



Presentation to Colorado House Energy & Environment Committee

February 1, 2023



A Little About Me



Wendy Jaglom-Kurtz

- Manager on RMI's U.S. Program since 2019
- Focused on non-Federal climate action
- Boulder resident since 2015
- Raising my two girls (+ two kitties) in CO
- Decade of climate and energy consulting before coming to RMI
- East Coaster before coming to CO (NY, NC, DC)

Overview & Context Setting

Colorado's Progress on Climate &
How Everything Fits Together

AGENDA

- 01** Intro to RMI
- 02** Colorado's Climate Progress
- 03** Emerging Technologies
- 04** Federal Investment Opportunity

Intro to RMI



WHO WE ARE

RMI is an independent, non-partisan, global nonprofit organization of 600+ experts working to accelerate...

OUR MISSION: Transforming the global energy system to secure a clean, prosperous, zero-carbon future for all.



Founded and headquartered in Colorado, RMI has a long history of working with Colorado legislators, state agencies, regulators, utilities, municipalities, and other stakeholders.

Colorado's Climate Progress



Colorado has persistently taken climate action across sectors



Cross-cutting

- **HB19-1261** – economy-wide targets
- **SB19-096** – GHG emissions tracking
- **SB21-230** – capitalizes state green bank
- **HB22-1244** – air toxics rule



Electricity

- **SB19-236** – Xcel clean energy plan (CEP)
- **HB21-1266** – expands CEPs
- **SB21-072** – modernize transmission
- **HB21-272** – PUC “Justice40
- **HB22-1394** – just transition funds
- **HB22-1381** – geothermal energy grants



Buildings

- **SB21-246** – beneficial electrification plans
- **SB21-264** – clean heat plans
- **HB21-1286** – building performance standards
- **HB22-1381** – geothermal grants
- **SB22-051** – heat pump tax credits
- **HB22-1362** – energy code board



Transportation

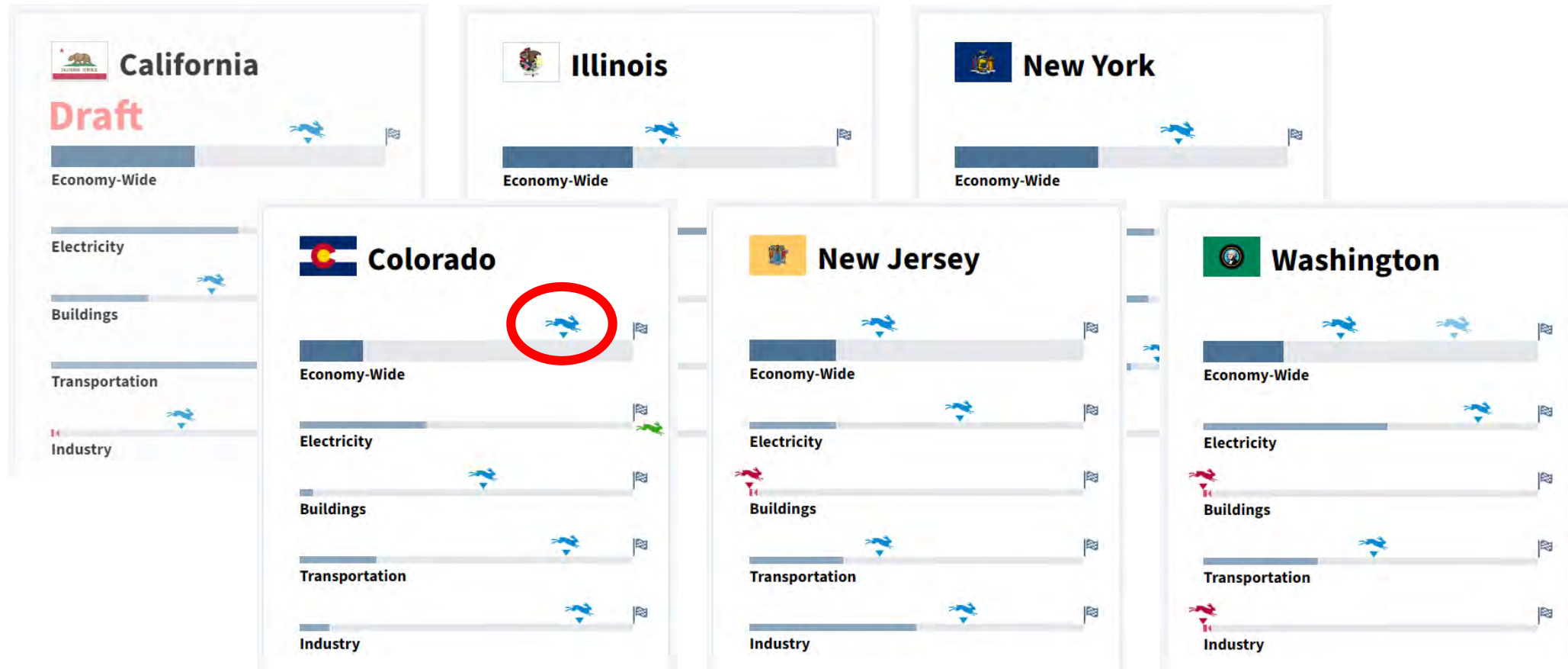
- **SB19-077** – transportation electrification plans
- **HB19-1159** – EV tax credits
- **SB21-260** – GHG budgets for transportation planning
- **SB22-193** – AQ investments



Industry

- **SB19-181** – O&G emissions reductions
- **SB21-1266** – industry sector targets
- **SB22-198** – orphaned O&G well enterprise

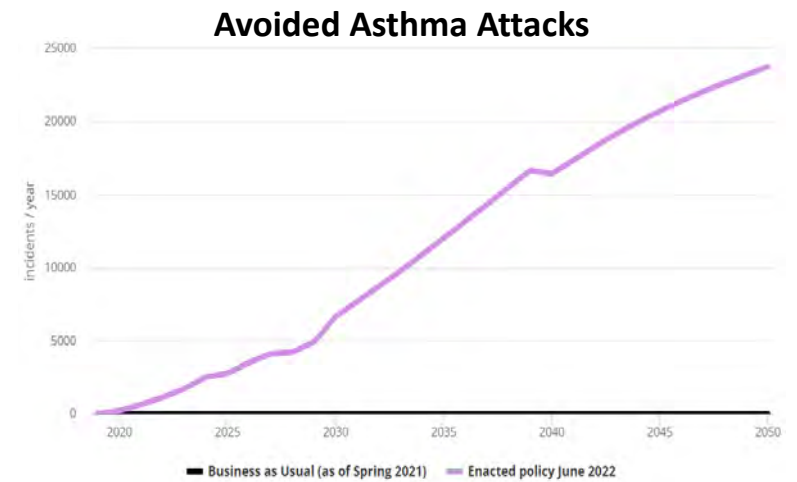
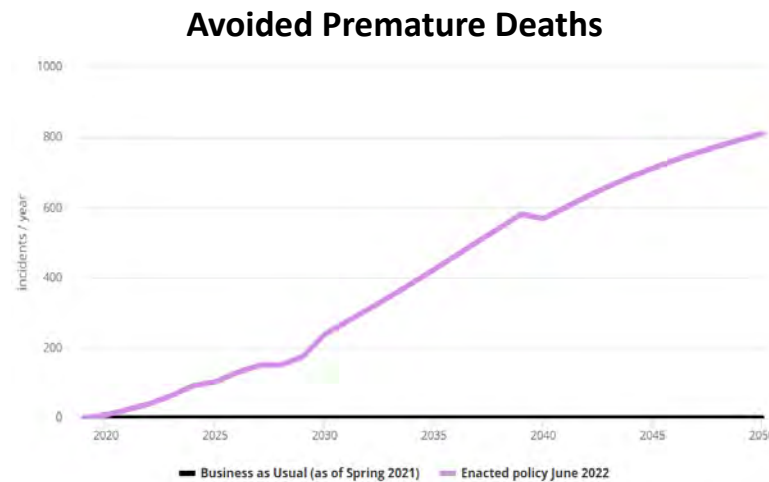
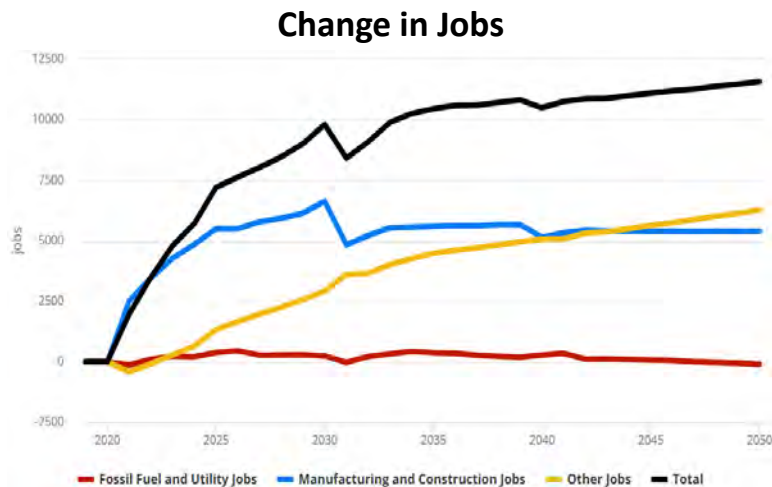
Colorado is one of the nation's leading states



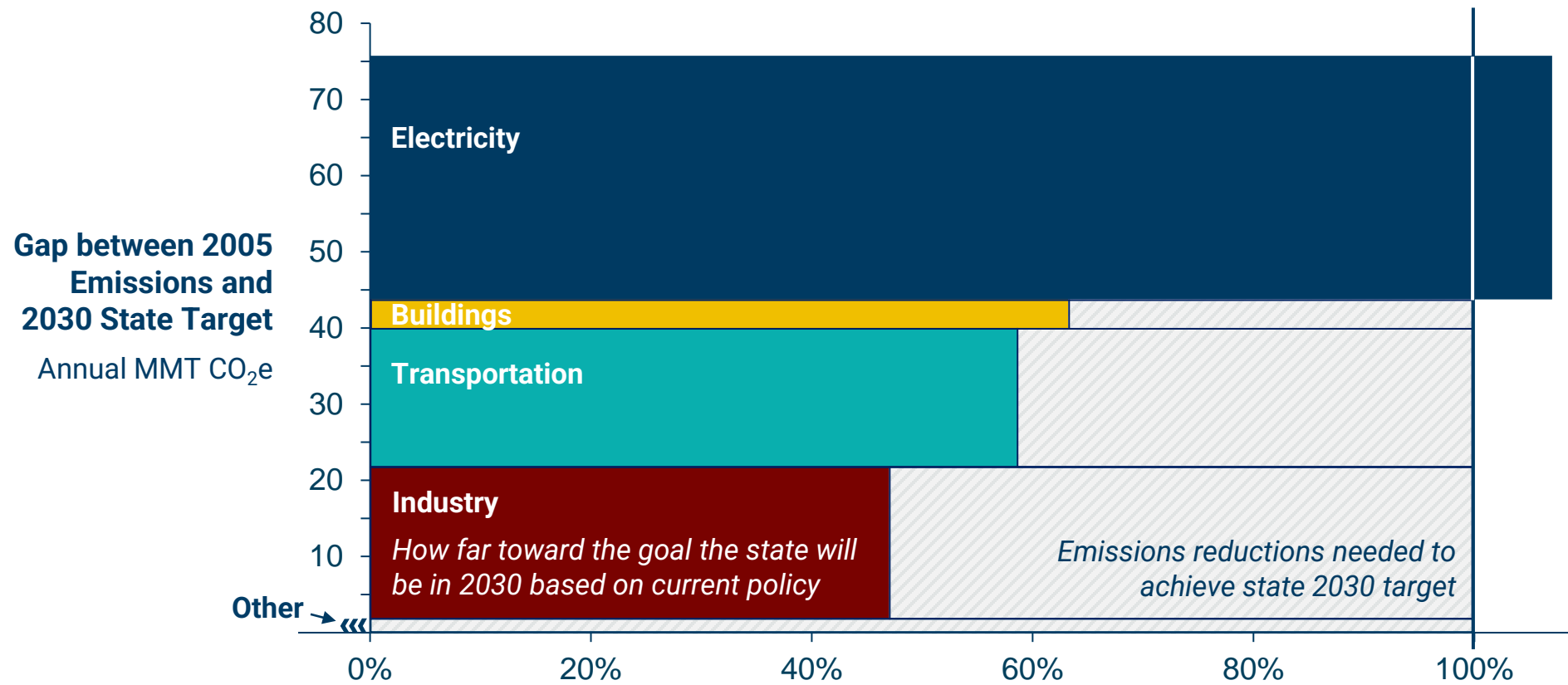
<https://statescorecard.rmi.org/>

Colorado's actions will deliver large-scale, long-lasting benefits to Coloradans

- Consumer savings
- Economic opportunity (jobs, GDP)
- Improved health outcomes
- Stronger, more resilient communities



However, the work is not done!

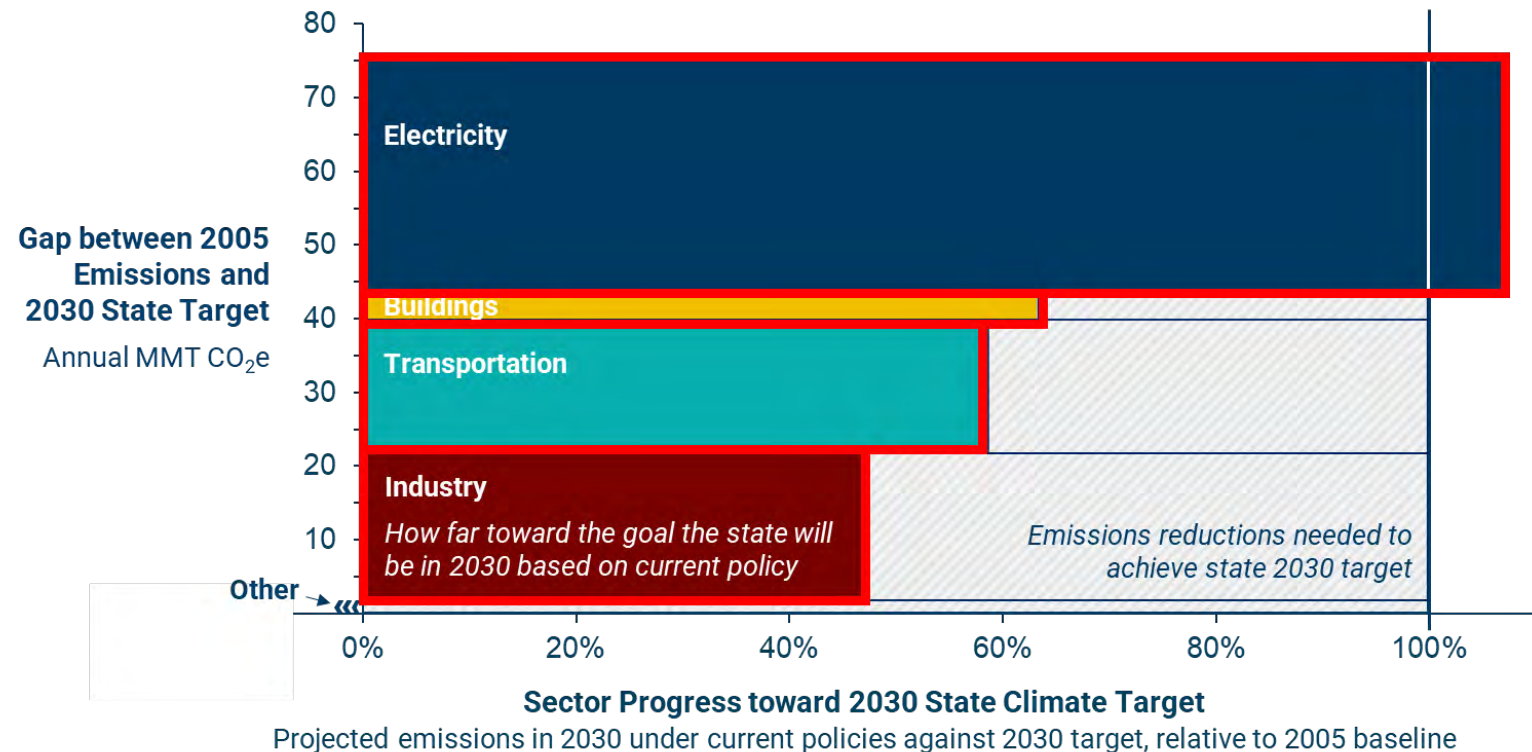


Sector Progress toward 2030 State Climate Target

Projected emissions in 2030 under current policies against 2030 target, relative to 2005 baseline

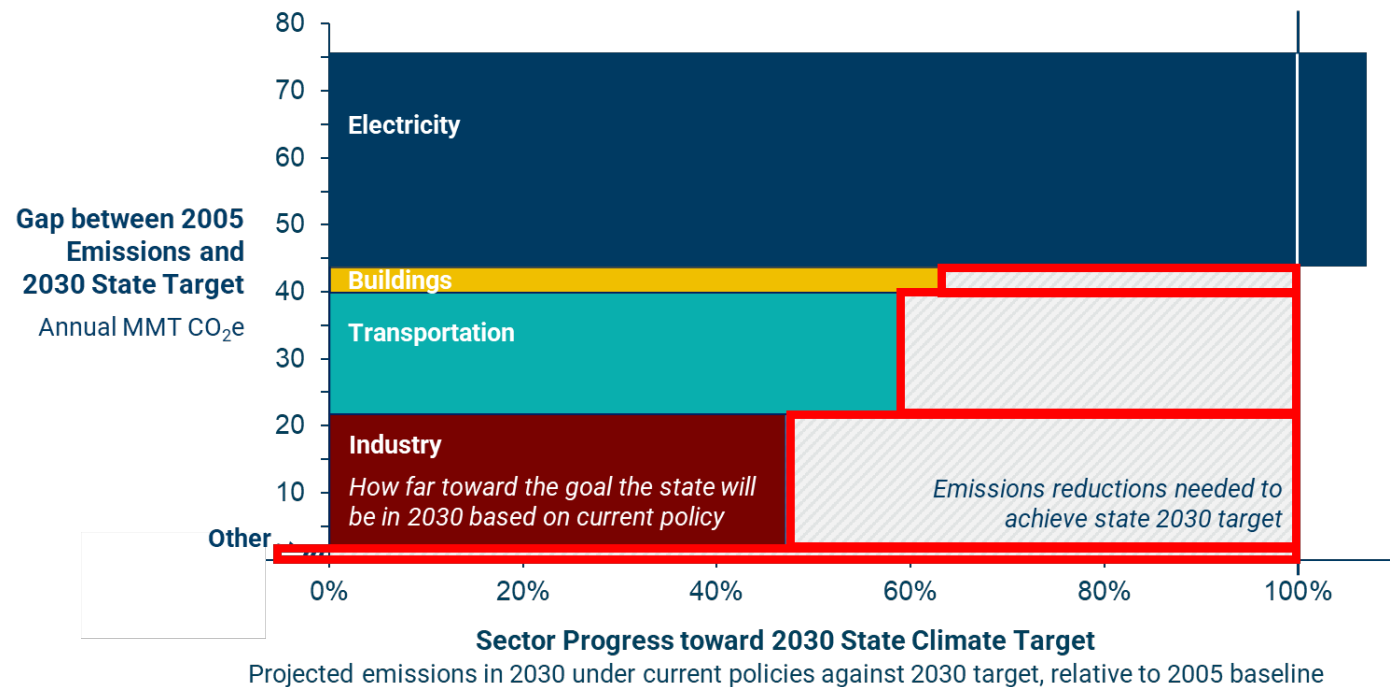
More work is needed to lock in projected emissions reductions

- Implement
- Enforce
- Deploy
- Address bottlenecks



Additional policies are needed to close remaining emissions gaps equitably

- Efficiency
- Electrification
- Emerging Technologies



Several key efforts are already underway to help close remaining gaps

Buildings

- Building Performance Standards
- Energy Code Board
- Clean Heat Plan Filings

Transportation

- Advanced Clean Trucks
- Low NOx Truck Rule
- 2023 EV Plan

Industry

- O&G GHG intensity verification rules
- O&G midstream working group
- GEMM 2
- WISHH (DOE hydrogen hub)

Additional actions will be needed to achieve 2030 state goals

Buildings

- Increased speed + scale of efficiency + electrification
 - Expanded and trained workforce (incl. contractors)
 - Additional incentives for new technologies

Transportation

- Rapid vehicle electrification
 - Advanced Clean Cars 2
 - Accessible EV charging solutions
- VMT reduction
 - Land use reform
 - Transit investment

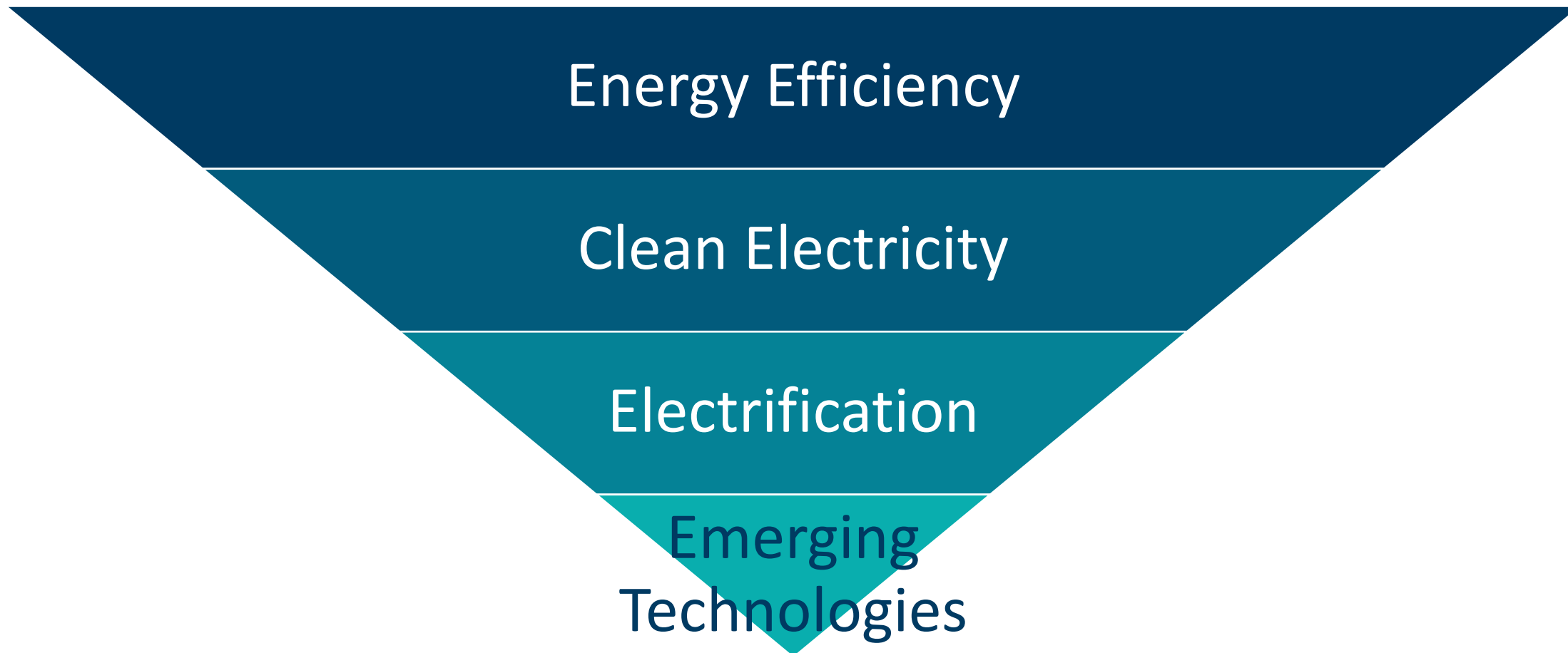
Industry

- Support for new and emerging technologies
- Support for innovative solutions

Emerging Technologies

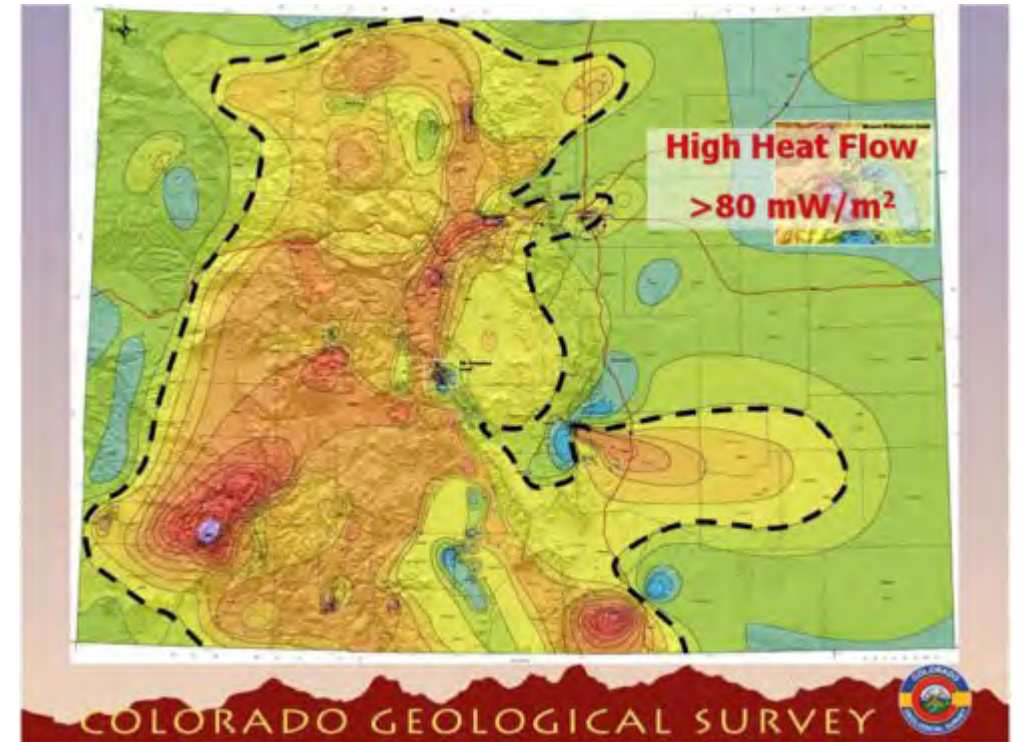


Emerging technologies can complement the core decarbonization building blocks

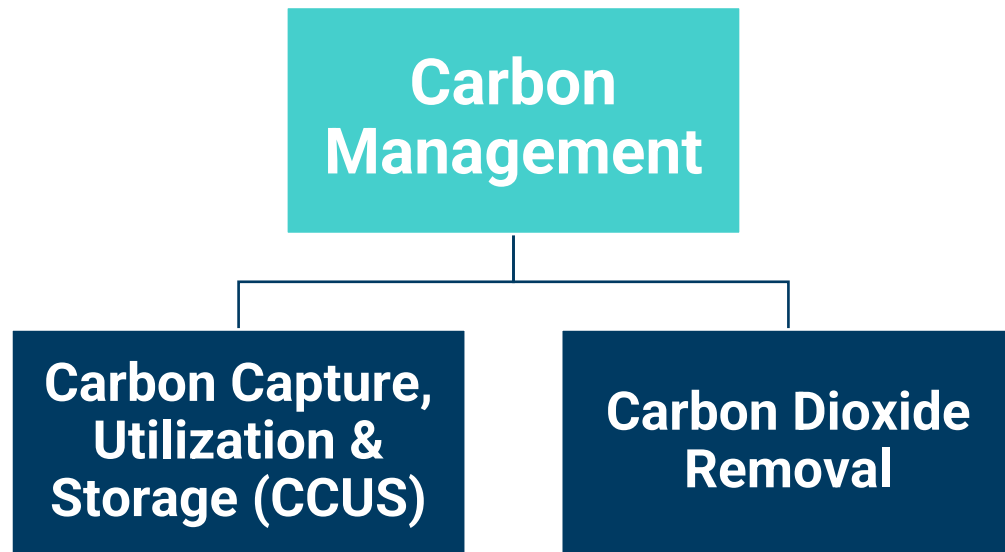


Geothermal Energy

- Renewable electricity source (alongside wind + solar)
 - Provides clean, firm energy
- Available for heating + cooling
- Provides opportunities for oil & gas workers, communities, + industry
- Colorado has abundant resources



Carbon Management



- **Carbon Capture, Utilization, and Storage (CCUS)**
 - Captures CO₂ at point sources
 - Useful for decarbonizing hard-to-abate sectors (e.g., industrial processes)
- **Carbon Dioxide Removal (CDR)**
 - Removes CO₂ directly from the air or oceans
 - Includes direct air capture (DAC), among other technologies
 - Addresses emissions that can't be eliminated and historical emissions by reducing atmospheric concentration of CO₂

Hydrogen

- **Useful for decarbonizing hard-to-abate sectors**
 - Feedstock for industrial processes
 - Heavy transport
- **Can be produced in multiple ways, with differing emissions implications:**
 - “Green” Hydrogen – requires large volumes of clean electricity
 - “Blue” Hydrogen – requires CO₂ pipelines, injection wells
- **Eligible for federal investment and incentives**
 - Hydrogen Hubs – Western Interstate Hydrogen Hub (WISHH)
 - Hydrogen Production Tax Credit (PTC) – 45V

Federal Investment Opportunity

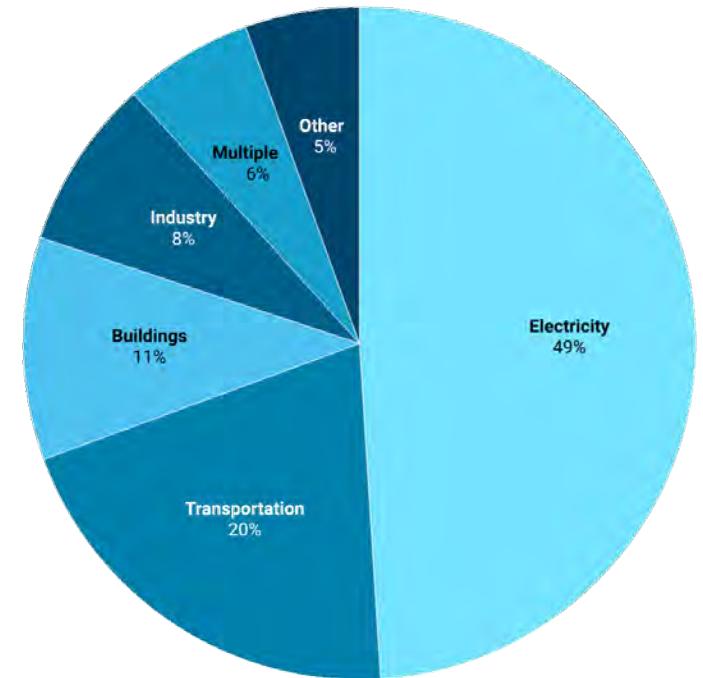


The Inflation Reduction Act (IRA) is a \$19 Billion opportunity for Colorado

- Reduce prices for consumers and businesses
- Rebuild + boost manufacturing
- Lower energy costs
- Create good-paying jobs
- Support small businesses
- Reduce air pollution
- Support rural communities
- Build resilience
- **Keep money in the state**

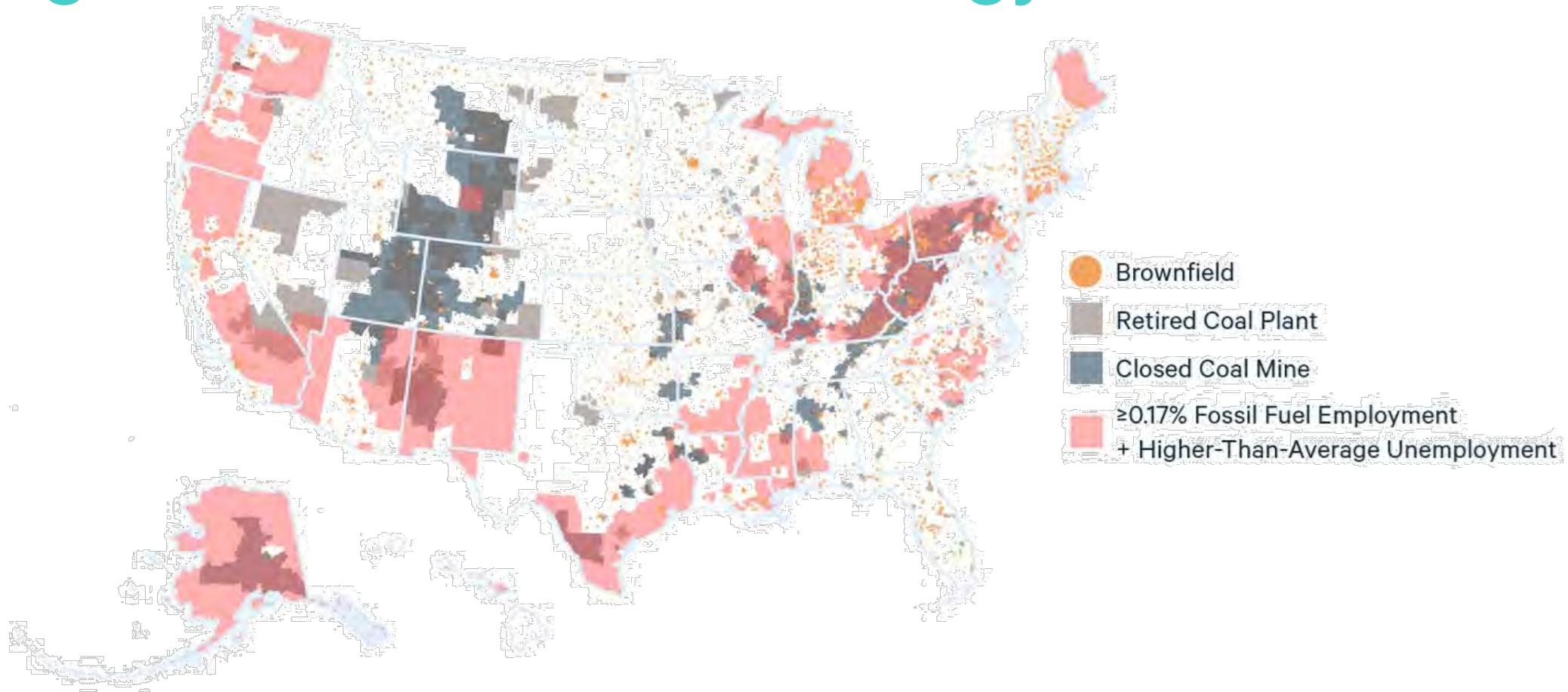
Colorado can attract significantly more federal investment than implied by CBO

- Preliminary analysis indicates Colorado could attract as much as **\$19 Billion**—three times as much as indicated by estimates from the Congressional Budget Office
 - Promote uptake of clean technologies
 - Pursue competitive provisions
 - Implement enabling policies
- Many IRA provisions are:
 - Uncapped
 - Distributed on a competitive or first-come, first-served basis



Projected Colorado Benefits from IRA by Sector
Other benefits include those for agriculture, forestry, land use, and water.

Colorado is uniquely positioned to take advantage of tax credits due to high concentration of “energy communities”



The state has many roles to play in maximizing the benefits of the IRA

- Set up state-run programs
- Directly access grants, loans, and credits
- Support and enable uptake of private sector and consumer incentives
- Pass complementary, enabling, and supportive policies to address risks and barriers
- Leverage improved economics and other game-changing provisions to pursue ambitious policies
- Ensure integration of new incentives in government planning and processes

Recap

- **Colorado is a national climate leader** and has made significant progress on climate goals.
- **A lot of work remains to be done** to implement and enforce existing policies, rapidly deploy needed infrastructure and technologies, and develop additional policies to promote efficiency and electrification.
- **Emerging technologies can complement the core decarbonization building blocks** (energy efficiency, clean electricity, and electrification).
- **The Inflation Reduction Act** presents a \$19 Billion opportunity to attract massive federal investment to Colorado.

A scenic landscape featuring a valley with green fields and a forested mountain range. The sky is filled with soft, white clouds. In the foreground, there are trees with autumn-colored leaves. A large teal circle is overlaid on the left side of the image, containing the text 'Q&A' in white.

Q&A

Transmission



Transmission in Colorado and across the United States

Chaz Teplin, PhD

Principal – Carbon-Free Electricity

Clean Competitive Grids



About me

- Chaz Teplin
- Lived in Colorado since 1996.
Raising 2 children here
- PhD in physics from CU-Boulder
- NREL scientist for 11 years
- Longmont start-up for ~4 years
- RMI since 2018

The Best Time to Plan Transmission Was 15 Years Ago. The Second-Best Time Is Now.

April 22, 2022

By Mathias Einberger, Charles Teplin

REPORT | 2021

The United States' Role in Limiting Warming to 1.5°C

By Charles Teplin, Zack Subin, Jacob Corvidae, Leia Guccione, Lena Hansen, Krutarth Jhaveri, Katie Mulvaney, Jon Rea

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HOME > REAL ESTATE

A Colorado man says his green home renovation paid off during a winter storm when temperatures dropped below -10 degrees

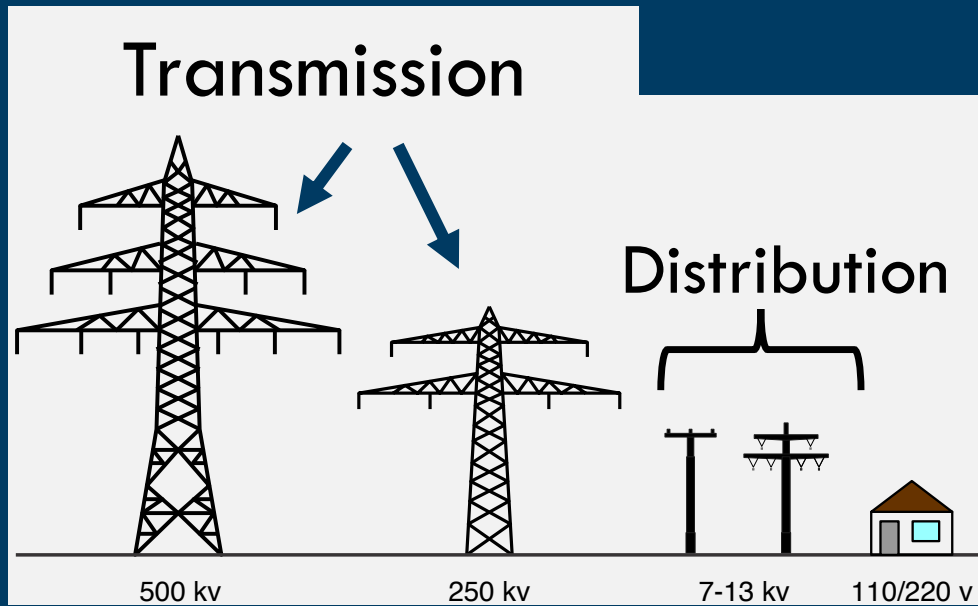
Chaz Teplin @ChazTeplin · Dec 22, 2022

Proof a heat pup works at 10 below



3,186 views 0:04 / 0:10

In this talk, I will share RMI's perspective on the state of the electric grid and transmission in Colorado and the US.



Talk Outline

- National transmission story
- Colorado's transmission system today and the planned Colorado's Power Pathway
- Transmission opportunities in Colorado

“Transmission” is the very high voltage power lines that carry power long distances.

The national transmission story

More and more – leaders & the press realize that expanded transmission is the key to the grid.

Esquire October 2022

The Sexiest Part of the Clean Energy Transition Is Big-Ass Power Lines

OK, sexy's a stretch. But high-voltage, long distance transmission lines are like an Interstate Highway System for wind and solar energy.

By Jack Holmes PUBLISHED: OCT 6, 2022

Unfortunately, I Care About Power Lines Now

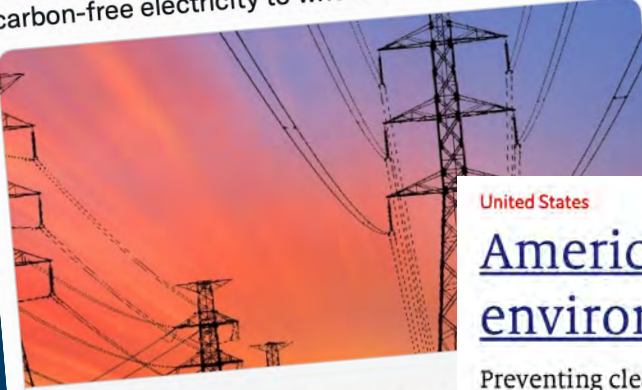
If America wants to fight climate change—or enjoy the benefits of a modern economy—it must get much better at building electricity transmission. Yikes.

By Robinson Meyer

The Atlantic
July 2021

Secretary Jennifer Granholm @SecGranholm

What good is clean energy if it can't reach our homes and businesses? @ENERGY's Building a Better Grid Initiative is expanding transmission to bring reliable, carbon-free electricity to where it's needed most.



energy.gov

Building a Better Grid in Action: Accelerating Deployment of Clean Energy Transmission
The Department of Energy's Building a Better Grid Initiative is expanding transmission to bring reliable, carbon-free electricity to where it's needed most. The Department of Energy's Building a Better Grid Initiative is expanding transmission to bring reliable, carbon-free electricity to where it's needed most.

4:19 PM · Jan 20, 2023 ·

The surprising key to a clean energy future

If you care about climate change, you should care about transmission.

By Bill Gates | January 24, 2023 · 5 minute read



Bill Gates last week

The Economist

Sunday

United States

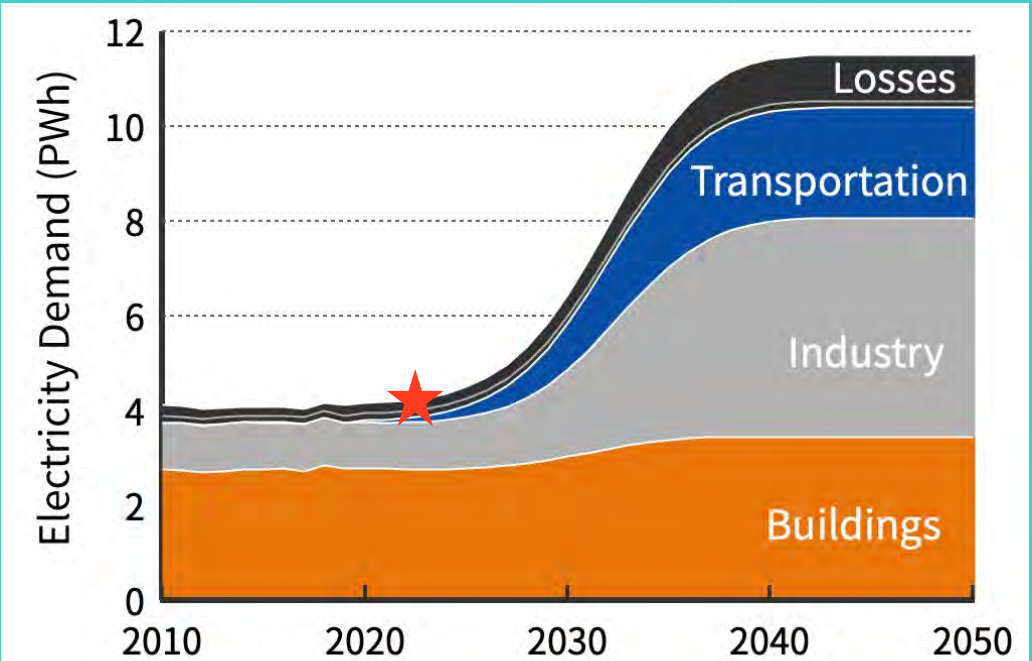
America needs a new environmentalism

Preventing clean-energy infrastructure from being built is no way to save the planet

We must expand transmission to connect low-cost generation, improve reliability, meet climate goals, & support new loads.

- To connect today's **low-cost generation** in places like Colorado's Eastern Plains, we need transmission.
- Transmission connecting US regions greatly **improves reliability**. Winter storms Uri & Elliot are prime examples.
- With transmission, geographic diversity & cooperation **reduces costs**.
- Simply, electrification will grow load and the need for a **larger grid**.

National RMI study. Other studies show similar demand growth.

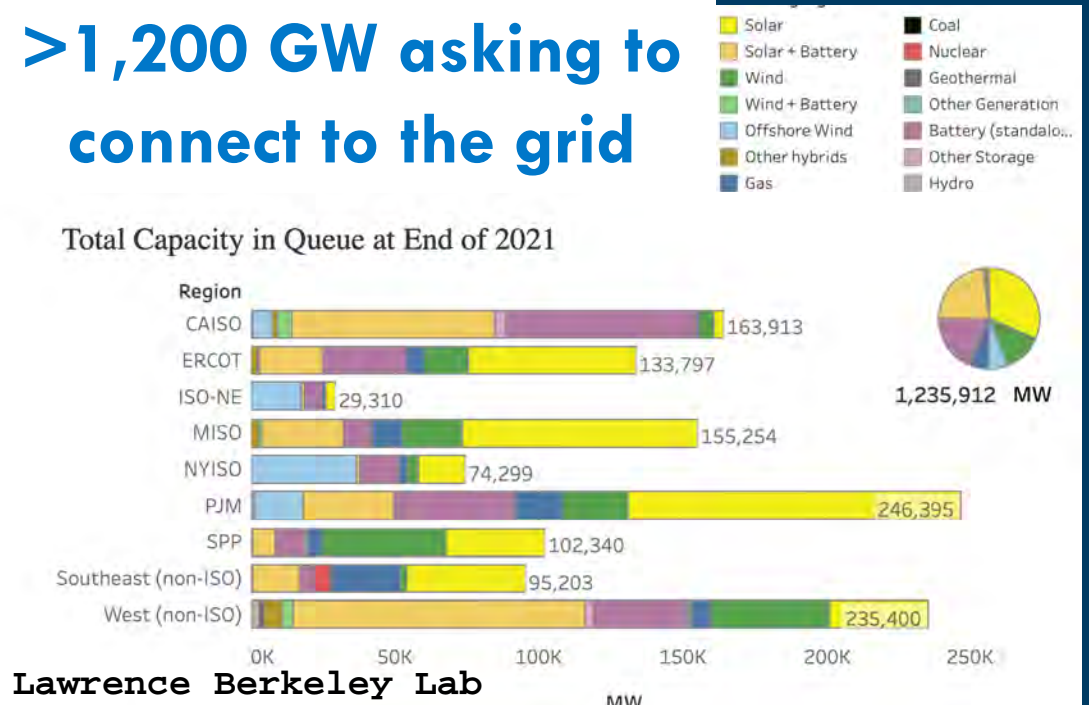


The national state of play

Limited transmission is preventing new generation.
Utilities are not planning the large lines that we need.

- Some success stories, with some new lines in progress.
 - Colorado, MISO, some independents
- But today's transmission plans are far short of what is needed.
- FERC is considering ordering improved planning – but only for “regional” lines.
- No one is planning West-Wide transmission.

>1,200 GW asking to connect to the grid



>1,200 GW of mostly low-cost wind, solar, and storage want to connect. Compare to Colorado peak load of ~10 GW and total US generating capacity of ~1,000 GW!

The case for transmission is strong! But challenges stand in the way of build-out.

OPPORTUNITIES

- New or upgraded transmission lines nearly always pay for themselves
- Transmission improves reliability & hedges against costly fuel spikes or extreme weather events
- Transmission supports emissions reductions both in Colorado and in neighboring states
- Jobs & economic development
- Non-partisan

CHALLENGES

- We are spending \$\$ on local transmission already.
- Transmission takes too long to plan, permit, & build. Often 15+ years.
 - Best time to plan: 15 years ago
 - Second-best time: today
- It's “Nobody’s job” to plan inter-regional transmission.
 - Finances dis-incent building transmission
- States often disagree about how to split transmission’s cost.

**Regional
transmission in
Colorado today**

Colorado is leading on in-state planning but needs to plan together with neighboring states

Today's CO grid is weakly connected to our neighbors

- Colorado peak load is ~13 GW
- The most we can export or import is 2 GW from Wyoming and Nebraska

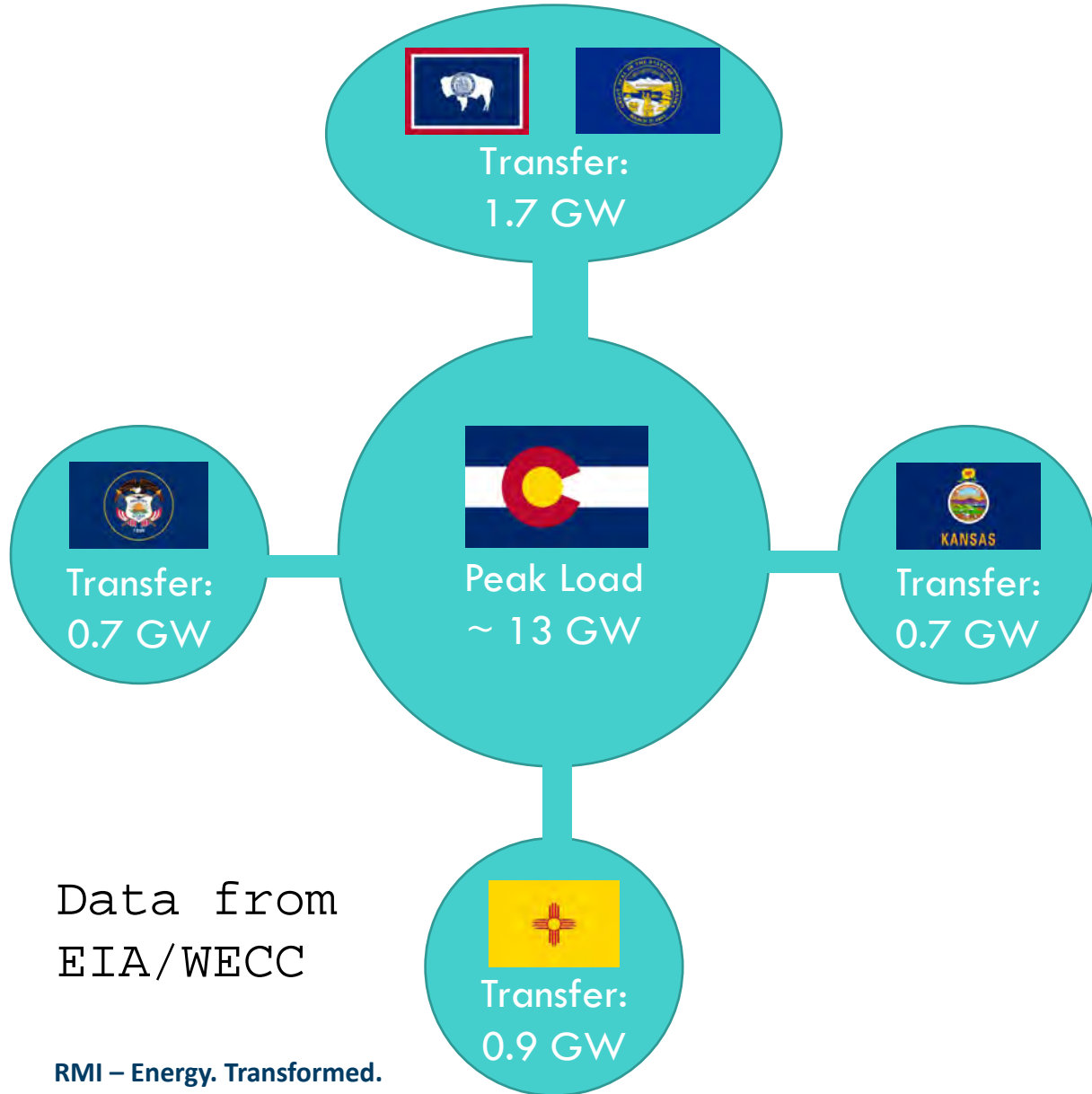
Power Pathway is well-designed to access in-state wind

- Xcel's Colorado's Power Pathway will allow us to develop wind from our Eastern Plains
- Power Pathway not routed for solar
- Private developers interested in new lines

Need for planning and coordination with our neighbors

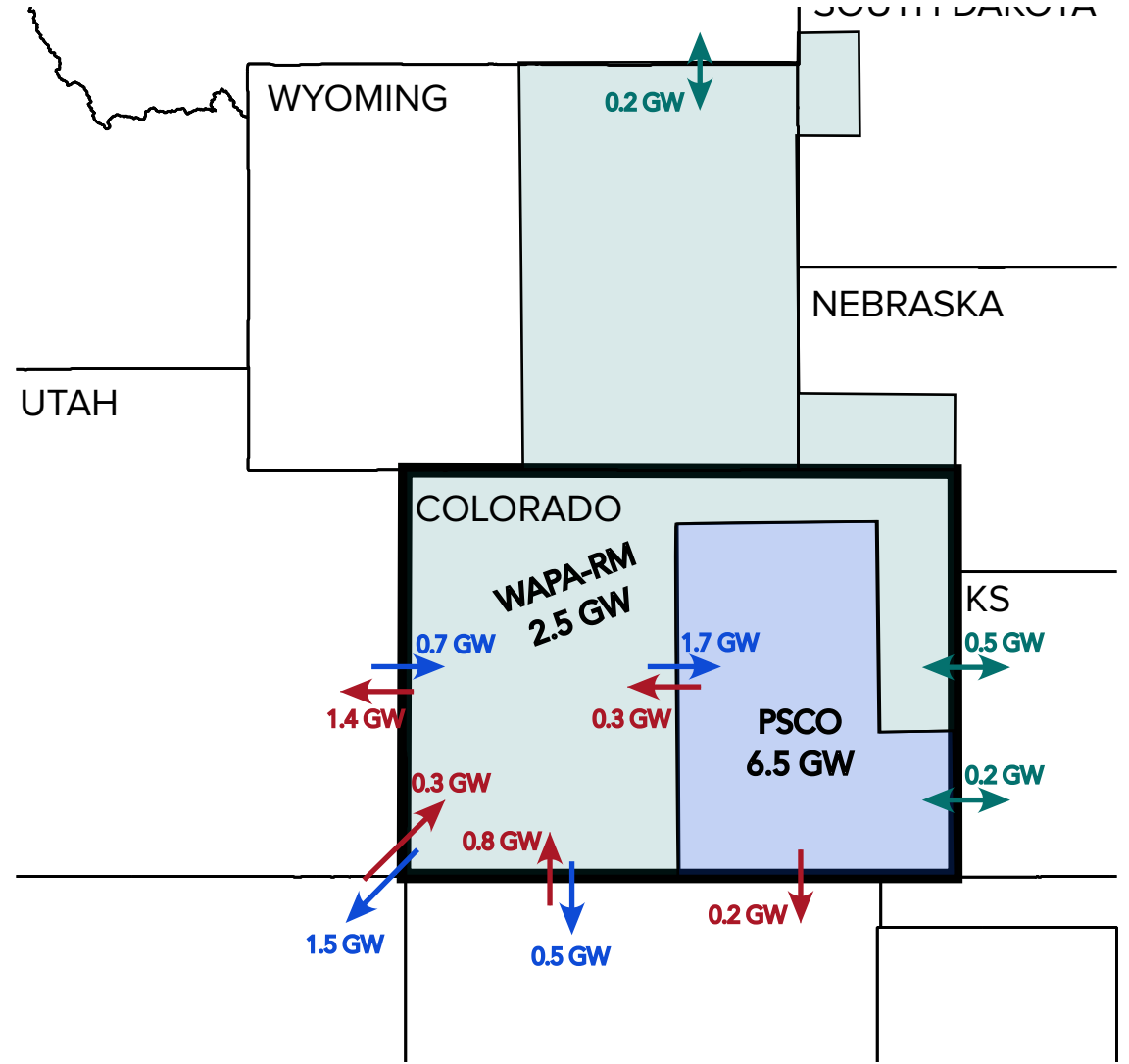
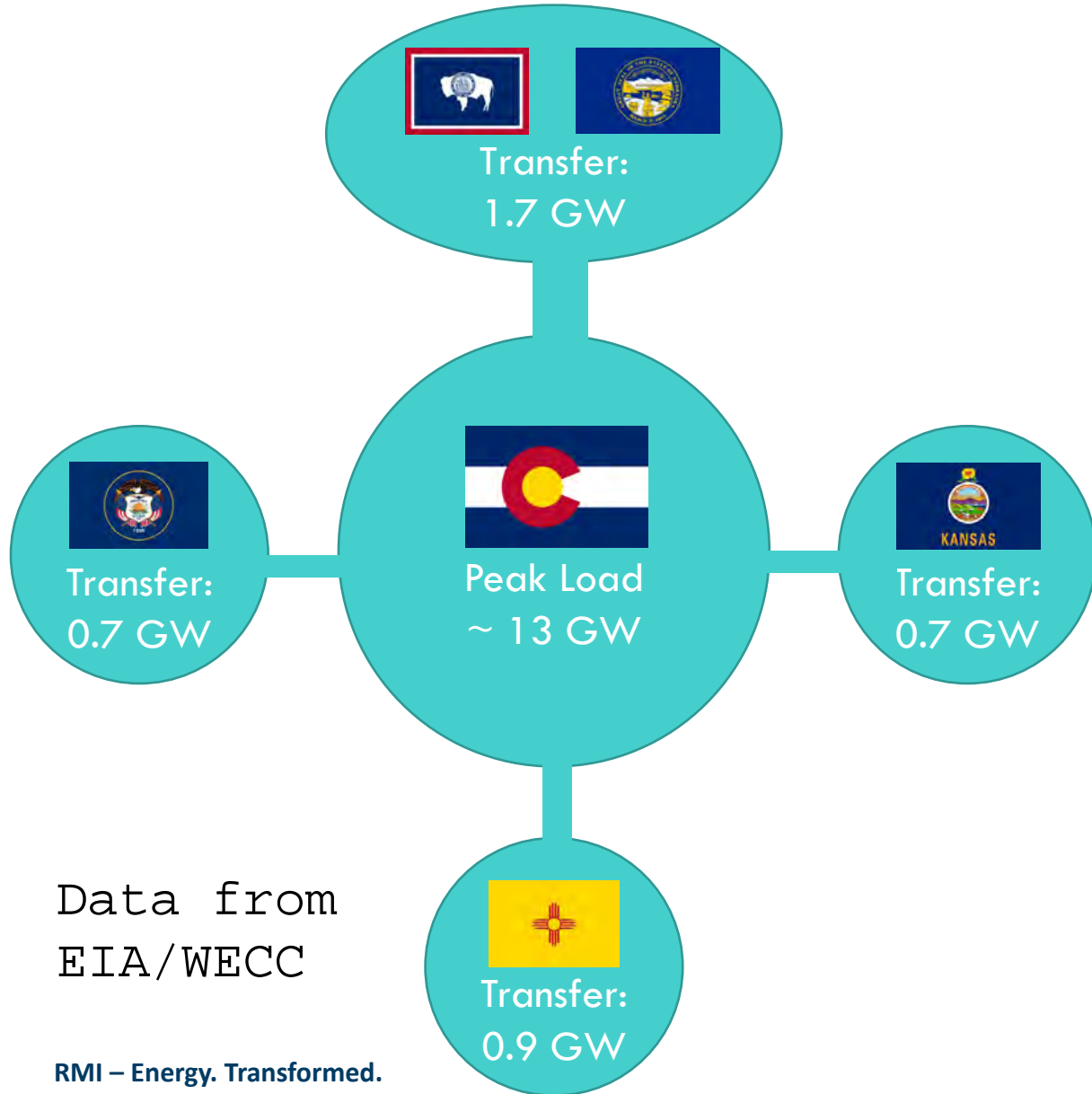
- For reliability, **economics**, and emissions goals, new connections to our neighbors are needed
- No meaningful coordination happening today but opportunity for CETA to support
- RTO bill helps! But not in time

Colorado Regional Transmission Capability in 2022



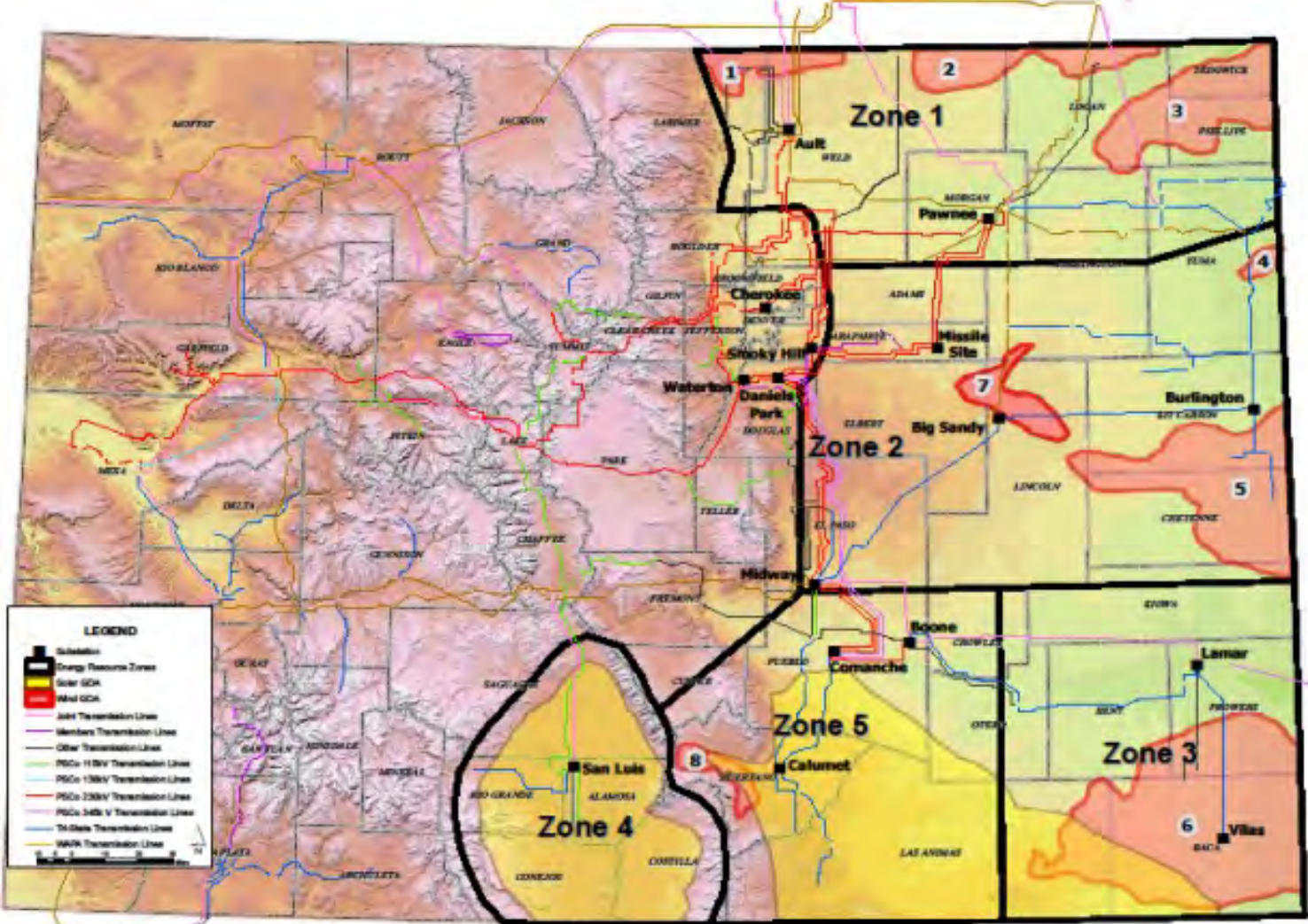
Data from
EIA/WECC

Colorado Regional Transmission Capability in 2022

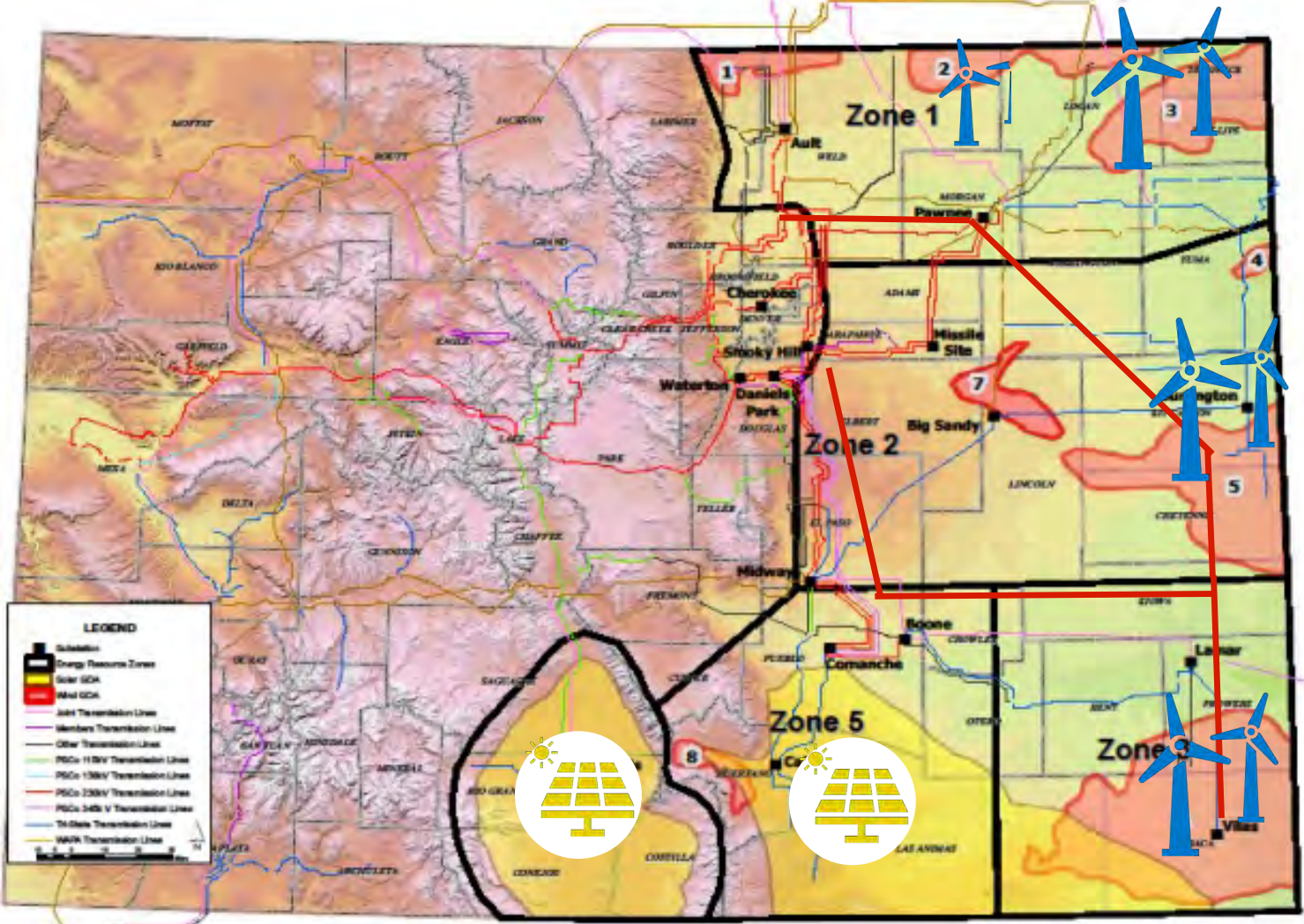


(This graphic ~2 years out of date)

The planned Colorado Power Pathway will allow us to access the excellent wind power in Eastern Colorado



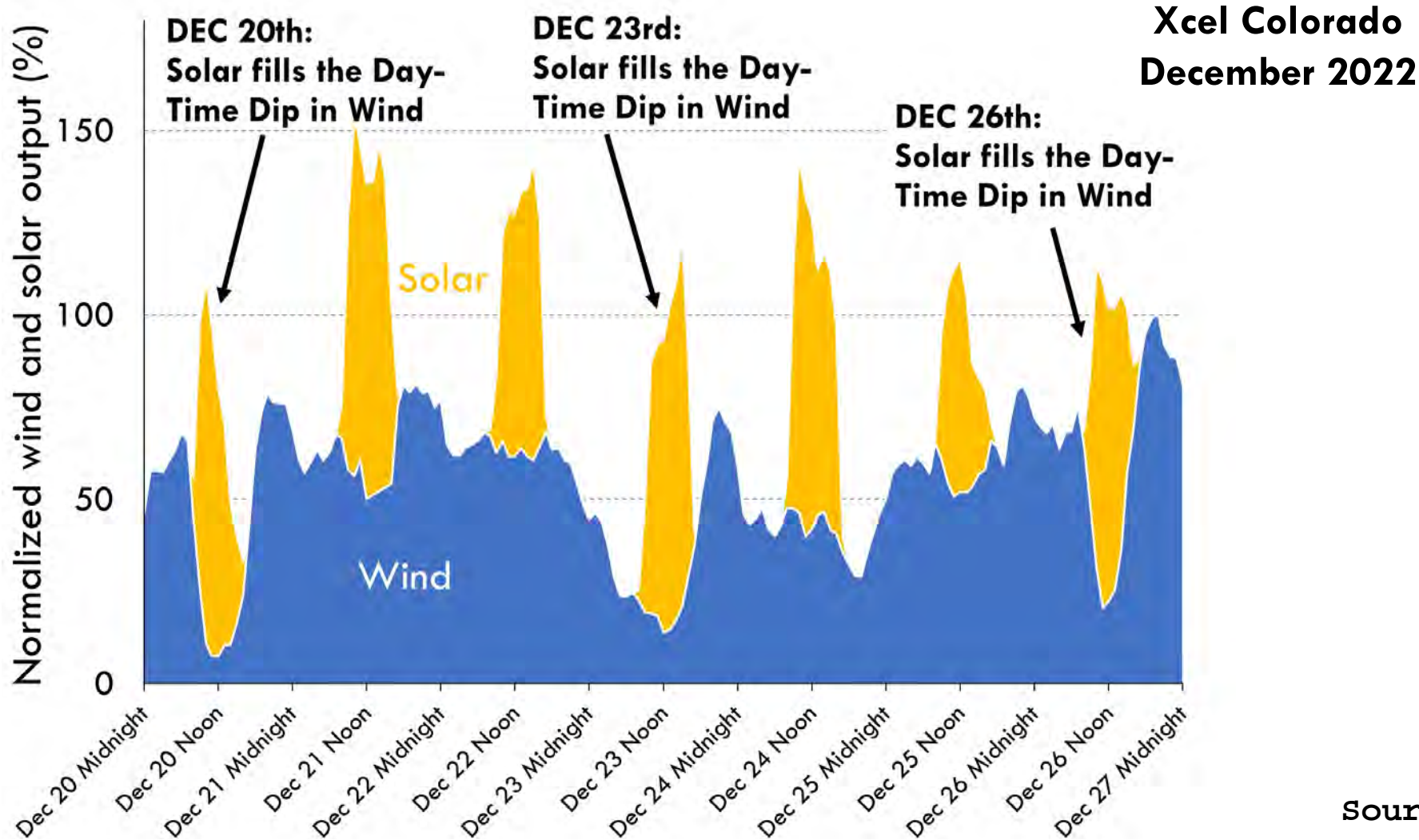
The planned Colorado Power Pathway will allow us to access the excellent wind power in Eastern Colorado



Transmission Opportunities in Colorado

- Connecting Colorado's best solar
- Connecting to our neighbors:
 - Example: Winter Storm Elliott
- Upgrading the existing system

Increased solar will complement today's and planned wind.



Power Pathways will connect excellent eastern wind generation. However, we lack transmission to the solar-rich San Luis Valley.

- Power Pathways will collect wind in Eastern Colorado.
- CETA could investigate line to San Luis Valley, which has Colorado's best solar.

BIG PIVOTS

Transmission to San Luis Valley?

Nov 29, 2022

Colorado's San Luis Valley rips with solar capacity but lacks a way to get the electricity to market. What will it take? A conversation is beginning at the state's PUC.

Chris Clack Testimony to PUC

HOW DOES THE CLEAN POWER PATHWAY ACCESS THE BEST WIND AND SOLAR RESOURCES?

The CPP appears to have the ability to collect wind from the Northeast and Central-east portions of Colorado. An optional portion, the May Valley Longhorn Extension, of the CPP extends into the Southeastern region that would actually be able to access the best wind resource. The CPP does not appear to have been designed to collect the best solar resources in the San Luis Valley or be able to collect solar from resource zone 5.

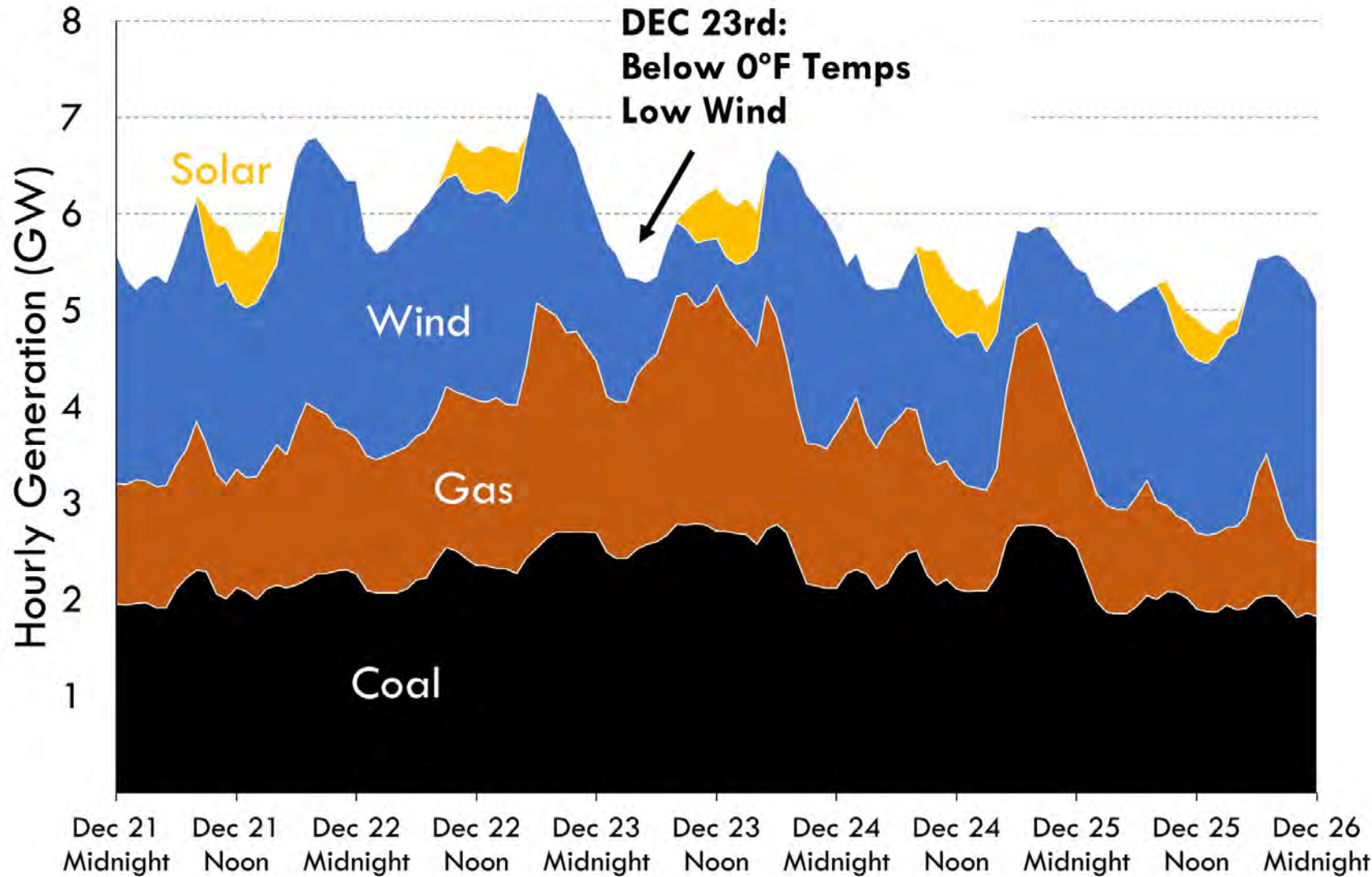
To retain reliability and cost-effectively meet Colorado's GHG targets, Colorado should increase connections to its neighbors.

- Decarbonization modeling consistently shows the need for more inter-regional transmission.
- Resource sharing across states and time zones reduces variability & increases reliability.
- With increased transmission, Colorado can export its excellent clean energy to its neighbors and beyond.



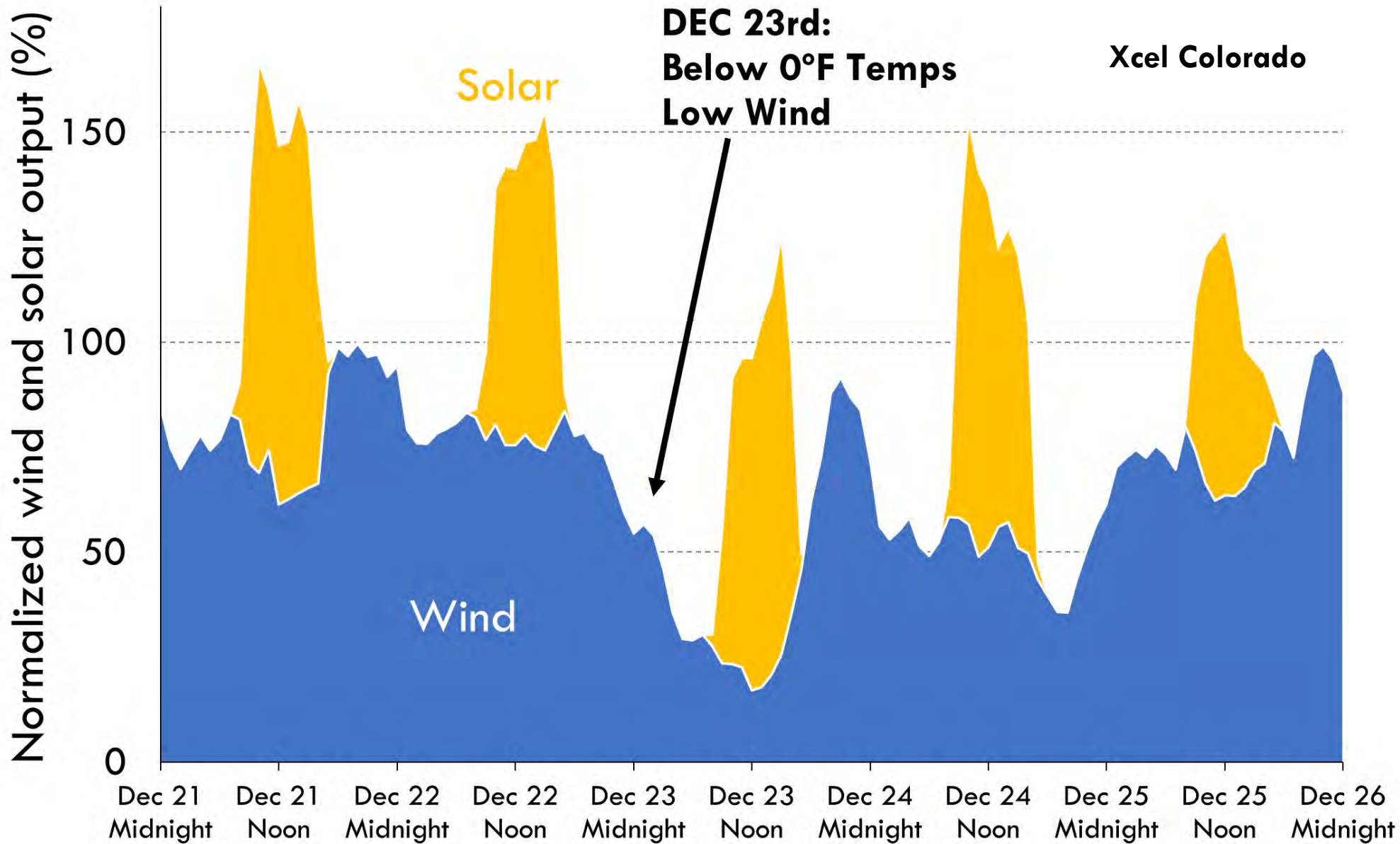
During December 2022's Winter Storm Elliott, wind output dropped

Xcel Colorado Generation – Late December 2022



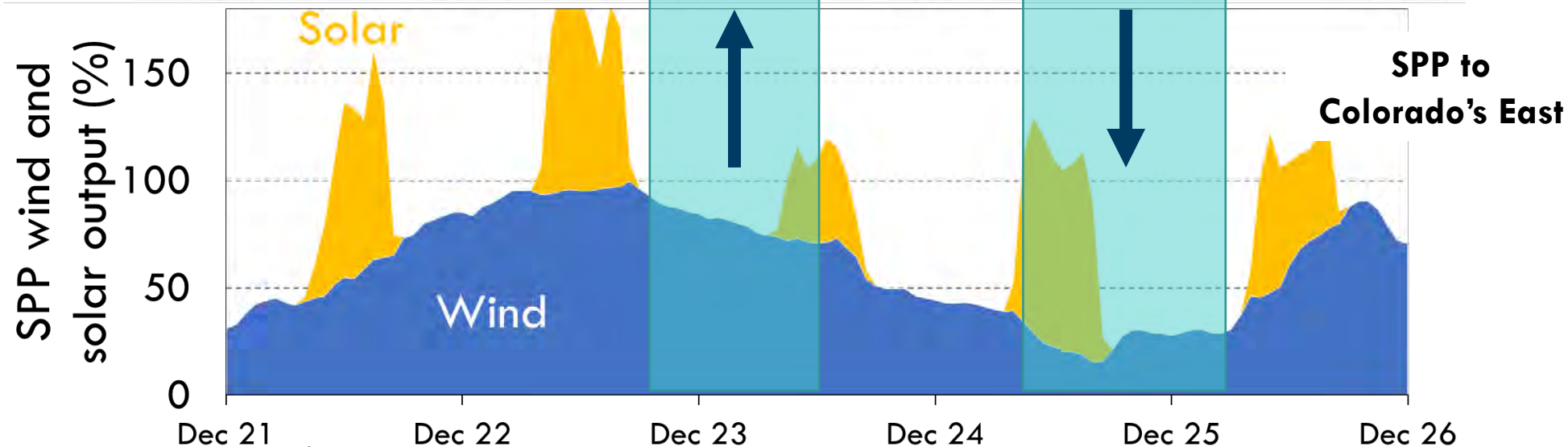
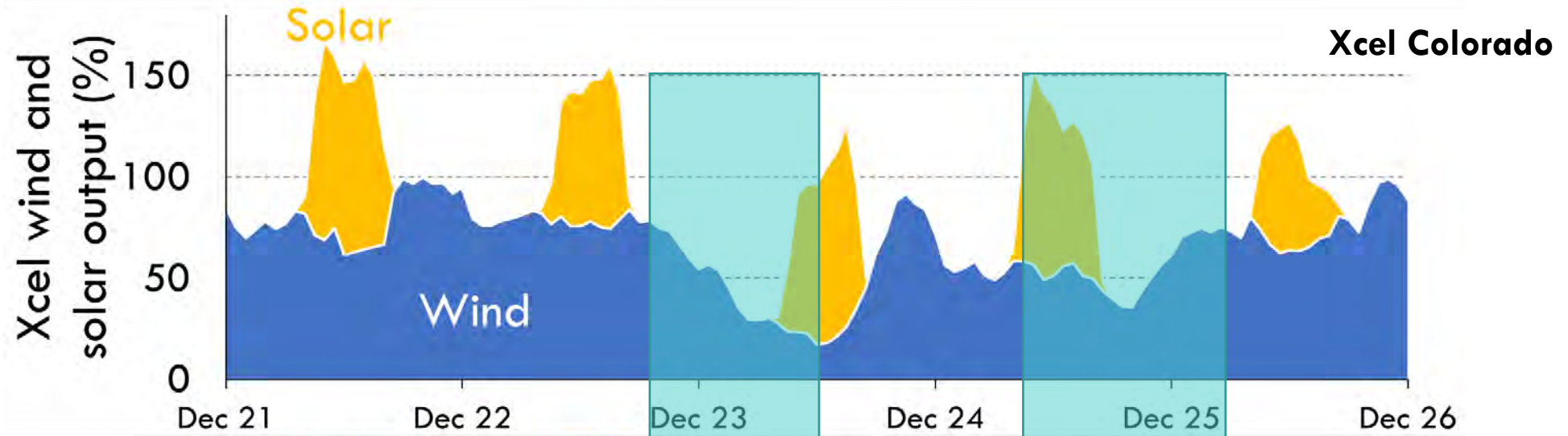
Source: EIA

When wind and solar are shown as a % of their max output, the December 23rd drop-off is clear



Source: EIA

During Storm Elliott, Colorado and our Eastern neighbors would have both benefitted from increased transmission

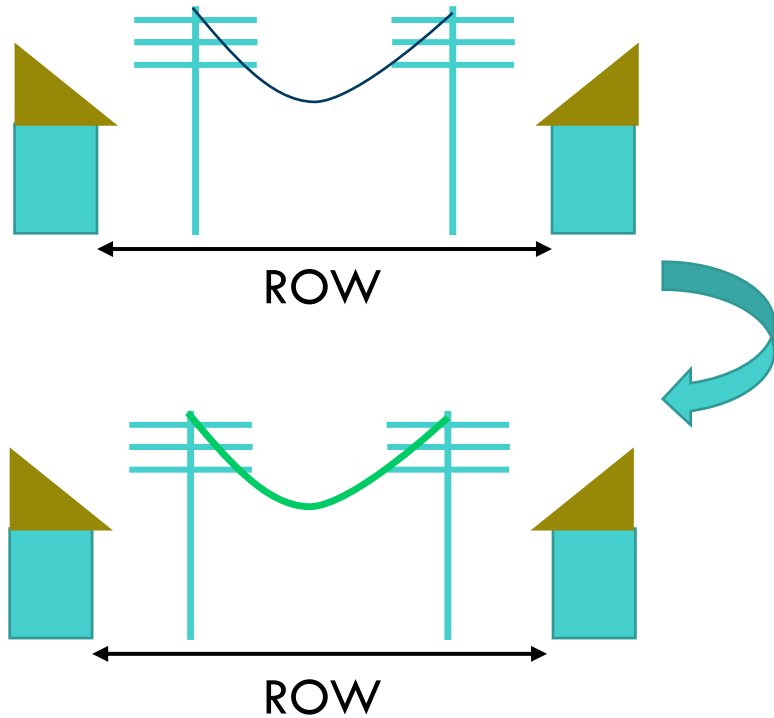


Source: EIA

Options to Make Building Transmission Easier

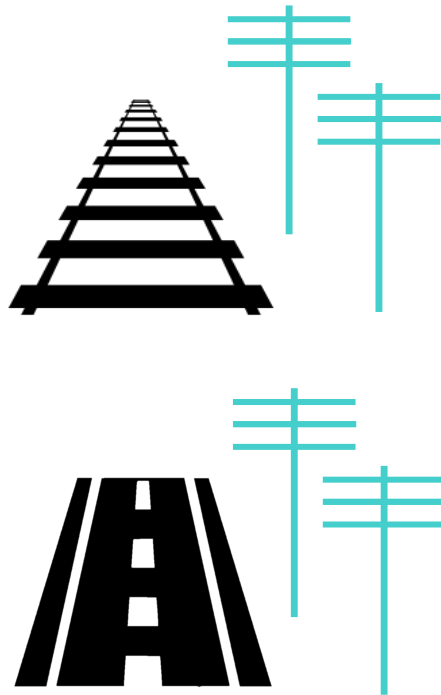
Upgrade Wires with High-Capacity Wires

- Add circuits
- Use newer technology



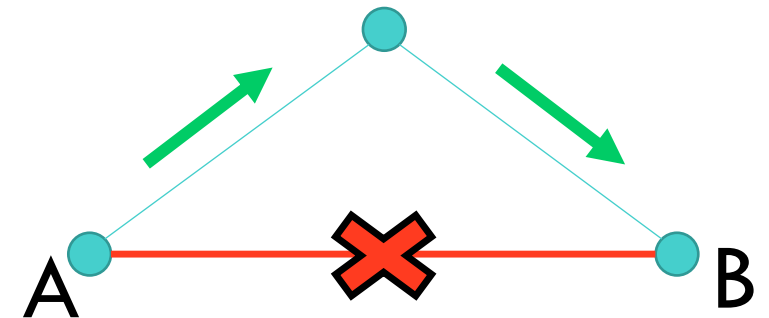
Leverage Existing Right of Ways

- Highways & railroads



Leverage New Grid Technologies

- “GETs” are low-cost devices that push more power through the existing system



Colorado can build on recent progress by planning and supporting transmission to neighboring states

- **Power Pathways is a good start that will help Colorado access its own wind power**
 - Additional transmission needed to access CO's best solar
- **To cost-effectively meet HB 1261 goals, create clean energy jobs, and support reliability, Colorado should connect to neighboring states**
 - CETA can help but political pressure is helpful
- **Colorado can leverage innovative technologies and solutions to get the most out of existing and new transmission**

