised merely further inquiry. After more than a decade, that investigation remains unopened. The

dockets here have been updated with massive additional evidence of the crippling effects of RF radiation on an admitted minority – but a suffering minority – of U.S. citizens. The FCC and its sister regulatory agencies share responsibility for adherence to the ADA and should replace promises with serious attention to a serious medical problem. This is one area where the FCC could lead in advice to electrosensitive persons about prudent avoidance."

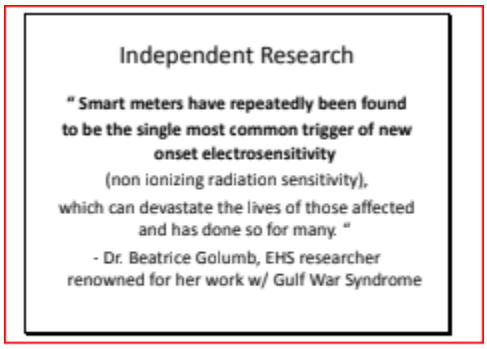
ET Docket No. 13-84 and ET Docket No. 03-137 https://www.fcc.gov/ecfs/document/6017477376/1

The FCC has systematically ignored the reports of harm, for decades, that should have informed proactive decision-making and policy-making.

In particular, the safe housing accommodation should be immediately addressed in regard to smart meters and the smart grid.

Authorization for and Defense of the Installation of Smart Meters by Mercenary Scientists and the FCC Must be Deleted, with an Emergency Preamble

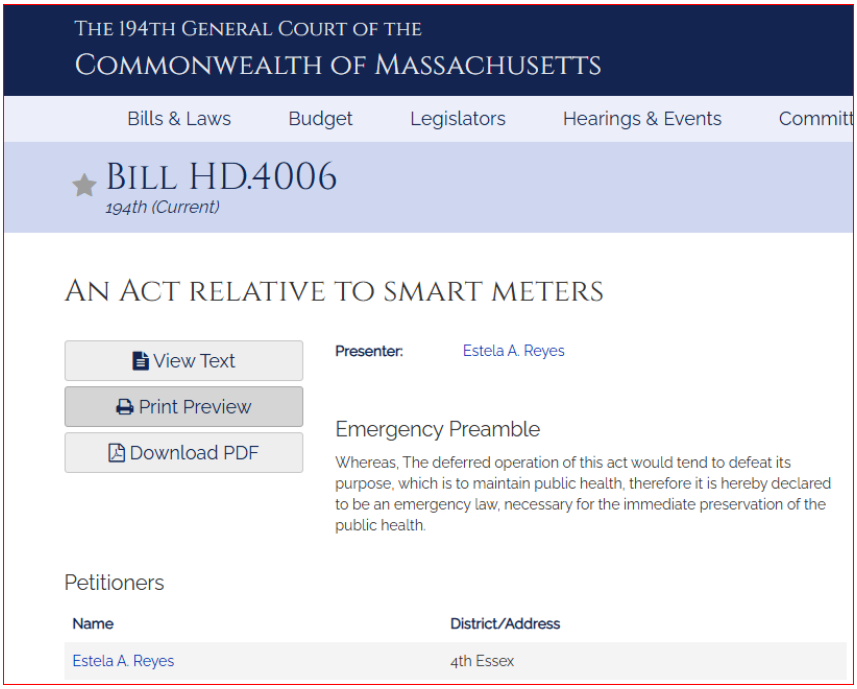
Instead of addressing the conflict between the ADA and the FCC that has been in effect for over a quarter of a century, the FCC escalated the level of suffering, harm, and acute disability by authorizing and defending the installation of unsafe wireless and powerline technologies on the grid and on homes and businesses.



The installation of a smart meter on a home has been identified as the most common trigger of EMR-s/EHS.

A proposed Massachusetts states smart meter bill, now in its 12th year for attempted passage, notes:

"Whereas, The deferred operation of this act would tend to defeat its purpose, which is to maintain public health, therefore it is hereby declared to be an emergency law, necessary for the immediate preservation of the public health."



https://malegislature.gov/Bills/194/HD4006.Html

Every state bill attempted across the country represents unacknowledged pain and suffering of non-consenting non-benefitting consumers, directly attributed to inaction at the level of the FCC and its utility and telecom partners.

Non-thermal effects below regulatory limits

As reported by Phonegate, *A study published in Bioengineering (March 2025) by an international team involving researchers from the Sorbonne University and CNRS (France), Naresuan University (Thailand), Xavier University (USA) and the University of Surrey (UK) reveals changes in reactive oxygen species (ROS) in human cells exposed to 1.8 GHz (3G) radiofrequencies, at levels up to 100,000 times lower than current regulatory limits. This scientific work provides new experimental evidence of non-thermal effects, challenging the regulatory paradigm based exclusively on tissue heating (thermal effects) recommended by ICNIRP (International Commission on Non-Ionizing Radiation Protection).*

Consequences for Public Health *This study reinforces the expectations of our NGO concerning the need for an urgent revision of European and international exposure standards. It also calls for:*

Realistic testing: Current protocols are carried out with artificial distances and modalities between the phone and the body, thus underestimating actual exposure.

Better public information: Users must be warned of the risks associated with prolonged use in direct contact with the body.

A strengthened precautionary principle: Public policies must incorporate these new data to protect vulnerable populations, especially children and pregnant women.

Framing exposures solely as accessibility, accommodation, and fair housing issues, which have been ignored, needs to be replaced research-based policy indicative of the fact that wireless is an environmental pollutant.

Utility ratepayers require immediate relief from the imposition of infrastructure associated with direct harm.

Delete the FCCs authority to dictate health policy, housing, access, and resulting human rights abuses.

April 9, 2025

In Support: HB25-1175 Smart Meter Opt-In Program, Concerning the establishment of an opt-in program for smart meters installed by a qualifying retail utility.

Dear Chair Winter and Esteemed Members of the Senate Committee on Transportation and Energy,

Please allow me to introduce myself, my name is Cecelia (Cece) Doucette and I am the Director of Massachusetts for Safe Technology. I am delighted to submit this testimony in support of Coloradans having the right to opt out of hazardous utility smart meters.

Why I Care

Like most, I had no idea wireless technology came to market with no biological safety testing. I spent eight years doing fundraising for my children's schools to bring in the industry's 21st Century Classroom campaign.

Then an engineer friend tipped me off there are biological effects. I am a technical writer by trade, so I wondered if there is any science to back up the insinuation of harm. I was stunned to discover, literally, thousands of peer-reviewed studies all over the world showing the effects illustrated on the next page.

Children, with their developing bodies and brains, are especially vulnerable as the science documents that the radiation pulsated by utility "smart" meters damages DNA, and hits the central nervous system and immune system especially hard. This helps to explain the crisis we are now in with anxiety, depression, suicidal ideation even among children, insomnia, headaches, anger, learning disabilities, fatigue, autism, ADD/ADHD and more.

Note, this risk is present for ALL WIRELESS DEVICES AND INFRASTRUCTURE: smart meters, cell towers, 5G small cells, our cell phones, tablets, laptops, baby monitors, gaming devices, smart appliances, and all other electronics for which we unwittingly sacrificed safety for convenience when we removed the wired connections.

If you are just joining the tech safety conversation, there is a lot of good news to share too.

Massachusetts for safe TECHNOLOGY

Are your symptoms caused by your wireless devices?

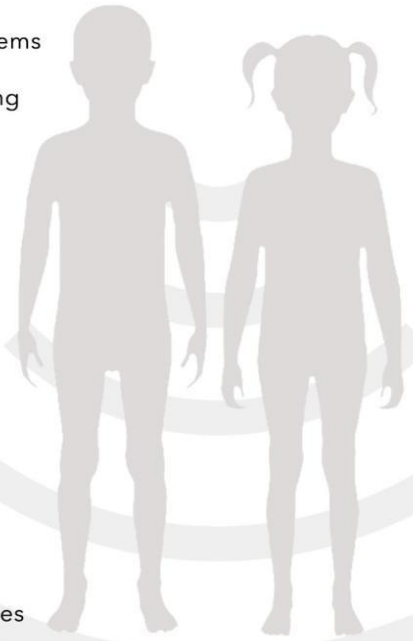
Common Symptoms of Microwave Sickness/Electro-Sensitivity

Brain
Headaches
Insomnia/Sleep Problems
Dizziness
Difficulty Concentrating
Memory Problems
Brain Fog
Fatigue

Ears
Tinnitus
Humming
Sharp Pain
Noise Sensitivity

Skin
Skin Rash
Itching
Burning
Facial Flushing

Eye
Pressure In/Behind Eyes
Eye Twitching
Deteriorating Vision
Vision Disturbances
Cataract



Children are more susceptible to biological effects from wireless radio frequency radiation

Heart
Palpitations
Arrhythmia
Chest Pain/Pressure
Difficulty Breathing
Low/High Blood Pressure

Mood
Irritability
Depression

Other
Adrenal Problems
Digestive Problems
Weight Loss/Gain
Tingling
Dehydration
Hair Loss
Flu Like Symptms

Longterm
Cancer
ADD/ADHD
Autism
Alzheimer's
Oxidative Stress
DNA Damage

Join us to learn the science and discover how you can have excellent tech connections without the radiation: MA4SafeTech.org

Massachusetts for safe TECHNOLOGY

The Good News

For everything we've inadvertently done to bring wireless tech harms into our lives, there are solutions available TODAY to fix it:

- The **New Hampshire Legislature** has already done the hard work for you via a year-long investigation. In the first 17 pages of their Commission Report, they document the conflicts of interest with our federal agencies and the wireless industry. They make 15 recommendations to transition away from wireless connections for primary connectivity, educate the public to use their own devices more safely, minimize wireless radiation in schools and other public places, and more. I was honored to help educate Rep. Patrick Abrami to learn the facts as he prepared his bi-partisan, bi-cameral bill, and to help him line up world-leading experts to testify.

- **Colorado's own Dr. Timothy Schoechle** is a world-leading expert in mitigating wireless radiation, especially with municipal infrastructure and utility meters/smart grid. I believe he is submitting testimony for you. You are very fortunate to have his expertise at the ready as he has worked with industry and can be your bridge to modernizing the grid safely.

Training

Training is available to you right now to educate the masses on wireless risks and safer technology solutions:

- My partner Dr. Mikko Ahonen, a leading radiofrequency radiation scientist in Finland, and I have developed a quick, affordable on-line course that can be completed in about an hour to teach the science and medical recommendations to use today's technology more safely. It offers a printable tip sheet at the end, along with a Certificate of Completion to track corporate/school/municipal/legislative training.

- I offer a free public education webinar each month so anyone joining this conversation can quickly come up to speed with the facts and baby steps we can all take toward safer tech use. My next Zoom is Monday, April 28, 4-6 p.m. MT and I would be honored to have you join us. Legislators from all over have learned with us in the past. Doe Kelly of Longmont for Safe Tech was my co-host for our February presentation, and a retired school librarian/tech teacher will join me this month.

- The Electromagnetic Fields (EMF) Medical Conference is now available on-line at no cost. I was honored to be brought in to help organize the conference and to lecture on state and local policy. All of us, along with our health care teams, first responders and school practitioners can learn directly from **world-leading scientists, doctors, building biologists,** attorneys and more to recognize, diagnose, treat and prevent electromagnetic radiation illnesses. You will hear how when smart meters (and close-range cell towers/5G small cells) go in, the rates of illness escalate.

Other Inroads

I was raised by a single Mom in a family of ten children. She could only do so much with such a large brood, so she taught us when we see a problem, we should do our best to be part of the solution.

So, that's what I've been doing since I discovered wireless is damaging us and our children. In addition to my above work with the NH Commission, the Safer Screentime Course, and the EMF Medical Conference:

- I helped my schools become the first in the nation to adopt Best Practices for Mobile Devices.
- I helped my public library become the first in the nation to loan a radiofrequency radiation detection meter; now others across the nation are adding RF meters to their Library of Things collections.
- My work is featured in the award-winning film Generation Zapped, which was selected by the United Nations Association Film Festival, and was just screened at Doe Kelly's well-attended event at the Longmont, CO library – the public is eagerly learning about this issue.

The point is, we can all be part of the solutions. Thankfully, other legislators are working hard on this issue too so you can take inspiration from them.

Legislative Inroads

Here in Massachusetts, we have two smart meter no-fee opt-out bills, one in the House, one in the Senate, each with an Emergency Preamble to protect public health:

- **S.2306 An Act relative to smart meters** is sponsored by Senator Michael O. Moore and is assigned to the Joint Committee on Telecommunications, Utilities and Energy. S.2306 requires a **no-fee wireless meter opt-out** and includes an emergency preamble, "Whereas, the deferred operation of this act would tend to defeat its purpose, which is to maintain public health, therefore it is hereby declared to be an emergency law, necessary for the immediate preservation of the public health."

- **H.3551 An Act relative to smart meters** is sponsored by Rep. Estela Reyes in the House to mirror Senator Moore's Senate bill.

- **Vermont**, in 2012, passed the nation's first no-fee opt-out bill (p.61) after an influential Senator (whose children's caregiver's husband got injured by wireless radiation) spoke with his industry associates and they came to an agreement. Here is what is on their government website today for the opt-out: "Some Vermont residents may not want to participate in the smart grid for a variety of reasons. The Department of Public Service (PSD) supports the ability for those customers to opt out, and filed Opt Out Principles in a proceeding under Docket 7307. Act 170 added 30 V.S.A. § 2811 (b), which prevents electric distribution utilities from assessing opt out fees." So, despite what you may hear from industry, a no-fee opt-out can and should be implemented as a first step toward public safety.

- You are welcome to peruse the Bills in Other States page of my research repository to see just how many states are working on legislation toward safe technology. Here in MA, we lead the nation with six bills (two for smart-meter opt-out; protect kids in schools from wireless radiation; form a state-level investigative commission; strengthen civil rights for accommodations for those injured; and include electromagnetic radiation illnesses in our state's public health tracking database).

Right to Choose

I hope you will agree, we should all have a right to choose on issues that impact our health. Adults will make their choices around addictive behaviors such as drugs, alcohol, tobacco, gambling and pornography. But aren't we all morally obliged to protect our collective children for the survival of the species? Did you know wireless radiation hits the same addiction centers in our central nervous system?

As you may have seen, pre-pandemic the U.S. began a trend where we are living shorter lives. How long can we ignore this invisible environmental pollutant that causes chronic illnesses, kills sperm and causes miscarriages? You can see the wireless radiation infertility science here.

No Cavalry Coming

You may know that the Federal Communications Commission (FCC) was sued for ignoring 11,000 pages of evidence of harm entered into the public record. When presented with these filings, the D.C. Circuit Court of Appeals found the FCC to be "arbitrary and capricious" in ignoring the facts and reaffirming their toxic levels of public radiation exposure, set in 1996.

The courts did not give the FCC a deadline, so they have done nothing since the case was remanded back to the FCC in 2021.

There is one glimmer of hope though, Robert F. Kennedy, Jr. was one of the parties that sued the FCC and won. Perhaps he will be able to hold them accountable for protecting public health over corporate profits.

Federal policy change can take years though, so it is up to state legislators to protect their citizens now.

Please Pass HB25-1175 Smart Meter Opt-In Program

I hope by listening to testifiers and reading the written testimonies entered into the public record, you are figuring out that you do not want toxic radiating smart meters mounted on or in your home for electric, water, gas, solar or propane, or on your neighbor's home either as the radiation travels far.

One of my colleagues is Dr. Alexia McKnight, a veterinarian radiologist. She had no idea these low-level, non-ionizing radiation pulsations from smart meters could be damaging – and she works with radiation for a living – until installation of smart meters upended her life. See her TedX Talk here: https://www.youtube.com/watch?v=2-ua-e-rY5M.

Nobody wants this to happen to our loved ones or neighbors.

Please, as a first step toward safe technology, require the utility companies to offer a no-fee opt-out. Please also consider modifying the language of the bill to ensure:

- **All Colorado utilities offer the no-fee opt-in**, not just investor-owned utilities with a half million customers – everyone deserves the right to be safe in their homes, and no-fee is

critical for those with electromagnetic illnesses as most have lost their jobs because they can no longer access society due to ubiquitous electropollution, so they have limited income. It goes against disability rights to assess a fee for a public service.

- Replace the language "manually read meter" with "an **electromechanical analog meter** with no electronic components nor means of broadcasting radiofrequency radiation" – in other states we've seen digital meters installed and the utility companies say they don't transmit radiation, but when measured, we see that they are radiating. An analog meter is the only safe alternative.

This is not rocket science to fix, but it's up to us to become informed and put our boots on the ground to affect positive change. I hope you and your loved ones, and colleagues, will join me for our free public education webinar on April 28. We do a robust Q&A after the presentation and would be happy to answer your questions.

Below my signature I will include facts on smart meters from my research repository, Understanding EMFs, that are quick for you to peruse to grasp the gravity of wireless technology, and what we should be doing to advance technology safely.

I'd be honored to answer any questions you may have now, or down the road. There are many scientific, medical, engineering and other experts at the ready to help you and I can do introductions.

Thank you for your time and thoughtful consideration.

Respectfully,

Cecelia Doucette

Cecelia (Cece) Doucette, MTPW
Mom of Zoe and Julia
Technology Safety Educator
Director, Massachusetts for Safe Technology (https://www.ma4safetech.org/)
Education Services Director, Safer Screentime
Founder, Understanding EMFs
31 Fatima Drive, Ashland, MA 01721
508-881-3878 (landline, no text)

See additional quick facts below.

Massachusetts for safe TECHNOLOGY

Understanding EMFs: Utility “Smart” Meters

Engineer expert Robert Palma gives a good 5-min. testimony to the Iowa legislature on why smart meters are dangerous and why a no-fee opt-out is imperative for current installations:

- vimeo.com/559442439

"Smart" meters are the **gas, electric, water, propane and solar utility meters** being put on homes to replace the old analog meters ("smart" being a marketing term used by industry to psychologically steer consumers to adopt these devices -- inferring "smart" is a good choice when it is not).

- If the gas, electric and water meter(s) on your home no longer have the little dials that spin around but now have a digital display, you have a smart meter -- and the industry now has some newer units made to look like the older ones with dials, but that also emit microwave radiation using digital technology. If there is an **FCC ID number** somewhere on the face of the meter, then the device is transmitting data using wireless radiation.
- Some communities converted to digital meters so they no longer have to pay workers to walk from house to house doing monthly meter readings. They can have an employee do a drive-by instead, aiming their data reader from the street at your meter to track your usage. In communities that have gone on **the "smart grid"**, the drive-by readings are eliminated and the data is sent via wireless radiation to the utility company. From a business model, this makes sense for cost saves.
- As cost-saving as this is, the **smart meters emit high amounts of wi-fi radiation 24/7 and it goes through the walls and into our homes, schools and businesses.** Where housing units are close together, multitudes of meters are mounted in a bank where radiation exposure compounds.
- In some systems, the digital data collected from the "smart" meters travels from house to house in a grid, compounding as it goes so that houses further down the line are getting radiation exposure exponentially. The data goes to a transfer station which sends it to a third-party analyst who may **sell your usage data to smart appliance and other manufacturers**. Some see this as an invasion of privacy. Since the data is sent via wireless signals, there are **no secure wires to protect your data and it is therefore far easier to hack into**. Criminals could identify your patterns and know when the way is clear to break into your homes and businesses. Further, from a **national**

security standpoint, undesirables could readily shut down the entire grid leaving us vulnerable and stranded in the dark without water, gas or electricity.

- **Our bodies need a break** from the wi-fi radiation we are constantly bathed in. If the smart meters and other devices are emitting radiation 24/7, it can be harmful to our cells, disrupt our circadian rhythm, and impair the required cell repair and regeneration while we sleep that otherwise keeps us healthy. The result is a toxic build-up that shows up sooner rather than later in some as behavioral problems that look like **ADD or Autism, sleep disruption, fatigue, headaches, dizziness, nausea, nosebleeds, skin rashes/flushing and more**. The long-term accumulative effects may include **cancers, infertility, genotoxicity, neurotoxicity and more**. See the Science page.
- Please see the brochure **Are-They-Smart-for-You-v3.pdf** for a good visual of how the smart grid works and additional information.
- See **Scientists' Statement** on RF/EMF & Smart Meters Harm: The effects of pulsed radiofrequency and electromagnetic radiation emissions of smart meters; especially as it pertains to those adversely affected, as prepared for a Pennsylvania Supreme Court case: d3n8a8pro7vhmx.cloudfront.net/yesmaam/pages/9103/attachments/original/1638544479/Scientists-Statement.pdf?1638544479
- The **largest U.S. water utility indefinitely deferred their AMI project** after citizens provided the facts: https://www.wsscwater.com/AMI
- **Fire incidence increased** significantly in many states after smart meters were installed. See the expert 2021 presentation, The Discovery and Science of Smart Meter Fires: https://alpaca-chinchilla-x6xf.squarespace.com/s/2021-The-Discovery-and-Science-of-Smart-Meter-Fires-print.pdf
- Thank you to StopSmartMetersBC.com for compiling a list of Canadian and U.S. areas with **opt-outs**: https://stopsmartmetersbc.com/metersgrid/smart-meter-opt-out-options-and-fees/
- This **one-minute video** illustrates how utility meters, in this case **water meters**, pulse radiation: https://www.youtube.com/watch?v=VYVrHXmAxp0
- This **three-minute video** prepared for the Massachusetts Department of Public Utilities demonstrates how electric meters pulse radiation thousands of times per day: www.youtube.com/watch?v=I-fEjgvtJto

- New Hampshire issued a groundbreaking legislative commission report documenting wireless risks. **Dr. Kent Chamberlin** served on that commission, he is the Chair and Professor Emeritus of the University of New Hampshire's Department of Electrical and Computer Engineering. Dr. Chamberlin and Cece Doucette, Director of Massachusetts for Safe Technology, share the scientific literature on biological effects of radiofrequency radiation as it pertains to smart meters used for grid modernization and electric vehicles: www.youtube.com/watch?v=5_w9KweALQY&t=388s
    - Dr. Chamberlin's slides: https://alpaca-chinchilla-x6xf.square...
    - Cece Doucette's slides: https://alpaca-chinchilla-x6xf.square...
- **Chattanooga, TN** has become a national leader in fiber-to-the-premises, and has hard-wired the smart meters to the premises which eliminates the need to have radiating antennas; FTTP has also closed the digital divide: qz.com/streaming-services-antenna-state-subscriptions-report-1851291285
- **Dr. Alexia McKnight** was deeply harmed by a smart meter on her home. See her TedX Talk: www.youtube.com/watch?v=2-ua-e-rY5M
  Dr. McKnight and Cece Doucette presented the facts and solutions as invited speakers for a health and wellness **professional development day** at Dr. McKnight's children's schools: www.youtube.com/watch?v=1jlyuRcKI5w&list=PLMAz9ZRXjYmpnVJ1BLF3Yx_-jnO4nY9tK&index=23
- The following article illustrates how **communities are starting to tune in** to this issue. Out in the Berkshires in Massachusetts, residents, including a doctor, are raising the health issue with the digital water meters and their State Representative is listening: New water meters spark radiation fears in Housatonic
- After citizens educated their neighbors and public servants on the risks, the Town of **Wayland, Massachusetts** in 2018 Did Not Pass Article 24 for Advanced Water Meter Reading Infrastructure: https://www.wayland.ma.us/town-clerk/files/april-2-2018-annual-town-meeting-results
- The utility company ENMAX has a program in place for ratepayers to **send in their own readings** from their electric and gas meters; this can be a good model for other communities where customers wish to opt out of digital

meters: https://www.enmax.com/services/meter-services/meter-reading/submit-a-meter-reading

- Smart meters and faulty wiring can cause **dirty electricity** in the extremely low frequency (ELF) range. The major cause of ELF magnetic fields is wiring violations of the electric code. There are 3 wires for electricity: hot, neutral, and ground. The neutral and ground should only be connected where the electricity enters a building. This means the current in the hot and neutral wires are the same but flowing in an opposite direction. If this is the case there is zero ELF magnetic fields (+1 ampere, plus -1 ampere equals zero amperes and thus zero ELF magnetic fields).
- An all-too-common problem (and violation of the National Electric Code [NEC]) is the **neutral and ground wires are connected together** within a building. This means that an ELF magnetic fields will exist because the current in the hot and neutral wires are no longer equal. Dirty electricity can cause significant health issues and wear and tear on appliances.
- See **Virginians for Safe Technology** for information including industry myths vs. facts sheet, and funding paid to politicians from their energy company.
- **Rhode Islanders for Safe Technology** created this brochure to hand out in the community, including farmers markets: www.ma4safetech.org/s/RI4SafeTech-Smart-Meter-BROCHURE-2024.pdf

Solutions

- Where smart meters are **optional**: http://www.electrosmogprevention.org/stop-ca-smart-meter-news/where-smart-meters-are-optional/
- A **Roadmap to Challenging Smart and Digital Meter Mandates**: https://childrenshealthdefense.org/wp-content/uploads/8.5x11-Roadmap-to-Challenging-Smart-Digital-Meter-Mandates.pdf
- See the National Conference of State Legislatures webpage for a **map of the U.S.** showing various policies on utility meters: https://www.ncsl.org/energy/smart-meter-opt-out-policies.
- In **Massachusetts**, **National Grid** offers an opt-out from their digital **electrical meters**, at a cost; Eversource does not offer an opt-out: www.nationalgridus.com/MA-Home/Metering/Automated-Meter-Reading

- **National Grid** also offers **Massachusetts** customers an opt-out from **AMR gas meters**:
  AMR **Decline** Application: dyzz9obi78pm5.cloudfront.net/app/image/id/5df1092eec161c565bfcd912/n/lig-decline-amr-meter-app.pdf
  Remove AMR Meter
  Application: dyzz9obi78pm5.cloudfront.net/app/image/id/5df109308e121c8f7441b54e/n/lig-remove-amr-meter-app.pdf
- This is a good example to follow, **State of Vermont's Department of Public Services no-fee opt-out**: https://publicservice.vermont.gov/electric/smart_grid
- **Refurbished analog meters** are available for purchase: https://stopsmartmeters.org/2011/10/09/buy-your-analog-meter-here/
- People are already getting sick, and some municipalities have taken action. The State of **Hawaii** has arranged for an "opt-in" if a smart meter is desired, rather than blanketing the entire society: http://mauiindependent.org/smart-meter-victory-maui-utility-consumers/
- **Massachusetts** has two bills to allow ratepayers to choose an analog meter without being penalized by a fee. See all six sponsored MA bills below, and consider sharing these with your local, state and federal public servants as most have only been told of the financial benefits of wireless technology without being informed of the biological radiation risks: sites.google.com/site/understandingemfs/massachusetts-emf-bills-2025-26?authuser=0
- **Smart Meter Education Network** out of **Michigan** aims to support the fight against smart meters for the protection of one's health, privacy and the environment. This group offers how-to information: http://www.smartmetereducationnetwork.com/
- Consider hosting a screening of the film **Generation Zapped** in your community to educate your friends, family and public servants: http://generationzapped.com/
- Dr. Tim Schoechle, Ph.D. presents *Getting Smarter About the "Smart Grid": The **Technological Alternative** Needed for a Successful Energy Economy*, a one-hour talk and Q&A given at Creating Safe Havens in a Toxic, Electromagnetic World, a conference hosted by the **International Institute for Building-Biology & Ecology**:

  https://www.youtube.com/watch?v=DRHDAdbgWUc
- Dr. Darren Schmidt, Chiropractor, explains **how "smart" meters affect your body**:

https://www.youtube.com/watch?v=z2Mt00xY8eU&t=1821s#t=4.967528

- A group of **doctors in Eugene, Oregon** prepared the following document for their water and electric board: http://www.national-toxic-encephalopathy-foundation.org/wp-content/uploads/2012/01/Biological_and_Health_Effects_of_Microwave_Radio_Frequency_Transmissions.pdf
- **Hawaiian Electric** offers ratepayers information on mitigating **dirty electricity**:

  www.hawaiianelectric.com/electrical-services/power-quality/publications
- Several dedicated groups have developed additional websites to help us understand the impact of utility smart meters:
  - Halt "Smart" Meters in **Massachusetts**: http://haltmasmartmeters.org/
  - **Smart Grid Awareness** has a great archive of research, as well as insight on safety, fires and privacy: http://smartgridawareness.org/
  - Here is a **master list of articles** from Smart Grid Awareness that is searchable:

    http://smartgridawareness.org/about/listing-of-website-articles-with-links/

Lawsuits

- Stopsmartmeters.org lists some lawsuits that have been won, and others that lost but offer lessons learned:

  https://stopsmartmeters.org/smart-meter-lawsuits/

Addressing Controversy with Research

- **Dr. Federica Lamech**, MBBS, authored *Self-Reporting of Symptom Development from Exposure to Wireless Smart Meters' Radiofrequency Fields in Victoria*. It is a well documented 92 case series that is scientifically valid. It clearly demonstrates adverse health effects in the human population from smart meter emissions. This was endorsed by the **American Academy of Environmental Medicine**: https://www.emfacts.com/2013/11/wireless-smart-meter-case-studies-in-victoria-australia/
  - This article addresses the **no-credible-evidence controversy**: http://smartgridawareness.org/2014/02/27/smart-meter-no-credible-evidence-controversy/

- Dr. David Carpenter wrote the following rebuttal article endorsed by **50 physicians and EMR experts**: https://maisonsaine.ca/sante-et-securite/electrosmog/smart-meters-correcting-gross-misinformation.html
- Retired U.S. Government physicist **Ron Powell, Ph.D.**, from Maryland, has authored several papers to help consumers and public agencies understand the implications of smart meters including illness symptoms, questions to ask your energy company, FCC limits, a ranking of meter types and more: http://www.scribd.com/doc/291507610/Documents-on-Wireless-Technology-and-Health-by-Ronald-M-Powell-Ph-D

- **Jerry Flynn** served in the Canadian military for 26 years specializing in wireless radio systems, radio warfare and electronic warfare. He provides a history of military knowledge of harm from electromagnetic radiation, and why he is gravely concerned for the rollout of smart utility meters and the rest of our wireless devices: https://www.youtube.com/watch?v=c-F3nf47kAs
- Grassroots Environmental Education offers a **generic opt-out letter** to send to utility companies and local municipalities: http://grassrootsinfo.org/pdf/smartmeteroptout.pdf
- The following article explains why digital meters with the wireless signals turned off can still a biological hazard due to **dirty electricity**, and why pure analog meters are the best solution: http://www.smartmetereducationnetwork.com/dirty-electricity-and-smart-meters.php

Solar Panels & Meters

- In the U.S., most companies installing solar panel energy systems also install a solar smart meter to capture data. The Itron Solar Meter is one such device and residents, landlords and business owners would be wise to ensure they are installed with **maximum distance** in mind, avoiding heavily used common areas or sleeping areas: https://www.itron.com/na/solutions/product-catalog/solar-meter
- CreatingHealthHomes.com offers the following article to better understand **Solar Panels and EMFs**: http://www.createhealthyhomes.com/solar_panels.php
- **Jeromy Johnson** of EMF Analysis offers these insights: https://www.emfanalysis.com/wp-content/uploads/2017/10/Dark-Side-of-Solar-Draft.pdf

- **Bill Bathgate** may be able to offer additional support: bill.bathgate@defiltersllc.com, www.defiltersllc.com
- R Blank of Shield Your Body provided a webinar with Building Biologist Cathy Cooke, **Solar Power and EMF Health**: https://www.youtube.com/watch?v=nXMy7axpJLA

Note: The information provided here is publicly available on the Internet.

It is intended to provide a starting point to inform you of EMF dangers.

Please do your own research, draw your own conclusions, and act accordingly to protect those you love. http://tinyurl.com/Understanding-EMFs

Honorable Legislators,

My name is Debra Greene, I hold a PhD in Communication from Ohio State University, and am the Founding Director of Safe Tech Hawaii. I have over 20 years of experience in consumer wireless education and advocacy.

I'm writing on behalf of Safe Tech Hawaii in SUPPORT of HB25-1175, concerning the establishment of an opt-in program for smart meters.

We commend the authors of this proposed bill for writing a solid piece of legislation. This bill is extremely important in correcting the mistake of blanket installations of smart meters across the state.

Smart meter deployments demand an opt-in because it is well documented that they:

- Threaten the health of residents in the community
- Violate the privacy of residents
- Increase cyber vulnerability of the utility
- Compromise the supply of electricity to homes/businesses
- Decrease personal security
- Increase fire hazards
- Threaten property values in communities where installed
- Provide minimal, if any, benefits to customers

Wireless smart meters inflict all of this without any convincing evidence of financial benefit to customers. Thus, legislation such as HB25-1175 is absolutely necessary.

That said, we also believe that:

- **All** CO utilities should be required to offer the opt-in, not just investor owned utilities with a half million customers. All customers deserve the right to informed consent, including the right to opt-in to smart meter installations

- The language "manually read meter" should be replaced with the language "an '**electromechanical analog meter**' with no electronic components nor means of broadcasting radiofrequency radiation"

These two changes will add clarity and continuity to the proposed bill.

Thank you for your consideration.

Debra Greene, PhD
Founding Director
Safe Tech Hawaii
debra@SafeTechHawaii.com

Notes and supporting materials:

Report for Colorado PUC by E.L. Quinn, which includes a detailed description of how much can be learned about private lives from smart meter data:
http://www.dora.state.co.us/puc/DocketsDecisions/DocketFilings/09I-593EG/09I-593EG_Spring2009Report-SmartGridPrivacy.pdf

"Smart Meter Health Effects Survey" and report of results:
https://www.mainecoalitiontostopsmartmeters.org/wp-content/uploads/2013/01/Exhibit-10-Smart-Meter-Health-Effects-Report-Survey2.pdf

Research showing biological effects of wireless radiation from smart meters:
http://sagereports.com/smart-meter-rf/

WHO classification of microwave radiation as a Group 2B human carcinogen:
http://smartgridawareness.org/rf-health-effects/iarc-monograph-volume-102-rf-electro magnetic-fields/

Summary of evidence of smart meter fires:
http://emfsafetynetwork.org/wp-content/uploads/2016/01/Summary-of-Evidence-on-Smart-Meter-Fires.pdf

Testimony of Richard Conrad, PhD, on health effects from wireless radiation exposure from smart meters
https://www.mainecoalitiontostopsmartmeters.org/wp-content/uploads/2013/01/Exhibit-9-Conrad-Web.pdf

Please see additional documents uploaded individually as PDFs

Senate Transportation & Energy

04/09/2025 01:30 PM

HB25-1175 Smart Meter Opt-In Program

Typed Text of Testimony Submitted

Name, Position, Representing	Typed Text of Testimony
K Zimmer Amend themself	Hello, I am grateful for this opportunity to speak about the Proposed Opt-In House Bill. I live in Longmont and along with a large number of others in our community, have been trying to stop the implementation of the smart meters as well as the "opt-out" meters. Though we brought forth many researchers, scientists and studies on EMF and radio frequencies and the dangers of being surround by these devices, not one Longmont Power Company employee ever took the time to sit down with us to discuss our concerns. The city council would listen at the meetings as they had to and maybe even allowed us to express our concerns outside of the meetings, but it always appeared that they really did not care and it was onward with the roll out. My own experience was trying 3 times to get a hold of the city employee to discuss the questions that I had and this individual NEVER responded even after the mayor at council asked for my email so that he could reply. When I spoke in council, myself and others were basically put down by one particular council person who has since recently left the state. I had cancer over a decade ago. Since that time I have done much research on the environment, food, drugs, and radiation to see how I can improve my own health to make sure that this did not happen again. I was young and extremely healthy and fit. I had always followed the government advice in the past, but 3 of my 5 family members all got cancer. My quest was why and how am I going to stop that. Radiation was big on my list as I was warned by all of my doctors that the CT scans can actually CAUSE cancer. Now I had to heal from all of those scans and not add to my already burdened body. So long before I even heard of smart meters, I stopped using the microwave, took more care to keep my phone away or off, used a faraday cage on my old electric digital meter (very low RF), placed mitigating devices on my home and any thing else I could do to protect my and my family. Along came the smart meter roll out no matter how many years we tried to stop it. I personally know of people who have been bullied as they put up notices to not put on a smart or opt-out meter. I myself have received notice on my door knob stating that LPC can not read my meter and my service may be interrupted if I don't call them in 10 days. I called and told them that there is no obstruction only to receive a voicemail from the Longmont Power Company (LPC) stating that the notice was not true, it was to get me to call them since I have not had my meter changed yet. Within days, I received a certified letter from LPC saying that I have about 1 week where I "must" pick which meter. This letter was labeled "letter one"

	I, and several others who were also experiencing this wrote a letter back saying we would like more information on fires, human and animal harm, asking if they are grounded. We are still waiting. These are the same questions that we asked them to provide for years and all they kept saying was that they were safe or cell phone are worse. This is a partial truth. We can get away from our phones, turn them off. It's an option. Turns out both the smart meter and opt-out meter have many health concerns as well as data collecting, fire concerns, frequencies that are not compatible with our own. That is why people like me and others, get headaches, are unable to sleep and just generally don't feel well when exposed for too long. No one knows our own bodies like ourselves. No one can say one prescription is right for everyone. But much of the updated research studies show DNA damage and so much more when there is too much RF exposure. The reason I wrote down amend was because I think your HB is to allow people to opt-in, which is great, but everyone else will receive this new opt-out meter, which also has it's set of problems. Is it grounded, is it still tracking our data (that is unconstitutional), there is a thing such as dirty electricity, and other issues. Being safe and feeling good in our own homes is pivotal to what our country was founded on. Our old analog and/or old digital worked just fine. These new ones will have to be replaced often, maybe 5-8 years. What about our environment? Where are these made? Who is making all of the money from all of this? Here is a site: https://smartmetereducationnetwork.com/dirty-electricity-and-smart-meters.php There are many once we start looking. You will be the example for ALL of Colorado. We are so grateful you are doing all of this. In the end a representative must ask, who am I doing this for? My constituents or the people above me pressuring me, saying that this will be good for the environment, when in reality, that comes at the expense of hurting other areas of the environment as well as harming the people that they serve. All while they are lining their pockets with more grants, more money and squashing the rights of the people they are supposed to care about. Believe it or not, this is a constitutional issue and must be treated as such. People are pretty smart. When we care about something, we do the research, we try to remedy the situation the best we can. But how can we when it is strapped to our homes and never turns off? Think of the damage to the brains of young and old alike. Thank you for reading. Sincerely, Kim Zimmer, Longmont
Dariel Monley For Tech Safe Schools - Longmont	I support HB 1175 -- the Opt-In Smart Meter Bill. I support this bill but wish to see two amendments: 1) For those customers who choose not to opt in to a Smart Meter, we want a totally harmless alternative--an “Electromechanical analog meter”, meaning a purely electric and mechanical device, using no electronic components, no switch mode power supply, no transmitter, no antenna, and no radio frequency emissions, and has no

	wireless capabilities, and it is not battery powered. This is critical for all those who are EMF-sensitive and more and more of us are developing these sensitivities. 2) Smart meter opt-ins must be required for ALL utility companies operating in Colorado, not just utility companies with 500,000 or more customers. Thank you to Sponsor Rep Sheila Lieder and Co-sponsor Rep Junie Joseph for stepping up to make this safer and citizen-friendly legislation available to us. I look forward to the addition of these amendments, making it even better, and to seeing it passed into law.
Barbara Mueser For themself	I am "for" SmartMeters having an Opt-in provision. Informed Consent is important for our democracy. I also want to amend the bill for these 2 important clarifications that will serve the Coloradoans who are not customers in a 500,000 or more service community. 1. Provide a clear definition: “Electromechanical analog meter”, means a purely electric and mechanical device, using no electronic components, no switch mode power supply, no transmitter, no antenna, and no radio frequency emissions, has no wireless capabilities, and it is not battery powered. 2. Smart meter opt-ins must be required for ALL utility companies operating in Colorado, not just utility companies with 500,000 or more customers. Thank you to all those who will represent the people of Colorado having a choice to Opt-in no matter where they live. Barbara Mueser Longmont, CO 80503
Zyan Caryngton Amend themself	Last year a smart meter was placed on my daughter's house, followed by an "opt-out" meter, both of which have made her so sick with migraines, ear & head pain, and electrical "jolts" permeating her body, as if she were getting zapped or electrocuted. She has many other health issues as well after just two weeks of this meter on her home, and she has had to vacate her home, which she had purchased only 8 months prior. Please allow everyone in CO to opt-in for an Electromechanical analog meter that is a purely electric and mechanical device, using no electronic components, no switch mode power supply, no transmitter, no antenna, and no radio frequency emissions, and is not battery powered. We must have an accurate description of this meter in this bill. Please include the Longmont Utility Company in this bill so my daughter can return home.
Angela Green Amend themself	To Senate Transportatin and Energy Chair and Committee: Please make 2 amendments and support HB25-1175 “Smart Meter Opt-In Program: 1.) All CO utilities, (not just Xcel or those w/ 500K+ customers), need to give utility customers ample notice and full disclosure, while requesting customer’s permission to “opt-in” and allow Smart Meter Technology to be installed adjacent to, or around their homes.

	2.) HB-1175 should be more applicable to our health by requiring Utility Companies to specifically make available an “Electromechanical Analog Meter” with absolutely no electronic components and w/o the ability to broadcast Radiation Frequencies. Thank you for considering the above amendments. I know at least 3 people who cannot function normally in homes with smart meters or other EMF’s. Sincerely, Angela Green, Boulder 80301
Patricia Burke Amend themself	Amend to include: All CO utilities offer the opt-in, not just investor-owned utilities with a half million customers (that would protect residents from Xcel Energy in Longmont) Replace the language "manually read meter" as an option to a broadcasting "smart" meter, with the language "an 'electromechanical analog meter' with no electronic components nor means of broadcasting radiofrequency radiation"
Erin Meschke Amend themself	thank you for he opportunity to speak. my name is erin meschke, i live in boulder, and represent myself. i do not like submitting written testimony because i am fairly convinced it is not appropriately considered but i'm currently traveling and cannot guarantee my participation this afternoon so will hope committee members actually read my comments. i liked HB25-1175 better when it was a true opt-in measure, as is reflected in the title. the strikebelow amendment from the house changes to an opt-out but that is better than the mandatory program some utility companies currently have. while support HB25-1175, i am officially in an amend position because a couple changes need to be made for better protection. many of you might think this bill isn’t necessary because you either don’t know or don’t understand the harms that can come from smart meters. technology is generally supposed to make life easier and, over time, usually makes things less expensive but some technologies like smart meters come with undisclosed, or even covered up, risks. whether it’s the constantly pulsing, communication component and electromagnetic frequencies (EMFs), or the dirty electricity from meters that don’t follow licensing guidelines or require licensed electricians for installation, a growing number of people are tracing their mystery illnesses to their smart meter. the ability to opt-in, as originally presented in HB25-1175, should have been the way this new technology was rolled out. instead, smart meters were presented as a forced upgrade with limited opt-out that, in some areas was hard, costly, or impossible to get. i was able to opt-out but had to insist to maintain that desire as xcel didn’t want to exempt my home. in densely populated areas, like my current neighborhood, not having a smart meter on my home doesn’t necessarily protect my family because my neighbors have the increased EMFs, dirty electricity, and fire risk. in 2018, the US national toxicology program in the national institutes of health conducted a $30 million study that showed there was “clear evidence” that electromagnetic radiation is associated with DNA damage and cancer. the WHO’s international agency for research on cancer classifies everything on the RF-EMF spectrum as a 2B “possible human” carcinogen. A california investigation for the utility company PG&E determined smart meters could pulse up to 192,000 times a day. on top of that, most smart meters no longer have surge suppression that older,

	analog meters had so pose a greater fire risk. In March 2015, about 5,000 smart meters instantly exploded due to overvoltage when a dump truck hit a PG&E power pole in stockton, california. according to EMF safety network, there have been at least 10 similar incidences in the US — and more in canada, australia and new zealand. there are two changes i think should be made. the words, “and does not communication potential” or “does not communicate with anything” should be added to the noncommunciating meter definition. the second amendment that needs to be made is around a qualifying retail utility. the 500,000 customer threshold needs to be eliminated to protect all coloradans regardless of utility size. in the end, an opt-in was better than the current opt-out but everyone needs to be protected so i ask amend and then pass HB25-1175 thank you.

Susan Foster

PO Box 1444
Lyons, CO 80540
susan.foster04@gmail.com
(858) 756-3532

April 9, 2025

RE: HB25-1175 Smart Meter Opt-In Program

Dear Representatives Lieder, Joseph & Sen. Rodriguez

I'm writing to thank the three of you for introducing HB25-1175, the Smart Meter Opt-In Program. I do indeed support the bill, though I have some suggestions with respect to specific language that I believe needs to be clarified.

I have two suggestions:

1) Your bill focuses on investor-owned utilities with 500,000 customers or more. This leaves a number of us out in cities like Longmont where I live. We have a municipal utility for the approximately 99,000 people who live in Longmont that operates under the umbrella of Platte River Power Authority with three other sister cities. We would like to have the same rights to "opt in". Right now, your bill excludes us.

2) A distinction needs to be made that allows customers to have electromechanical analog meters. In California there are two opt-out options: 1) digital opt-out meters that have switch mode power supplies (SMPS) for an AC/DC conversion. This conversion process may add transients to the wiring and create health problems. These meters are read every other month and should not be confused with analog meters; 2) electromechanical analog meters (the kind with the dials on the faces that we have had prior to the introduction of smart meters) do not represent a health threat and have the lowest fire risk of all electric meter options. Please include "electromechanical analog meters" as an option.

In addition, I will be addressing health concerns as well as fire concerns of smart meters.

My Qualifications:

I am a medical writer and have studied wireless technology utilizing electromagnetic radiation, the fire risks, the human health risks, as well as the risks to wildlife and the environment as a whole for 25 years. I am a Fire & Utility Consultant as well as an Honorary Firefighter with the San Diego Fire Department.

In 2004, I organized a SPECT brain scan study of California firefighters who had endured a five-year exposure to a 2G tower in front of their station. All six firefighters in our pilot study were found to have brain damage. 25 of the 27 men who rotated through the station experienced

In May 2015, an impaired driver hit a utility pole in Stockton California. A transmission line dropped on a distribution line and a massive surge or transient went through parts of Stockton. 5000 smart meters exploded or caught on fire; 80 house fires were started as a result of this incident.

In my work with the firefighters of California, I interviewed a fire chief of a small town in California who was standing in his driveway when his smart meter spontaneously ignited. He made two calls, one to his own fire department and one to PG&E, the northern California utility. Why call PG&E? Smart meter fires are electrical fires, and the grid needs to be cut before the fire can be fought through conventional means. The grid was cut and the fire department arrived. Standing in the background throughout the firefight at the chief's home and his next-door neighbor's home, three men stood in the background. When the fire was completely extinguished in both homes the three men silently stepped forward and started removing the smart gas meter, the smart electric meter, and the smart water meter. It is against the law to remove anything from the scene of a fire until an investigation has taken place. The chief told the men from PG&E to leave the meters where they were. They said nothing to him but continued to dismantle the meters. Then the three men from PG&E departed. They ignored the law, and they ignored the fire chief who not only knew the law, but he also was telling them not to take evidence away from the scene of his own house fire – ignited by a smart meter.

This is happening across the country. Utilities are always notified when a smart meter is on fire and they always come to remove the smart meter. Firefighters will sometimes indicate it was clear that the fire started at the location of the meter, but most often they will indicate that a fire is an "electrical fire." It is not their job to investigate the fire. It is the firefighters' job to save lives and extinguish the fire.

No one in the country is keeping track of smart meter fires. That omission is intentional.

Thank you for introducing this essential bill. To reiterate, please make sure we are all included – not just investor-owned utilities with over 500,000 customers, and please make sure that electromechanical analog meters are an option.

Respectfully submitted,

SUSAN FOSTER
Medical Writer
Fire & Utility Consultant
Honorary Firefighter SDFD
PO Box 1444
Lyons, CO 80540
858-756-3532
susan.foster@dotlaw.biz

neurological symptoms that included migraine/severe headaches, sleep disruption including inability to go to sleep and waking up as if they had been anesthetized, cognitive impairment which resulted in getting lost on 911 calls in the very town they had grown up in. The men also experienced ADHD-like and neurobehavioral symptoms including depression, anxiety and sudden outbursts of anger, all symptoms which are not characteristic of firefighters.

Additionally, I co-authored the Malibu Fire Safety Protocol. This was passed unanimously by the Malibu Planning Commission and the Malibu City Council. Malibu is a city that has been severely damaged by two telecommunications-initiated fires. I worked for two years on the Fire Safety Protocol. Our team was comprised of an attorney, a professional electrical engineer, and me. We established a policy for Malibu, incorporating it into a zoning resolution, where eight engineering design documents are required to be signed and sealed by telecommunications professional engineers prior to the applicant coming to the city to apply for a permit. We know we won't stop all cell tower fires from happening, but we will significantly reduce the risk.

Health Risks with Smart Meters:

Utility promises of "no adverse health impact" are misleading. After the capital investment smart meters provide 10.5% profit to the utilities. Actual energy savings to the utilities and the customers have not been proven but that is not why I am writing in support of this bill. I believe there can be significant health risks associated with smart meters because of the pulsed electromagnetic radiation that travels throughout the home and then through the mesh network – from the meter to the next smart meter and the next and the next until it is collected every 8 or 10 meters, and from there relayed to a relay station and then on to the utility.

Electromagnetic radiation is emitted from smart meters in bursts of radiation. These pulses are emitted with greater frequency than the utilities and the municipalities reveal. I will give you an example from Longmont, Colorado. On the AMI website for this municipally owned utility, there is a "Common Questions" section. One of the questions asks how often the meter communicates. The answer is "less than one second per hour."

I hired a certified building biologist to measure the emissions from a smart meter in Longmont using his sophisticated equipment. He captured one spike or burst of radiation every 11 seconds. That means that the meters are actually communicating 372 times per hour. The city website is misleading. Some cities' meters pulse every five seconds but every 10 or 11 seconds is standard. Think of each burst of radiation as a pin pricking your skin. Now think of somebody pricking you in the arm with the pin – albeit very quickly – every 11 seconds for an hour. Then think of that over 24 hours. Then think of that for 365 days every year while your body is trying to function normally.

The Longmont website is further deceptive, perhaps with misleading documentation provided by the manufacturer of the meters the city of Longmont purchased. Nonetheless, health assurances are given. These assurances are patently false.

There are thousands of peer-reviewed studies showing biological harm from electromagnetic radiation at non-thermal levels. The symptoms include but are not limited to vertigo, migraine, severe headaches, foggy thinking, cognitive impairment, ADHD, learning disabilities, neurobehavioral symptoms including but not limited to depression, anxiety, angry outbursts,

sleep disturbances, neurological and immunological challenges and infertility. The Federal Communications Commission only recognizes thermal or heating of tissue as a risk. They ignore the nonthermal evidence because it behooves them to do so. Their job is to foster the buildout of telecommunications in the country. They do not have a single health expert within the FCC. To state this more clearly, the FCC is in charge of the nation's health but it is NOT a health agency. They offer shelter and facilitation to the telecommunications industry. There is no path for remedy for the consumer to the FCC.

According to Harvard University's Edmond & Lily Safra Center for Ethics Norm Alster's research publication, ***Captured Agency: How the Federal Communications Commission Is Dominated by the Industries It Presumably Regulates*** **[attached]**, the very agency that is in charge of our health vis-à-vis wireless communication is itself captured by the telecommunications industry. This publication is essential reading for those who want to understand why they have not heard about the dangers of electromagnetic radiation and why they should take steps immediately to protect themselves. Every Coloradans right to opt-out of the smart meter, and opt-in only by choice, is essential.

We should have the freedom to choose how we are being exposed. People can turn their cell phone off or choose not to use one at all. People can choose to have their computers wired as opposed to wireless, but a smart meter is pulsing electromagnetic radiation along the wires in a home 24/7. It is my opinion that it is imperative to have the right to opt-out of a smart meter, or a traditional digital "opt-out" meter.

I strongly believe the choice of an electromechanical analog meter must remain an option.

Typical digital opt-out meters, including those purchased in Colorado, may or may not be fitted with an antenna that can radiate sometimes by default, sometimes on remote command. The average consumer is not going to know if their opt-out meter has a radiation component to it. In addition, there is something called a switch mode power supply (SMPS) which, depending on the quality of the opt-out meter, may present a problem to individuals who are sensitive because it creates transients that run into the home on the wiring and these transients or extra current can be converted to RF, i.e. radiofrequency radiation.

Fire Risks with Smart Meters:

Smart meters were poorly designed and as a result they have a fire flaw. This flaw creates a larger risk now particularly in fire prone states because of frequent power shutoffs during high winds. Every time the power is shut off, and every time power is turned back on, there is the opportunity for a "surge" or transient (extra electricity) to travel along the wires to the smart meter. Smart meters lack a traditional fuse that you would have in an electric panel. They have a varistor which can hold back about 350 V; this is the same level of protection as the electronics in a TV. Transients in the 5000 V to 10,000 V range can occur, bypass the varistor, and current will continue to flow onto the home wires for approximately nine minutes after the smart meter explodes/catches fire. It takes approximately nine minutes to burn the wire that connects the current from the smart meter to the home. During those nine minutes current continues to flow into the home. If the voltage is sufficient, appliances inside the home may be set on fire.

Health, Safety, Environmental and Economic Risks,
Testimony of Patricia Burke et. al. for MA DPU Dockets 21-80, 21-81, 21-82

This testimony addresses the opportunity and urgency for the Massachusetts Dept. of Public Utilities, environmental groups, utilities, and industry to recognize and act prudently regarding recent legal developments concerning Federal Communications Commission (FCC) radio frequency exposure guidelines.

Safety questions raised by the court's August 13, 2021 ruling against the FCC pertain directly to impending decisions and proceedings by the MA DPU regarding wireless smart utility meters, mesh networks, powerline communications, and other grid infrastructure investments.

The MA DPU is in a position to adjust grid modernization strategic planning, to reflect necessary recognition that the health and safety assumptions driving pending grid policy and investment decisions, sourced back to 2014, are based on FCC guidelines that have been determined by the court to be ***not evidence-based.***

In addition, in 2014, MA DPU 12-76-B misrepresented FCC exposure limits as protective of both thermal and non-thermal impacts of radio frequency exposures.

The MA DPU's claim is misleading and inaccurate.

In 2014, members of the public voiced this concern to the MA DPU. [1]

The August 2021 court decision against the FCC correctly identified the scope of FCC limits as excluding non-thermal impacts.

The misrepresentation by the MA DPU of the scope of the FCC's exposure limits regarding non-thermal effects has never been addressed, despite being brought to the agency's attention in filings by the public, and as outlined in MA-DPU 12-76-B itself, seven years ago.

The court further ruled "The factual premise—the non-existence of non-thermal biological effects—underlying the current RF guidelines may no longer be accurate."

As reported by Children's Health Defense, "According to the Court's decision, the FCC failed to provide evidence to support its decision in regard to the non-cancer health effects and that it also failed to respond to the extensive evidence that was filed with the FCC (via the docket which is also called "record") that shows that the current radiofrequency emissions guidelines may cause negative health effects unrelated to cancer. The court stated that, the FCC's failure, undermines the Commission's conclusions regarding the adequacy of its testing procedures, particularly as they relate to children, and its conclusions regarding the implications of long-term exposure to RF radiation, exposure to RF

[1] As noted by Last Tree Laws, "evidence regarding detrimental non-ionizing radiation public and environmental health impacts, in addition to problems related to privacy, cybersecurity, and costs, has been provided to the department and utilities on an ongoing basis, as seen in D.P.U. dockets 13-83, 12-76, 12-76-A, 21-80, 20-69, and 21-90, as far back as 2012."

pulsation or modulation, and the effects of wireless technologies that were developed since 1996. The court also found that the FCC 2019 decision was arbitrary and capricious in its failure to respond to comments concerning environmental harm caused by RF radiation."

The opening brief filed with the Court by Children's Health Defense specifically refers to issues associated with smart meters.

In its ruling, the Court remanded the issues of chronic long term exposures, and pulsed modulated exposures, both associated with smart grid infrastructure, to the FCC.

Recent Action: MA DPU 20-69 and MA DPU 20-69-A - Background: Customer-Facing Grid Modernization Investments

The Commonwealth of Massachusetts

DEPARTMENT OF PUBLIC UTILITIES

D.P.U. 20-69-A May 21, 2021

Investigation by the Department of Public Utilities on its own Motion into the Modernization of the Electric Grid – Phase Two.

ORDER ADDRESSING FORM AND CONTENT OF: (1) GRID MODERNIZATION PLAN FILINGS; (2) ELECTRIC VEHICLE PROPOSALS REQUIRED UNDER THE TRANSPORTATION ACT, CHAPTER 383 OF THE ACTS OF 2020, AND OTHER ELECTRIC VEHICLE PROGRAM PROPOSALS; AND (3) BATTERY ENERGY STORAGE PROPOSALS

SOURCE: https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/13552861

The three grid modernization dockets: MA DPU Dockets 21-80, 21-81, and 21-82 were ordered following proceedings for MA DPU 20-69.

The three EV dockets 21-90, 21-91, and 21-92 were also ordered as the result of MA DPU 20-69.

"D.P.U. 20-69-A May 21, 2021 Investigation by the Department of Public Utilities on its own Motion into the Modernization of the Electric Grid – Phase Two, ORDER ADDRESSING FORM AND CONTENT OF: (1) GRID MODERNIZATION PLAN FILINGS; (2) ELECTRIC VEHICLE PROPOSALS REQUIRED UNDER THE TRANSPORTATION ACT, CHAPTER 383 OF THE ACTS OF 2020, AND OTHER ELECTRIC VEHICLE PROGRAM PROPOSALS; AND (3) BATTERY ENERGY STORAGE PROPOSALS"

Direct Quotes, MA-DPU-20-69-A; Demonstrate That the MA DPU Has Instructed Massachusetts Investor-Owned Utilities to Deploy Advanced Metering Functionality/AMI Technology

Page 1 "On July 2, 2020, the Department of Public Utilities ("Department") initiated the second phase of its inquiry into the modernization of the electric grid. Grid Modernization – Phase II, D.P.U. 20-69 (2020). The purpose of this investigation is to consider the next appropriate steps for **the deployment of**

advanced metering functionality in the Commonwealth. D.P.U. 20-69, at 3. Recognizing that continued growth in the electric vehicle sector will be critical to the achievement of the necessary reductions in the Commonwealth's greenhouse gas emissions, the Department determined that the investigation would consider, among other things, whether a targeted deployment of **advanced metering functionality** to electric vehicle customers was appropriate."

Page 3 "the Department opened the instant investigation to consider the **next appropriate steps for the deployment of advanced metering functionality**. D.P.U. 20-69, at 3."

Page 5,6 "the Department **sought comments from the Companies and interested stakeholders** on a number of specific topics including: (1) the capabilities of the Companies' current systems to support advanced metering functionality; (2) the feasibility of targeted deployment of advanced metering functionality to certain customer segments, such as electric vehicle customers; (3) alternative solutions to advanced metering infrastructure ("AMI") and the compatibility of such solutions with the Companies' current systems; (4) end-of-life meter replacement strategies, including cost recovery associated with such strategies, that will support the Department's grid modernization objectives and avoid or minimize stranded costs, and (5) dynamic pricing options to provide effective price signals to customers. D.P.U. 20-69, at 3-8. **Stakeholders also submitted comments on a wide variety of other topics.** [2] The summary of comments below is limited to those topics relevant to the issues addressed in this Order." [3]

Recent Court Ruling Against the FCC, and MA DPU 20-69 "Alleged" Health Concerns

On May 21, 2021, in MA DPU 20-69-A, on page 35, the MA DPU characterized concerns about radio frequency exposures as "alleged."

The MA DPU wrote:

*"Citing **alleged** health concerns associated with the radio frequency emissions from AMI meters, a number of commenters urge the Department to ensure that individual customers are able to opt-out of receiving AMI meters."*

[2] .Among the "other topics" discussed by stakeholders at the listening session for MA DPU 20-69 were health concerns, including the question of exposures in multi-family dwellings. This complexity is not addressed in the subsequent opt out instructions to outlined by the MA DPU for utilities. Testifiers also identified the need to specify provision of a true analogue as the opt out meter choice, also not addressed by the DPU.

[3] Comment was also introduced into the proceeding for docket 20-69, noting inaccurate results reporting, cost over-runs, misleading opt out statistics, and other concerns regarding the National Grid smart meter pilot program conducted in Worcester MA, which was conducted to inform policy decisions regarding smart meters. These concerns have been submitted in other MA DPU proceedings and have not been addressed (including MA DPU 14-109, 15-21, 16-28, 17-53, 18-28, 18-29, 20-69) In addition, commenters raised on-going concerns about the MA DPU's promotion of the "expert" opinion of Peter Valberg and product defense firm Gradient regarding health and safety of smart meters.

On August 13, 2021, in its decision 20-1025, the United Stated Court of Appeals for the District of Columbia found these concerns not "alleged."

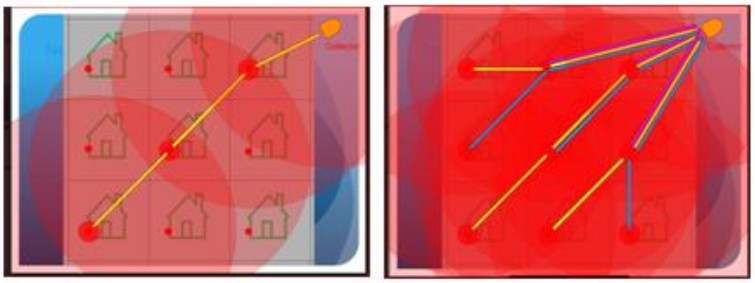
The court noted "The factual premise—the non-existence of non-thermal biological effects—underlying the current RF guidelines may no longer be accurate."

The court also noted, "record evidence that exposure to RF radiation at levels below the Commission's current limits may cause negative health effects unrelated to cancer."

This ruling by the court directly contradicts earlier statements made by the MA DPU, including but not limited to the reliance on FCC guidelines as a basis for dismissing public concern, and the MA DPU implying that FCC guidelines are inclusive of non-thermal effects.

This court ruling raises the question of whether or not the DPU's policy decision to offer an opt out meter will meet the requirement stated in MA DPU 12-76, that "the Department must ensure that electric distribution companies provide safe and reliable electricity to all ratepayers."

Smart Meters Increase RF Exposures in Communities, Court Has Ruled: FCC Guidelines "Not Evidence-Based"



Direct Quotes: MA DPU 20-69-A; MA DPU Directs Utilities to Invest in AMI, Refers to Health Concerns as "Alleged," Proposes Opt Out Tariff

Quotes from docket 20-69-A indicate that the MA DPU specified smart meters/AMI/advanced meter functionality as the technology choice *despite public testimony regarding health concerns:*

Page 21 "Advanced Meter Infrastructure Opt-Out A number of commenters argue that the Department should provide individuals with the ability to opt-out of receiving an AMI meter (CLF Comments at 10; see, generally, Public Commenters). In particular, **65 public commenters assert that there are a number of health concerns associated with the radio frequency emissions from AMI meters and, therefore, urge the Department to require the Companies to allow customers to opt-out of an AMI meter and receive an analog meter at little or no cost** (see, generally, Public Commenters). Finally, 16 public commenters suggest that outreach and education regarding energy conservation could achieve demand

reduction goals without the need for AMI meters (see, e.g., Comments of Anne Frances Martin; Comments of Lokita Jackson; Comments of Dorothy Baker"

Page 25 "After review of the extensive comments submitted and the information gathered over four days of technical sessions, the Department has determined that a targeted deployment of AMI to electric vehicle customers is not likely to be cost-effective. Instead, in consideration of the Commonwealth's long-term energy policy and climate goals, as well as the current status of the Companies' metering infrastructure, **the Department finds it appropriate to consider a path to achieve advanced metering functionality through a full-scale deployment of AMI**. Below, **the Department provides guidance on the content and format of the Companies' forthcoming grid modernization plans to achieve advanced metering functionality through the full-scale deployment of AMI."**

Page 27 "given that the costs to upgrade back-office supporting systems to enable advanced metering functionality through **AMI meters** do not vary significantly between a targeted and a full-scale deployment, full utilization of these upgraded back-office systems will likely result in efficiency gains (Eversource Comments at 11-16; National Grid Comments at 24-25, 27). For these reasons, the Department is persuaded that it is not appropriate to pursue a targeted deployment of advanced metering functionality for electric vehicle customers through alternative metering strategies.7 **Instead, the Department shifts its focus to the achievement of advanced metering functionality in support of our grid modernization objectives and the Commonwealth's long-term energy policies through a full-scale deployment of AMI"**

Page 28 "Content and Form of Grid Modernization Plan Filings 1. Introduction Each company's next grid modernization plan filing must include: (1) **a five-year strategic plan, including a plan for the full deployment of advanced metering functionality;** (2) separate four-year grid-facing and customer-facing short-term investment plans;8 and (3) a composite business case in support of both short-term investment plans."

Page 35 "4. Cost-Based Opt-Out Tariffs Citing **alleged** health concerns associated with the radio frequency emissions from AMI meters, a number of commenters urge the Department to ensure that individual customers are able to opt-out of receiving AMI meters (see, generally, Public Commenters; Senator Moore Comments at 1; Senator DiZoglio Comments at 1; Representative Linsky Comments at 1-2). In D.P.U. 12-76-B at 47-49, the Department addressed this issue and determined that each company would be required to have an opt-out tariff in effect before the deployment of new advanced meters as part of the company's grid modernization plan. Consistent with this finding, **each company shall include as part of its customer-facing investment plan an illustrative AMI meter opt-out tariff for Department review, with proposed opt-out charges that adhere to traditional ratemaking principles of cost causation.14,15"**

Page 36 "As discussed above, the next grid modernization plans will include proposals to achieve advanced metering functionality through the full-scale deployment of AMI and separate short-term investment plans for grid-facing and customer-facing investments. In addition, we anticipate that these

new plans will include proposals involving newer grid modernization technologies or present novel approaches to achieving our grid modernization objectives."

Page 52 "VIII. CONCLUSION Our investigation of the **next appropriate steps for the deployment of advanced metering functionality in the Commonwealth to meet the Department's grid modernization objectives** has benefitted greatly from the extensive participation of stakeholders. After review of stakeholder comments and information gathered over four days of technical sessions, the Department has determined that a targeted deployment of AMI to electric vehicle customers is not likely to be cost-effective. Instead, in the upcoming grid modernization plan filings**, the Department will consider the achievement of advanced metering functionality in support of our grid modernization objectives through a full-scale deployment of AMI."**

Court Ruling Against FCC, Issued August 13, 2021, Regarding FCC Radiofrequency Exposure Guidelines, Submitted for Dockets MA DPU 21-80, 21-81, 21-82; August 20, 2021

I, Patricia Burke, submitted the decision by the U.S. Court of Appeals regarding FCC exposure limits to the MA DPU for the three Grid Modernization proceedings MA DPU 21-80, 21-81, and 21-82, on August 21, 2021.

National Grid: https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/13916143
NStar/Eversource :https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/13889389
Unitil: https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/13889390


United States Court of Appeals

SOURCE:
https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/$file/20-1025-1910111.pdf

Explanation: United States Court of Appeals For The District Of Columbia Circuit; Argued January 25, 2021; Decided August 13, 2021; No. 20-1025 Environmental Health Trust, Et Al., Petitioners V. Federal Communications Commission And United States Of America

Quotes from the Petitioners' summaries regarding the decision:

As reported by the Children's Health Defense,

"The Children's Health Defense (CHD) won its historic case against the Federal Communications Commission (FCC) for the agency's decision not to review its health and safety guidelines for wireless-based technologies, including 5G. On Friday, Aug. 13 , the U.S. Court of Appeals for the DC Circuit published its decision, ruling that the FCC failed to consider the non-cancer evidence regarding adverse health effects of wireless technology when it decided that its 1996 radiofrequency (RF) emission guidelines protect the public's health.

CHD filed the case on February 2, 2020, shortly after the FCC closed the docket it had opened in 2013 seeking public comment on its health guidelines for wireless technologies, which had not been updated in over two decades. Despite thousands of comments and scientific evidence submitted by scientists, doctors and medical organizations, and statements by those who have been injured by RF radiation attesting to the need for stricter guidelines, on Dec. 4, 2019 the FCC published its decision affirming the adequacy of its guidelines without proper assessment of the comments or the evidence.

The case brought by CHD (consolidated with another similar suit brought by the Environmental Health Trust) claimed that the FCC lacked reasoned decision making and that its refusal to address the evidence was arbitrary and capricious. In a 2-to-1 ruling, the Court agreed, citing numerous instances of the Commission's arbitrary and capricious failures to respond, including to evidence that exposure to RF radiation at levels below current limits may cause negative health effects; the inadequacy of testing procedures particularly related to children, to long-term exposure to RF radiation, to pulsed and modulated RF radiation; and the implications of technological developments that have occurred since 1996. The court also noted the agency's complete failure to respond to comments about environmental harms.

The court's judgment states:
"The case be remanded to the commission to provide a reasoned explanation for its determination that its guidelines adequately protect against harmful effects of exposure to radiofrequency radiation…"

"According to the Court's decision, the FCC failed to provide evidence to support its decision in regard to the non-cancer health effects and that it **also failed to respond to the extensive evidence that was filed** with the FCC (via the docket which is also called "record") that shows that **the current radiofrequency emissions guidelines may cause negative health effects unrelated to cancer.** The court stated that, the FCC's failure, undermines the Commission's conclusions regarding the adequacy of its testing

procedures, particularly as they relate to **children**, and its conclusions regarding **the implications of long-term exposure to RF radiation, exposure to RF pulsation or modulation, and the effects of wireless technologies that were developed since 1996.** The court also found that the FCC 2019 decision was arbitrary and capricious in its failure to respond to comments concerning **environmental harm** caused by RF radiation."

As reported by the Environmental Health Trust, "The court granted the petitions for review because, contrary to the requirements of the Administrative Procedure Act (APA**), the commission failed to provide a reasoned explanation for its assertion that its guidelines adequately protect against the harmful effects of exposure to radiofrequency radiation."**

"The Petitioners contend **the FCC ignored the extensive evidence submitted to the agency showing that non-thermal levels of pulsed and modulated RFR emitted by wireless technology are harmful to humans, wildlife and the environment,** and its order failed to provide a record of a reasoned decision making. Therefore, the Petitioners claim the FCC has violated the Administrative Procedure Act (APA) and **its decision is capricious, arbitrary and not evidence-based.** In addition, the Petitioners argue that the FCC violated NEPA because the agency did not consider the environmental impacts of its decision. FCC also violated the 1996 Telecommunications Act (TCA) in failing to consider the impact of its decision on public health and safety."

Children's Health Defense explains, "In 1996, the FCC adopted guidelines which only protect consumers from adverse effects occurring at levels of radiation that cause thermal effects (temperature change in tissue), while ignoring substantial evidence of profound harms from pulsed and modulated RF radiation at non-thermal levels. The FCC hasn't reviewed its guidelines or the evidence since, despite clear scientific evidence of harm and growing rates of RF-related sickness.

In 2012, the Government Accountability Office of Congress published a report recommending the FCC reassess its guidelines. As a result, in 2013 the FCC published an inquiry to decide whether the guidelines should be reviewed. It opened docket 13-84 for the public to file comments.

Thousands of comments and scientific evidence by scientists, medical organizations and doctors, as well as hundreds of comments by people who have become sick from this radiation were filed in support of new rules. Nevertheless, on Dec. 4, 2019, the FCC closed the docket and published its decision, affirming the adequacy of its guidelines without proper assessment of the comments or the evidence.

The lawsuit, called a Petition for Review, contends that the agency's decision is arbitrary, capricious, not evidence-based, an abuse of discretion and in violation of the Administrative Procedures Act (APA). CHD's lawsuit was joined by nine individual petitioners. Petitioners include Professor David Carpenter MD, a world-renowned scientist and public health expert who is co-editor of the BioInitiative Report, the most comprehensive review of the science on RF effects; physicians who see the sickness caused by wireless radiation in their clinics; and a mother whose son died of a cell phone-related brain tumor. CHD's lawsuit was filed in the U.S. Court of Appeals for the Ninth Circuit. However it was transferred to the U.S. Court of Appeals for the DC Circuit where it was joined with a similar lawsuit filed by the

Environmental Health Trust and Consumers for Safe Cell Phones. The main brief and the reply brief were filed jointly by all petitioners."

Would it not also be arbitrary, capricious, and not evidence-based for the MA DPU, industry, and environmental organizations to disregard the Court's ruling and its implications as they apply to public policy mandating AMI and related grid investments, and issues of public safety, environmental protection, and human rights?

The Court ruled the FCC failed to engage at the level of reasoned decision-making required from a federal agency. Furthermore, the commission failed to provide an analysis of the evidence showing how it reached its decision.

Likewise, ratepayers have questioned whether the process by which the MA DPU addressed health concerns in 2014 constituted reasoned decision making, especially because a state agency provided misleading, inaccurate information about the scope of the FCC guidelines.

The basis of the assumption that smart meters are safe is based on FCC guidelines now remanded by the Court.

The MA DPU cannot reasonably make implications to the public, ratepayers, or investors, that mandated smart meter deployment is prudent and safe.

Direct Quotes: United States Court Of Appeals For The District Of Columbia Circuit; August 13, 2021 Ruling Regarding Inadequacy of FCC Review Of Radio Frequency Exposure Limits

"The factual premise—the non-existence of non-thermal biological effects—underlying the current RF guidelines may no longer be accurate."

"One agency's unexplained adoption of an unreasoned analysis just compounds rather than vitiates the analytical void. Said another way, **two wrongs do not make a right**."

".. we find the Commission's order **arbitrary and capricious** in its failure to respond to record evidence that exposure to **RF radiation at levels below the Commission's current limits may cause negative health effects** unrelated to cancer. That failure undermines the Commission's conclusions regarding the adequacy of its **testing procedures**, particularly as they relate to **children**, **and its conclusions regarding the implications of long-term exposure to RF radiation, exposure to RF pulsation or modulation, and the implications of technological developments that have occurred since 1996, all of which depend on the premise that exposure to RF radiation at levels below its current limits causes no negative health effects.** Accordingly, we find those conclusions **arbitrary and capricious** as well. Finally, we find the Commission's order arbitrary and capricious in its complete failure to respond to comments concerning **environmental harm caused by RF radiation**."

"The Commission explained its decision **by asserting that "[n]o new information has been submitted** that would provide a convincing argument for modifying the extrapolation factor . . . at this time." Id. (internal alterations omitted). We rejected that explanation as **conclusory and unreasoned**. Id"

"The Commission last updated its limits for RF exposure in 1996. Resolution of Notice of Inquiry, Second Report and Order, Notice of Proposed Rulemaking, and Memorandum Opinion and Order, 34 FCC Rcd. 11,687, 11,689–90 (2019) ("2019 Order"); see also Telecommunications Act of 1996, Pub. L. No. 104-104, § 704(b), 110 Stat. 56, 152 (directing the Commission to "prescribe and make effective rules regarding the environmental effects of radio frequency emissions" within 180 days). The limits are based on standards for RF exposure 6 issued by the American National Standards Institute Committee ("ANSI"), the Institute of Electrical and Electronic Engineers, Inc. ("IEEE"), and the National Council on Radiation Protection and Measurements ("NCRP"). In re Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, 11 FCC Rcd. 15,123, 15,134–35, 15,146–47 (1996). **The limits are designed to protect against "thermal effects" of exposure to RF radiation, but not "nonthermal" effects.** EMR Network, 391 F.3d at 271."

"We do not agree that these statements provide a reasoned explanation for the Commission's decision to terminate its notice of inquiry. Rather, we find them to be of the conclusory variety that we have previously rejected as insufficient to sustain an agency's refusal to initiate a rulemaking."

The MA DPU's Reliance on FCC Guidelines in MA DPU 12-76-B Can No Longer Form the Basis of Representation of Safety to the Public, Until or Unless the Remand by the Court to the FCC is Addressed

MA DPU 12-76-B's dismissal of health concerns either references FCC guidelines, and/or references other agencies that rely on the FCC, or "expert" testimony provided by Peter Valberg of the product defense firm Gradient. [4]

While the FCC guidelines remain in effect, assurance of safety is not in effect, especially in regard to non-thermal effects of radio frequency exposures (below the heating threshold).

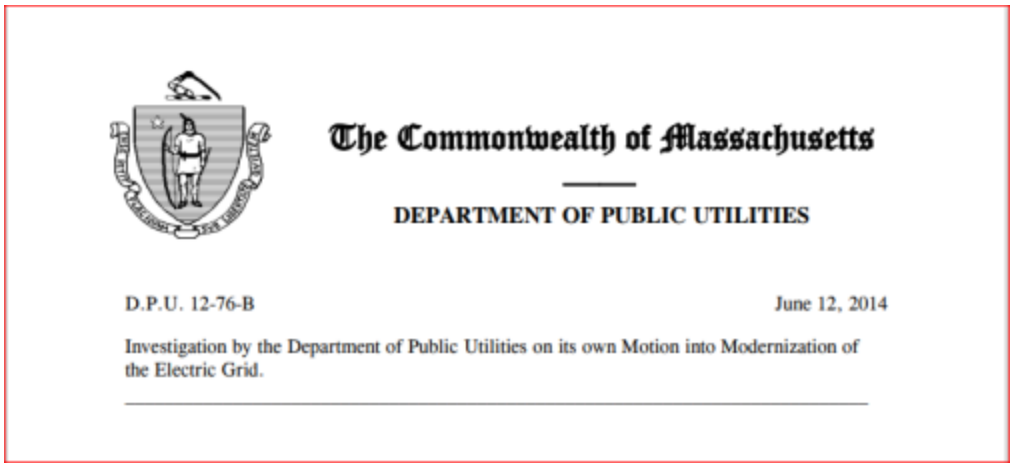
In addition, the MA DPU has misrepresented FCC guidelines in the text on page 43 and in Footnote 44, significantly misleading regulators, decision-makers, legislators, utilities, environmentalists, and the public about the scope and adequacy of FCC safety guidelines regarding non-thermal impacts.

[4] The MA DPU has received significant testimony from the public challenging the agency's reliance on comprised "experts" engaged in product defense,(including tobacco scientists), specifically regarding Peter Valberg, who testified for Philip Morris cigarettes the same week that he testified before the MA DPU to nullify citizen health concerns about smart meters. Valberg did not submit written testimony into the public record, yet his opinion is widely quoted in MA-DPU 12-76-B, which includes references that were not introduced in his verbal testimony. [In May of 2003, the Oak Hill Park Association, Newton, MA submitted a" Rebuttal of the May 2002 Report on Potential RF Health Impacts Related to AM Radio Antennas, 31 May 2003 "This analysis documents serious scientific and technical flaws in Peter Valberg's May 2002 report to the City of Newton on the potential RF health impacts of the proposed antenna array at 750 Saw Mill Brook Parkway.]

The MA DPU also presented its own determination regarding electromagnetic hypersensitivity.

As ordered by the court, the FCC must conduct a review of the 11,000 pages of evidence submitted into the 13-84 proceeding, including evidence of harm associated with smart meters.

Direct Quotes: MA DPU 12-76-B Relative to FCC Guidelines, 2014; (The Court Has Since Ruled, on August 13, 2021, That Current Radiofrequency Emissions Guidelines May Cause Negative Health Effects, Unrelated To Cancer)



The Commonwealth of Massachusetts

DEPARTMENT OF PUBLIC UTILITIES

D.P.U. 12-76-B June 12, 2014

Investigation by the Department of Public Utilities on its own Motion into Modernization of the Electric Grid.

MA DPU quotes from MA DPU 12-76-B discounting health concerns by referencing FCC guidelines:

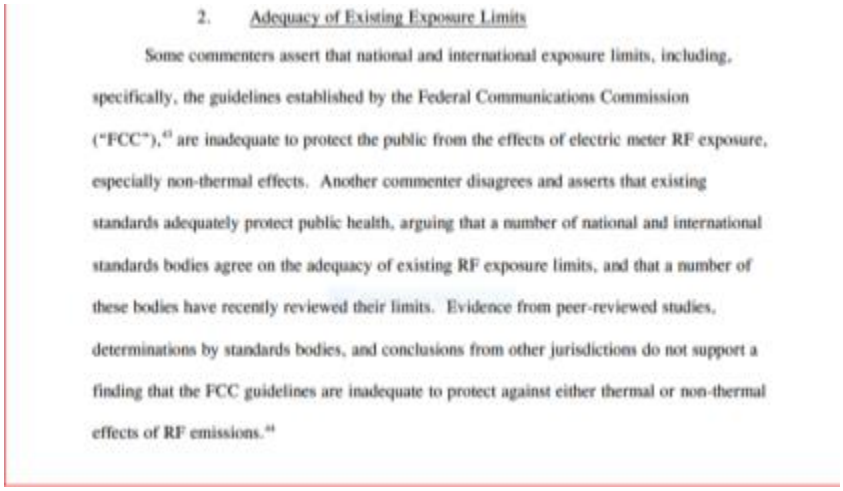
Footnote 41 Page 42 "Key distinctions between wireless phones and RF-emitting meters include proximity to the body, duty cycle, and RF frequency. Levy/Page Memorandum at 1-3. RF field strength declines rapidly from the source and is extremely small at any reasonable distance from the advanced meter. Taking into account the duty cycle of the meter (below one percent), this results in 90 percent of measured RF values being less than 0.1 percent of the **FCC Maximum Permissible Exposure ("MPE").** Electric Power Research Institute, Characterization of Radio Frequency Emissions from Two Models of Wireless Smart Meters at 6.3, 7.1 (2011) ("EPRI Study").

Text Page 42 "In assessing arguments and cited studies, we also consider their consistency with the weight of scientific evidence and determinations made by other jurisdictions. Other jurisdictions that have considered potential health impacts of RF, **including regulatory bodies** and public health organizations, do not find that RF exposure from advanced meters, operating **under established U.S. and international exposure limit guidelines,** leads to adverse health effects.42"

Text Page 43 "In sum, considering the well accepted standards for review of scientific arguments and associated evidence **we find that the studies cited by opponents of smart meters do not amount to credible evidence of health impacts."**[5]

[5] A Review of the Smart Meter "No Credible Evidence" Health Effects Controversy https://smartgridawareness.org/2014/02/27/smart-meter-no-credible-evidence-controversy/

Text Page 43 "2. **Adequacy of Existing Exposure Limits Some commenters assert that national and international exposure limits, including, specifically, the guidelines established by the Federal Communications Commission ("FCC"),43 are inadequate to protect the public from the effects of electric meter RF exposure, especially non-thermal effects.** Another commenter disagrees and asserts that existing standards adequately protect public health, arguing that a number **of national and international standards bodies** agree on the adequacy of existing RF exposure limits, and that a number of these bodies have recently reviewed their limits**. Evidence from peer-reviewed studies, determinations by standards bodies, and conclusions from other jurisdictions do not support a finding that the FCC guidelines are inadequate to protect against either thermal or non-thermal effects of RF emissions**.44"



2. Adequacy of Existing Exposure Limits

Some commenters assert that national and international exposure limits, including, specifically, the guidelines established by the Federal Communications Commission ("FCC"),[43] are inadequate to protect the public from the effects of electric meter RF exposure, especially non-thermal effects. Another commenter disagrees and asserts that existing standards adequately protect public health, arguing that a number of national and international standards bodies agree on the adequacy of existing RF exposure limits, and that a number of these bodies have recently reviewed their limits. Evidence from peer-reviewed studies, determinations by standards bodies, and conclusions from other jurisdictions do not support a finding that the FCC guidelines are inadequate to protect against either thermal or non-thermal effects of RF emissions.[44]

SOURCE: https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/9235208

Footnote 43 page 43 "The FCC regulates communications by radio, television, wire, satellites, and cable within the United States and its territories. 47 U.S.C. §§ 151, 154. Under the National Policy Act of 1969, **the FCC has responsibility for the development and enforcement of the federally mandated RF exposure limits.** 42 U.S.C. § 4321 et seq."

Footnote 44 page 43 "See, e.g., Tr. 4, at 945, 977-979, 1012 (existing exposure limits adequately protect public health; national and international standards bodies agree on the adequacy of existing RF limits); California Council on Science and Technology, Health Impacts of Radio Frequency Exposure from Smart Meters at 2, 5 (2011) **(FCC guidelines provide an adequate factor of safety against RF health impacts of smart meters**; evidence does not support a causal link between RF emissions and non-thermal health impacts); Maine Examiners Report 44 **(there is no basis for finding that the FCC limits inadequate for both thermal and non-thermal effects**); Colorado Department of Public Health and Environment, Fact Sheet on Smart Meters and Associated Health Concerns at 3 (2012) ("[o]verall, based on the current knowledge, **additional standards are not needed to protect public health**")."

Text Page 44 "3. Cumulative Impacts Some commenters suggest that electric meter RF emissions add to the background level of RF fields in an environment in which a number of other RF-emitting devices operate, such as cell phones, household appliances, and wireless communications devices and networks,

furthering the potential health issues for the public**. However, advanced meter RF emissions, as studied in reports evaluating their compliance with FCC and other limits**, are far below emissions levels associated with these other devices under both peak and time-averaged exposure.45 Even under conservative estimates, RF emissions from advanced meters are **less than one percent of FCC and other limits relative to time-averaged exposures** and less than four percent relative to peak exposures."

Text Page 45 "In addition, a number of independent studies have verified the compliance of advanced meters with FCC and other national and international limits.47 These reports evaluate electric meter RF emissions under multiple installation scenarios, including individual and aggregate installations with multiple meters.48 **Finally, the FCC has indicated that banks of RF-emitting electric meters fall below FCC public exposure limits. Letter from Julius Knapp, Chief, Federal Communications Commission Office of Engineering and Technology, to Cindy Sage,** Sage Associates Environmental Consultants (August 6, 2010) ("FCC/OET Letter").49 Specifically, the FCC stated that "[i]rrespective of duty cycle, based on the practical separation distance and the need for orderly communications among several devices, even multiple units or 'banks' of meters in the same location will be compliant with the public exposure limits." **FCC/OET Letter at 2."**

Footnote 47 Page 45 " Cascadia PM, LLC, Report of Results of Smart Meter RF Testing – Maui at 10 (2014) ("Maui Report") (meter readings at no time exceeded .015 percent of the general population exposure limit); EPRI Study at 7-1 (showing that the subject smart meter emissions are small in comparison to the applicable **FCC limits for exposure**; this finding of compliance with the MPE holds true whether or not the peak measured fields are corrected for meter duty cycles, whether spatial averaging or any other factor that reduces RF fields such as the construction materials of homes is considered, or whether the meters exist in a large group, or whether individuals are outside near the smart meter or inside their residence); City of Naperville Smart Grid Initiative, Pilot 2 RF Emissions Testing – Summary Report – V2.0, at 26 (2011) ("NSGI Report") (even under the worst case scenario, the instantaneous peak measurements observed from a smart meter **are far below the FCC MPE limit)."**

Footnote 49 page 45 "This letter was issued in response to a letter from Cindy Sage of Sage Associates Environmental Consultants requesting that the **FCC review compliance with FCC RF exposure limits for "smart meters," in particular, the installation of multiple adjacent "smart meters" and the associated exposure effects."**

Text Page 46 "**Electromagnetic Hypersensitivity** Some commenters assert that advanced meters pose a particular health threat to individuals with electromagnetic hypersensitivity. We recognize that certain individuals report a heightened sensitivity to RF emissions and attribute illness or other physical symptoms to RF exposure. **While we appreciate that their symptoms are serious, based on all of the testimony and the materials we have reviewed we are unable to conclude that RF exposure and, specifically, RF from electric meters, is the cause of those symptoms.**50"

Footnote 50 Page 46 "See, e.g., Tr. 4, at 986; World Health Organization, Electromagnetic Fields and Public Health: Electromagnetic Hypersensitivity,

http://www.who.int/pehemf/publications/facts/fs296/en/ (last visited June 11, 2014); **Texas Commission Report at 55-57 (2012);[6] Exponent Report at 35" (references FCC) [7]**

Text Page 47 "7. **Conclusion In the absence of credible evidence of harm to human health from advanced meters, we will allow electric distribution companies to include the broad deployment of advanced meters in their plans to achieve advanced meter functionality.** However, as discussed further below, companies will be required to provide customers with an option to decline the installation of an advanced meter."

Appendix 1 Page 29 "IV. CONCERNS ABOUT HEALTH EFFECTS AND OPT-OUT PROVISIONS A. Concerns about Health Effects In the Straw Proposal, the Department recognized the possibility that some electricity customers would question the effects of radio frequencies ("RF") on their health. Straw Proposal at 31. **The Department received numerous comments from individuals and organizations on the potential health effects resulting from exposure to RF emitted by certain electric meters7** (HaltMASmartMeters Comments at 1, 3; StopSmartMetersMassachusetts Comments at 1-3; EMR Policy Institute ("EMRPI") Comments at 1-2; Massachusetts Association for the Chemically Injured, Inc. ("MACI") Comments at 1-2; American Academy of Environmental Medicine ("AAEM") Comments at 1-3; David Carpenter Comments at 4). Additionally, many participants addressed this issue during the panel hearing session on Health and Safety held on February 27, 2014 (Tr. 4, at 935-1074). **Several commenters assert that RF-emitting meters pose a health threat to the public, and particularly to subsets of the population that report chemical and electrical sensitivity** (Tr. 4, at 949, 956-958, 986, 994; MACI Comments at 1-2; AAEM Comments at 1-2; HaltMASmartMeters Reply Comments at 6). These commenters argue that **sensitive populations may be unable to live in their** homes with the deployment of RF-emitting meters (StopSmartMetersMassachusetts Comments at 4; HaltMASmartMeters Comments at 1; MACI Comments at 5). **Commenters contend that current Federal Communication Commission ("FCC") standards to which RF-emitting meter manufacturers are required to adhere are outdated, and that studies that indicate meter adherence to these standards is inadequate** (StopSmartMetersMassachusetts Comments at 4-5; HaltMASmartMeters Reply Comments at 5; MACI Comments at 5**). These commenters argue that FCC standards only account for thermal effects and do not address non-thermal effects** (Tr. 4, at 965-966; AAEM Comments at 2; HaltMASmartMeters Reply Comments at 5).8 **Additionally, they assert that studies evaluating RF exposure, including those on which FCC bases its standards, have not looked specifically at RF-emitting meters, have rejected critical variables such as the effects of whole body exposure, have not evaluated RF exposure impacts on children, and are inherently flawed in their research methodologies** (StopSmartMetersMassachusetts Comments at 3-5; HaltMASmartMeters Reply Comments at 5; MACI Comments at 5-6**). Gradient Consulting ("Gradient") disagrees and asserts that existing standards**

[6] The Texas Commission Report was compiled by a security analyst with no public health expertise. A rebuttal of that document is available here: https://www.eiwellspring.org/smartmeter/ACC_TPUCrebuttal.htm and here: https://smartgridawareness.org/2014/01/16/rebuttal-texas-smart-meter-report/

[7] Exponent is another company engaged in product defense. Exponent and Gradient provided testimony in favor of smart meters in many proceedings across the US, and were also referenced by the National Council of State Legislatures.

adequately protect public health (Tr. 4, at 945, 977-979). Gradient argues that standards bodies establish these standards through an evaluation of peer-reviewed, reproducible science, evaluating both thermal and non-thermal effects of RF exposure (Tr. 4, at 945, 977-979). Gradient also notes that a number of national and international standards bodies agree on the adequacy of existing RF standards, and that a number of these bodies have recently reviewed their standards (Tr. 4, at 978, 1012).9 Commenters cite a number of studies that identify both **thermal and non-thermal effects of RF exposure**, concluding that there is evidence for adverse health effects (Tr. 4, at 958; MACI Comments at 4; David Carpenter Comments at 2-4). MACI and HaltMASmartMeters argue that the health impacts of RF-emitting meters are not adequately settled scientifically and that further study and research are necessary (MACI Comments at 4-5; HaltMASmartMeters Reply Comments at 6). AAEM contends that **studies exist that correlate RF exposure with cancer, neurological disease, reproductive disorders, immune dysfunction, and electromagnetic hypersensitivity** (AAEM Comments at 1-3). Commenters also note that the World Health Organization ("WHO") recently classified RF energy as a class 2B possible carcinogen, as evidence of the detrimental effects of exposure to emissions from RF-emitting electric meters (Tr. 4, at 947; StopSmartMetersMassachusetts Comments at 2-3; HaltSmartMetersMA Reply Comments at 5). **Gradient asserts that national and international studies have not shown a causal link between RF exposures and any detrimental health effects, including those identified above** (Tr. 4, at 943, 986, 1069). MACI and David Carpenter assert that **cumulative and aggregate exposure is a critical factor for which existing studies and standards do not account**, and that the deployment of new RF-emitting electric meters will add to the existing RF baseline in the environment, further compromising the health of sensitive individuals (MACI Comments at 4; David Carpenter Comments at 4-6). They also maintain **that RF exposure from banks of meters, such as in a large apartment building, is particularly problematic given the potential for higher levels of RF emissions and that studies have not evaluated whether this type of installation is in compliance with RF standards** (Tr. 4, at 997, 1032, 1033; Fournier Reply Comments at 11). **Gradient states that RF exposure from meters at a distance of four feet is hundredths of a percent of the FCC exposure standard, and thus unlikely to cause any adverse health impacts (Tr. 4, at 1005-1006)."**

Appendix 1 Page29 Footnote 8 "Thermal effects refer to body tissue heating and associated tissue damage, whereas non-thermal effects refer to all other biological impacts (Tr. 4, at 943)."

MA DPU 12-76-B is inaccurate, misleading, and misrepresents the scope and protection of FCC limits.

In 2014, public commenters informed the MA DPU that safety claims smart meters, including portraying FCC limits as protective of non-thermal impacts, voiced by the MA DPU in policy-making, were inaccurate.

Scope of FCC Guidelines Court Ruling, Relative to Misrepresentation of Fact in MA DPU 12-76-B

The Court issued the following statement regarding the FCC in its decision:

".. we find the Commission's order **arbitrary and capricious in its failure to respond to record evidence that exposure to RF radiation at levels below the Commission's current limits may cause negative health effects** unrelated to cancer. That failure undermines the Commission's conclusions regarding the **adequacy of its testing procedures**, particularly as they relate to **children,** and its conclusions regarding the implications of **long-term exposure to RF radiation, exposure to RF pulsation or modulation, and the implications of technological developments that have occurred since 1996,** all of which depend on the premise that exposure to RF radiation at levels below its current limits causes no negative health effects. Accordingly, we find those conclusions arbitrary and capricious as well. Finally, we find the Commission's order arbitrary and capricious in its complete failure to respond to comments concerning environmental harm caused by RF radiation."

1. "adequacy of its testing procedures"

When faced with questions concerning the safety of wireless smart meters, the industry and regulators measured meter transmissions in isolation, in laboratory settings, and/or averaged the peak exposures (MA DPU 12-76-8 Footnote 47 Page 45), evaluating readings against theoretical FCC guidelines, which have now been remanded to the FCC by the court.[8]

2. "children"

In her March 21, 2014 reply testimony to the MA DPU, Janet Newton of the EMR Policy Institute noted that the National Academies of Science had identified lack of research on the impacts of children as one of twenty short-comings in the research record.

3. "conclusions regarding the implications of long-term exposure to rf radiation"

Long term, involuntary, ubiquitous exposure to RF, including night-time exposures, is introduced into communities by the deployment of wireless utility meters and infrastructure. The Court remanded this issue to the FCC. Janet Newton's testimony included the National Academies of Science identifying lack of adequate study of long term exposure as a research deficit.

4. "exposure to RF pulsation or modulation"

This was also noted in Janet Newton's testimony referencing the National Academies report. The court remanded this issue to the FCC.

[8] Issues regarding the safety of smart meters appear to include both the transmission of radio frequencies through the air, and transmissions riding on the household electrical service. See: Pre-Filed Testimony by Erik S. Anderson, P.E., C.F.E.I. on behalf of Warren Woodward, April 3, 2017; available at http://docket.images.azcc.gov/0000178630.pdf and based upon a "Report on Examination of Selected Sources of EMF at Selected Residences in Hastings-on-Hudson" by Isotrope Wireless, dated November 23, 2013: "There was a substantial conducted 915 MHz component on the power line." Report available at: https://skyvisionsolutions.files.wordpress.com/2014/04/report-on-examination-of-selected-sources-of-emf-at-selected-residences.pdf.

5. "the implications of technological developments that have occurred since 1996"

The court has identified new applications for wireless technologies, introduced since 1996, which includes smart meters, as an area of inadequate health and safety inquiry, in its remand to the FCC.

6. "two wrongs do not make a right."

Regulators, health officials, legislators, and other decision makers have received reports from the public about health harm associated with wireless exposures, including the acute onset of electromagnetic hypersensitivity associated with wireless utility meters.

While organizations including the MA DPU disregarded the concerns on the basis of FCC guidelines, the court has ruled that **"The factual premise—the non-existence of non-thermal biological effects—underlying the current RF guidelines may no longer be accurate."**

6. "scientific evidence and evidence of existing sickness"

The court ruled that FCC failure to address reports of harm was arbitrary and capricious, and not science-based. Testimony submitted to the FCC for consideration of the need to review safety standards included reports of acute onset of electromagnetic hypersensitivity (also known as radiation sickness) associated with the installation of smart meters and smart grid infrastructure.

7. "record evidence that exposure to RF radiation at levels below the Commission's current limits may cause negative health effects unrelated to cancer."

The court ruled, "The factual premise—the non-existence of non-thermal biological effects—underlying the current RF guidelines may no longer be accurate."

This directly contradicts MA DPU 12-76-B implications that the FCC guidelines encompass non-thermal effects, and that the guidelines are adequate.

8." that its current regulations are inadequate or the factual premises underlying its prior judgment have eroded, it must offer more to justify its decision to retain its regulations than mere conclusory statements. Rather, the agency must provide "assurance that [it] considered the relevant factors," and it must provide analysis that follows "a discernable path to which the court may defer."

In addition to the FCC, other agencies have been presented with public concern and reports of harm indicating that FCC regulations are inadequate, including the MA DPU (for example, MA DPU 13-83).

The court noted, “Petitioners also point to approximately 200 comments submitted by individuals who advised the Commission that either they or their family members suffer from radiation sickness, “a constellation of mainly neurological symptoms that manifest as a result of RF[] exposure.” Pet’rs’ Br. at 30–31, 30 n.99.” (Within the FCC inquiry there are reports of harm to citizens associated with the installation of smart meters, including the acute onset of electromagnetic hypersensitivity.)

At this time, the standards remain in effect, but the court has indicated that there is a question as to whether FCC assumptions and claims about safety are evidence based.

The MA DPU’s Portrayal Of “Alleged” Health Concerns Associated With Non-Thermal Impacts Cannot Be Demonstrated To Be Evidence-Based

Claims that smart meters are safe, based on FCC guidelines, could be described as “alleged,” as the court has now demanded further scrutiny.

Misrepresentation of fact regarding RF safety claims may be actionable in tort law.

The FCC must prove that its decision making was reasoned.

FCC assumptions and safety claims are also contradicted by both FCC orders 19-126 and 19-176.

Implications Of FCC 19-126, And 19-176 Resolution Of Notice Of Inquiry, Second Report And Order; Notice Of Proposed Rulemaking, And Memorandum Opinion And Order Adopted: November 27, 2019; Released: December 4, 2019

Source: https://docs.fcc.gov/public/attachments/FCC-19-126A1.pdf
Page 56, and footnotes starting on page 57

In addition to the August 13 court ruling regarding the FCC’s decision not to revisit its radiofrequency exposure limits, the FCC’s 19-176 Notice of Proposed Rulemaking raises concerns regarding the Massachusetts Department of Public Utilities’ claim that FCC guidelines are adequate because they are protective of non-thermal effects. It also negates the FCC’s denial of non-thermal effects.

Order FCC 19-126 **recognizes biological and adverse effects below the heating threshold**. The document notes it is necessary to determine guidelines "aimed at prevention of electrostimulation due to RF electric fields induced internally within the human body in the presence of an external electromagnetic field outside the body—the primary human reaction to electromagnetic field energy at these frequencies...., [the goal being that] the internal electric field avoids neural stimulation **effects unrelated to heating**.328"

The FCC noted that these reactions occur instantaneously.

The FCC's current method of averaging exposure levels over 30 minutes – which obscures pulsation effects, (utilized to justify smart meter safety)—ignores RF electric fields induced internally within the human body in the presence of an external electromagnetic field outside the body.

The FCC noted, in the range between 3 Hz and 10 MH, "[a]dverse neural stimulation effects …such as perception of tingling, shock, pain, or altered behavior due to excitation of tissue in the body's peripheral nervous system."

As the FCC stated in its own admission, externally generated EMF interferes with internal electrical and biological responses. The adverse impact of *pulsed* RF/EMFs on physiology has not been addressed by the FCC, or the MA DPU, as noted by the court ruling.

In its decision by the Court, safety testing procedures were remanded to the FCC.

Misrepresentation of Fact by MA DPU: 12-76-B

In its MA DPU order 12-76-B, the MA DPU stated, "Evidence from peer-reviewed studies, determinations by standards bodies, and conclusions from other jurisdictions do not support a finding that the FCC guidelines are inadequate to protect against either thermal or non-thermal effects of RF emissions."

My understanding is that "There are three types of misrepresentation in contract law: innocent misrepresentation, fraudulent misrepresentation, and negligent misrepresentation."

Whether the misrepresentation in MA DPU 12-76-B of the FCC limits including non-thermal effects was sourced from "another commenter," Peter Valberg, or Gradient,(none of whom submitted written testimony) or from the MA DPU staff, the fact remains that the MA DPU published a claim about health and safety that is unsubstantiated and misleading, and not evidence-based.

Not correcting the misrepresentation made by the MA DPU about the scope of FCC guidelines to the public, to investor-owned utilities, and to investors enables the DPU to potentially defraud ratepayers and investors in Massachusetts and elsewhere, regarding the costs and benefits of future investments. [9]

Despite public testimony regarding the misrepresentation of FCC limits dating back to 2014, the MA DPU has taken no corrective action.

[9] Investor-owned utilities in MA also serve portions of Rhode Island, Connecticut, New Hampshire and New York.

The court's ruling against the FCC affirms the validity of citizen testimony given back in 2014, regarding the misrepresentation of MA DPU 12-76-B, as well as other concerns brought before the MA DPU, as outlined in the order itself.

Consideration of Adequacy of Safety Testing Procedures for Smart Meters

By way of background, the Court ruling against the FCC provided an overview of the FCC actions that resulted in the court's decision:

The court described the FCC's actions:

"The Commission (FCC) divided its notice of inquiry into five sections. In the first section, it sought **comment on the propriety of its exposure limits for RF radiation**, particularly as they relate to device use by children. Id. at 3,575–80. In the second section, the Commission sought comment **on how to better provide information to consumers and the public about exposure to RF radiation and methods for reducing exposure.** Id. at 3,580–82. In the third section, the Commission sought comment on **whether it should impose additional precautionary restrictions on devices and facilities that are unlikely to expose people to RF radiation in excess of the limits set by the Commission's guidelines**. Id. at 3,582–85. In the fourth and fifth sections, the Commission sought comment on **whether it should change its methods for determining whether devices and facilities comply with the Commission's guidelines**. Id. at 3,585–89. The Commission explained that it was issuing the notice of inquiry in response to changes in the ubiquity of wireless devices and in scientific standards and research since 1996. In December 2019, the Commission issued a final order resolving its 2013 notice of inquiry by **declining to undertake any of the changes contemplated in the notice of inquiry.** See 2019 Order, 34 FCC Rcd. at 11,692–97

"…the Commission's decision to terminate its notice of inquiry must be "reasoned" if it is to survive arbitrary and capricious review**. When an agency in the Commission's position is confronted with evidence that its current regulations are inadequate or the factual premises underlying its prior judgment have eroded, it must offer more to justify its decision to retain its regulations than mere conclusory statements."**

In the ruling against the FCC, the court noted " we find the Commission's order **arbitrary and capricious** in its failure to respond to record evidence that exposure to **RF radiation at levels below the Commission's current limits may cause negative health effects** unrelated to cancer. That failure undermines the Commission's conclusions regarding the adequacy of its **testing procedures**…."

Testing procedures for smart meter safety have exclusively on engineering measurements, rather than scientifically investigating whether or not and/or how biology is being impacted by the environmental stressor of RF exposure introduced by the meter technology.

Emerging Research: "Effects of radiofrequency electromagnetic radiation on neurotransmitters in the brain"

Recent review article, "Effects of radiofrequency electromagnetic radiation on neurotransmitters in the brain" has just been published. http://journal.frontiersin.org/article/10.3389/fpubh.2021.691880/:

"**Many studies have shown that the nervous system is an important target organ system sensitive to EMR.** In recent years, an increasing number of studies have focused on the neurobiological effects of EMR, including the metabolism and transport of neurotransmitters. As messengers of synaptic transmission, neurotransmitters play critical roles in cognitive and emotional behavior.[ ], the effects of EMR on the metabolism and receptors of neurotransmitters in the brain are summarized. "

"Discussion" " **It is known that the response to non-thermal EMR depends on both power density and duration of exposure.** Some studies show no effect under fixed short-term EMR exposures, but this does not imply no effects under longer-term exposures (5, 124). In a recent review, Leach et al. analyzed **2,653 papers captured in the database examine the bioeffect outcomes in the 300 MHz–3 GHz range. The results showed three times more biological "Effect" than "No Effect" papers (125).**."

"… some studies have suggested that the **calcium activation** could be the initial event leading to alteration in protein configuration, followed by generation of ROS and ultimately activation of the molecular apoptosis pathways (101). Lushchak et al. reported that **EMR exposure may firstly produce the free radicals in the brain** and later they are converted to ROS (126). The elevation of ROS level can attack various biomolecules in the cell. The raised ROS can also in turn trigger calcium release, and then **activate the genetic factors leading to DNA damage** (110). Any alteration in gene and enzyme levels, may result in the activation of downstream signaling (114), particularly the mitochondria-dependent caspase-3 pathway can cause the apoptosis of neurons (113, 127), which would lead to altered behavioral manifestations and pathophysiological changes in the brain**. In a word, EMR exposure does increases the intracellular calcium and the formation of ROS, which would alter the cellular function eventually and lead to numerous biological effects including neurotransmitter imbalance**."

Environmental Impacts of Non-ionizing EMFs

In addition to harm to human health, evidence of environmental harm is being increasingly documented by independent, non-industry researchers. This research deficiency holds implications for farming and food supply assets and potential financial harm to industries in Massachusetts.

Effects of non-ionizing electromagnetic fields on flora and fauna, part 1. Rising ambient EMF levels in the environment B Blake Levitt , Henry C Lai , Albert M Manville

Effects of non-ionizing electromagnetic fields on flora and fauna, Part 2 impacts: how species interact with natural and man-made EMF B Blake Levitt , Henry C Lai , Albert M Manville

In particular, the court ruling against the FCC noted, "The court also found that the FCC 2019 decision was arbitrary and capricious in its failure to respond to comments concerning **environmental harm** caused by RF radiation."

Implications/Conclusions

1. **Opt Out Policies to Address What the MA DPU Has Characterized As "Alleged" Are Unreasoned, A Moratorium on Further Investment in Wireless is Warranted** As a result of the court's ruling on the FCC case, and especially in light of the FCC admission of non-thermal effects in 19-126, as a responsible future planning scenario, the MA DPU could halt plans for deployment of wireless and powerline smart meters, until the FCC remand is addressed.

2. **Opt Out Policies to Address What the MA DPU Has Characterized As "Alleged" Is Unreasoned, Other Technology Choices Should be Promoted** As a result of the court's ruling on the FCC case, the MA DPU could modify its order and solicit plans for wired, non-emitting technology that does not utilize the airwaves or the household wiring and utility grid as an antenna. One could argue that continued expense associated with not recognizing the FCC court decision would be against the public interest, and irresponsible to both ratepayers and investors.

3. **Ratepayers Need Protection from Unresponsive Policy Making** If the MA DPU continues to direct investor-owned utilities to deploy smart meters, policies should be in place to protect ratepayers from costs associated with inadequate scrutiny of both health and environmental impacts.

4**. Ratepayers Need the Right to Opt In, With Informed Consent** Due to emerging questions regarding public safety, until the FCC conducts a review of the science in accordance with the law, smart meters, including digital meters, should only be offered as an "opt-in" option with informed consent, after full disclosure about the FCC court case and findings.

5. **The MA DPU Should Address Misrepresentation of Safety** Considering the FCC court ruling, if the MA DPU and NGrid misrepresented the safety of wireless smart meters to the Worcester community and others, including the MA DPU's inaccurate claim of FCC protection from non-thermal effects,

- the DPU should clarify to the public that MA DPU claims about FCC guidelines encompassing non-thermal effects were misleading, and inaccurate

-the DPU should inform all customers who currently have smart meters, including those auto-enrolled in the Worcester pilot program, that safety claims regarding the meters are under review, and that historical claims are not substantiated

- The DPU can specify that ratepayers can request and receive an analogue meter at no charge, *especially if they are experiencing adverse health effects.*

The MA DPU and National Grid could extend the Worcester pilot program to generate data to model the cost-benefit -analysis of installing smart meters, and then needing to address overlooked health and safety accommodation issues.

5. **The Grid Modernization Business Case Needs to Be Re-evaluated for the Possible Futures Scenario of Needing to Provide Protection in Multi-Family Dwellings, and Other Technical Challenges** In order MA DPU 20-69, the regulator failed to address concerns voiced by public testifiers about the exposures created in multi-family homes, proximal to banks of meters, or from neighboring meter emissions (noted in oral and written testimony of Helen Walker, Jean Lemieux, and others)

The MA DPU could instruct utilities to provide data regarding the potential impact of needing to protect health-vulnerable ratepayers in multi-family homes, in the future. Utilities could be instructed to provide a break- down of the percentage of meters in their service territory housed in multi-family dwellings, or in close proximity to other occupied premises (for example, on a garage proximal to a bedroom.)

Will this accommodation interfere with the functioning of the mesh network, or will the mesh network or powerline choice render accommodation not possible?

6. **Emerging Accommodation Issues Created by Willful Reliance on Inadequate FCC Guidelines Require Consideration, Including Specification of the Opt Out Meter Technology, and Shielding**

Many commenters, including MACI, Massachusetts Association for the Chemically Injured, HaltMAsmartmeters, Stop Smart Meters MA, Last Tree Laws, and individual testifiers raised concerns over the years about the impact of increased radio frequency exposures for health vulnerable populations on housing accessibility.

If the issue of health effects is inadequately vetted by regulators, and the installation of smart meter s and smart grid infrastructure is eventually found to interfere with the protections of Fair Housing, ADA, and Rehabilitation Act, because it was ignored now, how will costs for remediation be allocated?

The MA DPU failed to address these complexities in its instruction to utilities to file opt out proposals and opt out fees, treating health concerns as "alleged." The MA DPU reduced the responsibility of the investor-owned utilities to simply offering an opt out policy and tariff, without specifying the type of meter required (analogue), and without addressing multiple dwellings and neighboring emissions.

The MA DPU could require utilities to re-file smart meter plans that incorporate expenses for accommodation, which includes professional shielding, for example, as provided in Sweden and other countries, to protect health vulnerable individuals.

7. The Proposed Opt Out Provision Discussion in Inadequate, Except in the Case of a Single Family Home Without Neighboring Meters Transmitting Nearby, Therefore the Business Case and Financial Forecasting is Incomplete, and the Question of Liability May Follow

The opt out provisions specified by the MA DPU and put forth by the utilities do not address any of the challenges of neighboring meters and multi-family homes.

This oversight may cause the entire smart meter deployment further complications and unaccounted-for costs down the road if the MA DPU is not able to justify claims of safety, particularly for a mesh network. Shielding and additional remediation will be necessary.

In addition, there will be questions regarding liability for health damages if the smart meter industry, the FCC, state utility regulators, and utilities willfully fail to address reports of harm and misrepresentation in response to the recent court action.

8. To Enable Data-Driven Decision Making, the MA DPU Should Quantify Populations that Have Been Identified as At Risk

Health care practitioners monitoring their patients over time noted a dramatic downturn in the condition of individuals with Lyme, Parkinson's, MS, Multiple Chemical Sensitivity and other environmental and chronic illnesses, following meter installations. Cardiac, neurological, and endocrine concerns, fertility issues, brain fog, and sleep disturbance have been reported, as well as research demonstrating increased risk for cancer.

More importantly, researcher Beatrice Golumb reports that the installation of a wireless smart utility meter is the single most common trigger for the onset of sensitivity to non-ionizing radiation, as she noted in her testimony submitted to the MA DPU for docket 20-69.

In addition to quantifying the risks of installations on or near multi-family dwellings, the MA DPU and health agencies could also quantify the cost-benefit implications of needing to accommodate health-vulnerable populations, as well as the health care savings associated with providing an EMF-protected environment. (This cost-benefit analysis is a common practice when discussing fossil fuels and particulate air pollution.)

The MA DPU Could Change Course

The MA DPU could adjust its course, and stop describing concerns as "alleged."

The MA DPU could stop referencing irrelevant engineering measurements, and treating the health and safety issue as a public relations concern rather than a science-based question, In light of tremendous suffering and harm to a portion of the population.

The court ruled:"The factual premise—the non-existence of non-thermal biological effects—underlying the current RF guidelines may no longer be accurate."

The court also ruled. "The Commission explained its decision by asserting that "[n]o new information has been submitted that would provide a convincing argument for modifying the extrapolation factor… at this time." Id. (internal alterations omitted). We rejected that explanation as conclusory and unreasoned. Id"

The court ruling against the FCC has affirmed many of the concerns brought before the MA DPU by the public over the last 7 years, dating back in 2014.

Had regulators and the industry heeded public testimony 7 years ago, initiatives in clean energy technology could have been 7 years ahead in adjusting to evidence that radio frequency exposure guidelines are inadequate.

In the words of the court, the MA DPU, like the FCC, was "**confronted with evidence that its current regulations are inadequate or the factual premises underlying its prior judgment have eroded."**

The MA DPU and utility regulators and decision-makers across the country could have acted nearly a decade ago on evidence that RF exposure limits are not protective enough, *especially for smart meters.* Electricity, water and gas are essential services provided by monopoly corporations. The standard of care in responsible policy-making must be greater than the industry practice of hiring marketers and mercenary tobacco scientists.

These concerns have also been raised in countless proceedings across the country, as ratepayers became injured as the result of wireless meter installations in other jurisdictions.

In recognizing the significance of the Court ruling against the FCC, for the MA DPU, environmental groups, utilities, and decision makers *to not act is unreasoned.*

Respectfully Submitted,

Patricia Burke, Stop Smart Meters MA, Halt MA Smart Meters.org, Worcester Opts Out, Scientific Alliance for Education, Millis, MA (Eversource customer)

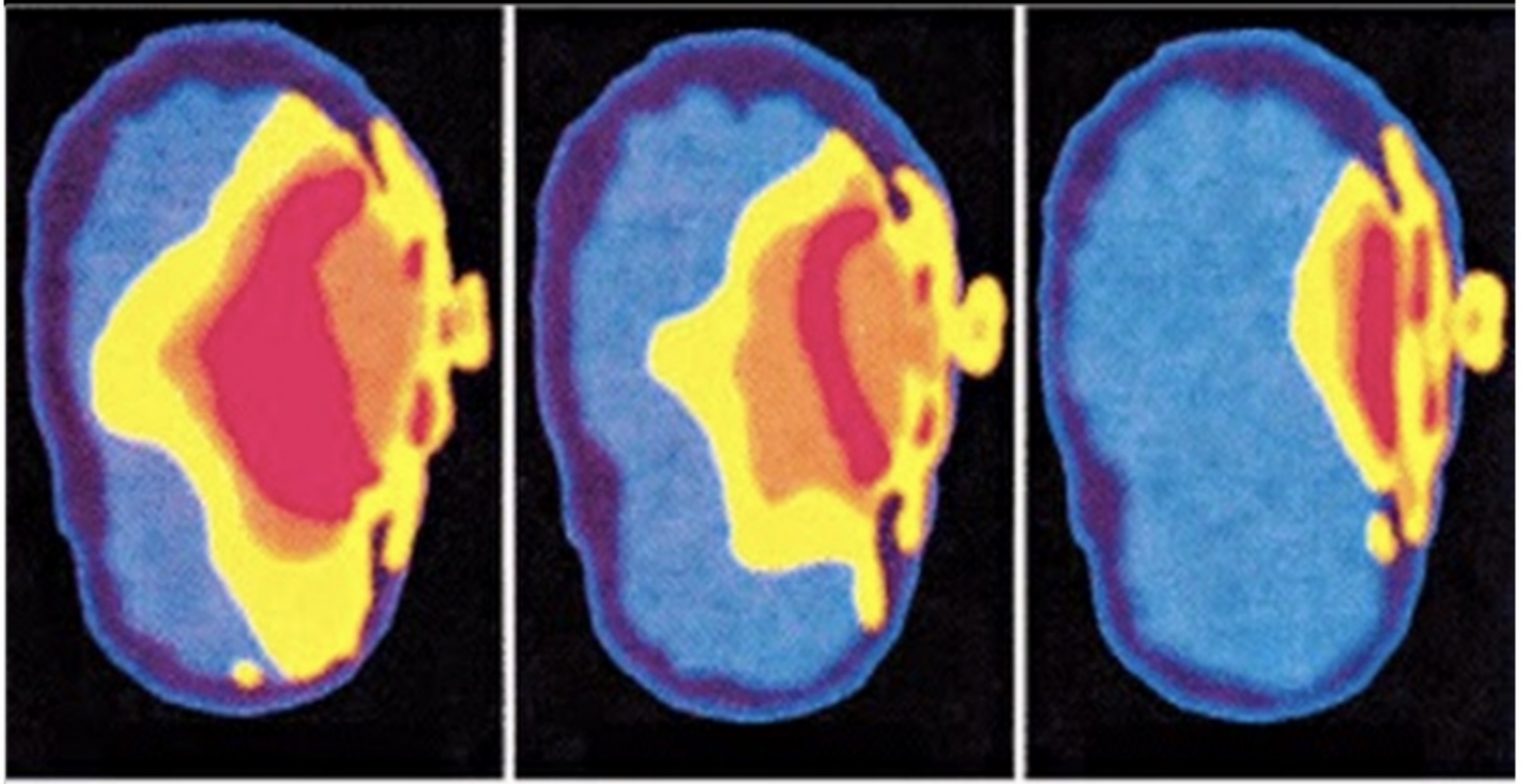
Nina Anderson, President, Scientific Alliance for Education, Sheffield MA (National Grid customer)

Kirstin Beatty, Director Last Tree Laws, Holyoke, MA 01040 (Municipal)

Margaret Patton, Halt MA Smart Meters, Wayland, MA 01778 (Eversource Customer)

Pamela Steinberg, Worcester, MA 01602 (National Grid customer)

Children Absorb 10 x More Microwave Radiation



5 Year Old | 10 Year Old | Adult

Slides from Dr. Om Ghandi,
As cited by the World Health Organization's International Agency for the Research on Cancer

Kimberly Edmundson

Meadowview • 1d •

If opting out of the smart meters were free with no extortion charges and monthly fees would you? Or are you getting one because you can not afford the extra fees to do so?

I want the meter.	37%
I am opting out regardless of fee's.	22%
I would opt out if it were no extra costs to me.	40%

126 votes

OVERVIEW:
Fire and Electrical Hazards from 'Smart', Wireless, PLC, and Digital Utility Meters

Nina Beety
July, 2019

In the last twelve+ years, utility companies have launched major roll-outs of electronic digital meters across the United States and globally for electric, natural gas, and water service. These meters include wireless transmitting Smart or AMI Meters, AMR meters and ERTs, and powerline communication (PLC, BPL) meters.

Due to meter design and function, these digital meters can malfunction in several ways. Electric digital meters can allow surges and overvoltage to flow into buildings which can burn wiring and destroy appliances and electronics. They can interfere with arc and ground fault circuit interrupters. Meters have exploded and have caused fires, and they have likely contributed to the severity of other fires. Some of the fires have resulted in the deaths of people and their pets. Water and gas AMI/AMR/digital meters pose additional hazards.

These problems are known to the industry, regulatory commissions, some fire officials, the news media, and insurance companies, and were the subject of a dispute before the National Labor Relations Board. This paper is on known problems with meters used in the U.S. and Canada, but electrical problems and fires are occurring internationally.

Australia, Daily Telegraph, March 1, 2012

> The state's electrical union fears someone will have to die before safety concerns about controversial smart meters are addressed. The Electrical Trades Union has repeated demands to suspend the rollout until power companies commit to mounting all meters on flame-resistant boards. But the Government and suppliers are adamant the units aren't a fire risk and are safer than those they replaced. Energy Safe Victoria is investigating claims power surges are causing smart meters to explode.[1]

"Our experience has shown that these issues are systemic in the industry and we are committed to delivering solutions that help our customers to overcome these challenges," said Sensus President Randy Bays in 2014.[2] Sensus manufacturers Smart Meters.

Institute of Electrical and Electronics Engineers (IEEE), 2012:[3]

> We are seeing a spate of reports from around the United States—and indeed around the world—of fires believed to have been caused by smart meters that were

[1] http://www.heraldsun.com.au/news/more-news/smart-meter-death-fears/story-fn7x8me2-1226285463342

[2] http://globalnews.ca/news/1489707/manufacturer-defends-smart-meters-after-fires/ August 3, 2014, citing Sensus press release

[3] http://spectrum.ieee.org/energywise/energy/the-smarter-grid/smart-meter-fire-reports

> faulty, incorrectly installed, or connected to circuits where there were unfortunate and unforeseen effects. This appears to be not just a matter of freak incidents that may or may not have taken place here or there… Obviously all companies with smart meter programs, and all their suppliers and sub-contractors, are going to have to take a close look at the issue of fire hazards. This is just the beginning of a difficult story. Companies installing smart meters already have run into a lot of consumer push-back because of concerns about privacy, security, and--sometimes--higher rather lower electricity costs. The last thing the smart grid needs is meters causing fires.

Utility companies and regulatory commissions have publicly denied these problems. Fire and electrical risks have not been disclosed to the public. In California, the California Public Utilities Commission refused to release results of a 2013 preliminary investigation on Smart Meter fires and declined to investigate further. California fire officials have yet to launch a public investigation despite continuing problems.

These electrical problems include:

Related issues:

In the U.S., common names for these meters include Smart, AMI (advanced metering infrastructure), AMR (automated meter reading), PLC (powerline communication), BPL (broadband over powerline), and ERT (encoder receiver transmitter). I use “Smart” or “digital” to describe these meters. Common electric meter brands used in California by investor owned utilities (IOUs) and municipal utility districts are Landis & Gyr, GE/Aclara (Aclara acquired GE’s electric meter division in 2015), and Itron.

Surges, surge protection, and grounding

Surges in the electrical current flowing through power lines can be caused by lightning strikes, power lines touching (eg. during windstorms, from falling branches, or when a pole is knocked down), malfunctioning transformers or other electrical equipment, disconnection and reconnection of power, arcing, fires on the lines, momentary connection losses, and other electrical problems.

Cyber-security expert Cynthia Ayres also told the Michigan legislature:

> It should be noted that massive surges (with much greater effects than weather related or other types of flow interruptions) are associated with severe space weather (geomagnetic storms caused by coronal mass ejections from the sun) and electromagnetic pulse (EMP) associated with high–altitude nuclear explosions – both of which have been known to cause arching [sic] and fires.[4]

Without protection, surges can flow into a building, destroying wiring and appliances, and start a fire. This can happen in seconds.

Detroit, March 17, 2017:

> A 95-year-old grandmother died this week after she was rushed to the hospital after power was restored to the family’s home and a surge started a fire.
> Reginald Hollman said after last week’s powerful storm, his family home lost power.

[4] Testimony to Michigan House Energy Committee March 7, 2017
https://smartgridawareness.org/2017/03/12/expert-testimony-retain-analog-systems/

> When power was restored, he said a surge rushed through home, starting a massive fire.[5]

Traditional analog electromechanical electric meters have a ground connection as well as surge protection which is based on spark-gap technology (like a spark plug).[6] The spark gap functions like a circuit breaker and protects the house from surges and overvoltage conditions. The analog electric meter clips to a pair of semi-circular metal rings that is connected to the meter box. These are connected to a neutral wire, then to a grounding rod which is in the ground. Spark gap technology allows current that exceeds a set threshold – generally 450 volts -- to "jump the gap", and the voltage is conducted to the ground. This spares the meter, the building, the building's wiring, and the plugged-in electronics from damage and fire. One engineer told me that a particular analog meter model would entirely disconnect power to the house if a surge was present and reset on the next half-cycle (within a few milliseconds) once the surge was gone.

The 1973 patent[7] for an overvoltage surge arrestor for GE meters by Ansell Palmer is an example of this technology.

Electric Power Research Institute, 2010:

> Electromechanical meters had no digital circuitry. They utilized spark-gap to control the location of arc-over and to dissipate the energy of typical voltage events. As a result, they were generally immune to standard surge events. This nature is evidenced in the section of ANSI C12.1 that specifies voltage surge testing, but allows that 'This test may be omitted for electromechanical meters and registers."[8]

This sophisticated spark-gap technology has worked for decades, protecting buildings from overvoltage conditions. Even with lightning strikes, analog meters with this technology have survived and protected their buildings. And this technology works repeatedly without damage to the meter, because there are no electronic components to wear out. In the case of a home that survived two lightning strikes (up to 30 million volts), the home and the meter were fine, because the surge went to ground.

New Smart/AMI/AMR/digital meters do not have this surge protection and do not have a connection to the ground.[9] See Appendix A photos comparing the back of an analog meter

---

[5] http://www.fox2detroit.com/news/local-news/242346844-story link no longer works,

[6] http://www.google.ca/patents/US3735259

[7] http://www.google.ca/patents/US3735259

[8] https://skyvisionsolutions.files.wordpress.com/2015/06/epri_-accuracy-of-digital-meters.pdf
"Accuracy of Digital Electricity Meters", Electric Power Research Institute, May 2010, p.7

[9] For example, http://www.freedom2sayno2smartmeters.org/wp-content/uploads/2018/06/Evaluation-of-the-Aclara-I-210C-AMI-Meter-v1.3.pdf
p. 5-6, Evaluation of the Aclara I-210+C AMI Meter, William Bathgate, May 30, 2018
(Aclara purchased GE AMI division)

with the back of an AMI meter.

Instead, meter manufacturers put a varistor – a voltage dependent resistor, or variable resistor -- on the digital meter circuit board.

All electronics have varistors. When there is an increase in voltage, the varistor will increase the resistance of the circuit to try to dampen the amount of voltage going across the lead. Voltage exceeding the varistor's limit (300-350 volts) will cause the varistor to explode, ruining the circuit board and the appliance or electronic equipment.

However, with a Smart/digital meter, when the varistor blows out, the current from the utility pole, including high voltage current, will flow directly into the building if any appliances or electronics are drawing power, and many of today's electronics and appliances are always on. The results can be burned wiring, damaged electronics and equipment, including well pumps, and fires.

"Varistors are useful for short duration protection in case of high transient voltage surges in the order of 1-1000 microseconds. They are however not suited to handle sustained surges. If a transient pulse energy in joules (J) is too high and significantly exceeds the absolute maximum ratings, they can melt, burn or explode."[10]

Electrical engineer William Bathgate:

> This small electronic part cannot withstand more than a 300 Volts AC surge. The part will explode when a line voltage surge exceeds this limit, such as when a tree branch touches the high voltage lines or lightning strike occurs nearby. Once this Varistor explosion has occurred it permits high voltage transfer to the other circuit board components and the circuit board substrate. This results in the AMI meter literally exploding from the meter socket or in a severe melting of the plastic components, likely leading to a fire and/or severe home damage. Most customers that comment when this occurs say they hear a load pop or a boom, followed by lights flickering, and followed by arcing at the meter housing. This is not how a circuit board should be protected…There is no sound electronic engineering firm that would permit 240 volts AC to short circuit across the circuit boards due to a component failure such as a Varistor. This is extremely dangerous. Once the progression of the subsequent short circuit begins the line transformer will apply up to 2,000 Amps to the meter housing until either the feed lines to the home disintegrate and vaporize or the transformer line breaker/fuse trips out after 50 seconds. By this time the damage is so extensive it is jeopardizing human and animal life. No such condition is possible from an Analog Meter.[11]

If a tree or branch falls across the lines and causes a high voltage line to contact a lower voltage utility line, much higher voltages can flow down the line into a building. And

---

[10] http://www.resistorguide.com/varistor/

[11] https://mi-psc.force.com/sfc/servlet.shepherd/version/download/068t0000001UX3MAAW Testimony of William Bathgate, 8/29/17, Michigan Public Service Commission

lightning strikes are about 30 million volts.

Electric meter testing company TESCO, 2015: [12]

"Electronic meters fail as do electromechanical meters but differently."

New failure modes include "Power supply damage due to lightning surges and other causes".

The fire department cannot get there in time once this chain of events starts because it happens so fast.

Repeated surges up to the meter varistor's maximum threshold will weaken the varistor and eventually destroy it, also allowing unregulated current to flow into the building.

Fire Chief Duane Roddy testified to the Michigan House Energy Committee in 2017 that he watched a Smart Meter ignite and arc at his home from a surge.[13] The electricity kept flowing and arcing, melting the lines to his house, and didn't stop until the transformer on the pole blew, and then the fuse on the pole finally tripped. In Pacific Grove, California, PG&E crews shut off power to repair a transformer. When they re-connected the power, they heard a popping sound, and a nearby building's Smart Meter and panel caught fire.[14]

This situation is similar to the 60 cent bolt that fails and brings down an airplane

Circuit breakers inside a house or building do not protect from outside electrical problems or incoming surges from the power lines. If an overage comes from the street or from the meter, the building's circuit breakers will not trip. Circuit breakers in a building only protect from inside electrical problems.

When a varistor explodes, it makes a popping sound.

Branches and trees fell on lines in the California North Bay fires, causing contact between higher voltage and lower voltage lines. Lines caught fire from the high voltage current. This high voltage current was flowing into homes, blowing out the varistors. Automatic restarters kept re-energizing the lines, keeping this high voltage current flowing and also sending repeated surges down lines into buildings, intensifying the problem – a particular problem

---

[12] Tom Lawton at 2015 conference sponsored by the Edison Electric Institute (EEI).
http://web.archive.org/web/20151123003953/http://www.slideshare.net/bravenna/site-verification-and-its-role-in-asset-management
http://www.eei.org/about/meetings/Meeting_Documents/FINAL - Metering Agenda-LaJolla.pdf
http://smartgridawareness.org/2015/11/03/catastrophic-failures-expected-with-smart-meters/

[13] https://youtu.be/qhQGmP_ixJw?t=2853 47:33 - 52:16
Michigan House Energy Committee February 21, 2017 (Fire Chief Roddy's testimony was not reported by the Detroit News)

[14] Incident report, January 22, 2012; https://cedarstreettimes.com/weekend-fire-puts-favaloros-out-of-commission/

with PG&E's system. Smart Meters could have malfunctioned in very significant numbers and actually caused many of the building fires.

East Palo Alto, Stockton, Summerland, Ontario, and Forest, Ontario are a few incidents when many Smart Meters failed simultaneously and spectacularly due to a surge.

Stockton, March 30, 2015:

> The smart meters were unable to handle the surge and exploded. Some of the explosions were serious, others were not.
> ...Stockton fire Capt. Bryan Carr with Engine 6, one of several fire crews dispatched Monday morning as dozens of electric customers began reporting explosions, smoke or the smell of burning wires, described the scene as "unreal" when his engine pulled onto Fairbury Lane, a residential street in southeast Stockton… His best estimate was that 50 or 60 homes had some type of significant electrical damage.[15]
> (GE and Landis & Gyr Smart Meters)

Summerland, British Columbia, Nov. 26, 2014:
69 Smart Meters damaged, and some blew off buildings.[16]

> (Itron Smart Meters)

Forest, Ontario, Nov. 7, 2013:

> 60-70 Smart Meters explode due to winds at Fairview Court Apartments.
> Don Plowright, who lives with his wife in the Fairview Court Apartments, says the meters sustained a lot of damage. "Some of them blew right off and hit one of the windows," he remarks. "Ours was all blackened. The people next to us, the meter was blown right off and the wires were sticking out."
> …Apparently, this was a totally new experience for Hydro One crews. 'They were really surprised. They said that they'd never had anything like this happen before...'
> Hydro One employee Ron Core, one of the crew members onsite, says the surge was caused when a 16,000 volt line landed on a 2,000 volt line during the high winds last Thursday, blowing one transformer and destroying the Smart Meters.
> … When [the meters] were installed at his former residence, Plowright says, "The guy that looked after that say they're not very good. Most of the old ones were made in Canada. These are made in China and they're not made to stand up to real rough weather. He didn't think much of them." The meters are manufactured by a company called Landis + Gyr…[17]

---

[15] CBS 13 http://scoopfeed.net/2015/04/05/stockton-ca-smart-meters-explode-after-truck-causes-power-surge/ link no longer works
http://www.recordnet.com/article/20150330/NEWS/150339956/101007/A_NEWS
https://www.youtube.com/watch?v=dpoJ-kP27aI

[16] http://www.stopsmartmetersbc.com/z/2014-12-14-power-surge-in-summerland-were-meters-involved/
http://globalnews.ca/video/1724887/summerland-still-dealing-with-november-power-surge-fall-out video is missing

[17] Forest Standard, November 7, 2013 (emphasis added)

East Palo Alto, Aug. 25, 2011:

> When Pacific Gas and Electric turned the power back on, the surge blew up a number of smart meters in homes. More than 80 fires were reported, and a number of home appliances were damaged. Homes that did not yet have the smart meters installed reported no problem.[18]
> Television sets and lights popped and and blew out in two East Palo Alto neighborhoods after a power surge Thursday night..[19]
> …The sustained electrical surge to more than 200 East Palo Alto homes and businesses lasted for about one hour and 20 minutes, until a PG&E crew shut off the power, according to a Menlo Park Fire Protection District incident report… Palo Alto utilities spokeswoman Debbie Katz said that surges have not burned out the city's analog meters.... "The idea with SmartMeters is to make the customers' and the utility's life better, but this is a good example of how sometimes the old way is the good way," Katz said.[20]
> (GE and Landis & Gyr Smart Meters)

Mindy Spatt, communications director of The Utility Reform Network (TURN):

> In the collective memory of TURN, we have not seen similar incidents with analog meters.[21]

Along with other utility companies in California, Pacific Gas and Electric instituted a Public Safety Power Shutoff (PSPS) policy during extreme fire danger conditions to de-energize both transmission and distribution lines. PG&E in particular began activating this with little advance warning to officials of affected communities which caused problems.[22] However, re-energizing electrical lines after power shut-offs will cause power surges, and these surges will hit all the Smart Meters in the area. No one is talking about this risk or the potential impact on well pumps and water availability.

---

[18] CBS 13 http://scoopfeed.net/2015/04/05/stockton-ca-smart-meters-explode-after-truck-causes-power-surge/ (emphasis added) link no longer works

[19] http://www.paloaltoonline.com/news/2011/08/25/power-surge-pops-lights-televisions-in-east-palo-alto

[20] http://www.paloaltoonline.com/news/2011/09/04/power-surge-raises-questions-about-smartmeters (emphasis added)

[21] ibid

[22] California Department of Public Health's county and city health officers heard a presentation June 6, 2019. It discussed the problems with PSPS as well as PG&E specific problems, which include PG&E's practice of sending public relations people to talk to local officials when there is a problem.
https://www.cdph.ca.gov/Programs/CCLHO/Pages/CCLHOBoardofDirectors.aspx June 6, 2019

National Electrical Code violation

National Electrical Code Section 240.4:

> 240.4 Protection of Conductors. Conductors, other than flexible cords, flexible cables, and fixture wires, shall be protected against overcurrent in accordance with their ampacities specified in 310.15, unless otherwise permitted or required in 240.4(A) through (G)[23]

All electrical components must be protected by a circuit breaker.

The NEC also says:

> Article 230 Services
> VII. Service Equipment – Overcurrent Protection
> 230.90 Where Required. Each ungrounded service conductor shall have overload protection.
>
> Article 240 Overcurrent Protection
> 240.15 Ungrounded Conductors.
> (A) Overcurrent Device Required. A fuse or an overcurrent trip unit of a circuit breaker shall be connected in series with each ungrounded conductor. A combination of a current transformer and overcurrent relay shall be considered equivalent to an overcurrent trip unit.[24]

Analog meters are grounded; they are directly connected to the ground via spark-gap technology, protected from surges. Smart/digital meters are not grounded.

Utility companies were granted an exemption from 240.4 when they were using analog meters, not electronic devices. Now however, utility companies have replaced analog meters with electronic Smart/digital meters and haven't made any provision for that change by installing a circuit breaker. When there's a surge, it goes directly to the Smart/digital meter's circuit board with potentially catastrophic results.

Since utility companies changed the nature of the meter, did not put in a circuit breaker, and have not revised the situation with the regulating body, they could be found in violation of the terms of the National Electrical Code exemption.

Electrical Engineer Tony Simmons:[25]

> I am a retired Electrical Engineer licensed in Nevada and California. I have 11 years' experience in electric utility meter operations ..The problem is meters and sockets

---

[23] National Electrical Code (2008)

[24] ibid

[25] http://www.stopsmartmetersbc.com/bcuc-smart-meter-fires-the-failure-to-protect/
http://tinyurl.com/SMFireReport
p. 32-33

> are NOT known to be properly protected with the correct fuse.
> …
> All electrical equipment is expected to fail eventually. The question is not "does it create a hazard If it fails"; the question is "does it create a hazard when it fails". The answer depends on the rating of the fuse protecting the meter and socket.
>
> The first instruction [below] is to use fuses. The second instruction is to not use the meter (as) a protective device – don't rely on the remote switch as a safety feature.
>
> (from the [Itron] manual)
> "All voltage paths (measurement and auxiliary) must be fused.
> Do not use any meter functions or features for primary protection purposes.
> Do not install the meter where failure of the device could cause death, injury or release sufficient energy to start a fire."
>
> … The more practical solution is use the correct fuse to protect the meter and socket as ITRON indirectly instructs. This is where the electric utility industry went wrong. Big time.

If the utilities were required to install a circuit breaker outside the meter -- between meter and building – the costs would have been substantial, and utility companies likely wouldn't have been able to make their business cases to the state regulatory commissions. In addition, the public would have raised safety questions about the new meters versus the analog meters, and refused to fund them.

In addition, master disconnect switches for buildings are often located next to electric meters. A meter fire makes it impossible for emergency responders to access the switch and turn off the electricity to a building. Electricity has to be disconnected at the pole by the utility company, resulting in a dangerous delay. This is another serious safety problem that is not addressed in state and local electrical codes.

No Protective Device Coordination Study

Electrical engineer Tony Simmons:[26]

> The utilities failed to perform the industry standard Protective Device Coordination Study. This study is also called the Short Circuit Coordination Study or mostly commonly, the coordination study.

Coordinated Power Engineering Inc.[27]

> A Short Circuit and Coordination Study is critical for the safe, efficient, and economical operation of any electrical distribution system. A Short Circuit Study will help to ensure that personnel and equipment are protected by establishing proper

---

[26] http://www.stopsmartmetersbc.com/bcuc-smart-meter-fires-the-failure-to-protect/
http://tinyurl.com/SMFireReport
p. 33

[27] www.cpeinc.net/PDFs/SCCCspecs.pdf (emphasis added)

> interrupting ratings. When an electrical fault exceeds the interrupting rating of the protective device, the consequences can be devastating, including injury, damaged electrical equipment, and costly downtime. A Coordination Study maximizes power system selectivity by isolating faults to the nearest protective device, as well as helping to avoid nuisance operations that are due to transformer inrush or motor starting operations.
>
> [National Fire Protection Association] NFPA 70B maintains that a Short Circuit and Coordination Study is a very important, yet sometimes overlooked step after the initial design and before the implementation of an electrical distribution system. The [National Electrical Code] NEC addresses the importance of this type of study in articles 110-9, 110-10, 240, and 517.17. It is clear that a third-party, independent study performed during/after the equipment submittal process, can prove to be invaluable. A Short Circuit and Coordination Study serves to incorporate all the system changes that come about after the initial design.

Smart and digital meters were not a part of the initial electrical power system design.

New failure mode – "catastrophic" failure

Electric Power Research Institute:

> The average person may have experienced a broken-down car, a worn-out appliance, or a piece of electrical equipment that died in a lightening[sp] storm, but most don't likely recall their electricity meter ever failing. Such is the reliable legacy of the electromechanical meter.
>
> By anyone's assessment, traditional electromechanical meters are an amazing piece of engineering work. Refined over a hundred years, the design of a standard residential electricity meter became an impressive combination of economy, accuracy, durability, and simplicity.[28]

According to industry experts, Smart/digital meters are subject to new failure modes, One of these new failure modes is catastrophic failure. Analog electromechanical meters do not have this failure mode.

From a presentation by TESCO in 2015:

> Electronic Meters – new failure modes require new testing and inspection methods
> Electronic meters fail as do electromechanical meters but differently.
> - Their overall life expectancy is not nearly the same
> - Failure modes include drift (unexpected)
> - Failure modes include catastrophic (expected)
> - Power supply damage due to lightning surges and other causes…"[29]

---

[28] "Accuracy of Digital Electricity Meters", Electric Power Research Institute, May 2010

[29] Slide from presentation by TESCO representative Tom Lawton at 2015 conference sponsored by the Edison Electric Institute (EEI). TESCO (The Eastern Specialty Company) is an electric meter testing equipment and services company. (emphasis added) http://web.archive.org/web/20151123003953/http://www.slideshare.net/bravenna/site-

The Saskatchewan government launched an investigation after a series of Smart Meter fires. “Eight meters failed catastrophically, melting or burning, and in some cases damaging the sides of houses.”[30] The report stated:

> A catastrophic failure has been defined by the consultants and industry as a meter which has burnt, melted, blackened, caught fire, arced, sparked, or exploded/blown from the premises.[31]

Overheating, inferior materials

Digital/Smart meters have electronics inside which create heat. Analog meters do not have electronic components which generate heat.

> “The electronics inside smart meters typically employ metal-oxide varistors (MOVs) for overvoltage surge protection. The problem arises from the lack of the heavy heat sinking capacity of the MOVs. This is needed in order to avoid failure due to overheating when they are energized. The physical construction of the smart meters does not allow for the heat generated by the energized MOVs to escape into the environment as there are few metal parts to act as a heat sink**.** Under the right conditions of over-voltage and line impedance, it may be possible to cause the MOV to burst into flames.[32] The Fire Marshal’s report[33] from Ontario, Canada noted overheating and fires associated with MOVs.”[34]

---

verification-and-its-role-in-asset-management
http://www.eei.org/about/meetings/Meeting_Documents/FINAL - Metering Agenda-LaJolla.pdf
http://smartgridawareness.org/2015/11/03/catastrophic-failures-expected-with-smart-meters/

[30] http://www.saskatchewan.ca/~/media/news release backgrounders/2014/oct/1 cic introduction.pdf p.2
http://www.saskatchewan.ca/~/media/news release backgrounders/2014/oct/2 pwc final report.pdf p.3

[31] http://www.saskatchewan.ca/~/media/news release backgrounders/2014/oct/3 ritenburg final report.pdf
http://www.saskatchewan.ca/government/news-and-media/2014/october/27/smart-meter-review
CIC Smart Meter Review Makes Recommendations to Improve Crown Procurement
The head of the provincial utility SaskPower resigned after these reports were released.

[32] http://en.wikipedia.org/wiki/Varistor

[33] https://skyvisionsolutions.files.wordpress.com/2014/08/firemarshall-report-smart-meter-fires-canada.pdf
“Utility “Smart Meters”, Ontario Fire Marshall Armen Kassabian, June 15, 2012

[34] https://takebackyourpower.net/smart-meter-fire-risk-liability-is-undeniable-and-unprecedented/

Norman Lambe, a California insurance adjuster, has investigated fire-related Smart Meter incidents. In 2015, he said that overheating is a primary cause of these fires. He said the meters spark and make too much heat when they operate, and the materials within the meters are flammable in the right heat conditions.[35]

"Today's meters are light. The old ones were heavy and dissipated heat a lot better, actually," said Ken Dimpfl, manager of meter engineering with American Electric Power (AEP), while discussing temperature data analytics at Utility Analytics Week in New Orleans.[36]

The UK East Sussex Fire Service reports: "[T]he amount of current being drawn is an important factor, since the greater the current, the higher the risk of resistance heating in a poor connection."[37]

Burned meter-to-meter-box connections

Engineer William Bathgate's Smart Meter was installed in 2015. By 2017, due to network malfunctions, the utility company wasn't receiving the meter's wireless data transmissions, so they started sending him estimated bills. He decided to opt-out.

> When the AMI meter was removed. I discovered that the one set of contacts had all burned up from excessive heat.
>
> This was a new meter box in 2015 and in use for about 2 years. It could have easily led to a meter fire without warning. If I had not changed my meter, I would never have known there was a problem. How many other meter boxes are at risk with the same conditions today? The only way we will know is when we begin to see more meter fires. Unfortunately once a fire begins at the meter contacts all evidence of the root cause are near impossible to determine. The utility concludes without any evidence that the meter fire occurred due to customer wiring. Had I known that placing an AMI meter on my home would lead to burned contacts on my home, I would never have permitted its installation.[38]

---

35 http://www.naturalnews.com/055227_smart_meters_catching_fire_safety_risks.html#ixzz4JiYE2Q2R

36 http://smartgridawareness.org/2015/11/03/catastrophic-failures-expected-with-smart-meters/

37 Investigation Report into: Fires Originating in Electrical Intakes, Mark Hobbs, Lead Fire Investigation Officer, East Sussex Fire & Rescue Service, UK, July 2010

38 https://mi-psc.force.com/sfc/servlet.shepherd/version/download/068t0000001UX3MAAW (emphasis added)

Faulty remote disconnect switch

PG&E whistleblower Patrick Wrigley told the CPUC December 20, 2012:

> I was a meter reader for nine and a half years with PG&E in the Marin office before I was illegally fired because I was not intimidated into being quiet with the problems I saw firsthand regarding smart meters' inaccuracy…The fact that PG&E knows that they do catch on fire when they are remotely turned back on when a customer who is delinquent in their bill finally pays their bill. These meters catch fire. They know it, and they are covering it up.[39]

Utility companies used to send an employee to manually disconnect electricity from a building. With Smart Meters, the company sends a wireless signal to the meter, and it disconnects the electricity. Electricians have told me it takes strength to turn off a house's electrical power, and wonder what could be so powerful in a plastic Smart Meter to disconnect this current. With disconnection, there can also be arcing.

From Reno, Nevada:

> While city fire investigators have been unable to determine exactly what is causing the meters to combust, the electrician who replaces the burned meters said it appears to him that the "relays" inside the meter are overheating at the switch NV Energy uses to remotely disconnect the power.
> "That's where I think the problems are occurring," he said. "I even saw a couple here where the meters had just started to turn black. Everything in the panel is fine, it's just the meter is starting to go."
> A forensic investigator hired by the Reno Fire Department to examine four of the meters involved in the Reno and Sparks fires found that the blazes started within the meter itself.[40]

In 2011, an electrician wrote:

> One of the novel features in the new meters is the incorporation of an internal disconnect switch that the power company purports safely disconnects/reconnects power to the dwelling it supplies by remote control. This disconnect feature is a new and significant change to the old style analog meters. The safety of the new disconnect feature is in question.
>
> As a California Electrical Contractor, I estimate that a 200 amp disconnect enclosure would be sized roughly 20″x 20″x 6″, several times larger than a smart meter. Concerned about this, I asked other electrical contractors' opinions about the remote disconnect switch. Like myself, they found it hard to believe a 100, 200, or 400 amp disconnect switch can be crammed into a tiny meter enclosure.

He asked:

---

[39] California Public Utilities Public Participation Hearing (PPH), December 20, 2012, Santa Rosa, From the official transcript
http://www.scribd.com/doc/118148663/CPUC-PPH-Santa-Rosa-Transcript

[40] https://www.rgj.com/story/news/2014/09/21/reno-smart-meter-fires-widespread-first-feared/15897355/

> Is there a full load test for the meter disconnect switch?
> If a dwelling's electrical service is rated at 200 amps, the meter has the potential to have a 200 amp load. Are the smart meter disconnects rated for the maximum potential load of the dwelling it serves?
> Are the smart meter disconnects tested and certified to safely disconnect/reconnect under full load conditions?[41]

Is the disconnect switch certified at all? In the new UL 2735 certifications, are meter models certified without the disconnect switch or other components?

Electrical engineer William Bathgate:

> After a hard look at the design and construction of this ITRON meter there are the following observations:
> The biggest weakness is the power disconnect, it suffers from a small surface area for the disconnect contact and would be prone to excessive heating and likely result in contact pitting and carbon deposits that are not readily visible by the customer and there is not a sensory circuit that could detect it and report it to the customer or the utility. The design would be prone to creating unpredicted fires.[42]

Electrical engineers evaluated the British Columbia Utility Commission's draft report on Smart Meter fire safety concerns (Itron Smart Meters) and among their conclusions found:[43]

> A critical item missing in this Report is any investigation and discussion about the meter's built-in 200 Ampere disconnect switch. The switch is not CSA[44] certified, yet it is being used as a "Service Disconnect Switch" – (CSA Code definition), for which it is not designed. Several requests for technical performance and certification data have been ignored by [utility company] BC Hydro and by Itron. The switch is a potential failure mechanism, in particular during fault conditions, because as described elsewhere, the electrical protection on the HV side of the transformer does not appear to adequately protect the electronic meter from excessive fault current. This BCUC Report states that BC Hydro meters do not need to be certified under the Electrical Safety Regulations, however it also states that BC Hydro is NOT exempt from the Electrical Safety Act. An immediate investigation into the design, certification, testing, operation and capabilities of this disconnect switch is

---

[41] http://1hope.org/hopeblog/unknown-safety-of-smartmeters-new-disconnect-switch/
Unknown Safety of New On-Off Switch in Smart Meters:
CPUC Meter Safety Testing Confirmation Needed.

[42] http://www.stopsmartmetersbc.com/wp-content/uploads/2017/04/Evaluation-of-the-ITRON-Open-Way-AMI-Meter-PowerPoint-by-William-Bathgate-Jan.12-2017-v8-3-2-2017.pdf
http://www.stopsmartmetersbc.com/bcuc-smart-meter-fires-the-failure-to-protect/
Cited in http://tinyurl.com/SMFireReport p. 34

[43] http://www.stopsmartmetersbc.com/bcuc-smart-meter-fires-the-failure-to-protect/
http://tinyurl.com/SMFireReport p. 77

[44] Canadian Standards Association

required.

British Columbia never finalized its report.

Insurance adjuster Norman Lambe to New Mexico Public Regulatory Commission:

> Unlike analog meters, "smart" meters can turn power "on" or "off' remotely. Sometimes, during activation of this remote switch, a tremendous burst of power can cause arcing in the meter and result in fire. As noted in the report by EFI Global (CFRE NL 3 b p.4), "All observed damage to the electrical panel and the meter itself is consistent with a fire triggered by extreme heat at the defective switch contacts inside the meter. The heat transferred to the metal clips, which were held in position by a resin-based insulator. the extreme heat ignited the insulator. The ensuing fire burned upward inside the panel, explaining the damage to the circuit breaker located directly above it. Open flame conducts electricity, so the flame drew an arc between the two energized power rails in the panel, explaining the unusual arc patterns in the center circuit on the panel, which was not part of the 'HP' meter circuit."[45]

Portland General Electric removed 70,000 Smart Meters after several house fires, saying the disconnect switch was faulty.

In 2015, Quebec began requiring a separation distance of three linear meters between propane tanks and Smart Meters. The rule only applied to Smart Meters. Utility company Hydro Quebec inspected properties to check compliance. "Until your installation has been checked and found to be up to code, the remote service interruption feature will be deactivated."[46]

Circuit boards in electric meters

Electrical engineer William Bathgate:

> The fact that there is a set of circuit boards in a power meter at all is a large risk. The circuit boards would not be able to withstand a lightning strike or a power surge without an explosive reaction and likely melting of the circuits. This would lead to total destruction of the unit and lead to a possible fire.[47]

EMSG Inc.:

> Circuit boards aren't invulnerable either. Over time, they experience a great deal of wear and tear that can deteriorate their performance and functionality. Things such as the weather, humidity, age, and even elevation can affect the condition of a

---

[45] http://www.electronicsilentspring.com/wp-content/uploads/2016/10/nl.pdf -- p. 8

[46] http://ofsys.hydroquebec.com/T/OFSYS/SM2/2/S/F/4947/13087532/Dnm3qyNW.html

[47] http://www.stopsmartmetersbc.com/bcuc-smart-meter-fires-the-failure-to-protect/
http://tinyurl.com/SMFireReport
p. 34

board.[48]

Smart/digital meter circuit boards are not in a climate-controlled, protected space. They are outdoors, exposed to all the elements including sun, extreme hot and cold temperatures, moisture, wind, dust, rain, and snow.

Energy Central:

> Look under the plastic covers of any smart device, and you will see a printed circuit board and attachments and wires that should be familiar to anyone in the computer industry. This simple fact should give everyone using this equipment pause. Why would this equipment, whose origins and designs have been forged in a throw-away culture of consumer electrics, be durable enough for the demands of the electric utility? The answer is clear. They aren't.
>
> …Enter the electronic era. Smart meters are already posting failure rates, anecdotally, in the 5% per annum range. This is ten times the failure rate of the traditional meter, and the lifecycle of the product has barely begun. Each additional device connecting the meter to the mothership also has a failure rate. The stability of the grid can only be as good as the weakest device -- yet we don't know which devices are weak. Selecting products for reliability is now essential, but the tools for making associations between products and reliability are entirely missing.[49]

Melting solder can create new circuit pathways

Fire and excessive heat can melt solder. This is a circuit board vulnerability. If the solder melts, it can create a new pathway, resulting in a short circuit, and potentially, a fire.

Thinner blades, meters don't fit sockets, pitting

Bobby Reed, a Texas IBEW business manager and troubleshooter for utility company Oncor was fired by Oncor after he testified to the Texas legislature about Smart Meter fires and electrical problems that were regularly occurring and the risk to electrical workers. The complaint to the National Labor Relations Board[50] about his firing detailed evidence that Smart Meter fires, burned Smart Meters, overheating, arcing, burned meter sockets, and malfunctioning Smart Meters are regularly occurring and are known to Oncor and CenterPoint, two Texas utility companies.

> What I came to testify about today is when they started installing the AMS meters, I noticed that the tickets that I worked or the work orders that I went out on were beginning to be increasingly of the meters burning up and burning up the meter

---

[48] http://emsginc.com/resources/5-most-common-pcb-repairs/

[49] https://www.energycentral.com/c/iu/dirty-little-secret-smart-devices-are-consumer-electronics

[50] NLRB Decision and Order: http://apps.nlrb.gov/link/document.aspx/09031d4582177a1a Bobby Reed's Senate testimony is on p. 13-14

> bases. And it's kind of a two-issue thing there I wanted to bring up to you.
> But I can't tell you how many times I went out. And when I go to a low income house where this lady comes out, this elderly woman, that's widow woman and she says, you know, "What's the problem?" And I said, "Well, your meter base burnt up, and it's your equipment and you have to pay for the repairs before you can get your lights back on." And she tells me, "Well, I've been living here for 45 years, and I've never had a problem until they installed that meter." And that just has happened a lot.
> When this started to increase--
> SEN. CARONA: Do you believe that it is attributable directly to the meter or perhaps the age of the line in a box?
> MR. REED: No, it's the meter. And I've read that about the wiring in the box. But the meter is just a little bit bigger than the old analog meter, and especially for an older house, it's a 100-amp meter base normally. And when you have to set that meter, it's a little bigger, and the cover won't go down. So people have to manipulate that meter in order to get the cover to lock.
> But when I started noticing this, I called the union there in Houston and asked them if they were experiencing the same thing. And he told me he would go by the meter shop that next day and then call me. And he called me the next day and said that they are experiencing a significant increase in the meters being turned in that are burnt up from the old analog meters to now, the AMS meter."

Two reasons identified by union workers were the thinner blades in Smart Meters, and that Landis and Gyr Smart Meters were too big for the meter socket.

> Smart meters do not fit into the base properly, leaving a gap which leads to arcing and fires. The base was designed and certified to hold an analog and nothing else.

The meters mentioned were Itron and Landis & Gyr. In California, Itron Smart Meters are used by Southern California Edison, San Diego Gas and Electric, and Los Angeles Department of Water and Power. Landis & Gyr Smart Meters are used by PG&E and Sacramento Municipal Utility District.

The blades of the meters must provide contact with the jaws of the meter socket. If the blades are too thin or the meter isn't the right size, this causes inadequate contact or gaps, and that will cause arcing. This is a fire hazard and also results in pitting of the metal surface which will increase arcing. Arcing also creates transients which in turn affect the electrical wiring and appliances and electronics.

Sharon Noble, Coalition to Stop Smart Meters BC, has been investigating Smart Meter fires for many years and lobbying the government to take action. In 2014, she wrote,

> According to electrical engineers in our group, the Canadian Standards Association (CSA) is quite concerned because the base was certified to hold an analog, not an digital meter running on electricity. CSA said the bases could lose their certification because there has been no testing to ensure that the base and the meter are compatible. Due to the thermal resistance created by the corrosion, the electricity begins to arc and these arcs ignite the main insulation wiring causing electrical

shorts that start fires.[51]

Malfunctioning temperature alarms and sensors

Thermal sensors have actually been installed in some meters to notify utility companies of potential problems or shut off the electricity. However, these have malfunctioned as well.

Engineer William Bathgate: "There are supposed to be sensors of high heat within the meter, but it did not detect the condition at my home [with the burned contacts]."[52]

Take Back Your Power:[53]

> As reported in a 2013 Illinois Commerce Commission (ICC) report,[54] some utilities are attempting to mitigate smart meter fire risks by 'proactive temperature monitoring.' However, as stated in the ICC report: "The majority of ComEd's AMI meters (GE) are equipped with temperature sensors and can report their internal temperature on command -- [a]though the temperature sensor was not designed for that function. However, a problem with the scans soon made itself known. Apparently, radiofrequencies can enter the meter and cause the temperature sensor to report significantly inaccurate measurements."
>
> Also, the previously mentioned document[55] submitted to the Maryland Public Service Commission in the form of comments contains the following language: 'T]he meter (BGE uses L&G) burned up despite the sensing device. Although no fire occurred, the safety system failed miserably. "[They] could actually hear the meter sizzling as if something was being fried inside it. " What this clearly demonstrates is that the remote sensing system the utilities are relying on is hardly foolproof. One can only imagine what would have happened if there had been a real fire.'"

Switching mode power supply surges (SMPS), damaged appliances

A switching mode power supply (SMPS) in the Smart/digital meter constantly converts the incoming alternating current (AC) to direct current (DC) to power the meter and its electronics. This causes surges. These constant surges go into the home or building along the wiring and to all electronics and appliances and their varistors. A varistor in a piece of

---

[51] http://marylandsmartmeterawareness.org/smart-meter-news/maryland-smart-meter-awareness-and-anne-arundel-county-environmental-council-request-moratorium-on-all-smart-meter-installations-in-wake-of-house-fires/

[52] https://mi-psc.force.com/sfc/servlet.shepherd/version/download/068t0000001UX3MAAW

[53] https://takebackyourpower.net/smart-meter-fire-risk-liability-is-undeniable-and-unprecedented/

[54] https://skyvisionsolutions.files.wordpress.com/2014/08/icc-smart-meter-fires-staff-report-2013.pdf

[55] https://skyvisionsolutions.files.wordpress.com/2014/08/comments-on-meter-fires-from-msma-final.pdf

equipment can take only so many surges before it fails and destroys the motherboard.

Many people have reported damaged or destroyed appliances and electronics after Smart Meter installations. This can occur weeks or many months later.

RF signal and SMPS transients routed onto building wiring

Every electronic component you purchase needs a connection to ground to work. It protects the circuit by routing the currents to ground. On the 3-prong plug for electronics and appliances is the wire for the ground.

The switching mode power supply (SMPS) in electronic devices creates transient voltage. If the SMPS creates transient voltage above 60 Hz, those transients are normally routed to ground, just like surges.

Smart/digital meters create transients but have no ground path. Therefore, there is no way for the meters to shunt the transients to ground.

Electrical engineer William Bathgate:

> On examination of typical meters, including ABB, GE, ITRON and Landis+Gyr, and many others they report that, in addition to its RF transmitter, each wireless digital meter also has a component called the 'switching-mode power supply' (SMPS) – switching power supply for short. Its function is to 'step down' the 240v alternating current (AC) coming in from the utility pole power lines to the 3.3 to 12 volts of direct current (DC) required to run the meter's digital electronics which record the electricity usage data and send out the various RF transmissions.
>
> The SMPS function emits sharp spikes of millisecond bursts constantly, 24/7. The SMPS on the commonly used Silver Springs Network, OWS 514 NIC model, for instance, which is within the smart meter models widely installed by PG&E and other utilities throughout their territory, has been measured to emit spikes of up to 50,000 Hz and higher. This constant pulsing of high frequencies, in addition to the RF function, is causing not only interference with other electric and electronic equipment in many homes with smart meters installed, but also is causing havoc with biological systems in its field of exposure. [56]

A 2010 report by Cindy Sage/Sage Associates and electrical engineer James Biergiel warned

> Typical gauge electrical wiring that provides electricity to buildings (60 Hz power) is not constructed or intended to carry high frequency harmonics that are increasingly present on normal electrical wiring…Harmonics are higher frequencies than 60 Hz that carry more energy, and ride along on the electrical wiring in bursts It may be contributing to electrical fires where there is a weak spot (older wiring, undersized neutrals for the electrical load, poor grounding, use of aluminum conductors, etc.).

---

[56] https://www.defiltersllc.com/new-critical-problem-with-smart-meters/
New Critical Problem with 'Smart' Meters -- Just When You Thought It Was Safe to Opt-Out, William Bathgate

> The use of smart meters will place an entirely new and significantly increased burden on existing electrical wiring because of the very short, very high intensity wireless emissions (radio frequency bursts) that the meters produce to signal the utility about energy usage.
> … [W]hen the wireless signal is produced in the meter... it boomerangs around on all the conductive components and can be coupled onto the wiring, water and gas lines, etc. where it can be carried to other parts of the residence or building.
> It is an over-current condition on the wiring. It produces heat where the neutral cannot properly handle it. The location of the fire does NOT have to be in close proximity to the main electrical panel where the smart meter is installed.
> … For fires that are 'unexplained' or termed electrical in nature, fire inspectors should check whether smart meters were installed within the last year or so at the main panel serving the buildings. They should question contractors and electricians who may have observed damage from the fire such as damage along a neutral, melted aluminum conductor or other evidence that would imply an overcurrent condition.
> … Faulty wiring, faulty grounding or over-burdened electrical wiring may be unable to take the additional energy load.[57]

Interference with AFCI/GFCI

Wireless signals and transients produced by the Smart/digital meters interfere with ground fault circuit interrupters (GFCIs) and arc fault circuit interrupters (AFCIs). This interference can make them trip or prevent them from tripping[58] PG&E reported this in 2011, though they claimed these were "limited problems."

In 2014, a Masters degree candidate at the University of Texas studied Smart Meter interference with GFCIs.

> It has been reported that the RF transmissions from Smart Meters can induce false tripping events on GFCI outlets installed on temporary construction poles…Controlled investigations in the laboratory have shown that the tripping events are repeatable and it has been found that the RF transmissions from the Smart Meter's wireless radio are likely the cause of the unexpected GFCI tripping events. The tripping is caused through the coupling of the roughly 900 – 930 MHz transmissions into the sense electronics within the GFCI…It was concluded that both radiative and conductive interference was occurring, both of which could completely independently cause the GFCI to trip…Not only could conductive interference occur between the two devices, but the wire used to power the GFCI off of the Smart Meter was acting as an antenna.[59]

---

[57] http://eon3emfblog.net/wp-content/uploads/2010/09/Wireless-Smart-Meters-and-Potential-for-Electrical-Fires.pdf
Wireless Smart Meters and Potential for Electrical Fires, Cindy Sage, Sage Associates and James J. Biergiel, EMF Electrical Consultant, July 2010

[58] https://skyvisionsolutions.files.wordpress.com/2014/08/pge-gfci-and-afci-rf-interference.jpg

[59] https://rc.library.uta.edu/uta-

Certified home inspector Jim Hime:

> Smart meters are now being installed in my area. Smart meters are starting to trip AFCI's as reported by 2 electricians I know and work with so far.
>
> As you know, an arc fault breaker looks at an electrical [sine] wave and figures out what's right and what's not. When it "see's" the signature of an arc, it trips. RF (radio frequency) interference has nearly the same electrical signature as an electrical arc.
>
> Guess how the new smart meters talk to the home office? (radio frequency) Where the electrical panel is located next to the smart meter problems have developed according to my bubba electricians.
>
> This is NOT a builders problem. It is a utility company problem. A builder has no control over a utility company. What can someone do? Write your congressmen and ask that the utility companies go back to the drawing board…[60]

Moisture, heat, and flammable lithium batteries

Smart/digital meters are not watertight or hermetically sealed.

Ritenburg & Associates Report, October 24, 2014:

> After reviewing the information available, we are of the opinion that moisture and contaminants within the Sensus meter has been a major factor in the meter failures and ensuing fires. We have not found any issues with the new meter installation methods and practices… As there is some danger with destructive meter failures and potential resulting fires, we recommend that the existing Sensus Generation 3.3 meters be replaced as soon as possible. As the existing meter fires have had a close relationship to precipitation levels, SaskPower might wish to consider replacement no later than the end of winter and before the spring thaw and spring rains begin. [61]

Smart/digital meters use 1-cell lithium batteries for the memory, and gas Smart Meters use lithium batteries for the RF transmission. Lithium batteries are very flammable to water, causing them to catch fire or explode. Since meter cases are not watertight, batteries are

---

ir/bitstream/handle/10106/24887/Donahue_uta_2502M_12842.pdf?sequence=1&isAllowed=y
"The Study of the Effect of Smart Meter RF Transmissions on Ground Fault Circuit Interrupters" Simon Donahue, December 2014, University of Texas

[60] https://forum.nachi.org/t/smart-meters-tripping-afcis/63603
"Smart Meters tripping AFCIs", Jim Hime, October 2011, InterNational Association of Certified Home Inspectors

[61] http://www.saskatchewan.ca/~/media/news release backgrounders/2014/oct/3 ritenburg final report.pdf
CIC SaskPower Smart Meter Program: Electrical Fire Investigation and Review, Ritenburg and Associates, Ltd., October 24, 2014 (p. 3, 26)

exposed to moisture, including humidity and rain. In a fire, the plastic cases and parts of gas and electric Smart/digital meters will melt and burn, exposing the explosive batteries to water. Furthermore, in coastal areas, there is salt in the vapor, and that salty moisture can corrode the batteries. Components on a circuit board will not last; this salt will cause corrosion including to the solder joints. Over time, this will cause bridging, leading to short circuits and circuit board failures.

Lithium batteries are also vulnerable to overheating which will cause them to explode.

Gas AMI/AMR digital meters containing lithium batteries pose additional threats of ignition of gas lines if gas meters catch fire, melt, or explode.

Risks from AMI/AMR water meters

AMI/AMR digital water meters contain lithium batteries and are a fire risk due to their normal proximity to water. These meters are also commonly located in the public rights of way, and can be near trees and vegetation. New water meter pit covers are made of flammable fiberglass instead of dense concrete in order for the RF signal to pass. These covers and meter plastic components would be destroyed in an externally originating fire or a meter fire.

Water lines could be ruptured if water meters catch fire or explode. If that happens, water pressure and water availability to fight fires will be compromised. This may already have happened in fires.

Analog electromechanical and water and gas flow meters do not contain these ignition sources.

UL certification of meter models that cause fires

In 2012, Underwriters Laboratory said:

> UL has a program for Listing of Utility Meters, but since there is no regulation in USA that requires utility meters to be Certified, this is an entirely voluntary program.[62]

However, the public increasingly raised the issue of no UL certification of Smart Meters especially in light of fires and electrical problems.[63]

In 2015, MetLabs acknowledged fire hazards and other problems, and announced a new

---

62 http://www.psc.state.fl.us/Files/PDF/Utilities/Electricgas/SmartMeters/09_20_2012/WorkshopComments/MaredyHanford.pdf -- p. 4
Correspondence with Mike Chan, Underwriters Laboratory, Sept 24, 2012 (emphasis added)

63 http://www.smartgridtoday.com/public/ComEd-asks-GE-to-get-UL-seal-based-on-consumer-expectations.cfm link no longer works

voluntary UL standard for these meters:

> In the past, design flaws in smart meter units have been known to cause serious fire hazards and spotty performance. This has caused a lot of concern for utilities and manufacturers of smart meters….To prevent problems like this, a new voluntary safety standard – UL 2735 – has been created for electric utility meters…[64]

However, doubts have been voiced about this new testing.

Insurance adjuster Norman Lambe told the New Mexico PRC in 2016:[65]

> UL has a new certification standard that is said to have been developed to insure the safety of "smart" meters, UL Standard 2735. But, even this certification is not sufficient. The very meters that have received this certification, Sensus and Landis & Gyr, have caused fires.

For instance, the Smart Meters in Saskatchewan that caused fires were sent for certification, and "…the Sensus meters passed all safety tests under the UL 2735 Standard for Safety for Electric Utility Meters, which test resistance to flame, water, temperature swings and exposure to various voltages and other extreme operating conditions."[66]

Underwriters Laboratory and other certification companies may remove the remote disconnect switch and other components before testing. These companies may test components individually, not as a complete meter. Meters may only be tested in a laboratory and in isolation, not under "real world" conditions -- being connected to a building, in an analog-certified socket, in a mesh network, PLC, or cellular system, and as part of a bank of meters.

Flawed FCC requirements and testing

Isotrope, LLC: [67]

> Conclusions in this report include the observation that [FCC] Part 15 radiated--- and conducted---emissions testing of electrical meters does not replicate actual conditions because a power cord is attached to the meter socket in the test

---

[64] http://www.metlabs.com/blog/meters/new-ul-2735-electric-utility-meter-standard-ensures-safety-and-performance/ (emphasis added)
New UL 2735 Electric Utility Meter Standard Ensures Safety and Performance
Posted in http://smartmeterharm.org/2016/01/05/international-lab-says-smart-meter-design-flaws-known-to-cause-serious-fire-hazards/

[65] http://www.electronicsilentspring.com/wp-content/uploads/2016/10/nl.pdf (emphasis added)

[66] https://www.greentechmedia.com/articles/read/sensus-smart-meters-pass-ul-safety-tests-but-fire-concerns-remain

[67] Report on Examination of Selected Sources of Electromagnetic Fields at Selected Residences in Hastings-on-Hudson, November 23, 2013
http://stopsmartmetersny.org/images/Report_on_Examination_of_Selected_Sources_of_Electromagnetic_Fields_at_Selected_Residences_20140301.pdf (emphasis added)

chamber rather than simulating the installation of the meter on a meter socket connected to both the power grid secondary and the residence distribution panel. Moreover, while the conducted emissions from the meter at 915 MHz ISM frequencies in a residence was observed to be substantial, FCC Part 15 regulations limit conducted emissions testing to 30 MHz, ignoring the conducted emissions of the AMR radio signal.

…

7. Summary Conclusions

…

- AMR Conducted Emissions Are Strong, but Not Regulated. The conducted emissions of the AMR electric meters at the 915 MHz band are substantial, but are not regulated by Part 15 (which cuts off above 30 MHz). If the 30 MHz limit were applied to 915 MHz, it is probable that the meter would fail a lab test, subject to the following observation.
- AMR Meter Lab Testing Fails to Simulate in Situ Wiring. The lab testing of the AMR meters employed a simple power cord temporarily attached to the meter mounted in a panel. The meter does not normally employ a power cord. This approach does not simulate the manner in which the house wiring feeds through the electric meter. The meter has two power connections: one entering the meter typically from the top to deliver power to the meter and another exiting the bottom of rear of the meter panel to supply power to the main breaker panel. Using a power cord instead of setting up the power wiring the way the device is actually used may not reveal how the house circuit wiring through the meter may act. The actual in situ wiring may be more like an antenna that may pick up unwanted RF energy and noise within the meter and conduct it into the residence. See photo appended to this report [p. 15-16]

Other noise frequencies above 30 Hz caused by the switched mode power supply would not be regulated by FCC Part 15 either.

Inadequate worker qualifications and training, poor installation quality

PG&E hired the company Wellington to install most Smart Meters. Wellington hired people who were not electricians and gave them a minimum of training on how to remove the analog electric meters and install gas and electric Smart Meters. Installers were paid per meter they installed and were also awarded bonuses for exceeding quotas. They incentivized installing meters as quickly as possible. This was true of other utility companies in the U.S. and other countries. Many times these contractors would not notify building occupants they were installing meters and disconnecting the electricity, endangering the people in the building or home. There were also accounts of contractors removing the meters under load – not disconnecting the electricity at all. This is a fire risk and a very hazardous procedure.

The Saskatchewan provincial government changed the law to allow SaskPower to use unqualified workers to install Smart Meters.[68] This was discovered through Freedom of

[68] http://www.theglobeandmail.com/news/national/saskatchewan-changed-law-to-allow-unqualified-workers-to-install-smart-meters-ndp/article20086884/
http://www.ndpcaucus.sk.ca/government_has_known_using_non_electrical_workers_mad

Information requests. "(International Brotherhood of Electrical Workers) IBEW Local 2067 originally fought the exemption, saying it had 'serious reservations about the potential for injury or property damage and the lack of qualified supervision.' The change went ahead anyway. On March 1 this year [2014], the meter replacement workers were brought into the union, their safety training "beefed up," and wages and benefits increased."[69]

Tennessee IBEW local 1288 strongly opposed Smart Meters over the high program costs, fire danger, overbilling by the meters, loss of jobs and value of on-site inspections.[70]

However, in California and other areas, IBEW actually promoted Smart Meters and the temp jobs at public city and county hearings, and opposed Smart Meter moratoriums.

IBEW supported unskilled workers installing Smart Meters. Why? Because "the meter replacement workers were brought into the union." How much did utility companies and contractors pay IBEW to enroll installers as temporary union members? Which state officials gave these temp workers a qualifications waiver from state safety rules?

A former Wellington worker talked with Stop Smart Meters! in 2011:

> SSM: The FCC requires that these devices be installed by trained professional electricians. What kind of training did you receive prior to working as a 'smart' meter installer?
>
> WW: We received only two weeks of training before they sent us out to do the installations. Though the procedure is relatively simple, if you get it wrong this can lead to arcing, shorts- even house fires. The blades on the back of the meter have to be aligned properly with the jaws on the socket the meter gets placed in. I kept hearing one of the managers say, "you guys weren't trained properly." …There was a lot of pressure on workers to install as many meters as possible in a day in order to earn bonuses. I overheard numerous times while at work, "you could have burned that goddamned house down."…The more you called Wellington, the worse it looked on your record- because you're wasting time. I saw sparks coming from one of the meters on a home. I reported it but am not sure what- if anything- was done.[71]

A fire captain called PG&E when he had electrical problems following Smart Meter installation. A PG&E worker checked his electrical system.

---

e_smart_meters_dangerous link no longer works

[69] http://www.leaderpost.com/health/Smart+meter+installers+problem+Union/10141322/story.html (emphasis added) link no longer works

[70] https://web.archive.org/web/20130617155711/http://www.wmctv.com/story/22229806/unions-oppose-mlgws-smart-meter-expansion

[71] http://stopsmartmeters.org/2011/01/26/stop-smart-metersexclusive-interview-with-a-wellington-energy-whistleblower/

> He then proceeded to tell me that they were having nothing but problems with the contractor who was installing the meters and that it was costing PG&E more money to follow the contractors through each neighborhood and fix the problems they were causing and that the reason they did this is that PG&E didn't want to pay its own workers wages and wanted a cheaper price…
> He then went on, telling me that the burnt area was more than likely due to the contractors not being able to fit the new Smartmeter into place, so they widened the receiving clip and shoved it into place. By them widening the clips, they caused an area of no contact which then caused arcing every time we used an appliance with 220v.
> …He then kept telling us more and more about all the problems and how this company only gave these people installing the meters two days of training and were hiring people who were not electricians. He also told us about injuries to contact [contract?] employees were receiving due to lack of training.[72]

Vulnerability to hacking

Cybersecurity has been a problem with Smart Meters from the beginning.

Reuters, 2014:

> Traditionally, energy utilities have kept infrastructure like power plants safe from cyber attack by keeping it separate from the open Internet. But that is rapidly changing as a new generation of "smart" power meters hooks up customers to their utilities through the web,
> …Last November, Felix Lindner came very close to shutting down the power supply of Ettlingen, a town of almost 40,000 people in the south of Germany. "We could have switched off everything: power, water, gas," Lindner, head of Berlin-based Recurity Labs, an IT security company, said. Fortunately for residents, Lindner's cyber attack on its energy utility, Stadtwerke Ettlingen, was simulated. But he revealed how easy it was to hack into the utility's network through its IT grid, which gave him access to its control room.[73]

Interview with former CIA director James Woolsey:[74]

> …What they're doing now, they're constructing what they call a "Smart Grid." And they're going to make it easier for you and me to call our homes on our cell phone and turn down our air-conditioning on a hot afternoon if we're not there. Great, but that may well mean that a hacker in Shanghai with his cell phone could do the same thing or worse. And a so-called "Smart Grid" that is as vulnerable as what we've got is not smart at all, it's a really, really stupid grid.

---

[72] http://emfsafetynetwork.org/?p=4904#.Tgq5IjufSvo.email (emphasis added)

[73] http://www.abs-cbnnews.com/business/tech-biz/07/16/14/smart-technology-could-make-utilities-more-vulnerable-hackers
'Smart' technology could make utilities more vulnerable to hackers, 7-16-14

[74] http://www.youtube.com/watch?v=1lF3eywqD-I
EnergyNow, June 19, 2011

> [ASSURAS] Vulnerabilities is what you're telling me. We're not taking care of them. [WOOLSEY] We're not.

A widespread hack in Puerto Rico allowed electricity theft and fraudulent bills.

Smart Meters allow access to energy data and use for surveillance, data alteration, and being able to shut-off power to individual meters, neighborhoods, or the grid itself.

Doug Powell, Manager of SMI Security, Privacy & Safety, Canadian utility BC Hydro:

> Every endpoint [meter] is a new potential threat vector.[75]

Bloomburg, 2015:

> 'Introducing smart meters means you install access points to the electricity grid in private homes,' said Reinhard Gruenwald, an energy expert at the Office of Technology Assessment at the German Bundestag, a scientific institution advising German lawmakers.[76]

This vulnerability brings fire and explosion risks, says Karthik Pattabiraman, [77] associate professor of electrical and computer engineering at University of British Columbia, discussing his recent published research on improving Smart Meter security:

> Hacked meters can even cause house fires and explosions or even a widespread blackout. Unlike remote servers, smart meters can be relatively easily accessed by attackers, so each smart meter must be quite hackproof and resilient in the field.

Danger due to meter location

Sparks, Nevada fire chief Tom Garrison was interviewed on Nevada Smart Meter fires:

> Fires sparked by smart meters can be dangerous because they often start outside of the house and cannot be detected by smoke detectors, Garrison said. "It can burn a long time and enter the attic or the walls," Garrison said of a smart-meter blaze. "The occupants inside may not even be aware the house is on fire. This is very alarming to me."[78]

---

[75] https://www.businesswire.com/news/home/20120412005992/en/Hacking-Expert-David-Chalk-Joins-Urgent-Call

[76] https://www.bloomberg.com/news/articles/2015-04-01/turkish-blackout-shows-world-power-grids-under-threat
Turkey's 10-Hour Blackout Shows Threat to World Power Grids

[77] https://news.ubc.ca/2019/06/06/ubc-researchers-find-ways-to-hackproof-smart-meters/
UBC researchers find ways to hackproof smart meters

[78] https://www.offthegridnews.com/2014/10/01/this-womans-death-may-confirm-all-your-suspicions-about-smart-meters/

Vibration and heat in building materials from RF emissions

Thermografix Consulting Corporation thermal radiation consultant and Red Seal journeyman electrician Curtis Bennett has measured heat buildup in buildings as a result of vibration caused by internal or external RF emissions. He has repeatedly warned that fire wall and structural integrity are being compromised by this exposure, and that this can lead to fire wall failure.[79] He says building codes were designed to protect and shield building materials from 60 Hz electromagnetic fields and their impact on material integrity. Those fields vibrate molecules, changing molecular polarity at 120 times per second. This vibration also causes heat.

But, building codes were not designed for the much higher frequencies and vibration of wireless radiation exposure. PG&E electric Smart Meters constantly transmit at 924 MHz and 2.4 GHz for the Home Area Network. This high frequency radiation causes molecules in building materials, metal, and in the body to change polarity 1.8 billion times per second and 4.8 billion times per second. “There is a physical interaction with the frequencies at molecular levels affecting building code compliance by vibrating the building billions of times per second.”[80] These exposures violate building codes which prohibit vibration.[81]

Accelerated corrosion

In metal, these near-field exposures can cause metal fatigue and rapid non-oxidative corrosion from electron-stripping.

Andrew Michrowski PhD:[82]

> The rate of corrosion is directly proportional to the frequency of emissions - 3 GHz signals will corrode 10X faster than 300 MHz, and 500,000X faster than powerfrequency (60Hz) corroding water mains, gas pipelines, reinforced concrete re-bars, etc.

Violation of FCC Grants of Equipment Authorization

EMF Safety Network, California Public Utilities Commission, A.10-04-018 excerpts:

> …
> 5. FCC Grants of Equipment Authorization, which govern the rules upon which FCC compliance is based, warns that RF exposure compliance depends on specific conditions.

---

[79] http://youtu.be/GtlWW6PY-vk

[80] https://www.bcuc.com/Documents/Proceedings/2012/DOC_32604_C19-6_WKCC-Submission-RDCK-Nelson-Creston_Suspension.pdf

[81] http://thermoguy.com/fortisbc-canadian-wireless-smart-meter-programs-not-compliant-with-building-codes/

[82] Personal correspondence, 2014, with Dr. Michrowski, Planetary Association for Clean Energy (PACE)

> 6. Network has researched FCC conditions for the following meters that PG&E is deploying: FCC ID numbers OWS-NIC514, OWS-NIC507, and LLB6327PWM.
> 7. Network believes that PG&E Smart Meters violate one or more FCC conditions that determine RF exposure compliance. The conditions include one or more of the following, depending on the specific make and model of Smart Meter:
> –– limited single module approval requires professional installation;
> –– antenna(s) must provide a separation distance of at least 20 centimeters (cm) from all persons;
> –– antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter;
> ...
> 8. I doubt that several weeks of installer training qualifies PG&E installers as "professionals" and also doubts that Smart Meter installers are given accurate information about RF operating conditions.
> 9. Many PG&E Smart Meters are installed within 20 cm of public access. In some cases the meters are installed inside homes and businesses. In many situations Smart Meters are easily accessible to the public.
> 10. PG&E Smart Meters are widely co-located in banks of multiple meters. Co-location also occurs within Smart Meters because electric Smart Meters include at least two internal RF antennas. One antenna is used for the mesh network system and the other is for Home Area Network (HAN) systems. Antennas are designed to work in conjunction with HAN and RF appliances and with other Smart Meters in a mesh network.
> 11. Antennas have separate Grants of Equipment Authorization, which suggests that manufacturers have tested antennas in isolation and individually, and not in combination, which is how the Smart Meter and the Smart Grid system were designed to operate…[83] (emphasis added.

This lack of compliance may have electrical safety consequences.

Other fire-related issues with Smart or digital meters

Removing meters and hampering investigations

A fire scene is essentially a crime scene, and must be preserved pending investigation by fire personnel. However, PG&E and other utility companies are usually very quick to respond to incidents and pull off the meter and take it away. They often arrive at the fire scene before the fire department.[84] Utility personnel do not let investigators examine meters, and they have even questioned the fire department's authority to have the meter.

From Nevada:

> In some cases, fire investigators who did respond had difficulty confiscating the

[83] http://emfsafetynetwork.org/wp-content/uploads/2012/11/129162.pdf
Application for Rehearing, California Public Utilities Commission

[84] https://smartgridawareness.org/2015/07/28/utilities-remove-burned-smart-meter-evidence-from-fire-scenes/

burned meters as evidence.
"I notified (the NV Energy employee) that the smart meter remains were evidence for the investigation and would be logged in at the Sparks Police Department for investigation hold," the Sparks investigator on a fire on Windswept Drive wrote. "(He) asked under what authority we have to keep their property."[85]

From Quebec:

Quebec City's fire department says Hydro-Québec has been too quick to remove smart meters from the scenes of fires where faulty wiring may be an issue.
The fire department says the meters are sometimes gone before investigators can look at them to find out whether their wires might have been damaged, which could lead to a short circuit and a fire.
"A fire is considered a crime scene and at a crime scene evidence should be left alone," said France Voiselle, a department spokeswoman.
But Patrice Lavoie, a spokesman for Hydro-Québec, said the meters belong to the public utility and the meters don't cause fires.
"We are totally entitled to bring them back to our office," he said.[86]

Insurance adjuster Norman Lambe, New Mexico Public Regulatory Commission:

Q. What are some of the issues that have arisen from "smart" meter-caused fires?
A. In cases of fire involving "smart" meters, by the time a representative from the insurance company arrives at the scene, the utility has already responded, usually during the course of the local fire department's fire suppression efforts. Utility companies commonly remove the "smart" meter that had malfunctioned and/or ignited prior to completion of the necessary investigation into the cause of the fire. This hampers my ability to see that a proper investigation is performed for insurance purposes. This also complicates the job of Fire Marshals and/or fire department investigators. This may potentially also lead to a misdiagnosis by fire departments and insurance agencies and an undercounting of the total number of "smart" meter caused fires.
Utility companies have kept the "smart" meters, claiming that they are the company's property, and they can do with them as they please. It can take me several months, if not years, to obtain the "smart" meter that is believed to be the same one involved in, and the primary cause of a particular fire. Thus, the timeframe required to perform the requisite analysis is substantially extended; consequently, fires caused by "smart" meters can be extremely challenging to investigate and resolve.
…(Claim number 2015-2031-77A)This case exemplifies the difficulty that we encounter when trying to obtain access to "smart" meters in order to perform a proper investigation. We still have not been permitted the opportunity to inspect the meter by Nevada Energy. Residents stated that the "smart" meter exploded. The inability to access the meters in "smart" meter fire cases is a consistent

[85] https://www.rgj.com/story/news/2014/09/21/reno-smart-meter-fires-widespread-first-feared/15897355/

[86] http://www.cbc.ca/news/canada/montreal/quebec-city-firefighters-ask-hydro-québec-to-leave-smart-meters-alone-1.2983309

> problem…(Re: Friars Village Shopping Mall) Please note that as of the date of this testimony, more than two years later, we have not yet been able to gain access to our insured's "smart" meter in order to perform the requisite investigation.[87]

A fire broke out at a home In Firebaugh, California:

> [Jose] Valdez and his family ran out and firefighters had already started pouring water on the house.
> He noticed several PG&E employees got there almost as quickly, and he says one of them removed the smart meter while the firefighters worked. Firebaugh's fire chief saw it too.
> He says he [has] never seen that before, but he thinks he knows why they may have wanted the device.
> "Investigation after the fire was put out revealed that in all probability the fire was caused by a problem in the electrical panel and the problem in the electrical panel, in my belief, was the Smart Meter that was installed in the panel by PG&E," said John Borboa.[88]

In Nevada:

> The investigation files also offer evidence that the meter blazes could be more widespread than even fire investigators know. In the reports, NV Energy employees on the scenes of two of the fires told investigators that such blazes happened regularly.
> In an interview last week, an electrician who helps NV Energy replace the meters told the Reno Gazette-Journal that often meters would be fixed before the fire department could even be called. The RGJ has withheld his name because he continues to do work for NV Energy and didn't want to put his employment at risk.
> "NV Energy was so quick in having me or one of the other guys out there that the fire department never knew about them," he said. "We'd have the panel changed out and power turned on within five hours and a guy painting the wall right behind us."
> He said that he's fixed 15 or 16 burned-out meters in the past two years in Reno, Sparks and Gardnerville.
> "The fire department was never called on most of them. I only saw the fire department on two or three of them," he said.
> … Another worker on scene at that fire told Sparks investigators he "has been replacing about two smart meters a month that have failed and caused damage to the residential or commercial buildings."
> "NV Energy collects all the damaged smart meters and has not admitted to the problems with them," he told investigators, according to the report.[89]

---

[87] http://www.electronicsilentspring.com/wp-content/uploads/2016/10/nl.pdf' https://skyvisionsolutions.files.wordpress.com/2016/08/lambe-testimony-in-new-mexico.pdf Norman Lambe testimony, July 13, 2016, PNM rate case, New Mexico PRC

[88] https://abc30.com/lawsuits-claim-faulty-pg-e-smart-meters-started-house-fires/2657513/ with video
Lawsuits claim faulty PG&E Smart Meters started house fires, November 17, 2017

[89] https://www.rgj.com/story/news/2014/09/21/reno-smart-meter-fires-widespread-first-

This situation is likely illegal, and utility workers and IBEW members are participating in the cover-up.

> At a fire in June 2013, an NV Energy trouble technician told firefighters that exploding smart meters were a "big problem," and that trouble technicians and meter technicians have opted out of having them installed on their own homes — which they did out of safety concerns as well as in protest to NV Energy's decision to lay off meter readers once the smart meters were installed.[90]

Non-specific and inadequate fire coding

Complicating and impeding investigations and research is the lack of specific fire coding for fires related to Smart Meters. Coding is vague, and there is no coding for a Smart Meter or electric meter as primary or secondary cause.

A UK report said: “The current (CLG) Fire & Rescue Service Incident Recording System is not configured to capture specific details of fires originating in electrical equipment.”[91]

Punished whistleblowers

- Oncor employee Bobby Reed testified before the Texas legislature about Smart Meter fires and was fired. The union filed a complaint with the NLRB.
- PG&E meter reader Patrick Wrigley testified before CPUC Administrative Law Judge Amy Yip-Kikugawa that he was fired because he spoke up on meter inaccuracy. He also told her that PG&E knows Smart Meters cause fires.
- Sensus: Engineer Don Baker was fired for warning of meter defects creating a fire hazard. He filed a qui tam lawsuit against Sensus, Alabama Power and Southern Company because he said they knew of the defects.[92] U.S. DOJ refused to hear the case.

These whistleblowers were ignored.

Problems undercounted due to lack of proper investigation

The Canadian report by Ritenburg and Associates[93] on SaskPower’s meter fires found

---

feared/15897355/

[90] ibid (emphasis added)

[91] Investigation Report into: Fires Originating in Electrical Intakes, Mark Hobbs, Lead Fire Investigation Officer, East Sussex Fire & Rescue Service, UK, July 2010

[92] http://stopsmartmeters.org/2012/01/20/meters-that-endanger-shocking-details-from-a-whistleblower/
http://stopsmartmeters.org/wp-content/uploads/2012/01/Alabama-Baker-Sensus-Complaint.pdf

[93] http://www.saskatchewan.ca/~/media/news release backgrounders/2014/oct/3 ritenburg

malfunctioning meters were often not investigated. Instead, they were returned to the manufacturer for replacement. Meter malfunctions or issues were also not thoroughly recorded. The Ritenburg report has photos of meters tagged as “communication errors” but have signs of arcing on the circuit board.

Many more meters may be malfunctioning due to burgeoning conditions that can culminate in fire, but they are not being counted. Therefore, the true scope of the problem will not be known. This benefits meter manufacturers, utility companies, and states and provinces which bear the liability.

SaskPower told Ritenburg that it’s normal for communication to be lost with meters “for up to a day.” Ritenburg’s response: “This trend makes reporting of off-normal conditions on a timely basis somewhat unreliable.”

Saskatchewan ordered SaskPower to remove all its Smart Meters, and Ritenburg reported that SaskPower was simply disposing of the meters, not examining them for signs of degradation. This is unprofessional and lacking in any regard for public safety. It is likely common practice for most, if not all, utilities. How can the public trust these companies and workers to deliver gas and electricity safely to their communities?

Elimination of monthly inspections

Utility companies no longer visually inspect meters every month. Meter reader jobs were eliminated by Smart Meters, which wirelessly transmits customer usage data constantly instead. Labor cost-cutting was a key part of alleged program “benefits”. However, those monthly meter visits could identify meter safety issues. The public has repeatedly warned about this cost to public safety and opposed these job losses.

Increasing terpene production in surrounding trees due to stress

Studies have shown significant stress, injury, and death to trees from RF exposure due to cell towers and radar[94], and the public has reported rapid negative health changes to trees following Smart Meter roll-outs. This occurred in Monterey. Trees produce terpenes -- volatile oils that are aerosols -- under normal conditions. When trees are stressed or injured, they emit more terpenes. Increased volatile oils due to wireless radiation exposure would create a more flammable environment for fire.

Inaction from fire safety administrators

Some fire and public safety officials have been outspoken about these fire and electrical hazards, and helpful in researching this issue, such as the 2017 testimony of retired fire

---

final report.pdf

[94] http://kompetenzinitiative.net/KIT/wp-content/uploads/2016/06/Tree-damages-in-the-vicinity-of-mobile-phone-base-stations.pdf
https://www.researchgate.net/publication/306435017_Radiofrequency_radiation_injures_trees_around_mobile_phone_base_stations

captain Duane Roddy to the Michigan House Energy Committee. Others have kept quiet, unresponsive to records requests, and uninterested in investigating, while others have even said the meters are safe.. Some fire personnel have expressed fear of retribution, fear for their jobs, or the risk of lawsuits if they speak out on the fire and electrical problems they've seen.

From Nevada:

> "Given the lingering safety question presented by the Reno and Sparks fire departments' expert, staff believes it would be prudent to gather some information from NV Energy regarding any fires which have occurred where NV Energy equipment may have been involved," PUC lawyer Tammy Cordova wrote. Not everybody is convinced that the meters are a menace. Nevada State Fire Marshal Peter Mulvihill thinks the gadgets are safe, although he said the new fires warrant an investigation. NV Energy, which has installed 1.1 million meters, also defends their safety.[95]

Preserving the fire scene is essential.[96] Fire officials and insurance companies must thoroughly investigate first. Yet, state, county, and city fire officials haven't stopped utility companies from removing meters from fire scenes. They also haven't insisted on conducting their own investigations, and haven't gotten specific fire coding. Why?

A PG&E email[97] to the CPUC surfaced several years ago about getting the help of "sympathetic" fire officials after Smart Meters exploded at two shopping malls.

PG&E advertises its close relationship with fire officials in television ads. Fire departments also get grants from PG&E for equipment. PG&E and other utility companies routinely train fire personnel for electrical and gas fires. This creates a cozy relationship particularly with fire department upper management.

The report on British Columbia fires and investigations[98] indicates some fire safety officials and agencies may have become politically compromised -- a disturbing prospect. In 2016, twelve horses were killed, eleven injured, two severely so, and two firefighters were injured in a catastrophic barn fire in Florida.[99] Initial quotes from Fire Rescue and fire investigators

---

[95] http://www.offthegridnews.com/2014/10/01/this-womans-death-may-confirm-all-your-suspicions-about-smart-meters/

[96] https://www.iveyengineering.com/steps-fire-explosion-experts-use-investigate-building-fire/

[97] PG&E email: 84. "We have contacted several fire chiefs who are sympathetic" ftp://ftp2.cpuc.ca.gov/PG&E20150130ResponseToA1312012Ruling/2011/09/SB_GT&S_023103 1.pdf

[98] http://www.stopsmartmetersbc.com/bcuc-smart-meter-fires-the-failure-to-protect/ http://tinyurl.com/SMFireReport

[99] https://smartgridawareness.org/2017/12/09/questions-remain-regarding-fire-linked-to-utility-meter/

were that the cause was a catastrophic failure of the meter “causing flames and sparks to ignite hay, feed and other combustible materials that were nearby”. But that changed. The incident report later issued by the county and its inspector painted a very different picture -- “a unspecified electrical malfunction on the south end of the building…(I was unable to identify which device caused the fire without further specific testing and examination…).” The investigation office did no further testing once arson was ruled out, turning the case over to private investigators. Smart Grid Awareness researched this and was unable to discover any final resolution or determination.

If some fire administration officials are no longer objective and won’t speak out and expose a fire hazard, they harm the public and the fire fighters on the line that must deal with the consequences and risk their lives. That is unacceptable.

Inaction from regulatory agencies, exemptions and loopholes

It only took six GE dishwashers to overheat and one dishwasher fire to initiate a total recall. Nothing has happened with Smart Meters.

In California, the 2010 Vacaville death of Larry Nikkel in a Smart Meter fire[100] was never publicly investigated by the local district attorney, the CPUC, or other officials. It was swept under the rug until it was uncovered and investigated by consumer advocacy groups in 2013. Likewise, no action was taken following whistleblower Patrick Wrigley’s stunning 2012 CPUC testimony about Smart Meter fires, overbilling, and other problems.

No State or federal action has been taken despite deaths, house fires, extensive damage to personal property, and failure of the meters themselves.

Utility companies appear to be exempt from National Electrical Code rules.

> 90.2 Scope
> (B) Not Covered. This Code does not cover the following:
> (5) Installations under the exclusive control of an electric utility where such installations
> a. Consist of service drops or service laterals, and associated metering, or
> b. Are located in legally established easements or rights-of-way designated by or recognized by public service commissions, utility commissions, or other regulatory agencies having jurisdiction for such installations, or
> c. Are on property owned or leased by the electric utility for the purpose of communications, metering, generation, control, transformation, transmission, or distribution of electric energy.[101]

Are utilities covered under state or local electrical code rules and if so, how are these rules

---

[100] http://stopsmartmeters.org/2013/06/21/when-smart-meters-kill-the-story-of-larry-nikkel-details-emerge-of-vacaville-ca-smart-meter-fire-death/

[101] NFPA 70 National Electric Code 2008 (emphasis added)

enforced? If not, what rules govern their practices, and who monitors compliance?

Meters have been exempt from UL certification, and the new questionable 2735 certification is voluntary and ineffective. When people file complaints with consumer agencies, they're generally told Smart Meters are exempt or not under their jurisdiction. The U.S. Consumer Products Safety Commission (CPSC) has now said it is willing to take complaints, but time will tell whether it takes action on complaints.

News media censorship and failure to investigate

In-depth news media reporting on fires has been infrequent. The Firebaugh story is a refreshing exception. Actual investigation or follow-up is rare. The utility companies are often given the last word in news coverage, and their explanations are reported as fact. This is public relations, not journalism.

An example is the censorship and slant by the Detroit News in reporting on the Michigan House Energy Committee in 2017.[102]. It did not report on Fire Chief Duane Roddy's testimony on the Smart Meter fire at his home. Instead, it wrote about public testimony, describing it as "fears", "concerns", "worries", and "alleged health effects", and it let utility company DTE have the talking points.

Orlean Koehle's house survived the Santa Rosa fire but all the homes in her neighborhood burned. She found out her home was the only one with an analog meter; all the neighbors had Smart Meters. She wrote an editorial for the Santa Rosa Press Democrat detailing this, but the newspaper refused to publish it. The Siskiyou Daily News did publish it, but did not archive it on its website.

The California mainstream news generally focused on protests of the Smart Meter program, frequently using words such as "concerns" and "fears". The news paid little attention to the actual issues raised by the public and experts, or criticized those who raised them without doing any investigation.

Regulatory commission defense of the Smart Meter program

The CPUC and its personnel have blocked investigation into Smart Meter program defects and defended the program, [103] a position duplicated across the country. An example of this

---

[102] http://www.detroitnews.com/story/news/local/michigan/2017/02/21/smart-meter-trial/98202698/

[103] City and County of San Francisco (CCSF) petition to modify 09-3-026, 6-17-10 p. 1
The City requests an immediate suspension of PG&E's further installation of SmartMeters until the Commission concludes its investigation into the significant problems created by PG&E's deployment of its SmartMeters. In view of the problems already known to the Commission, it is unreasonable for PG&E to simply continue installing SmartMeters as if nothing is wrong. [initially, the petition focused on Smart Meter reliability and accuracy problems; later in the proceeding, the City added electromagnetic

happened with the Structure Group report on Smart Meter accuracy. The CPUC's Office of Ratepayer Advocates attempted its own investigation, but had to abandon it because the CPUC commissioners would not support it.

The California Public Utility Code has a gaping regulatory hole. It does not compel CPUC investigations, no matter how many incidents occur, how many complaints are made, or what the nature of the complaints is. The CPUC "may" take steps when faced with health and safety problems, consumer fraud, and other problems, but those steps are optional, according to Sections 701, 762, and 768. This same problem is likely faced in all other states. In 2012, I outlined needed changes in the code, including thresholds for mandatory investigation of utility problems and timelines for action, and changing the language in the Public Utilities Code from "may" to "shall" on CPUC responsibilities.[104]

The CPUC refused to initiate investigations on Smart Meter problems despite repeated recommendations by the Office of Ratepayer Advocates (formerly the Division of Ratepayer Advocates) in 2010:

> DRA recommends immediate Commission action to address concerns about RF interference and possible adverse impacts on health and safety. Such concerns have been raised in filings by local governments, and consumers, and by numerous individual customers in person at Commission public business meetings. This level of public concern warrants action by the Commission to determine if these concerns are well founded, regardless of CARE's Application.
> 1. The Commission has a responsibility to protect public health and safety. Although DRA's statutory mandate is to try to obtain "the lowest possible rate for service consistent with reliable and safe service levels" (Public Utilities Code § 309.5(a)), and in that role supports the provision of service that is safe and reliable, the Commission has the primary authority and responsibility to protect the health and welfare of California residents by ensuring that public utility service is safe and reliable. See, e.g., Public Utilities Code §§ 45113, 76114, 76215, and 768.16[105]

In the Smart Meter opt-out proceeding (Application No. 11-03-014), Chairman Michael Peevey allowed utility companies and their experts to present evidence, and then improperly closed the proceeding, issuing a decision before the other parties had presented their evidence.[106]

---

emissions from Smart Meters]

[104] http://smartmeterharm.org/2012/12/14/report-smart-meter-problems-dec-2012/

[105] CPUC Division of Ratepayer Advocates (DRA) response to Californians for Renewable Energy (CARE) application for modification, October 20, 2010 (A.10-09-012), p. 5

[106] San Francisco, Comments on CPUC Proposed Decision, Opt-out Proceeding, 12-11-11, p. 4-6

EMF Safety Network: [107]

> In the 2014 California Public Utilities Commission (CPUC) Annual Report to the Governor and the Legislature states, “There was some concern regarding fires in smart meters but this was investigated by CPUC staff in 2013. Staff determined that, of reported fires involving smart meter installation, none were actually caused by the smart meter.” EMF Safety Network sent a records act request for the details of that investigation in 2014, which the CPUC has ignored.

California cities and counties which passed ordinances banning Smart Meters faced bullying by CPUC officials who claimed exclusive jurisdiction over utility companies, despite policing powers granted under state law to cities and counties (recently reaffirmed by the California Supreme Court), and local franchises with PG&E.

Pennsylvania:

> The commissioners' mostly polite questions indicated they have no desire to undermine the statewide changeover to smart meters, which is mandated by a 2008 law. Smart meters have attracted opposition from some customers who worried about health effects of the wireless technology and loss of privacy, concerns that regulators say are overblown.
>
> Robert F. Powelson, the commission chairman, said the meeting was intended only to gather information about the "isolated incidents" involving overheating meters,

---

The City recommends that the Commission reject the PD [Proposed Decision] in its entirety for two reasons. First, the PD makes these findings without a hearing and without allowing the parties to this proceeding – other than PG&E – to submit any evidence. The Commission cannot make such a finding when it prevented the parties other than PG&E from making a record.
…The parties were never given an opportunity to submit written testimony. Despite this procedural posture, the PD would dispose of this case without a hearing. The PD determines that a hearing is not necessary because “there were no disputed factual issues material to the resolution of this application.” The PD, however, makes this determination based solely on the uncontested evidence submitted by PG&E in support of its application. The PD errs by ignoring the many protests and motions filed in this proceeding…
… It seems obvious from the proceedings in this case that a complete record would show that there are disputed factual issues that require a hearing.
In issuing the PD without allowing the other parties to this proceeding to submit evidence the PD has denied these parties their legal right to be heard in this ratesetting proceeding.

[107] http://emfsafetynetwork.org/smart-meters/smart-meter-fires-and-explosions/
Quote from CPUC Report to the Governor, see page 5:
https://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=3292

> and public questions were not permitted.
> …"This hearing is not a debate about whether or not to meter," he said. "We are moving forward with metering in Pennsylvania."
> Commissioner James H. Cawley agreed. "We want this done," he said. "We want it done safely, of course, because the benefits to customers are enormous."[108]

The National Association of Regulatory Commissions conferences and meetings set national policy, and the utility industry, industry-affiliated groups, and commissioners lead the sessions. Public stakeholders are not heard or included.

PG&E/CPUC emails released due to San Bruno explosion lawsuits showed the cozy relationship between CPUC commissioners and staff and PG&E, and the joint maneuvers they took on many utility issues, including Smart Meters.

PG&E email July 2, 2010 on a meeting with former CPUC Chair Michael Peevey:

> …SmartMeters – Mike [Peevey] grumbled about the CCSF PFM [City and County of San Francisco Petition for Modification] and the folks in Sebastopool [sp] who want to delay SmartMeter implementation. He implied that this wasn't going to happen, and that by the time the Commission got around to acting on [PUC filings], we [PG&E] would have installed all of our meters…
> Miscellaneous – Mike couldn't hide his disdain for Mark Toney and TuRN. He was particularly incensed, along with Clanon [Paul Clanon, CPUC Executive Director], about TURN's refusal to modify their website about opposition to SmartMeters. I'm not too concerned about TURN and the GRC [General Rate Case] at this point. I don't believe we need them as a settlement partner with Peevey as the assigned Commissioner. [109]

Florida Public Service Commission Chair Nancy Argenziano upon her retirement:

> [M]ost of you will understand the relief I feel at leaving the fetid pit of the PSC. I tell you that in my weirdest nightmare, I would not have expected to come upon the corruption; the bought and sold nature of everything related to the operation of the PSC; the reduction of the office of PSC legal to the office of regulated utilities' apologist; the subjugation of "the public" to the schemes of the regulated utilities, resulting in a de facto "Regulated Industries Service Commission"; the almost universal expectation that if you audition well, PSC employees and Commissioners will be rewarded with lucrative jobs with the utilities regulated; … I will be pleased to meet with any group which wants to understand the deep, dark, behind the scenes truths of what happens in your state government.[110]

---

[108] https://web.archive.org/web/20111210072634/http://www.wptv.com/dpp/news/region_c_palm_beach_county/some-homeowners-concerned-about-meter-installation

[109] 7-2-10 PG&E email filed ex parte on 12-22-14
http://emfsafetynetwork.org/wp-content/uploads/2014/12/PGE-Letter-to-Mr.-Sullivan-Exhibits-1-17_-12-22-14.pdf
Brian Cherry to Thomas Bottorff (PG&E)

[110] October 12, 2010

Unsafe time-of-use rates

Time-of-use rates give cheaper rates at off-peak times -- typically at night. They are being phased in to incentivize people to use appliances, such as washers, driers, ovens, and dishwashers, at night or other off-peak times.

UK fire officials condemned TOU rates in 2016, saying they were never consulted about this unsafe plan, appliances should never be run when people are sleeping, and this scheme would result in fires and lost lives.[111]

TOU rates are a major 'green' reason for Smart Meters. Proponents claim this will cut peak time energy use, but this isn't a safe practice. British Gas said in 2016, "We have no plans to trial or launch any time-of-use tariffs that offer cheaper electricity at night.'[112]

Utility company lack of transparency and misinformation

Utility companies have blamed customers for most Smart Meter problems, including fires and electrical problems.

Florida:

> But the Florida utility [FPL] assured residents that it was nothing to worry about, smart meters don't cause fires….however a spokesperson for the utility said they'd responded to 30 complaints related to meter fires and that "you could have wiring issues if you have dimming lights or power issues on one end of your home and not the other."[113]

Pennsylvania:

> A Peco Energy Co. executive said Thursday the suspension of a ballyhooed smart-meter installation program would likely continue until early October while the utility evaluates what caused 29 of the devices to overheat and catch fire…Peco and representatives of the three biggest smart-meter manufacturers indicated the overheating problems are most likely caused by "external" problems in the panels

---

https://miamiherald.typepad.com/nakedpolitics/2010/10/nancy-argenziano-resigns-from-psc-to- oppose-scott-and-corrupt-legislature.html
http://miamiherald.typepad.com/nakedpolitics/2010/10/nancy-argenziano-resigns-from-psc-to-oppose-scott-and-corrupt-legislature.html
http://www.heraldtribune.com/article/20101023/ARTICLE/10231027

[111] http://www.thisismoney.co.uk/money/bills/article-3505060/Using-washing-machine-night-cost-life-Firefighters-warn-plan-charge-different-rates-different-times-day.html

[112] ibid

[113] https://web.archive.org/web/20111210072634/http://www.wptv.com/dpp/news/region_c_palm_beach_county/some-homeowners-concerned-about-meter-installation

mounted to walls into which the meter is plugged, not by a defect in the device itself.[114]

Texas:

Justin Ozuna with Oncor told News 8 that the company is aware of the fatality and is trying to gather more information, including when the meter was installed and other account history.
He also noted that smart meters operate in the same way as older, analog meters and don't use any extra energy.[115]

Charles Phillips saw smoke coming from the transformer in his back yard one morning last November. When he went out to inspect the damage, he says he saw a CenterPoint Energy contractor at his meter box with a fire extinguisher.
"He told me it had caught on fire," Phillips said. "He had talked to his boss. Evidently, he told him to put it out, which is what he did."
But that was just the beginning. Inside Phillips' home, two TVs were fried, his air-conditioner and garage door opener stopped working and all of the wires and cables hooked up to his electronics were melted from the jolt his electronics took when the smart meter on his home sparked a fire.
,,, But both CenterPoint and the subcontractor installing the smart meters across Houston say the damage is not their fault or their responsibility.
"People generally don't think about that equipment being owned by them, but it's the same with the water piping inside your home, the gas piping inside your home; it's customer-owned equipment," said CenterPoint Energy spokesman Floyd LeBlanc.
… LeBlanc says CenterPoint has had less than 100 reports of electrical fires caused during more than 1 million smart meter installations, but the power company doesn't like to use the word "fire" to describe the problem.
"When we talk about fires, we're talking about structures on fire," said LeBlanc, explaining that there have been no houses that have burned in Houston, only electrical wiring, equipment and appliances.[116]

Nevada:

Egan and Smith said they take concerns over meter flame outs very seriously and have worked hard to determine the fault of each individual fire reported by the department. In most cases, the cause remains elusive. In others, outside factors played a role, Smith said.
In one case, the fire was helped along by water damage. In another case, the company had the burned out meter X-rayed and found the inside components intact, indicating the fire came from somewhere else. In another case, wind slammed a door shut, likely jiggling lose a connection in the meter and sparking the

---

[114] https://web.archive.org/web/20150326112331/http://articles.philly.com/2012-09-14/business/33818402_1_smart-meter-installation-program-smart-meters-new-meters

[115] http://www.kens5.com/story/news/nation-now/2015/02/03/family-blames-smart-meter-on-house-fire-that-killed-74-year-old/22799387/ link no longer works

[116] http://www.click2houston.com/news/local-2-investigates-smart-meter-fires

> blaze, Smith said.
> Often, the fire is started by arcing within the panel that the meter is plugged into. NV Energy realized this year, Smith said, and replaced many customer panels in order to reduce the probability of a fire.
> "There's many, many situations you have to study," Smith said. "Each one of these conditions are unique. There's not a common pattern that we have seen. We have not found an individual meter to be defective in all the meters we have studied this far."[117]

Getting accurate information or any information has been difficult.[118]

From Nevada:

> NV Energy had been required to provide semi-annual reports on the meters to the Public Utilities Commission, but stopped filing the reports in June 2012.
> Those reports contain somewhat haphazard data on meter malfunctions, using different terminology to describe meters that appear to have been damaged or destroyed by some sort of overheating.
> In short, the company reported 45 "burned" or "smoked" meters between Jan. 1, 2011 and June 30, 2012. A total of 3,767 malfunctioning meters that succumbed to a variety of problems.[119]

Instead utility companies engage in endless public relations campaigns,[120] and when they cannot avoid the lawsuits, the settlements are generally sealed and complainants gagged. This lack of accountability keeps secret the extent and severity of fire and electrical problems, adding to the public risk, and it further destroys the credibility of utility companies.

Insurance industry silence

With all the known fires, deaths, injuries, and property damage related to Smart/digital meters, the amount of claims must be staggering. Yet, the insurance industry and its investigators haven't exposed this issue. Norman Lambe is a rare example. Why?

Former executives from utility companies, Smart Meter manufacturer Siemens, and Smart Grid companies Cisco and Accenture sit on insurance company boards of directors. These

---

[117] https://www.rgj.com/story/news/2014/09/21/reno-smart-meter-fires-widespread-first-feared/15897355/ (emphasis added)

[118] http://smartmeterharm.org/2014/07/13/how-many-rf-pulses-per-day-from-a-smart-meter/ -- one example

[119] https://www.rgj.com/story/news/2014/09/21/reno-smart-meter-fires-widespread-first-feared/15897355/

[120] For example, PG&E hired PR firm Edelman to counter public opposition to Smart Meters, and product defense firm Exponent as investigator when PG&E caused a gas explosion in Carmel, destroying a home.

include

Liberty Mutual:
- Tom May, Eversource Energy (formerly Northeast Utiltiies) -- retired Chairman, President and CEO
- Eric Spiegel, Siemens Corporation -- retired President and CEO

The Hartford:
- Michael G. Morris, American Electric Power Company -- retired President and CEO, and former Chairman; Northeast Utilities – former Chairman, President, and CEO;
- Carlos Dominquez, Cisco -- 22 years including technology representative for the Chairman and CEO

USAA:
- Admiral Thomas B. Fargo, Hawaiian Electric Industries -- Director
- John F. Young, Exelon Corporation -- Director; Exelon Power -- former President and CEO; Exelon Generating -- former President; Exelon Corp. -- former Executive VP, Finance and Markets

MetLife
- Cheryl W. Grisé, Northeast Utilities -- former Executive Vice President

State Farm:
- Pamela B. Strobel, Exelon Corp.-- former Executive Vice President and Chief Administrative Officer

Geico is a Berkshire Hathaway company. BH companies include Berkshire Energy Company.

- - - - - - - - - - - - - - - - -

Conclusion

> The electrician interviewed by the Reno Gazette-Journal said he still has a smart meter on his home.
> "But I check it a lot," he said, noting that if it is hot enough to hurt your hand or the screen goes black help should be sought.
> "The lawyers say it's a real low percentage, but when it's your house a real big percentage," he said.
> City officials have not recommended that meters be removed. They are waiting for the Public Utilities Commission to decide whether an investigation is warranted. But if you're worried about your smart meter, here is what you can do:
> • If your meter is extremely hot, smoking or you notice signs of arcing, call 911 to have the fire department check it.
> • If you are experiencing a problem, but have no immediate fire danger, you can call the Public Utilities Commission consumer line…[121]

[121] ibid

This is the new “smart” reality, but the public has not been informed. People didn’t have to monitor analog meters for overheating.

From the British Columbia Report: BCUC and Smart Meter Fires: The Failure to Protect

> … Who is watching out for us, ensuring that these devices that are being put on our homes without our permission, mandated by law, are safe? No one. This is in our hands and this report provides the means by which we can and must demand a recall.[122]

Its findings are a warning for every state and region:

1. No agency is tracking fires;
2. Regulations and laws are being broken with impunity, e.g. meters are being removed from the fire scene, electrical inspections are not being done;
3. Reporting is haphazard at best;
4. The meter is combustible, poorly designed, and not certified by any agency to be safe;
5. BC Hydro did not perform its due diligence by having an independent Electrical Engineer inspect the meter prior to signing the contract. Rather, it accepted ITRON’s assurances;
6. Smart meters have burned, melted and caused homes to burn. BC Hydro and [British Columbia Utility Commission] both deny this is happening.

- - - - - - - - - - - - - - - - -

Michigan Senator Patrick Colbeck testimony to Michigan House Energy Committee:

> When I look at what happens with smart meters, in particular, I’m actually concerned it is putting our homes, our nation, and frankly some of the power suppliers at significant risk…That is a risk that is not entertained when you have an analog meter…Against this increased risk, there is little to no consumer benefit to the adoption of smart meters.[123]

- - - - - - - - - - - - - - - - -

- Smart/digital meters are ignition sources installed on every building and many water lines.

- Flame-resistant roofing material and “defensive” zones of cleared vegetation are useless if a building ignites from within and threatens homes and trees around it.

- The most preventable fire hazard in every community may be Smart/digital utility meters.

---

[122] http://www.stopsmartmetersbc.com/bcuc-smart-meter-fires-the-failure-to-protect/
http://www.stopsmartmetersbc.com/smart-meter-fires/

[123] Sen. Colbeck was an aerospace engineer prior to becoming state senator. Testimony to the Michigan House Energy Committee March 7, 2017
https://smartgridawareness.org/2017/03/13/secure-your-family-with-an-analog-meter/

What is the extent of fires and electrical damage related to Smart/digital meters? Were Smart Meters a factor in the recent California fires? If so, how much of a factor? These questions and many more need to be answered:

Fire season has begun. These actions must be taken now:

- An urgent re-evaluation of the Smart Meter program and consideration of a repeal in light of program weaknesses, problems, and costs, using a process that facilitates public involvement.
- Public investigations into electrical and fire problems associated with Smart/digital meters, with testimony by independent experts, whistleblowers, and public stakeholders.
- A moratorium on further installations, including Smart/AMR water meters, and Smart/digital met metering on solar arrays.
- Public investigations into overbilling, accuracy, health, security and other problems with Smart/digital meters utilizing independent experts, whistleblowers, and public stakeholders.
- An immediate no-cost opt-out and replacement of electric, natural gas, and water Smart/digital meters with analog meters for all residential and commercial customers who request it
- Public investigations into the California Public Utilities Commission and other utility regulatory commissions to discover the extent and length of knowledge of Smart Meter program problems, actions taken to block investigations, personnel involved, and coordination with utility companies and other state utility commissions.
- Investigation by state insurance commissioners into insurance company knowledge of fires, deaths, and property damage related to Smart/digital meters.
- Investigation of waivers granted from state electrical worker requirements for temporary meter installation workers
- Prohibition against utility company personnel removing Smart/digital meters and other equipment from fire scenes, with substantial penalties for violations.
- Re-evaluation of the National Electrical Code and utility company exemption.
- Revision of state electrical codes and electrical worker qualification requirements to eliminate exemptions for utility companies
- Mandated release of all utility company records and communications on damaged and malfunctioning Smart/digital meters, surges, electrical problems resulting in fires, property damage, injuries, and deaths including to pets.
- Mandated disclosure of claims paid by utility companies for fire or surge electrical damage or appliance/electronics damage to property owners, insurance companies, and city, county, and state entities

- - - - - - - - - - - - - - - - -

Nina Beety is an investigative writer and public speaker, and the author of "Analysis: Smart Meter and Smart Grid Problems – Legislative Proposal, 2012". Her website is www.smartmeterharm.org. She lives in California.

Resources on Smart Meter fires and electrical hazards include:

- EMF Safety Network www.emfsafetynetwork.org.
  Archive of Smart Meter-related fires and electrical problems
  http://emfsafetynetwork.org/smart-meters/smart-meter-fires-and-explosions/
  http://emfsafetynetwork.org/smart-meters/complaints/ - electrical problems and interference
- Coalition to Stop Smart Meters BC www.stopsmartmetersbc.com
  Extensive reporting on fires. Two fire reports:
  http://tinyurl.com/SMFireReport -- 2017, including Appendix B p. 74-109
  http://www.citizensforsafetechnology.org/Truth-About-Smart-Meter-Fires-and-Failures-in-BC--FULL-REPORT,2,3989 -- 2014
- SkyVision Solutions/Smart Grid Awareness www.smartgridawareness.org. Articles include https://smartgridawareness.org/2014/08/03/smart-meters-increase-the-risk-of-fires/
  http://smartgridawareness.org/2015/11/03/catastrophic-failures-expected-with-smart-meters/
  https://skyvisionsolutions.files.wordpress.com/2014/08/firemarshall-report-smart-meter-fires-canada.pdf
  https://smartgridawareness.org/2015/07/28/utilities-remove-burned-smart-meter-evidence-from-fire-scenes/
  https://smartgridawareness.org/2017/12/09/questions-remain-regarding-fire-linked-to-utility-meter/
  https://smartgridawareness.org/2017/01/13/secure-your-family-with-an-analog-meter/
- Stop Smart Meters www.stopsmartmeters.org
  Investigation on Larry Nikkel's death and other fires. Articles include
  https://stopsmartmeters.org/frequently-asked-questions/faq-fire-and-safety-issues/
  http://stopsmartmeters.org/2013/06/21/when-smart-meters-kill-the-story-of-larry-nikkel-details-emerge-of-vacaville-ca-smart-meter-fire-death/
  http://stopsmartmeters.org/2011/01/26/stop-smart-metersexclusive-interview-with-a-wellington-energy-whistleblower/
  http://stopsmartmeters.org/2012/01/20/meters-that-endanger-shocking-details-from-a-whistleblower/
- Thermographix Consulting Corp. www.thermoguy.com, Canada[124]
- Film: Take Back Your Power www.takebackyourpower.net
  Footage and accounts of Smart Meter fires. Articles include
  https://takebackyourpower.net/smart-meter-fire-risk-liability-is-undeniable-and-unprecedented/
- Smart Meter Harm www.smartmeterharm.org
  http://smartmeterharm.org/2012/12/14/report-smart-meter-problems-dec-2012/

[124] http://thermoguy.com/wp-content/uploads/Smart_Meter_Fires_and_Installation1.pdf

Appendix A:

What is missing on the AMI meter?

From
Evaluation of the Aclara
I-210+C AMI Meter[125]
City of Talent, Oregon
Town Hall Meeting
By William Bathgate, EE, ME
May 30, 2018

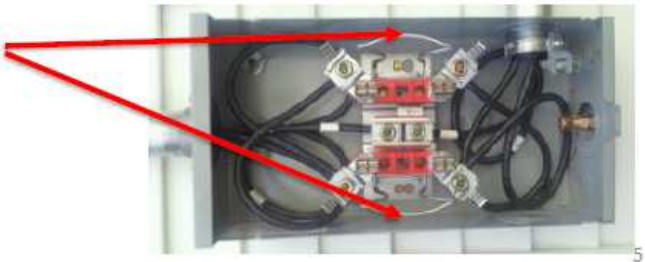
[125] http://www.freedom2sayno2smartmeters.org/wp-content/uploads/2018/06/Evaluation-of-the-Aclara-I-210C-AMI-Meter-v1.3.pdf

ANALOG METER

What is missing on the AMI Meter?

Analog Meter - Surge Suppression tabs which allows any power surge or lightning strike to safely route to earth ground, they touch the semicircular rings of the meter box.

Inside of your meter box are two semicircular rings that connect to the metal chassis of the box which is connected to the neutral wire and ground rod.



6/1/2018

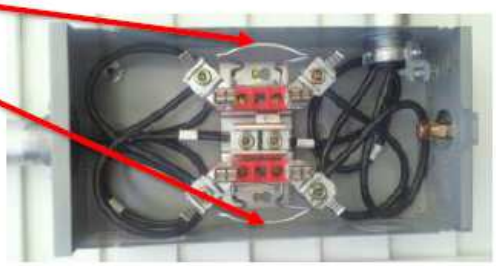
5

AMI DIGITAL METER

What is missing on the AMI Meter?

AMI Meter - Surge Suppression is not present, therefore any power surge or lightning strike will route to the electronics boards and cause an explosion and likely a fire.

Inside of your meter box are two semicircular rings that now connect to nothing in the meter, therefore surge suppression no longer exists



Smart Meters

A 21st Century Technology, a 21st Century Threat

Smart Meters: A 21st Century Technology, a 21st Century Threat

Page 8 photo courtesy of Wikimedia
http://commons.wikimedia.org/wiki/File:Sen._Barack_Obama_smiles.jpg

Table of Contents

Chapter 4 – Smart Meters and Public Health: The Real Truth about Radiofrequency Radiation

Chapter 5 – Smart Strategies for Protecting Yourself and Your Family from Smart Meters

Introduction

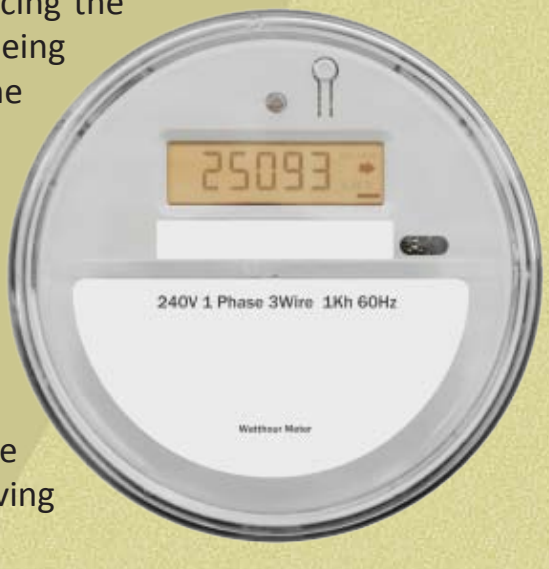
We live in an age of constantly unfolding technological wonders. Life, at its core, is not all that different than it was forty or fifty years ago. But, our daily routines have been inexorably altered by the transformative marvels of electronic information storage, processing, and communication. Because these fantastic innovations are still relatively new, we have not yet lost our ability to be awed by their scientific complexity, or by the way they allow us to transcend the normal limitations in time and space in our dealings with each other in the workplace, in educational settings, and in the comfort and privacy of our own homes.

While the technological transformation of society and culture has been pervasive and all encompassing, there is one area where the brilliance of the digital era has been a surprisingly late invitee to the dance. The electrical grid that supplies much of the human race with cheap and easy energy on-demand has been a key reason why the architects of modern civilization have been able to build the most materially prosperous civilization that has ever existed on the face of the earth. Yet, while electrical power is fundamental to everything we do, up until now the system by which this magical gift of nature is manufactured, distributed, and delivered has been left largely untouched by the electronic revolution that has brought significant change to almost every other aspect of our lives. The functioning of our electrical grid has not changed appreciably in many decades. As a result, a system that was once one of the great technological achievements of the modern world now seems hopelessly antiquated and obsolete.

Just as time and tide wait for no man, the digital revolution is destined to leave nothing out of its range or scope. With the full support and blessing of the federal government, as well as legislative bodies at the state and local levels, U.S. utility companies have begun to invest billions of dollars in a series of initiatives that are designed to modernize and streamline our electrical grid, by introducing digital technologies up and down the line. While these efforts are still in their nascent stages, they are already beginning to make an up-close-and-personal impact on the lives of millions of average Americans, thanks to the introduction of a new technology called Advanced Metering Infrastructure, or AMI.

While the use of the word “infrastructure” might make it sound like this is some sort of construction project, the name actually refers to a technological device

used for measuring power usage that is being installed in homes and businesses across the United States. More commonly known as "Smart Meters," these compact boxes communicate with utility companies via wireless signals transmitted in radiofrequency, or RF, wavelengths. While the older style of meter required electricity providers to dispatch a meter reader to a location periodically in order to monitor and record information about power usage, AMIs send this data to utility companies directly, which eliminates the need for a middleman. Smart Meters are gradually replacing the traditional analog meters that we are used to seeing mounted on the outsides of our houses, or in the basements of our apartment buildings. Smart Meters are being gradually being phased in, as traditional analog meters are gradually being phased out.



This represents the first significant step in a long-term program designed to rationalize the electrical grid in a way that will ultimately save money for consumers by dramatically improving the overall operating efficiency of this system.

Even though we are still in the early stages of the deployment of these new technologically sophisticated measuring devices, dark and ominous clouds are gathering on the horizon. The utility companies, the government, and the manufacturers of Smart Meters have been promoting them as a quintessential example of the triumph of technology over inefficiency. However, serious questions related to safety, cost, and reliability are now being raised by doctors, scientists, consumers, and advocacy groups about these harbingers of a new era. Before we stand passively by and allow Smart Meters to be installed in every home, business, and public building across the United States, we need to take a much closer look at what this technology is really all about, and what its arrival may mean for the health and welfare of the American people.

Chapter 1

The A-B-Cs of Smart Meters

The Era of the Smart Grid

On December 18, 2007, both houses of Congress approved the Energy Independence and Security Act (EISA), which President George W. Bush signed it into law the following day.[1] One section of the EISA–Title XIII–authorized the Department of Energy to provide full legislative, advisory, administrative, and financial support to an organized campaign to modernize the United States' electrical grid by integrating computers and electronic technologies up and down the line.[2] Once the transformation of the grid is complete, computer-based remote control, automation, and two-way communication technology will be installed and fully operational at each level of our electrical production and distribution system. While actual artificial intelligence may not be here yet, a totally rationalized electrical grid would theoretically operate almost like a living organism. Its new digital technology would act like the central nervous system, collecting data and passing it on to a sophisticated processing center for analysis, while also transmitting commands and instructions from one level of the grid to the next. Based on the advanced information processing and self-adjusting feedback abilities that our new electrical generating network will possess, this rapidly evolving system has been given a catchy new moniker–the Smart Grid.

Since 2009, the federal government has already subsidized the Smart Grid modernization project to the tune of $8 billion, with the promise of many billions more to come.[3] The U.S. is not the only country making the transition

to a Smart Grid, and while global investments in Smart Grid systems had only reached $16 billion as of 2010, that amount is expected to grow to an astonishing $2 trillion in just 20 short years.[4] Sensing new opportunities for substantial profit, private industry is rushing in to offer new products and concepts that will meet the demands of utility companies looking for appropriate digital technology that can efficiently interface with currently existing power plants, substations, transformers, transmission lines, and interior wiring, in order to upgrade and revitalize outdated systems.

Smart Meters are the first of these new innovations to penetrate the marketplace in a meaningful way, and because they are being installed directly in people's homes, they have become, in essence, the public face of the Smart Grid.

The Launching of the Smart Meter Campaign

Utility companies around the world are brimming with enthusiasm about the possibilities offered by AMI technology. Tens of billions have already been spent on the purchase and installment of Smart Meters equipment, primarily in North America, Europe, Asia, and Australia.[5] As of 2010, more than 20 million AMIs had been installed in the U.S., more than any other nation in the world, and 90% of these units were located in private residences.[6] At a cost of between $250 and $500 per installation, this means that somewhere between five and ten billion dollars have already been invested on Smart Meters by U.S. based power companies, which would tend to indicate that the industry must be expecting to reap big benefits in the very near future. The Obama Administration has expressed a total commitment to supporting this technology, and its 2009 stimulus package included $1 billion of matching funds designed to help utility companies finance the installation of millions of new Smart Meters across the land.[7]

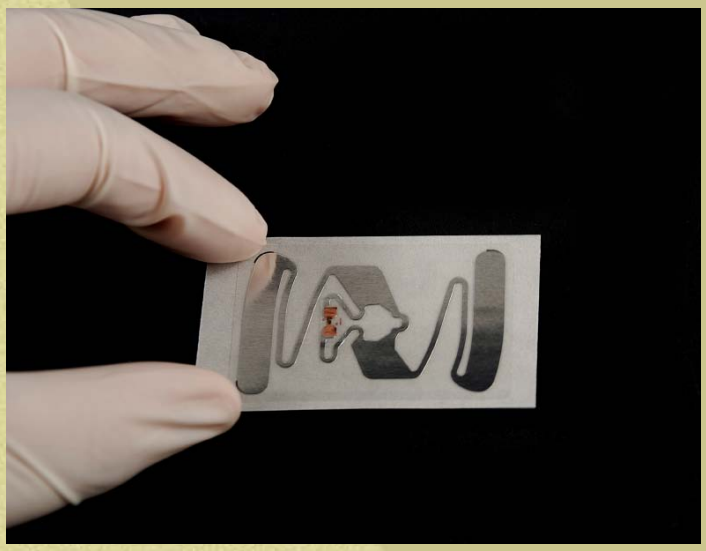
As of now, utility companies in about twenty-five states have begun installing Smart Meters, and lawmakers in those states have been busy adopting policies to regulate the deployment of this cutting edge technology.[8] With the momentum that the Smart Grid project in general has gained, it is only a matter of time until all fifty states decide to hop on board the AMI train, and the federal government is standing by ready to offer its full financial and regulatory support. Ultimately, the goal of the government and the utility industry is to achieve nothing less than 100% compliance with the Smart Meter program, which they claim is vital to the complete implementation of the Smart Grid.

As a propaganda device, Smart Meters represent a perfect opportunity for the utility companies, the electronics industry, and the government to sell the concept of grid modernization to consumers of electricity in a direct and personal way. The creation of the Smart Grid will ultimately require an investment of hundreds of billions of dollars of taxpayers' money at the federal, state, and local levels. In addition, utility companies will be spending hundreds of billions of dollars of their own money over the next fifteen to twenty years on this project, costs that will inevitably be passed on to their customers. Therefore, the actors responsible for pushing this initiative need a way to put a positive spin on these publicly subsidized investments. Also, selling the public on the idea that the slick new meters being installed in their homes have the potential to save them money is an excellent way to encourage public support for the ambitious and costly Smart Grid project.

The Energy Information Administration estimates that the average consumer should be able to save between $80 and $180 dollars per year with a full and complete Smart Meter layout, and a recent Department of Energy study claims that the Smart Meter system is already reducing annual energy consumption by 15% in the places where it has been implemented.[9]

How Smart Meters Work

The older analog meters used to record energy usage could not be read remotely. Consequently, utility companies had to periodically dispatch meter readers to collect information about electricity consumption directly from homes, businesses, and public buildings. Smart Meters function more like cell phones or shortwave radios, featuring two-way wireless communications systems that allow information



about electricity use to be sent directly on radio frequency (RF) bands to the utility supplier for recording and analysis. While analog meters had spinning dials that allowed a property owner to monitor their rate of energy consumption as it unfolded, Smart Meters accomplish essentially the same thing with an ever-changing digital display that registers and reports electricity usage in the standard kilowatt-hours (kWh) form. These wireless meters beam updated reports to the utility company every fifteen minutes, and at the end of each month, the numbers collected will be used to generate a new and accurate, up-to-the-minute utility bill.

Given the way that wireless technologies have been evolving and proliferating, the basic concept as just described may seem rather unremarkable. However, there is more to the Smart Meter system than just a simple change in the way electricity use will be recorded and processed by utility companies. Smart Meters are designed to be interactive technology that will help consumers learn everything they always wanted to know about their own electricity utilization habits, but were afraid to ask. It is this quality of the AMI system that is supposed to provide utility company customers with the vital information they need to help them save money by reducing their power consumption.

As a Smart Meter collects information, in addition to sending that data on to the provider, it can also transmit it to in-home display devices that will give homeowners and other interested parties a specific rundown on how much energy they are using, and on how their rates of consumption are changing throughout the day. Eventually, utility companies plan to institute variable pricing schemes that will give their customers a break on costs for power consumed during “off-peak” hours, when power demands are traditionally lower, and the information provided by Smart Meter systems will put electricity users in a much better position to make intelligent choices based on these kinds of considerations.

Home Area Networks (HANs)

What has just been described applies to a very basic Smart Meter set-up, where the AMI equipment functions as a more intelligent, communicative, and responsive replacement for traditional analog energy meters. This basic set-up is really only the beginning, because, Smart Meters can be programmed to establish a connection with literally any type of wireless device. It is this characteristic that gives this technology its superior potential as an energy management tool.

Digitalized wireless communications systems can be installed inside of basically anything that runs on an artificial power source. This means that refrigerators, washing machines, ovens, televisions, stereo systems, and anything else that uses electricity can be supplied with wireless technology that will allow it to establish a two-way link with a Smart Meter by transmitting and receiving RF signals on a compatible frequency. So instead of the old-fashioned kind of arrangement–where the meter measures gross energy consumption in a home–if a consumer purchases appliances and electronic equipment that have Wi-Fi capacity, those devices will be able to send information about how much energy they are using directly to the Smart Meter, which can then transmit this data on to the utility company for storage and analysis. When a Smart Meter and the electrical appliances and devices in a household are connected within such an interactive system, this is what is known as a Home-Area Network, or HAN.

Once a utility company has this kind of information about a customer's electricity usage in its possession, it can then set up a program on its website that will allow people to sign in and check out all of the details about their energy usage for themselves. A Home-Area Network arrangement takes all of the mystery out of

electricity consumption, allowing consumers to plan sensible strategies that can help them cut down on energy costs.

At the present time, appliances that offer Wi-Fi options for use with Smart Meters make up a relatively small percentage of the market. However, it is not unreasonable to assume that within five years all new appliances and other devices sold in the United States that use electricity will possess RF capabilities.

There is even more to an HAN than this. There are home energy management systems that can be added to an HAN, and these systems will enable utility company customers to program their appliances to shut on and off automatically based on pre-determined commands, making adjustments based on total energy consumption benchmarks and on the specifics of differential pricing schemes (i.e., lower prices for off-peak hours and vice versa). Home energy management systems will feature an in-home plug-in technological component that harvests information from the Smart Meter, and the appliances and devices in the HAN and then uploads that data wirelessly to an associated computer software program for display and analysis. The electricity consumer can use this computer program interactively, interfacing with the HAN to set up automatic controls that will turn individual appliances on and off as desired, although manual overrides will always be possible depending on the circumstances.

While the development of home energy management systems are currently lagging far behind Smart Meter installation programs, General Electric is one important manufacturing company that is determined to stay ahead of the game. GE has already come out with a home energy management device called the Nucleus, which will allow purchasers of GE's Brillion line of appliances to set up HANs that function interactively for the benefit of the electricity consumer, in exactly the way that has just been described.[10]

This all may sound a bit complicated, but, when a full Home-Area Network has been set up with Smart Meter, and individual electrical devices, in-house displays, and home energy management technology and information processing software all combine into an integrated whole, it is at this point that the true money-saving potential of consumer-level Smart Grid technology can finally be unlocked.

Smart Meters and Grid Efficiency

High rates of demand during certain hours of the day have been a thorn in the side of utility companies for quite some time. In most locales, power generation and distribution systems were not constructed to handle the heavy loads required to service everyone during periods when large numbers of people are demanding power at the same time. As a result, excessive energy demand can occasionally lead to blackouts, brownouts, or power rationing, which can cause serious inconvenience for a lot of people. Such an event could also draw angry responses from the general public, and howls of protest and outrage from elected officials responding to the complaints of their constituents. But, if people have specific, up-to-the-minute information available about their patterns of electricity usage that they can access easily and conveniently from the comfort of their own homes, it will make it much easier for them to adjust their power consumption habits by shifting some of their energy usage to off-peak hours when prices are reduced.

If the process works as anticipated, peak hour demands on grid systems will be eased and the overall pattern of consumer electricity consumption will even out as people begin spacing their usage to keep down costs. When peak-hour related demands are lessened, it will reduce the overall stress and strain on the grid considerably, which will save on repair and maintenance costs that are currently being transferred to the consumer. Because of the cyclical nature of power consumption under the current system, many utilities are forced to rely on specially constructed peak-load generators, which only function during periods of high demand and are left idle the rest of the year.[11] If Smart Meter usage is able to balance out the times when people consume power, it will reduce the need to construct expensive new part-time generators, while also allowing the peak-load facilities that currently exist to be put into full-time use as a way to meet future increases in demand for electricity. The costs of all new grid construction will eventually be passed on to the consumer in the form of higher energy prices, and this is yet another way in which Smart Grid innovations and Smart Meter installations will help utility company customers reduce their electricity bills.

Don't Believe the Hype

In the minds of many, there is a close link between technology and the march of progress. The utility companies are counting on this association to help them sell Smart Meters to the general public, and also to make it easier to get financial and legal assistance from government agencies eager to promote the next technological wonder.

While the connection between progress and technological advance is valid to a certain extent, in the real world, things are more complex than this simple concept suggests. While our machines can sometimes make us free, in other instances, they can turn us into their slaves. While they can sometimes improve the quality of our lives, they can also expose us to hidden dangers that those profiting from their introduction will not willingly disclose.

AMIs, at first glance, may seem like a benign or even potentially beneficial innovation. However, beneath the propaganda blitz that is accompanying the arrival of the Smart Grid there are important questions being raised about how safe, secure, and cost-effective Smart Meters really are. If the skeptics and critics are right, Smart Meters may, in reality, be the proverbial wolf in sheep's clothing, primed to do the bidding of greedy utility companies as they devour our money, our privacy, and our good health.

Chapter 2

A Cost-Benefit Analysis of Smart Meters: Who Bears the Cost, and Who Really Benefits?

I, for One, Welcome Our New Smart Meter Overlords

We have been assured by representatives of the utility companies and the government that Smart Grid technologies are being installed to improve energy efficiency, and that this will ultimately mean cheaper electricity for all. Digital information processing and wireless communication in electrical production and distribution is the wave of the future, we are told, and each and every innovation that brings the Smart Grid closer to fruition should be welcomed with open arms.

The Smart Meter is the first on these innovations to come into widespread usage, and its march to dominance has been truly impressive to behold. By 2020, it is estimated that almost one billion AMIs will be in use in homes, businesses, and other locations worldwide, and somewhere between 60 and 70% of all buildings wired for electricity in North America are expected to have these new meters installed by that time.[12] This rapid and expansive deployment has turned the Smart Meter into the lynchpin of the Smart Grid movement. The utility companies, in concert with the U.S. Department of Energy, have acted accordingly by launching an extensive public relations campaign designed to convince the American people that AMIs will save them money by forever revolutionizing the way they consume energy.

We have all heard the old saying about something that sounds too good to be true, and in this instance we would be well advised to heed that familiar caution.

Smart Meters will Save You Money – Eventually

Whatever positive effect the Smart Meter might eventually have on the costs of power, not even their most enthusiastic advocates will dispute that in the short run their installation is going to make the price of electricity go up. Despite annual profits in the $40 billion range, the utility companies are claiming that they cannot possibly afford to install Smart Meters in tens of millions of American homes and businesses out of their own pockets. So, they have let everyone know that they will be passing these costs on to their customers in the form of higher monthly electricity bills.[13] People are being promised that Smart Meters will help them save money in the long run, but only after ten years or so when the installation program is complete, and all of the costs associated with it have been completely paid.

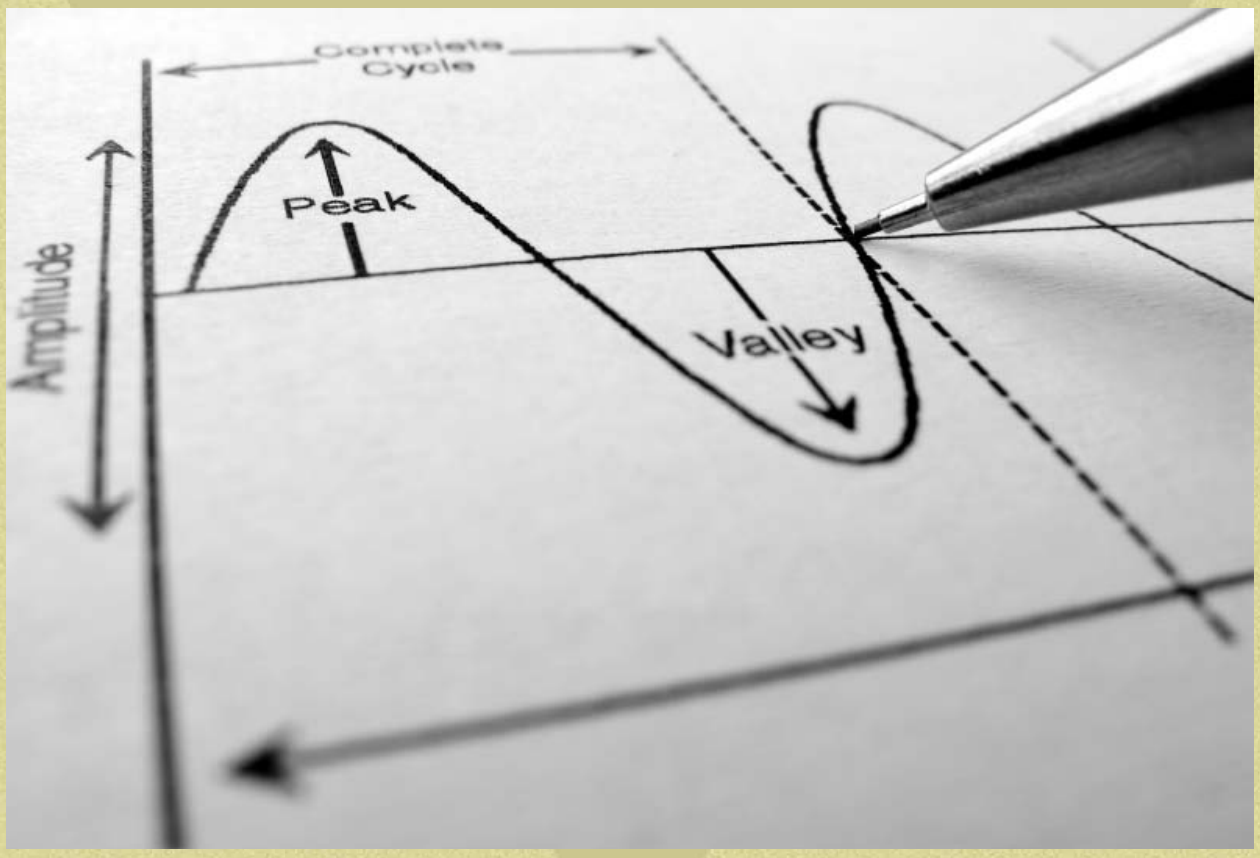
It is certainly true that, despite their high level of profit, utility companies really do not have the funds on hand to pay for the full costs of putting in tens of millions

of new Smart Meters, which can cost up to $500 each to install, when everything involved in the process is included in the calculations.[14] However, it must not be forgotten that the traditional analog meters that are still operating in most places are working perfectly fine, and there is no urgent reason why AMI technology needs to be installed everywhere overnight. If the utility companies were willing to introduce Smart Meters more gradually, they would be able to handle a good portion of the costs without too much trouble. But, they are in a rush to get them in as soon as possible, because that gives them the ideal justification for passing the financial burden on to their customers, who have no where else to turn to meet their power needs.

Utility companies operate as monopolies in their own markets and regions, and because they have so much wealth and power they are able to exercise significant control over public utilities commissions, elected officials, and government bureaucrats in each and every state. The interests of the consumer and the tax payer are always going to be the last consideration in a situation like this, which is why the proclamations by the power companies and the government that Smart Meters are being installed to benefit the public should be met with great skepticism.

The Truth about Peak Hour Pricing

Once AMI technology has been fully implemented, utility companies are promising to introduce tiered pricing schemes that will give consumers a break if they shift a percentage of their power usage to off-peak times. Let's be clear about what they are actually proposing. Instead of a flat rate for all kilowatt-hours used, power providers want to charge people more for using electricity at times of high demand while leaving other prices the same, and Smart Meters will make it easy for them to switch to this kind of system. Despite what the propaganda has implied, utility companies will *not* be cutting anyone's rates; rather, they will simply be raising the fees they charge for those who use electricity during peak hours, which are the times when people need power the most. In a burst of public candor that is rare when the subject is the utility industry, a representative of the public utilities commission in Nevada recently admitted the truth, telling a newspaper reporter that the introduction of Smart Meters in the state would only slow the rate of



increase in energy prices paid by consumers and would not lead to any real cost reductions or savings.[15]

Like college tuition, cable television, and property tax bills, the prices we pay for power consumption will always rise steadily at a pace that exceeds the rate of inflation. The introduction of differential pricing will allow utility companies to continue to raise their rates while claiming with a straight face that it is all part of a greater plan they are implementing for the good of their customers. People who are able to avert some of their power usage from peak hours may indeed end up paying less for their electricity, though those savings will only be relative and not absolute.

How large can we expect those savings to be, anyway? While it certainly may be possible for most people to shift some power consumption to off-peak hours, high demand for electricity is generally driven by circumstances that are beyond our ability to control. We use more electricity after six o'clock in the evening, for

example, because we are home and no longer at work, and because we need to turn on the lights to see after it gets dark. We use our heating systems and our air conditioners more frequently during the times of day when the temperatures are at their most extreme, and we are forced to use them more than usual during mid-winter cold spells or mid-summer heat waves. It is factors such as these that are largely responsible for the peak hour phenomenon. The higher demand for electricity during certain time periods is likely to be much more inflexible than the utility companies would like us believe.

In an effort to get the truth, engineer and energy expert Rob States looked closely at the potential savings, by shifting flexible power use from peak to off-peak hours, and he concluded that most consumers would be able to save no more than about $40 per year by using this strategy.[16] As already mentioned, the total cost of installing a new AMI system in an individual home could run to as much as $500. If this cost is inevitably going to be passed on to the consumer, it means that someone would have to spend more than twelve years paying off the costs of a Smart Meter installation before they could expect to see any relative reductions in their electricity bills, thanks to the new differential pricing scheme.

Even if people are able to reduce their power consumption during peak hours to a certain extent, and the demand for electricity begins to balance out across the day, do we really expect the utility companies to leave things as they are? If the public's electricity consumption habits shift into the lower costing off-peak hours to a degree that could cause the profits of the utility companies to take a dip, power providers will simply hunt down the lost higher-cost kilowatt hours in their new locations. The companies will then make up the lost profits, entrapping consumers in new pricing schemes that redefines the peak hour concept into something based on a more progressive, graded scale.

In other words, if consumption during the 6-7 p.m. hour goes down 10%, while consumption rises by 5% in the one hour immediately before and after this time, the utility companies will simply raise their rates by 5% in these new "semi-peak" periods to make up the difference (while keeping the 6-7 p.m. rates right where they are, naturally). In the end, regardless where you take your electricity usage, the power companies will use their Smart Meters to find you. They will increase

your rates during these hours based on the rationale that the changes in people's consumption habits have put new, unanticipated strains on the grid, and that they have no choice but to increase rates in order to keep up with the costs of maintenance and repair.

If there is anyone out there still clinging to the illusion that the point of Smart Meters is to help consumers save money by altering their patterns of electricity usage, consider this: natural gas companies across the country are also making the switch to Smart Meters, even though the peak hour concept has no relevance to an industry where the product to be used is stored at home in tanks that can be accessed at any time the consumer so chooses, without it having any effect whatsoever on the operations of the grid.

Do the Bells and Whistles Make a Difference?

While AMI promoters have touted the alleged benefits of differential pricing schemes, Smart Meter advocates say this is only the beginning of the story. In reality, utility companies assert that all the extras accompanying the Smart Meter will ultimately help their customers cut down on their electricity bills. Fully developed and realized RF Home Area Networks that feature in-home displays, programmable thermostats, home energy software, and Smart Meter-friendly appliances will be the real energy cost savers, it is claimed. Once consumers of electricity have access to all the information these intricate webs of digital interconnection can provide, they will be able to program their electrical devices and appliances to switch on and off at appropriate times in order to maximize energy savings.

However, the utility companies and the government have no intention of paying for any of these wonderful bells and whistles. The homeowner must purchase all in-home displays, digital thermostats, and home energy management systems separately. The only way to get appliances with RF capacity/Smart Meter compatibility will be to purchase them brand new at high-end retail prices.

Technological sophistication does not come cheaply. Anyone hoping to put together a functioning HAN that will allow them to program their personal household grids to achieve maximum savings might have to spend several thousands of dollars just to acquire all of the necessary elements. Even if it was true that a Smart Meter system, with all of the accoutrements added, would allow a person to save a noticeable amount of money on their electricity bills, it is not clear how many years they would need to experience those savings before they would finally be able to catch up with all they spent to install a complete system, on top of the AMI.

Even if such a system were installed, homeowners would then have to learn how to use it correctly and efficiently if they wanted to reap the benefits. Managing such a set-up would certainly be a complex undertaking. Those with advanced computer skills who possess a good grasp of mathematics might be able to calculate all of the numbers precisely enough to program everything to come on and off at just the right times to maximize energy efficiency, for many, or most, the whole thing would no doubt prove to be a confusing, frustrating, and time-consuming affair.

The complexity factor perhaps explains the results of a twelve-month British study carried out by University of East Anglia researcher Dr. Tom Hargreaves. This research project was designed to examine the results achieved by U.K. Smart Meter users who had installed more elaborate HAN set-ups that included extras, such as in-home displays. Contrary to expectations, it was discovered that in the majority of homes, Smart Meter technology had failed to deliver any noticeable savings. Also, people had mostly abandoned the interactive parts of the system because they were causing fights among family members over who was to blame for excessive power consumption, and over who should be allowed to use what electrical devices, at what times.[17]

Getting Smart about Smart Meters

From the standpoint of the energy user, saving money on electricity costs is simply a matter of eliminating waste and/or purchasing new electric appliances, gadgets, and devices that are more energy efficient than those that were being used before. Being an informed and aware consumer requires a bit of attention and effort. When

it comes to saving money on energy costs–or on anything else, for that matter–there is no shortcut or easy technological fix that can replace this tried-and-true method.

Putting false claims of a selfless commitment to public service aside, the truth is that utility companies love Smart Meters because installing this technology will make them eligible to receive government Smart Grid grants and special tax breaks. Also, because these digital measuring devices will enable them to save money on labor and transportation costs by firing or reassigning all of their meter readers. Smart Meters will be money-makers for the industries that choose to use them, and this is the one and only reason why utility companies are so anxious to get them installed as soon as possible.

Chapter 3
Invasion of the Privacy and Security Snatchers

Breaking the Fourth Wall

Traditional analog meters record power consumption, but outside of total kilowatt-hours used, they tell utility companies nothing about when, where, or how their customers are using electricity. However, Smart Meters are different, especially when they are integrated within a fully developed Home Area Network. Much like a TV sitcom peels back the fourth wall of a room so the audience can see everything that is transpiring inside, Smart Meter systems will casually eliminate barriers that have been protecting our privacy forever, giving utility companies full access to all of the details about what we are doing with the power we consume.

This kind of snooping may seem rather trivial. After all, is there really any harm if power companies know at what time we use our stoves to prepare lunch, or how many hours a day we spend on the computer? Perhaps the answer to this question would be "no, not really," if it was guaranteed that only the utility companies would have access to information about our individual power utilization habits. But, if those who have Smart Meters already installed in their homes have been assuming that the details about their electricity consumption habits are being kept private, they should think again.

Who Owns Your Information?

Most of us naturally assume that we have exclusive rights to control who gets to see our personal information and under what circumstances. However, the utility companies do not share this opinion. Their perspective is that the specifics about their customers' energy utilization patterns and practices should actually belong to them, and as such it should be left entirely up to them to decide what to do with all of that data.

For many utility companies, the best course of action is clear. They plan to sell information about their customers' energy use habits to any third party who might be interested. What this means is that avid television watchers, for example, can expect to be bombarded through email, snail mail, and by telephone with endless pitches offering to sell them a new flat screen TV, DVD player, or speaker stereo set up. Perhaps they will receive special offers to join Netflix, or to receive free installations if they agree to switch from cable to satellite. The possibilities are endless, as retailers will have a much better idea of whom to target with their sales pitches, once they know what people are actually doing in the privacy of their own homes.

Most of us naturally assume that we have exclusive rights to control who gets to see our personal information and under what circumstances.

The number of interested parties is likely to go far beyond this. As pointed out by the Electronic Frontier Foundation, a digital rights advocacy and legal organization that studies issues of electronic privacy,

> *"Without strong protections [for Smart Meter users], this information can and will be repurposed by interested parties. It's not hard to imagine a divorce lawyer subpoenaing this information, an insurance company interpreting the data in a way that allows it to penalize customers, or criminals intercepting the information to plan a burglary. Marketing companies will also desperately want to access this data to get new intimate new insights into your family's day-to-day routine–not to mention the government, which wants to mine the data for law enforcement and other purposes."*[18]

All of this should be enough to give everyone pause.

In response to public pressure, some state Public Utility Commissions and individual companies are promising to control the distribution of private information collected by Smart Meters. However, in most cases this will be done only through an "opt out" program. What this means is that it will be up to individual customers to let their utility companies know if they are not interested in having the details about

their power consumption habits revealed to third parties. If the opt out procedures are not followed to the letter, power providers will be left free to pass on this information to anyone interested in purchasing it.

Even this approach, which unfairly puts the burden on the consumer, is not being adopted universally. Many utility companies have made no commitments promising to prohibit the sharing of information if their customers so request. This is hardly surprising when you consider that selling the private data collected is one of the ways that power providers will be able to increase their profits following the installation of Smart Meters.

Who's in Charge Here?

Wherever there are computers, hackers and information thieves are sure to be close by, lurking in the shadows, waiting for their chance to cause mayhem and mischief. As referenced in the previous quote from the Electronic Frontier Foundation, criminals with computer expertise could very well find ways to steal the information being passed around in Smart Grid/Smart Meter-based communication networks. This means that even if a utility company was sincerely attempting to protect their customers from an invasion of their privacy, there is no guarantee that they would be able to do so.

Given the seriousness of this potential security threat, one would assume that government agencies and the utility industry would be hard at work developing electronic firewalls and fashioning effective strategies that would make it all-but-impossible for electricity consumers to have their personal information stolen electronically. The main priority of the power industry and the government throughout the process has been to get the Smart Grid up and running as soon as possible so the profits can start pouring in. As a result, the whole security situation, up until now, has basically been relegated to the back burner.

The truth is that when the Smart Meter installation program started, most of the actors involved weren't even thinking about the possible security risk, perhaps because it was not their information that hackers might be looking to steal. The Energy Independence and Security Act of 2007 split jurisdiction over the Smart Grid

between the Department of Energy, the Federal Communications Commission (for issues related to RF emissions), and state public utility commissions. However, it did not bother to clarify which if any agency would have a centralized, supervisory role with respect to security.[19] As a result, up until now it has basically been left up to local utility companies to deal with privacy and security issues in any way they see fit. In many cases, unfortunately, this has meant they have not been dealt with at all.

A Larger Threat Lurks

In 2009, a Seattle-based computer security services firm called IOActive decided to perform an independent test to evaluate Smart Grid security. Using a reverse-engineered Smart Meter, they were able to demonstrate how an electronic worm could be injected into the system that would allow a hacker to seize control over various elements of the new digitalized grid. They also showed how this kind of malware could spread quickly enough throughout the larger system to cause power outages over a wide geographical area.[20]

Some of the problems of security associated with Smart Grid development are technological in nature. In general, things are moving so fast that the design of Smart Meters and Smart Grid-related equipment has not been organized in any sensible or coordinated way. According to George W. Arnold, the National Coordinator for Smart Grid Interoperability at the National Institute of Standards and Technology (NIST), there are over twenty different organizations currently working on developing acceptable technological standards for Smart Grid applications.[21] Technology companies from all over the world are being contracted for various projects, which will present a challenge to those who must fit everything together. Another obstacle for engineers and designers to figure out is how the new U.S. grid can be integrated smoothly and efficiently with the developing systems in Canada and Mexico. When so many disparate elements are finally brought together under one organized umbrella, everything will have to be checked and re-checked repeatedly. This means that any chinks in the security armor that might exist in any one place or with any one particular piece of electronic gadgetry could take a long time to detect.

In its usual clumsy way, the government has suddenly decided to step in and take charge for two major reasons: in part, because of the uncertainty that is threatening to undermine the Smart Grid master plan, and in part because of fear over what cyber-terrorists might be able to do if they are able to hack into the new digitalized system. This could, of course, make things even worse than they already are. Naturally, bipartisanship in Congress is an impossibility in the present environment, so competing bills that would centralize Smart Grid policy management in either the Department of Homeland Security or the Federal Energy Regulatory Commission have been introduced. Now it is just a matter of waiting to see what–if anything–will come from attempts to negotiate some kind of a legislative compromise that will be ideologically acceptable to all parties involved.[22] Meanwhile, the Department of Energy has also decided it wants to get in on the act, currently being in the process of organizing an "Advanced Metering Infrastructure Security Task Force" in coordination with eleven of the largest utility companies.[23]

Profits First, Security Later

It is certainly within the power of the government and the utility companies, in consultation with experts in electronic security, to eventually discover and eliminate most of the vulnerabilities that might threaten the security of the Smart Grid. In fact, it seems likely that many, if not most, of the security problems caused by rushing devices like Smart Meters into production and deployment will in fact be dealt with at some point. There is little doubt that in the early years, openings will continue to exist in Smart Grid security that will be eminently exploitable by those with enough talent, imagination, and nefarious intent to make bad things happen. And even after the obvious holes have been closed, hackers and cyber-terrorists may still be able to outsmart the security experts on occasion. If there is one thing that has been learned in the age of the computer is that there is no such thing as a 100% hacker-proof electronic information system.

If there is one thing that has been learned in the age of the computer is that there is no such thing as a 100% hacker-proof electronic information system.

At this point, we cannot be sure how many people connected to the Smart Grid through AMI technology will end up having their personal information stolen. We also cannot be sure what terrorists targeting our power production and distribution systems may be able to accomplish once Smart Meters are installed in tens of millions of homes, offices, public buildings, and other locations all across North America. Smart Meters will act as de facto portals that provide direct access to the Smart Grid. Enterprising ne'er-do-wells of all stripes are bound to take advantage of the opportunities for mischief that the ubiquitous presence of AMI technology will provide.

While there may be uncertainties, there is one thing about which we can be sure: the complex skilled labor that will be necessary to make Smart Meters and the Smart Grid secure will end up adding tens of billions of dollars to the total price tag of the project, and all of that extra expense will be passed on to utility company customers in the form of higher electricity bills.

Chapter 4

Smart Meters and Public Health: The Real Truth about Radiofrequency Radiation

Don't Worry, Be Happy: Government, Mainstream Science Declare Smart Meters Completely Harmless

X-rays and nuclear fission byproducts are the most well-known examples of ionizing radiation, which is dangerous to human health because of its destructive effects on biological tissue. Non-ionizing forms of electromagnetic radiation, on the other hand, are usually not considered hazardous, unless they are intense enough to cause the cells of the body to begin heating up. For this reason, non-ionizing EMF (electromagnetic field) emissions are not subject to the same kind of regulation and control as their ionizing counterparts.

Radiofrequency microwave radiation (RF) is a type of non-ionizing EMF that has become a familiar part of our lives. Cell phones, wireless internet, Wi-Fi networks, cordless mobile phones, baby monitors, and now Smart Meters all use signals from the RF frequency range to transmit and receive digital information. These communications technologies have proliferated so rapidly that most Americans are now swimming in an invisible sea of EMF emissions.

According to medical authorities, this is nothing that anyone needs to be concerned about. To show just how benign RF is considered to be by those in positions of power, the U.S. government has left it to the Federal Communications Commission, a non-medical organization, to set limits on acceptable RF exposure. Of course, the role of the FCC is not to actually make decisions based on its own insights, rather

to simply enforce the status quo in an area where the issue is considered to have already been settled.

The "Science" of Smart Meter Safety

Based largely on radar experiments performed by the U.S. military in the 1950s, the FCC has been operating on the assumption that heating is the only potential health problem associated with human exposure to radiofrequency EMF emissions.[24] Consequently, they have established an allowable upper limit for human RF exposure of 600 µW/cm², for a period of up to 30 minutes.[25]

Obviously, this number needs some explanation. The mathematical sign 'µW/cm²' represents how many millionths of a watt of energy are hitting a one-square centimeter surface at a given moment. Meanwhile, the number 600 represents not cumulative exposure, but rather the average power density that someone standing in an RF field would be exposed to over thirty minute period of time. Intensities greater than 600 µW/cm², or exposures at this level for longer than a half hour can cause human tissue to begin heating up, and no one disputes that this heating can cause real damage to human or animal cells.

There are two serious problems with the existing FCC standards. The first is that those responsible for setting these particular limits have simply not kept up with the latest scientific research. This is possibly because this research has revealed some disturbing truths that could have the potential to upset the apple cart in an area where powerful industries are making a lot of money. The FCC, like every other government regulating agency, generally goes out of its way to protect the interests of the industries it is supposed to be controlling, often at the expense of the welfare of the American people. The evolution of our political system has been defined by the close links that exist between wealthy, powerful private interests and the government officials and bureaucrats who do their bidding. The latter in particular tends to take a "see no evil, hear no evil" approach when it comes to anything that might threaten the profits of the industries it has supposedly been assigned to regulate. Tellingly, the FCC has not updated its RF safety standards since 1992, even though most of the important research on the connection between RF exposure

and ill health in human beings has only taken place over these past twenty years.[26] The second problem with the current FCC limits is that they are not appropriate for evaluating the unique type of RF signals used by Smart Meters. Rather than running steadily or continuously, AMI technology instead transmits information through a series of very brief but very intense pulsed emissions, which is something quite different from the more familiar Wi-Fi and cell phone signals to which FCC rules could more properly be applied.

Individual pulses from Smart Meters have been measured at intensities as high as 300 µW/cm², which is half the 600 µW/cm² that the FCC claims is unsafe if exposure time goes past 30 minutes. However, at a rate of emission of 2-20 pulses a second, with a pulse duration of just 2 milliseconds each, the total cumulative RF exposure for a person in the vicinity of a Smart Meter for 30 minutes would average out to a power density that would fall far short of the FCC's allowable standards, which is why mainstream science has maintained these pulses are not something we have to worry about.[27] But, these pulses are an entirely different animal than continuous RF, and those who have looked into the question more deeply have discovered that the body is actually much more sensitive to these pulsed emissions than to their continuously-running cousins. This means that the average density approach to calculating RF danger is wildly misleading in the case of Smart Meters.

Smart Meters are so new that specific research into their effects is sparse, to say the least. One thing we do know is that strobe lights, which are the visual equivalent of Smart Meters, must be strictly regulated during manufacture because they will cause seizures at pulse rates above ten per second, a rate that is frequently surpassed by Smart Meters. Unlike strobe lights, Smart Meters cannot be turned off, and are left free to transmit twenty-four hours per day.[28] Chronic exposure to high-intensity pulses of non-ionizing EMF radiation is an unprecedented situation.

What is happening with Smart Meters is basically an ongoing medical experiment being carried out on tens of millions of human guinea pigs without their full knowledge or consent.

While there is uncertainty about Smart Meters in particular, after a couple of decades of serious research, much more is now known about the effects that radiofrequency microwave radiation can have on the human body in general. What has been discovered by this research is both frightening and eye opening.

The Bioinitiative Report: The Real Truth about RF Radiation

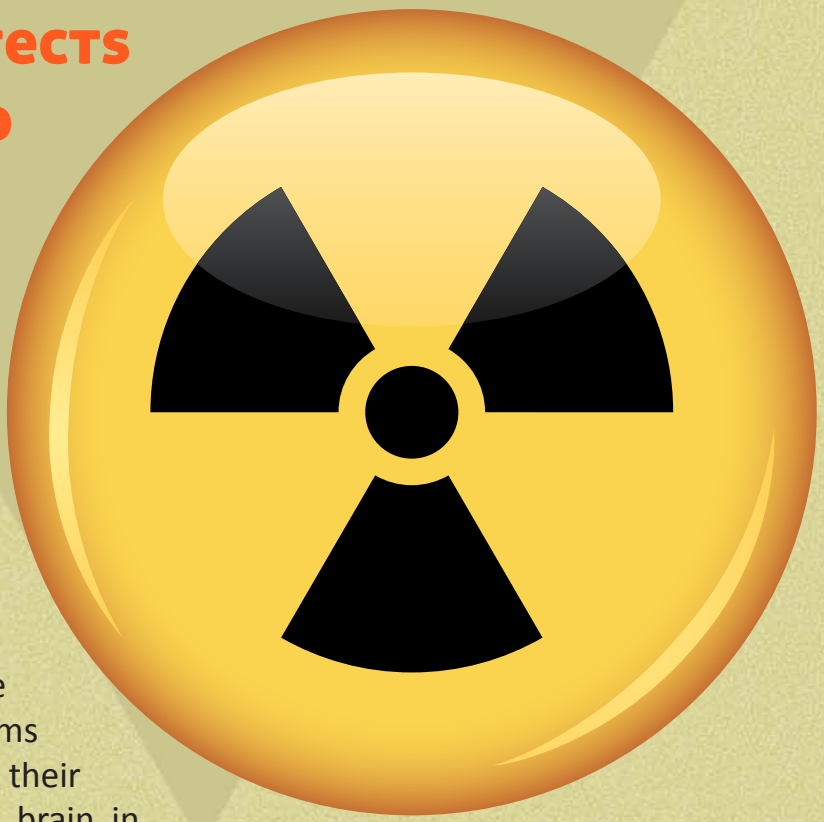
Released to the public on August 31, 2007, *The Bioinitiative Report: A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields,* is a true magnum opus for those seeking the truth about the actual health effects of the types of man-made non-ionizing EMF radiation that human beings are now subjected to on a daily basis. This includes both radiofrequency (RF) and extremely low frequency (ELF) waves, the latter of which is emitted in abundance by electric power lines.

Fourteen scientists and public health experts from the United States, Sweden, Denmark, Austria, and China have carefully and meticulously studied and analyzed all of the existing medical literature on the health effects of RF and ELF exposure. These experts found clear evidence to suggest these types of EMF emissions are definitively implicated in a whole host of serious health problems and chronic medical conditions. Furthermore, these researchers found that EMF waves are capable of causing deleterious effects on the human organism, even at levels that are thousands of times lower than the official limits set by the FCC.

While research into the subject is still somewhat in its infancy, these EMF health experts expressed a particular concern about the possible effects of pulsed EMF radiation like that used by Smart Meters. As a result, they recommended a new standard be set for this type of emission that would establish an upper allowable exposure limit for human beings of just .1 $\mu W/cm^2$ *per pulse,* which is 6,000 times below the FCC standard for continuous RF emissions over 30 minutes, and 3,000

times less than the peak pulse levels that have been measured by those investigating Smart Meter radiation.[29]

The Health Effects of Exposure to RF Radiation: A Summary



Unlike ionizing radiation, non-ionizing radiation does not affect the cells of the human body in obvious ways. However, as the authors of the *Bioinitiative Report* point out, human beings have sensitive bioelectrical systems functioning throughout their bodies, and the heart and brain in particular are regulated by bioelectrical signals that are quite sensitive to interference from outside sources. Therefore, it would hardly be surprising if research did reveal significant negative health effects associated with exposure to RF radiation. Research does indeed show this tendency, though claims by industry and government are to the contrary.

In 2011, the World Health Organization officially classified radio frequency emissions as a Class 2B carcinogen, meaning evidence exists to establish at least some linkage between RF exposure and the development of cancer.[30] This was largely as a result of research that showed ten years of cell phone usage could raise the risk of brain tumor and a related condition called acoustic neuroma by an astonishing 200-300% if the phone was used on just one side of the head.[31] For anyone who might feel this finding does not apply to Smart Meter emissions since these RF sources are usually

mounted on exterior walls of homes rather than being held in close proximity to the head, in reality, the cumulative, full-body exposures for those sharing a living space with an AMI are more than 100 times as great as what would be experienced by anyone using a cell phone in the normal way for an identical period of time.[32] Virtually everyone now uses cell phones as well as other types of wireless communication devices, so the addition of Smart Meters to people's homes will only add to the amount of unhealthy RF exposure to which most are already being subjected.

The linkage between cell phone use and brain tumors is sobering and frightening. But what the authors of the *Bioinitiative Report* discovered from their exhaustive meta-analysis of the existing medical literature is that the threat to human health from RF radiation goes well beyond this much-discussed and much-debated connection.

Many possible links between disease or serious medical condition and RF exposure have been found; some of the connections discussed in-depth in the *Bioinitiative Report* include:

- **Breast Cancer:** ELF (the close cousin of RF) has been shown to reduce levels of melatonin in the body, and lower levels of this important biochemical are associated with higher risk for breast cancer. It is especially critical for those recovering from this disease to lower their exposure to non-ionizing radiation, as a substantial amount of evidence exists to show this will undermine breast cancer treatment and make recurrence of the disease much more likely.

- **Leukemia:** One important study revealed that those who are exposed to ELF radiation as children while growing up near power lines are three times more likely to suffer from this type of cancer when they are adults.[33] Research on childhood leukemia has revealed that increased risk for this insidious malady begins to rise even when children are exposed to ELF at levels 1000 times below currently accepted safety standards.[34]

- **Other Cancers:** Studies analyzed in the *Bioinitiative Report* found increased risk for prostate cancer, non-Hodgkin's lymphoma, and malignant melanoma in electric utility workers and/or those exposed to significant amounts of power line ELF emissions.

- **Neurological disorders:** Laboratory studies have proven conclusively that the human nervous system is sensitive, and shows measurable reactions to ELF and RF energies. Exposure to EMF fields has been found to increase risk for Alzheimer's disease, motor neuron disease, and Parkinson's.[35] Special concerns have been raised about the effects of RF emissions on those with epilepsy, based on the fact that the specific type of neurological changes RF can cause are similar to what is found in the brains of those who suffer epileptic seizures.[36] In a controversial paper published in 2004, one researcher hypothesized that the great increases we have seen in the number of children being diagnosed with autism may be linked to neo-natal or fetal exposure to RF.[37] Much more study in this area is required, but there is no doubt that pre-birth exposure to RF emissions could very well cause important neurological changes in the brains of the unborn, and there is no disputing that the rise in autism has coincided to a significant degree with the proliferation of RF technologies.

- **Immune system malfunctioning:** Over-stimulation of the human immune system can cause serious allergic reactions as well as chronic inflammation, the latter of which over time can irreparably damage organs, cells, and tissues. The evidence is overwhelming that the body responds to ELF and RF radiation as if it were a foreign invader, so it is not surprising that *Bioinitiative Report* analysts found intriguing connections between non-ionizing EMF exposure and chronic allergies, inflammatory diseases, immune dysfunction, and general states of ill health.[38]

- **DNA effects:** A 2000-2004 European research study called the REFLEX Project was launched specifically to evaluate the effects that exposure to ELF and RF frequencies would have on human cell cultures. Among the DNA-related alterations found were breaks in DNA strands, the appearance of chromosomal aberrations, and changes in the way genes and proteins expressed themselves during cellular division, proliferation, and differentiation.[39] Significantly, these alterations were found to occur at exposures well below currently accepted safety standards. The scientists involved in the REFLEX Project were careful not to link these changes to any specific human disease or disorder, but there is little doubt that any changes occurring at the genetic level, where

everything that happens is so fundamental to normal biological functioning, could potentially be implicated in a whole range of serious medical conditions.

- **Electrical hypersensitivity:** This condition, which has now been acknowledged to exist by the World Health Organization, is believed to be responsible for the serious adverse reactions that occur in approximately 3% of those who are exposed to persistent ELF and/or RF radiation, and for the moderately adverse reactions that are experienced by up to 35% of those who are exposed to the usual electromagnetic stew of cell phone/cordless phone signals, Wi-Fi, wireless internet, power line fields, and now Smart Meters on a daily basis.[40] Symptoms of electrical hypersensitivity include skin rash, sleep disorders, muscle and joint pain (fibromyalgia), chronic fatigue, depression, headaches, dizziness, nausea, difficulty concentrating, memory loss, irritability, anxiety, weakness, muscle spasms, numbness, tingling, leg and foot pain, "flu-like" symptoms, and fever.[41]

Blaming the Victim when Profits are at Stake

The case of electrical hypersensitivity represents a textbook example of the tactics used by mainstream medical authorities to deny the existence of conditions or diseases that somehow contradict or call into question the currently existing paradigm. This is found particularly when acknowledging those conditions could ultimately prove to have a negative impact on the profit margins of large corporations or other wealthy and influential movers and shakers. The symptoms of this condition are so varied and diverse, and it can be difficult to diagnose without extensive epidemiological analysis, so electrical hypersensitivity is an easy target for so-called "skeptics," who usually rely on ridicule and dismissive sarcasm as opposed to real medical analysis.[42] These policemen for conventional wisdom have attacked the credentials and the integrity of those researchers who have verified the existence of electrical hypersensitivity, and they have essentially dismissed the victims of this disorder as nothing more than hypochondriacs.

This blame-the-victim mentality is beneath contempt, and it has made it hard for those suffering from electrical hypersensitivity to get the help they need. This has been especially true in the United States where mainstream medicine tends to be extremely conservative, arrogant, and subservient to the interests of the rich and powerful. In reality, the science behind the study of electrical hypersensitivity is sound and extensive, and there is no reason why those suffering from this disorder should be treated with anything other than sympathy and understanding.

Something Wicked this Way Comes: The Effects of Living in Smart-Metered Homes

While the *Bioinitiative Report* is a damning document, if we want to know whether or not RF emissions from Smart Meters are actually a threat to people's health, we need to know what kinds of health problems, if any, those sharing their homes with these energy-use tracking devices are actually experiencing in the here and now.

At this stage, no one can be sure what the long-term effects of being exposed to Smart Meter RF pulses all of the time might turn out to be.

The utility industry and the government would like us to believe that AMI units are completely safe and harmless, and that no one has really gotten sick from sharing a living area with a Smart Meter. In fact, the anecdotes have been poring in by the thousands from those whose health was perfectly fine until Smart Meters were installed in their homes by electric, gas, or water companies, after which they suddenly began experiencing all kinds of horrifying and disabling symptoms.

At this stage, no one can be sure what the long-term effects of being exposed to Smart Meter RF pulses all of the time might turn out to be. What the victims of AMI technology have experienced so far are a plethora of disturbing symptoms

and maladies that are frequently disabling, in and of themselves, and that also could be warning signs of more serious things to come. While the majority of those complaining about health problems following Smart Meter installations have reported terrible symptoms that are entirely new to them, many who were already suffering from some kind of serious medical condition claim that Smart Meters made things much worse.

The following are the symptoms most commonly reported by those whose suffering either started or worsened noticeably after having their traditional analog meter replaced with a Smart Meter:

- Heart palpitations
- Chest pain
- Headaches, including migraines
- Insomnia or sleep disruption
- Fainting spells or vertigo
- Memory loss
- Difficulty in concentrating
- Chronic fatigue
- Nausea
- Excessive anxiety
- Tingling sensations throughout the body
- Tinnitus (ringing in the ears)
- Difficulty in breathing

As can be readily seen, these are very similar to the types of symptoms that are reported by those who suffer from electrical hypersensitivity. There is also a lot of overlap with what is experienced by those who suffer from other difficult to diagnose chronic disorders such as fibromyalgia, chronic fatigue syndrome, Gulf War syndrome, and clinical depression. These types of symptoms are the reactions of a body under persistent siege by a foreign invader, and based on the evidence that has been collected it appears that somewhere between 5 and 10% of all utility company customers are reporting the onset of these symptoms within a few days of their Smart Meter installations.[43]

Mainstream medicine has been reluctant to acknowledge what has been happening. But, the anecdotal reports are piling up high from frustrated and angry people who were managing just fine before the miracle technology of Smart Meters came along and began destroying their health and ruining the quality of their lives. For the tens of thousands of Smart Meter victims found here in the United States alone, the arrival of AMI technology has turned their daily waking reality into something more closely resembling a nightmare.

Update to the "Bioinitiative Report": The Seletun Scientific Statement

In the wake of the *Bioinitiative Report*, an international scientific panel made up of experts on the biological effects of ELF and RF convened in Seletun, Norway to discuss the issue of human exposure to EMF fields from wireless communications and electric power technologies. Following this conference, seven scientists from five nations collaborated on the Seletun Scientific Statement, which was published in 2010 in the medical journal *Reviews on Environmental Health.*[44]

The Seletun scientists backed the findings of the *Bioinitiative Report* completely, and they called on governments around the planet to take action quickly to protect the people of the world from the grave threat of EMF pollution. They called for the establishment of emission standards that are 50,000 to 60,000 lower than the current standards that are being followed by the FCC and the International Commission on Non-Ionizing Radiation Protection (ICNIRP), emphasizing that "sensitive populations" (children, the elderly, the unborn, the ill, people with genetic or immunological problems, etc.), who make up 40-50% of the world's total population, are especially vulnerable to ELF and RF exposure.[45]

In summing up his thoughts on the issue, the chair of the Seletun scientific panel, Swedish neuroscientist Olle Johansson, released the following statement:

> *"Personally, I am very concerned for the grave consequences that may ensue if exposure guidelines are not changed by global governments… It is high time to ask ourselves: What happens when we, twenty-four hours around the*

clock, wherever we are, allow ourselves and our children to be used as guinea-pigs, whole-body-irradiated for the rest of our lives?" In not doing so, our politicians and health administrators may put us all at stake, since this is the largest human full-scale experiment ever!... Current US and ICNIRP standards for radiofrequency and microwave radiation from wireless technologies are entirely inadequate. They never were intended to address the kind of exposures from wireless devices that now affect over four billion people."

The Experiment Continues

Despite the blithe reassurances of the woefully–or willfully–ignorant mainstream medical community, is has become crystal clear that radiofrequency radiation is indeed a serious threat to human health. At this point, there is really no excuse for devices that emit as much RF energy as Smart Meters to be routinely installed in the homes of electric, gas, and water company customers. Yet, this is exactly what is happening, as the rollout of Smart Meters continues unabated, despite all the evidence of their destructiveness that has now emerged.

Chapter 5
Smart Strategies for Protecting Yourself and Your Family from Smart Meters

Opt Out Programs

Utility companies would like to make Smart Meters mandatory, but at the present time most state public utility commissions require power providers to offer their customers the option to refuse an AMI installation if they so choose. Under the rules of opt out programs, even those who have already had a Smart Meter installed can ask their utility company to come out and remove it.

In northern California, for example, Pacific Gas & Electric established a May 1, 2012 deadline for opting out that gave anti-Smart Meter activists very little time to organize a public information campaign to let people know how dangerous AMI technology really is.

While this sounds good on the surface, opt out programs appear to be public relations ploys more than anything else. Utility companies have been left free to continue their relentless PR campaigns assuring the public that Smart Meters are completely safe, and the concerns of those who object to this technology are usually dismissed with thinly veiled contempt. Even worse, the utility companies have been allowed to set arbitrary deadlines for those who want to opt out, and they are also being allowed to charge fees to those who choose to maintain their analog meters.

In northern California, for example, Pacific Gas & Electric established a May 1, 2012

deadline for opting out that gave anti-Smart Meter activists very little time to organize a public information campaign to let people know how dangerous AMI technology really is. At the same time, PG&E announced that anyone choosing to opt out would be charged a one-time "non-installation fee" of $75, and furthermore they would also be required to pay a $10 surcharge that would be added to each month's electricity bill in perpetuity.[46] In the state Nevada, things are going to be made even tougher on those smart enough to reject Smart Meters. The Public Utilities Commission there has just approved an opt out program; they are going to allow NV Energy, the state's largest power provider, to charge a whopping $110 for the non-installation fee (as if there was an actual expense there) plus $15 extra per month to help them pay the analog meter readers they would prefer to fire.[47] Not surprisingly, with just a few weeks to go before the May 1st deadline, only about 4,400 out of 6 million PG&E customers had chosen to exercise their rights to refuse a Smart Meter installation. Officials in Nevada are anticipating better than 99% compliance with that state's AMI roll out as well.[48]

While this sounds good on the surface, opt out programs appear to be public relations ploys more than anything else. turn out to be.

Unfortunately, these anemic numbers for opt out programs are being repeated around the country. In Portland, Oregon, only 2 customers out of the 800,000 who were given the chance chose to opt out.[49] This tells you all you need to know about how effective the slick, professionally produced public relations campaigns of the utility companies are, in comparison to the efforts of overworked, under-funded activists who are trying to get the truth out to the people. These activists are being labeled "conspiracy theorists," "kooks," or "tin hatters" for their trouble. The public is not completely blameless here, as all activists these days, regardless of what cause they are supporting, are struggling to overcome unprecedented levels of apathy and disinterest among a citizenry that has apparently lost its ability to discern the difference between truth and propaganda.

Protecting Your Right to a Smart Meter-free Existence

While opt out programs are useful, they are actually based on a deception. Despite what utility companies might tell their customers, the truth is that no one can be forced to accept a Smart Meter if they do not want one, regardless of whether or not they have followed the official opt out procedure prescribed by their electric company. No federal or state laws exist anywhere that would allow anyone to be compelled to accept a Smart Meter. When utility companies tell their customers that unless they have opted out they will have no choice but to accept an AMI device on their property (which is something that happens repeatedly), they are not telling the truth.

There are no laws to protect the right of utility companies to install Smart Meters against people's wills, but there are laws on the books that allow homeowners and landlords to take any steps they feel are necessary to protect their property from trespassers. During periods of time when Smart Meter installations are going on in their neighborhood or city, property owners should remember that they have the right to turn away anyone they do not want on their land, including those who arrive to install these dangerous RF-spewing machines.

Power companies can be sneaky and persistent, and they are not above using subterfuge to get access to people's homes. In a sense, this is because they have no

choice in the matter. Smart Meters operate on what are called mesh networks, communicating with one another antenna to antenna on a relay system that eventually carries all the information collected in a particular area back to utility company headquarters for storage and analysis. What this means is that even if only a few homeowners or landlords in a specific neighborhood refuse to allow Smart Meters on their property, it can break the AMI chain and make it impossible for a functioning network system to be installed and maintained in that particular neighborhood.

Utility companies are not above sending their workers on stealth missions to install Smart Meters on the property of recalcitrant homeowners when they know that no one will be around to turn them away. As a result, simply turning utility company representatives away when they first arrive to install their equipment is often not sufficient. This is why many people have taken steps to secure their analog meters so they cannot be removed without the use of force. Chains wrapped around meters and secured with padlocks can work quite well. Some have built impenetrable structures of wood or metal around their meters so they can be read by meter readers but not removed without violence. While power companies can be sneaky, they usually aren't looking for legal trouble, so their employees are unlikely to resort to vandalism just so they can remove an analog meter.

Utility company employees have been known to threaten those reluctant to accept Smart Meters on their property with fines or power disconnection if they refuse to comply. This is actually little more than a bluff. Up until now, no one has ever faced any negative consequences for successfully refusing or resisting a Smart Meter installation.

Shielding

The most difficult position anyone can find themselves in is if they have already had a Smart Meter installed, but missed the deadline for opting out. In this case, the only way for someone to protect themselves from pulsed RF emissions is to put up shielding. Materials specifically manufactured to provide protection from RF can be purchased online, and they generally should be placed on the interior wall directly behind the spot where a Smart Meter has been installed on the exterior of the house.

There are two options available for anyone who wants to screen out Smart Meter emissions: RF reflectors and RF absorbers.[i]

There are two options available for anyone who wants to screen out Smart Meter emissions: RF reflectors and RF absorbers.[50] The former would be generally preferable, except in cases where other sources of RF radiation besides Smart Meters are present in the vicinity. If these other sources are being used inside the home, reflective materials placed on the walls will prevent their RF emissions from escaping, thereby canceling out any advantages gained by keeping out Smart Meter emissions. In this case, something that absorbs RF waves from any direction would be the better selection. While it is possible to purchase materials specially designed to reflect or absorb RF emissions, aluminum foil folded thickly or aluminum mesh screen can do a decent job as well.[51]

Because Smart Meter radiation will spread out in every direction after being emitted, the amount of shielding used should cover at least 4-6 square feet of the interior wall behind the Smart Meter's location. No reflecting or absorbing material can be expected to filter out 100% of the RF radiation present, but shielding properly placed can certainly reduce interior exposures by a significant degree in most instances.

RF meters that measure the presence of EMF wavelengths are available for purchase online. One of these devices should always be used in test any shielding set-up to make sure that it is actually working.[52]

Saving the Future from the Smart Meter Menace

While those fighting the power of the utility companies face an uphill battle, the fight is far from hopeless. General public apathy notwithstanding, those who are standing up against Smart Meters have been able to raise enough of a stink to force public utility commissions across the land to approve opt out programs. Some politicians have taken notice of the activities of those opposing AMI, and there are at least some candidates for public office out there who have made opposition to Smart Meters a part of their platform. In the state of California, where anti-Smart Meter activism has been the most visible and the most effective, even more success on the political front has been achieved. Forty-five counties or municipalities across the state have now passed ordinances prohibiting AMI technology from being deployed within their borders. Anyone who is concerned about the possibility of Smart Meters coming to their town or area can join one or more of the many local or national groups that have formed around this issue. Most of these groups can be found quickly and easily with the help of an Internet search engine. As the saying goes, there is strength in numbers. If enough people raise their voices in protest, the Smart Meter train can still be stopped.

Learning to Live Smarter

If people don't educate themselves about the true nature of this menace, and the usual public laziness and indifference manage to rule the day, it will be only a matter of time before pressure from the utility companies, AMI manufacturers, and Smart Grid promoters convince the state and federal governments to pass laws forcing everyone to accept a Smart Meter, whether they like it or not, as a condition for staying on the grid.

In the end, if this happens it might really be a blessing in disguise. Without question, the best way for anyone to protect themselves and their loved ones from the high costs, security problems, and serious health dangers associated with Smart Meters and the Smart Grid in general is to choose the off-the-grid option. Living off the grid

can require some radical lifestyle changes, but they are the types of changes that can make us safer, freer, and happier than we have ever been before. By opting out of the grid altogether, we can opt in to a much better way of life, where dangerous and unnecessary devices like Smart Meters will find no comfort or shelter.

End Notes

1 http://energy.gov/oe/technology-development/smart-grid

2 http://energy.gov/oe/technology-development/smart-grid

3 http://energy.aol.com/2011/08/05/smart-grid-privacy-and-security-risks-loom-for-agencies/

4 http://www.zomepower.com/2012/01/smart-grid-investments-to-total-155b-annually-by-2018/

5 http://www.abiresearch.com/press/1688-Smart+Grid+Spending+Will+Top+%2445+Billion+by+2015

6 http://205.254.135.7/tools/faqs/faq.cfm?id=108&t=3

7 http://arstechnica.com/tech-policy/news/2009/10/obama-announces-stimulus-funding-for-the-smart-grid.ars

8 http://energy.aol.com/2011/08/05/smart-grid-privacy-and-security-risks-loom-for-agencies/

9 http://www.zomepower.com/2012/01/smart-grid-investments-to-total-155b-annually-by-2018/

10 http://www.greenbiz.com/blog/2012/03/08/ge-tools-make-dumb-appliances-smart-energy-management

11 http://tcipg.mste.illinois.edu/lessons/TimeSensitive.pdf

12 http://www.greenbiz.com/news/2011/08/10/chinas-smart-meter-boom-will-lead-1b-installations-2020

13 http://www.daggerpress.com/2012/03/16/del-glass-smart-meters-are-about-utility-corporations-making-more-money-and-the-citizens-of-maryland-paying-more-for-electricity-and-losing-their-privacy/

14 http://online.wsj.com/article/SB124050416142448555.html

15 http://nevadanewsandviews.com/archives/15479

16 http://electricsense.com/1256/smart-meters-electromagnetic-radiation-money-and-your-health/

17 http://www.environmental-expert.com/news/do-smart-meters-really-change-energy-use-254972

18 https://www.eff.org/deeplinks/2010/03/new-smart-meters-energy-use-put-privacy-risk

19 http://stopsmartmeters.org/frequently-asked-questions/

20 http://energy.aol.com/2011/08/05/smart-grid-privacy-and-security-risks-loom-for-agencies/

21 http://energy.aol.com/2011/08/05/smart-grid-privacy-and-security-risks-loom-for-agencies/

22 http://energy.aol.com/2011/08/05/smart-grid-privacy-and-security-risks-loom-for-agencies/

23 http://energy.aol.com/2011/08/05/smart-grid-privacy-and-security-risks-loom-for-agencies/

24 http://stopsmartmeters.org/2012/03/09/a-primer-on-the-fcc-guidelines-for-the-smart-meter-age/

25 http://stopsmartmeters.org/2012/03/09/a-primer-on-the-fcc-guidelines-for-the-smart-meter-age/

26 http://sagereports.com/smart-meter-rf/?page_id=188

27 http://stopsmartmeters.org/frequently-asked-questions/radio-frequency-radiation-issues/

28 http://stopsmartmeters.org/frequently-asked-questions/radio-frequency-radiation-issues/

29 http://www.bioinitiative.org/freeaccess/report/docs/report.pdf

30 http://betanews.com/2011/05/31/mobile-phones-are-as-cancerous-as-hpv-engine-exhaust-says-who/

31 http://www.bioinitiative.org/freeaccess/report/docs/report.pdf

32 http://www.committeetobridgethegap.org/pdf/110212_RFrad_comments.pdf

33 http://www.bioinitiative.org/freeaccess/report/docs/report.pdf

34 http://www.bioinitiative.org/freeaccess/report/docs/report.pdf

35 http://www.bioinitiative.org/freeaccess/report/docs/report.pdf

36 http://www.bioinitiative.org/freeaccess/report/docs/report.pdf

37 http://www.emfbioeffects.org/report.html

38 http://www.bioinitiative.org/freeaccess/report/docs/report.pdf

39 http://ec.europa.eu/research/environment/pdf/env_health_projects/electromagnetic_fields/e-reflex.pdf

40 http://www.weepinitiative.org/talkingtoyourdoctor.pdf

41 http://www.dirtyelectricity.ca/electrical_hypersensitivity.htm

42 http://www.skepdic.com/electrosensitives.html

43 http://smartmeterhelp.com/HealthSymptoms.cfm

44 http://electromagnetichealth.org/electromagnetic-health-blog/the-seletun-statement/

45 http://electromagnetichealth.org/electromagnetic-health-blog/the-seletun-statement/

46 http://www.cbsnews.com/8301-505245_162-57369888/pg-e-can-charge-customers-to-nix-smartmeters/

47 http://www.lvrj.com/business/nevada-puc-approves-smart-meter-opt-out-plan-140941433.html

48 http://www.lvrj.com/business/nevada-puc-approves-smart-meter-opt-out-plan-140941433.html

49 http://www.lvrj.com/business/nevada-puc-approves-smart-meter-opt-out-plan-140941433.html

50 http://www.lessemf.com/faq-shie.html#smart

51 http://www.youtube.com/watch?v=xJzBeUeXb0Q

52 http://stopsmartmeters.org/frequently-asked-questions/faq-shielding-and-measurement-issues/

i http://energy.aol.com/2011/08/05/smart-grid-privacy-and-security-risks-loom-for-agencies/

ii http://arstechnica.com/tech-policy/news/2009/10/obama-announces-stimulus-funding-for-the-smart-grid.ars

iii http://www.lessemf.com/faq-shie.html#smart

April 8, 2025

To: Representative Sheila Lieder

Thank you for allowing testimony to support smart meter opt-in legislation for the state of Colorado, HB25-1175.

My name is Alexia McKnight and I am a resident in Chadds Ford Pennsylvania. I have a biochemistry and a veterinary medical degree, after which I trained in magnetic resonance imaging at Mayo Clinic and then finished a residency in radiology at the University of Pennsylvania School of Veterinary Medicine. I have been a radiologist for 22 years and well understand the effects of ionizing radiation. As a profession, we take radiation seriously and respect the damage it can do with excessive exposure. We did not learn anything about the biological effects of non-ionizing radiation. I learned this the hard way.

I would propose most people acquire a headache here and there, have aches and pains, a bad mood, or forget a few things throughout the years. These things happen. Now imagine one day, all of a sudden the onset of a bad and constant headache all day every day. the complete inability to sleep— tossing and turning for eight straight hours, every night, feeling atypically wired, yet exhausted, unable to relax, painful abdomen, pain in the joints and muscles, a foul mood—irritable, agitated, snappy, and fatigued. This continues every single day, and progresses to memory and cognition failure. It is no longer possible to concentrate or even drive safely. The ability to read is gone, the heart stops beating normally.….

This is what happened to me. It was disabling. The progression from healthy adulthood to debilitation happened suddenly, as soon as and as long as the electric utility placed a wireless device on the outside of my home.

After the better part of a week of this and barely functioning, I left to sleep in the yard. This was December of 2015. The weather was cold enough to see my breathe, but out there in a sleeping bag inside a little sailboat parked in the side yard, I could fall asleep and stay asleep. Though not an ideal solution, it worked.

When the offending wireless device was finally removed—a Landis-Gyr electric smart meter—the symptoms I experienced inside my home resolved.

Some weeks later, the arrhythmia returned, the headaches returned, the insomnia returned, the foul mood returned, and unbeknownst to me the wireless smart meter meter had returned. Upon removing it a second time, the symptoms in the house resolved yet again. The sudden onset of symptoms correlated exactly when the meter was on, and resolution of symptoms when the meter was removed, both times. This was instrumental in determining cause.

Prior to the deployment of that wireless device on my home, I lived a normal life. I used to get pain in my ear if I held a cell phone to my head. My hand and arm would sting up to my elbow if I touched an iPad, I'd get some headaches traveling along interstate 95, but this was manageable—I used speaker phone instead, I stopped using the iPad, and the headaches while traveling were mostly transient. We can compare that to a runny nose from a pollen allergy—in stark contrast to a full blown asthma attack and the inability to breathe.

Similarly, after months of smart meter exposure, this electromagnetic syndrome progressed. I could no longer go to church, I could not visit most friends or family, I could not travel for work or pleasure. I could not attend my kids' school or athletic functions. I could not enjoy restaurants, concerts, public gatherings, family trips. I could not drive or ride in a new vehicle. If I did any of those activities, there was always some degree of suffering, and occasionally I'd be bedridden. My entire family was, and still is, affected. However, in electrically clean environments—one with no wireless RF radiation, no electric fields, no magnetic fields and no high frequency transients, I have no symptoms.

The mechanisms of injury are not my goal in this letter. They have been fully documented for decades, and are readily available by investigating. This is how I realized I was not the only one who was debilitated by electromagnetic radiation—investigating, researching, and studying. Not ignoring, not denying.

The electric utilities, the telecommunications industry, and the PA PUC are no strangers to the onslaught of legal suits as a result of negative and unintended sequela to wireless technologies. I know this to be true, as my family has been one of many hundreds of legal cases brought forth in the PUC court, simply to seek the ability to live life and be safe in our own homes. Industry's business model benefits from denying and ignoring the injuries, but legislators are better positioned to put forth higher moral fortitude to protect their constituents, and themselves.

In the same way that I have not experienced an asthma attack, or an anaphylactic reaction to penicillin or pollen or peanuts, I recognize many other people do. I would never deny or ignore their condition. I would also certainly never willfully expose an asthmatic to smoke knowing they won't be able to breath soon, or give peanuts or penicillin to somebody who tells me they get serious immune reactions.

As you may not (yet) have experienced headaches, insomnia, pains, memory loss, cognition impairment, depression, other mood changes, and cardiac arrhythmias from wireless technologies, you can offer the same courtesy to the growing percent of your constituents by allowing safer technologies through opt-in legislation permitting electromechanical analog meters throughout all utilities of the state.

Thank you,
Alexia McKnight, DVM, DACVR

258 Heyburn Rd.
Chadds Ford, PA 19317