
COLORADO OIL AND GAS INDUSTRY

Economic Assessment of 2,500-Foot Oil and Gas Setback Proposal

Research conducted for the Metro Denver Economic Development Corporation, the Denver South Economic Development Partnership, and the Common Sense Policy Roundtable by the:

BUSINESS RESEARCH DIVISION

Leeds School of Business
University of Colorado Boulder
420 UCB
Boulder, CO 80309-0420
Telephone: 303-492-3307
Colorado.edu/business/brd

June 2016



Business Research Division

The Business Research Division (BRD) of the Leeds School of Business at the University of Colorado Boulder has been serving Colorado for nearly 100 years. The BRD conducts economic impact studies and customized research projects that assist companies, associations, nonprofits, and government agencies with making informed business and policy decisions. Among the information offered to the public are the annual Colorado Business Economic Outlook Forum—now in its 52nd year—which provides a forecast of the state’s economy by sector, and the quarterly Leeds Business Confidence Index, which gauges Colorado business leaders’ opinions about the national and state economies and how their industry will perform in the upcoming quarter. The Colorado Business Review is a quarterly publication that offers decision makers industry-focused analysis and information as it relates to the Colorado economy.

BRD researchers collaborate with faculty researchers on projects, and graduate and undergraduate student assistants, who provide research assistance and gain valuable hands-on experience.

Visit us at:

www.colorado.edu/business/brd

TABLE OF CONTENTS

Table of Contents	ii
Summary.....	1
Prices versus Policy.....	1
Price Impact.....	1
Production Reduction Due to Setbacks	2
Methodology	3
Legislative Background	4
Price versus Legislation.....	9
Colorado Oil Production	10
Depleting Oil Well Production	12
Colorado Gas Production.....	13
Depleting Natural Gas Well Production	15
Rig Count	15
Oil Production Forecast	15
Commodity Prices.....	17
Severance Taxes	22
Assumptions	23
Economic Impact	24
Conclusion	25
Bibliography.....	26

SUMMARY

The Business Research Division (BRD) has studied the contributions of the oil and gas industry in Colorado since 2010. In 2014, the BRD began analyzing policy and price impacts on the oil and gas industry and the implications on the state economy using the REMI model with support from the Metro Denver Economic Development Corporation, the Denver South Economic Development Partnership, and the Common Sense Policy Roundtable. Three papers describe policy and price impacts:

- *Colorado Oil and Gas Industry: Updated Economic Assessment of Colorado Oil and Gas Ballot Initiatives in 2014* (September 2014)
- *Oil and Gas Prices – The Upside and the Downside* (January 2015)
- *Colorado Oil and Gas Industry: Updated Economic Assessment of Colorado Oil and Gas Prices* (August 2015)

This paper refines the work completed in 2014 and 2015, isolating potential *policy* impacts on production in Colorado. This research was conducted for the Metro Denver Economic Development Corporation, the Denver South Economic Development Partnership, and the Common Sense Policy Roundtable.

Prices versus Policy

Commodity prices began falling in mid-2014, reshaping the industry globally and locally. Prices and policy at face value have the similar effect—a decrease in oil and gas activity. However, each sends a different signal about uncertainty and long-term potential. While uncertainty surrounds prices in the short term, the expectation is that in the medium-term horizon, prices will rebound and production will follow.

Comparatively, uncertainty is relatively low for a setback measure—producers can be fairly certain about drilling that would be inaccessible and production that would be lost. (According to the Colorado Oil and Gas Conservation Commission [COGCC], a 2,500-foot setback measure would result in a 90.2% reduction in accessible land.) Local control measures, however, are less predictable than setbacks regarding where activity would be curtailed, as well as the rules that local communities would put in place, making local control initiatives highly uncertain and potentially resulting in a significant long-term reduction in production.

Price Impact

Nationally, the deterioration in oil and gas prices has resulted in some benefits and implications for the economy. Consumers and industry have benefited from lower gasoline prices for transportation, as well as lower natural gas prices for heating and industrial energy. Economies (nation and specifically, energy-intensive states) have also measured the economic costs, notably through

- Lower drilling permits and rig counts,
- Decreased fixed investment,
- Falling industry employment,
- Decreased industry wages,
- Energy-industry company bankruptcies,
- Increased commercial vacancy/shadow vacancy, and
- Lower public revenues (severance taxes, royalties, ad valorem taxes, property taxes, income taxes, etc.).

Technology and prices have led to the following observations about Colorado oil and gas industry activity:

- 1) Wells drilled over the past five years produce more in the first year than wells drilled prior.
- 2) The depletion rate for wells drilled in the past five years is faster than wells drilled prior.
- 3) The current rig count in Colorado is not great enough to keep new well production constant.
- 4) With a lower number of drilling rigs, wells drilled and oil and gas production will drop from record levels recorded in 2015.

Production Reduction Due to Setbacks

The price environment provides a new baseline for expected industry growth. A reduction in new production would have a compounding impact on industry output. Based on estimates provided by the COGCC, a 2,500-foot setback would curtail accessible drilling locations by 90.2%. Extrapolating this to a reduction in new production, coupled with the quickly depleting yields from existing wells, leads to deeper reductions in GDP, employment, and income compared to a baseline scenario. Assuming a 90.2% reduction in new production beginning in 2017, the compounding economic consequence would result in a lower real GDP by an average of \$7.1 billion and 54,000 fewer jobs in the first five years, and a lower GDP by an average of \$14.5 billion and 104,000 fewer jobs between 2017 and 2031. While the setback changes reduce growth potential, the model does not produce a scenario in which the reduction in oil and gas activity is recession-causing—continued GDP growth is observed throughout the forecast horizon.

The REMI model used for this analysis is the Tax PI model 1.7.105 for the state of Colorado, with 2013 data as the most recent historical year within the model. Researchers from the BRD examined the known, quantifiable industry metrics, ranging from production and prices to employment, wages, and taxes. The model was calibrated to adjust for the current low oil and gas price environment with a gradual increase in oil prices to \$73 per barrel in 2031 and in natural gas prices to \$5 per million BTUs.

METHODOLOGY

The Business Research Division at the University of Colorado Boulder was hired by the Metro Denver Economic Development Corporation, the Denver South Economic Development Partnership, and the Common Sense Policy Roundtable to conduct economic impact analyses on the proposed 2,500-foot setback for oil and gas development.

The research team used the REMI model version 1.7.105, build 4061 for the analysis. The REMI model is a dynamic forecasting and policy analysis model that incorporates econometric, input-output, and computable general equilibrium techniques. The model was created by REMI specifically for the state of Colorado using national and Colorado economic and demographic data. The REMI model used for this analysis is the Tax PI model 1.7.105 for the state of Colorado, with 2013 data as the most recent historical year within the model.

Economic impact studies detail the direct spending that a company or activity has on the area of study, as well as the indirect impact, which is the ripple effect that direct spending has on other businesses in the community. This term is also referred to as the *multiplier effect*, wherein companies utilize the local supply chain. A multiplier is a numeric way of describing the full effects of money changing hands within an economy. For instance, when the oil and gas industry contracts with fuel transportation companies, this affects transportation industries. This is the *indirect impact*. Additionally, spending by employees has an inherent effect on local communities as they purchase groceries, clothes, and gas; pay rent or a mortgage; get haircuts, etc. This is understood as the *induced impact*.

The REMI model was built with 2013 data as the most recent historical year; data beyond 2013 are forecasts within the model. Given the rapid changes observed in the energy industry, the model was calibrated to reflect more current data and expectations about economic growth using Moody's Analytics' baseline forecast through 2040. This calibration updated 22 GDP components within REMI, including 13 personal consumption expenditure values, 4 private fixed investment values, 3 government spending values, and 2 trade values. The employment/output ratio was updated to reflect productivity changes within the industry. As well, the Moody's baseline forecast for Mining employment (which includes oil and gas extraction, mining [except oil and gas], and support activities for mining) was entered into the model through 2040. These three changes effectively created a new national baseline forecast for the energy industry based on expectations in 2016. This model excludes the REMI government spending response to GDP. Last, the REMI population forecast for Colorado was updated to include the forecast for Colorado

population by age, gender, and race/ethnicity through 2050 from the Colorado Department of Local Affairs, State Demography Office.

This paper focuses on the economic impact of the 2,500-foot setback proposal, also known as Colorado Ballot Initiative #78 which proposes a mandatory setback of new oil and gas developments, including hydraulic fracturing from both “occupied structures” and “areas of special concern.” The COGCC used GIS techniques to study constrained potential oil and gas development based on COGCC staff’s interpretation of the initiative. COGCC experts estimated the 2,500-foot setback would render 90.2% of Colorado land off limits to future oil and gas exploration. However, the surface land is not necessarily indicative of the underlying resource—how productive the remaining 9.8% of available land may be (the land could produce more than 9.8% of potential production or less than 9.8% of potential production). The economic impact of the 2,500-foot setback was estimated using updated depletion rates for oil and gas wells, rig counts data, price forecasts from Moody’s and the Energy Information Administration (EIA), and the assumption of a 90.2% reduction in future drilling. The updated depletion rate analysis was conducted by Rich McClure, an energy industry engineer, using COGCC data.

LEGISLATIVE BACKGROUND

In early 2016, a total of 12 ballot initiatives were proposed with the goal of limiting oil and gas development and production within the state of Colorado. These initiatives can be categorized into three areas:

1. Local Control (Initiatives #40, #63, and #75)
2. Bans (Initiative #62)
3. Setbacks (Initiatives #76–#83)

The ballot initiatives proposed are as follows:

- Ballot Initiative #40 – Local government empowerment
- Ballot Initiative #62 – Hydraulic fracturing ban
- Ballot Initiative #63 – Right to a healthy environment
- Ballot Initiative #75 – Local government control of oil and gas development
- Ballot Initiative #76 – 2,500-foot setback from occupied structures and areas of special concern and prohibition on creating new areas and structures within 2,500 feet of oil and gas developments
- Ballot Initiative #77 – 4,000-foot setback from occupied structures and areas of special concern and prohibition on creating new areas and structures within 4,000 feet of oil and gas developments
- Ballot Initiative #78 – 2,500-foot setback from occupied structures and areas of special concern
- Ballot Initiative #79 – 4,000-foot setback from occupied structures and areas of special concern
- Ballot Initiative #80 – 2,500-foot setback with minor change in wording from #76
- Ballot Initiative #81 – 4,000-foot setback with minor change in wording from #77
- Ballot Initiative #82 – 2,500-foot setback with minor change in wording from #78
- Ballot Initiative #83 – 4,000-foot setback with minor change in wording from #79

Of the 12 proposed pieces of legislation, only three (ballot initiatives #63, #75, and #78) are currently considered potential measures, meaning that are in the process of gathering the required 98,492 signatures by August 8, 2016, in order to be placed onto the Colorado ballot.

Colorado Ballot Initiative #40 does not specifically contest oil and gas. It does, however, generally propose the empowerment of local governments to make their own decisions and local laws as they see fit. This would theoretically give local communities the “unalienable right” to refuse mineral rights for oil and gas corporations, and thus halt development. This initiative will not be on the 2016 Colorado ballot.

Colorado Ballot Initiative #62 proposes a ban on hydraulic fracturing (or fracking) within the state of Colorado. It specifies that this is not seizure of property by the Colorado government so no compensation for devalued property would be available on the state level. This initiative will not be on the Colorado ballot in 2016.

Colorado Ballot Initiative #63 proposes an amendment to Article II of the Colorado Constitution through the addition of Section 32. It declares in seven parts that the people of Colorado have the right to a healthy environment and therefore the state and local governments should give this the highest possible priority.

1. Summarizes the proposed amendment, stating that “a healthy environment is essential component to the health, safety, and welfare of natural persons” (Colorado Secretary of State 2016).
2. Provides legally specific definitions of “healthy environment” and “local government.”
3. Asserts that it is a human right to have a healthy environment.
4. Establishes that state and local governments should give the establishment and maintenance of a healthy environment the “highest priority.”
5. Empowers local governments to establish laws they deem necessary to achieve this goal. If there is a contradiction between state and local legislation, the more complete protection of the environment would supersede.
6. Empowers any “natural person or governmental entity” to seek the right to a healthy environment, and be awarded damages and legal compensation for their efforts.
7. Establishes this amendment as a part of the Colorado Constitution.

While the proposed amendment does not specifically oppose oil and gas development, it would give local governments the power to enact laws to protect a healthy environment. It is unlikely that this measure will be included on the 2016 Colorado ballot.

Colorado Ballot Initiative #75 proposes in four sections that local governments be given control of oil and gas development within their jurisdiction.

1. Establishes the reasons for proposing this additional legislation. First, oil and gas development has a negative impact on the health and well-being of citizens and land alike. Second, this impact is felt more strongly in the local Colorado communities. Third, local governments should have the right to protect their people from perceived threats to their wellbeing without fear of state preemption or legal repercussions.
2. Legally defines “local government” and “oil and gas development.”
3. Grants local governments the authority to adopt laws to regulate oil and gas development within their jurisdiction, including limitations or prohibition of these entities. Local governments can only create stronger restrictions than the general assembly or state government, and cannot lower the limitations on oil and gas established by the state. In the case of differing opinions between a state and local government concerning oil and gas development, state preemption is not valid and the local government may enact more restrictive laws if it wishes.
4. Establishes the legislation and gives the state power to make laws to aid the measures of this initiative, but not to restrict it in any way.

This ballot initiative is a potential measure for the 2016 Colorado ballot.

Colorado Ballot Initiative #76 is the first of eight ballot initiatives that proposes a mandatory setback of new oil and gas developments, including hydraulic fracturing from both “occupied structures” and “areas of special concern.” Ballot Initiative #76 specifically requires a setback of 2,500 feet along with a measure that would prohibit the addition of new occupied structures and areas of special concern within the established setback region. These limitations are defined in all of the eight variations of this initiative as:

1. Occupied structures – Any structure that needs a certificate of occupancy or structure designated specifically for human inhabitation.
2. Areas of special concern – Water sources and waterways both permanent and temporary, public parks and open space, permanent sport fields, amphitheaters, and the riparian regions surrounding waterways and watersheds.

Colorado Ballot Initiative #77 is the same #76, but it proposes a setback of 4,000 feet.

Colorado Ballot Initiative #78 specifically lays out the proposed legislation for a mandatory setback of oil and gas development in five sections. It differs from #76 in that it does not mention a ban on the

construction of new occupied structures and areas of special concern within 2,500 feet of current oil and gas developments.

1. Details the reasons for proposing this initiative.
 - a. Oil and gas development, including hydraulic fracturing, has been linked to health hazards as well as damaging impacts to environmental wellbeing.
 - b. The impact of oil and gas development is reduced by distance.
 - c. As such, it is necessary to require a setback of oil and gas development from occupied structures and areas of special concern
2. Defines specific terms used within the ballot initiative. "Occupied structures and areas of special concern were previously defined."
 - a. Oil and gas development – Drilling, processing, producing, and exploring for oil, gas, or other gas-like compounds, as well as the waste management of such procedures. This includes hydraulic fracturing.
 - b. Oil and gas development facility – Any specific location associated with oil and gas development, both past and present.
3. Outlines the setback proposing that all new oil and gas development be placed at least 2,500 feet from occupied structures and areas of special concern.
4. Gives state and local governments the power to establish and maintain setbacks more than 2,500 feet if they believe it is necessary.
5. States that no laws may be enacted to lower the 2,500-foot setback at any point, though laws may be enacted to aid in the enforcement of this proposed legislation.

Ballot Initiative #78 is the only one of the eight variations on #76 that is considered a potential measure. Ballot initiatives #76–#77 and #79–#83 will not be on the 2016 Colorado ballot.

Colorado Ballot Initiative #79 contains the same proposition as #78, but with a 4,000-foot setback.

Colorado Ballot Initiative #80 only varies from #76 in its definition of "oil and gas development." Instead of stating that oil and gas development "includes hydraulic fracturing," it reads that oil gas and development "includes the use of hydraulic fracturing."

Colorado Ballot Initiative #81 only varies from #77 in its definition of "oil and gas development" in the same way that Ballot Initiative #80 varies from Ballot Initiative #76.

Colorado Ballot Initiative #82 only varies from #78 in its definition of “oil and gas development” in the same way that ballot initiative #80 varies from Ballot Initiative #76.

Colorado Ballot Initiative #83 only varies from #79 in its definition of “oil and gas development” in the same way that Ballot Initiative #80 varies from Ballot Initiative #76.

In its May 2016 report, the COGCC investigated the effect that Colorado Ballot Initiative #78 would have on oil and gas companies’ surface access to oil reserves. This proposed legislation would require a mandatory distance of 2,500 feet between new oil and gas developmental facilities, including hydraulic fracturing sites, and occupied structures and areas of special concern. These two limitations were defined above in the description of Colorado Ballot Initiative #76.

The COGCC mapped out the regions that would no longer be accessible for oil and gas development as a result of this proposed mandate. The limitations on oil and gas development were estimated for the following six geographical regions:

- Colorado statewide
- Weld
- Garfield
- La Plata
- Rio Blanco
- Las Animas

Due to the degree of difficulty associated with accounting for all structures and areas mentioned in Ballot Initiative #78, estimates were made and certain areas were disregarded due to the lack of accurate information. For occupied structures, address points were used to approximate the 2,500-foot obligation without directly mapping all of these buildings across the state. For areas of special concern, several datasets that were required by the ballot initiative were not included as they could not be combined for estimation. Among these were drinking water sources, playgrounds, sports fields, and public parks and open spaces. Priority was given to the waterways and watersheds of Colorado as they make up a larger percentage of low population regions ideal for oil and gas development. All of these water features were graphed using the USGS National Hydrography Dataset.

The 2,500-foot buffer generated in the GIS feature datasets showed that 90.2% of Colorado’s surface would no longer be accessible for new oil and gas developments or hydraulic fracturing. In addition, 95% of the land in the top five oil and gas producing counties of Colorado would be off limits to new drilling and hydraulic fracturing endeavors (Weld – 85%, Garfield – 98.9%, La Plata – 99.6%, Rio Blanco – 99.2%, Las

Animas – 96.3%). The effect on areas of special concern was significantly larger for surface acreage available for oil and gas facility development than for occupied structures. Statewide, the setback from occupied structures would make 21.7% of the surface land unavailable, while for areas of special concern 89.1% of surface land would be unavailable. In addition, the ballot initiative states that the setback cannot be reduced. It should be noted that Weld County produced 89% of Colorado’s oil in 2015 and would register the least amount of land lost to the setback requirement compared with the remaining four top-producing counties.

PRICE VERSUS LEGISLATION

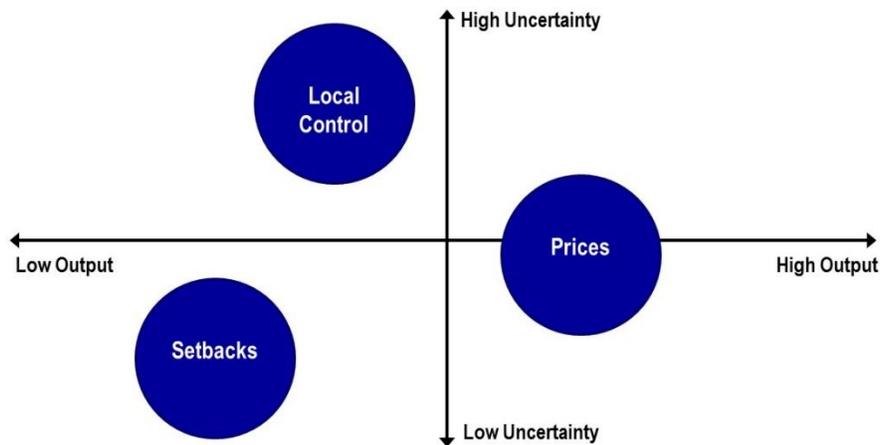
Commodity prices began falling in June 2014, effectively reshaping the industry globally and locally. Prices and legislation at face value have the similar effect—a decrease in oil and gas activity. However, each sends a different signal about uncertainty and long-term potential.

A statewide setback measure decreases production potential (output), but it is fairly predictable. Producers would largely be able to map parcels that would be off limits due to the setbacks, and could identify parcels that they could seek access to by obtaining owner permission. This scenario is described as low uncertainty, high reduction in output.

A local control measure, by contrast, is highly uncertain. It is unknown how many communities or which communities would enact restrictions on production. Would these be urban, Front Range communities? Cities across the state? Would these measures be enacted for a whole county? Few communities have enacted restrictions on fracking or production; currently, these are isolated to northern Front Range urban areas. This scenario is described as high uncertainty, potentially high reduction in output.

Prices have had a lagged and varying impact on production. The 54% decrease in prices from June 2014 to June 2016 has impacted the industry in terms of investment and employment—the oil and gas rig count dropped 76% and employment declined by 27%. However, while there is uncertainty about prices in the short term, the long-term price outlook is above the cost of production for most basins in Colorado. Likewise, the production (output) may be impacted in the short term, but the long-term production potential is unconstrained. For these reasons, this scenario is described as low uncertainty, high output.

FIGURE 1: PRICES VERSUS POLICY¹



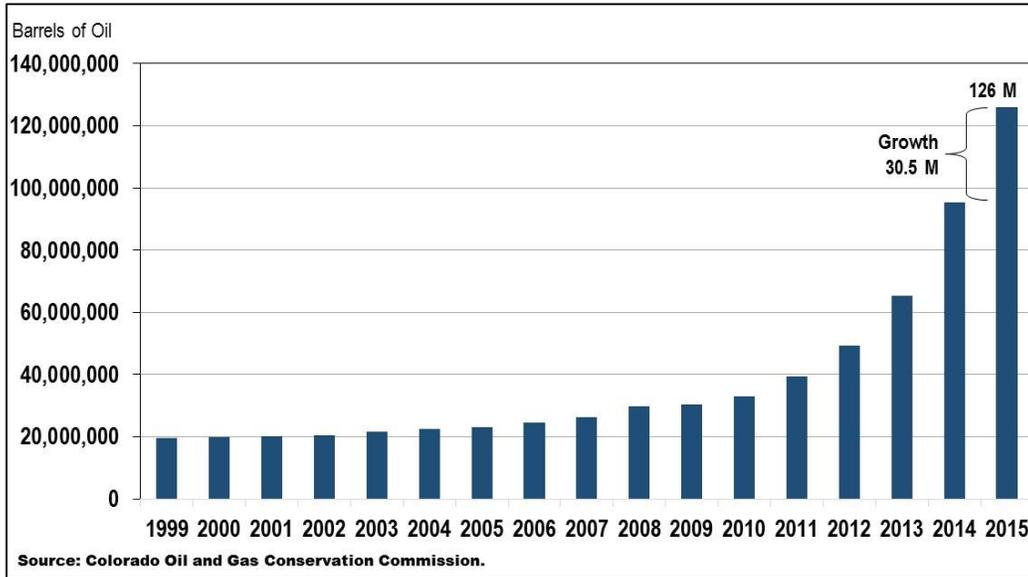
COLORADO OIL PRODUCTION

Resource extraction is concentrated in a few areas in Colorado. Nearly 97% of oil production and 90% of natural gas production occur in five counties according to production data from the COGCC.

The top five counties for oil production in 2015 were Weld, Rio Blanco, Garfield, Arapahoe, and Lincoln, with Weld accounting for nearly 90% of the state total. Weld has effectively increased market share each year since 1999 (earliest data available), climbing from 33% in 1999 to 89% in 2015.

¹The chart is only for illustrative purposes to demonstrate relative impacts on uncertainty and output; placement on continuum is subjective.

FIGURE 3: COLORADO OIL PRODUCTION, 1999–2015



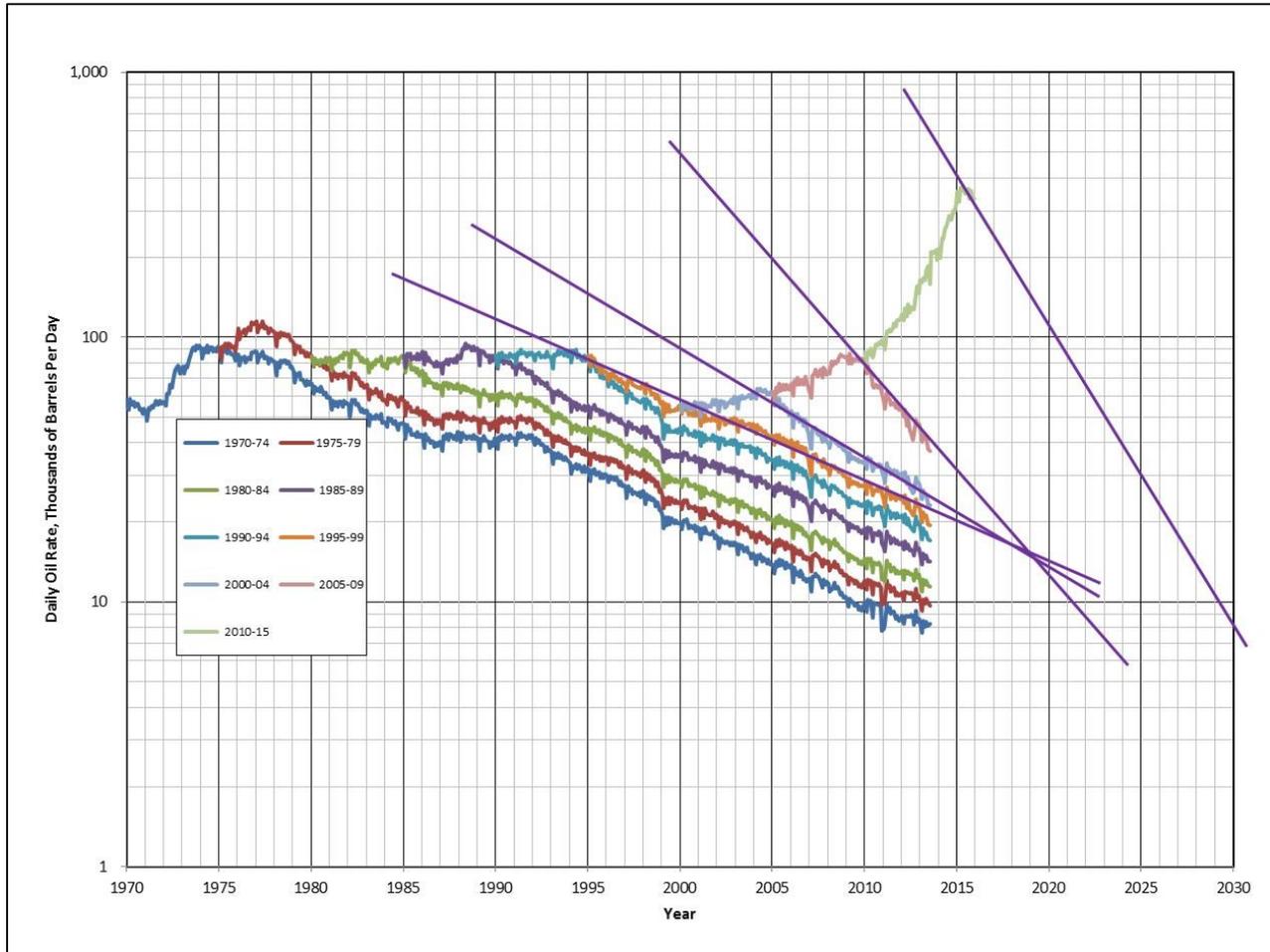
DEPLETING OIL WELL PRODUCTION

Wells typically record the greatest volume of production in year 1 and decrease at a slower rate with each successive year. Two critical observations about production from 1970–2015:

- 1) Each successive period records steeper depletion curves.
- 2) The 2010–2015 depletion curve is unprecedented in Colorado production history 1970–2015.

Colorado oil production spiked over the past five years, breaking the single-year production record established in the 1950s in the state. With each successive year beginning in 2012, Colorado produced more oil in a single-year period than at any point in the state’s history. If new production ceased in 2017, total production would deplete at a rate of 42% in year 1, 24% in year 2, and 18% in year 3, settling at about 6.9% per year by year 15. Production from wells started in 2010 will deplete at a slightly faster rate—46% in year 1, 26% in year 2, and 20% in year 3 before settling at 6.9% by year 15. A steeper depletion curve means that Colorado will need more aggressive drilling in order to maintain current production levels. Without further technology breakthroughs or oil discovery similar to the Denver-Julesburg (D-J) Basin, 2014 and 2015 will likely be the new peak, with lower production on the horizon.

FIGURE 4: COLORADO OIL WELL DEPLETION, 1970–2015

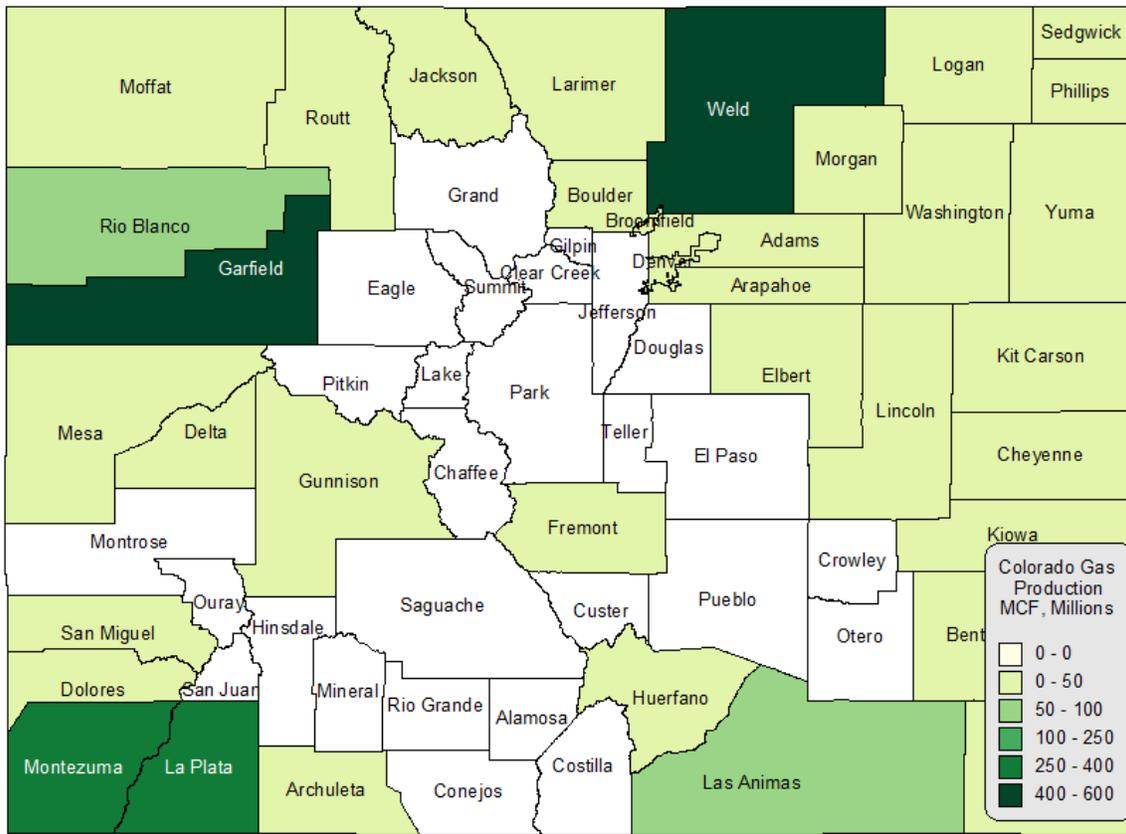


Source: Rich McClure using COGCC data.

COLORADO GAS PRODUCTION

The top five counties for gas production (natural and CO₂) in 2015 accounted for 89% of the total production of Colorado. These counties were Weld, Garfield, Montezuma, La Plata, and Las Animas, with Weld accounting for just over 27% of the state total.

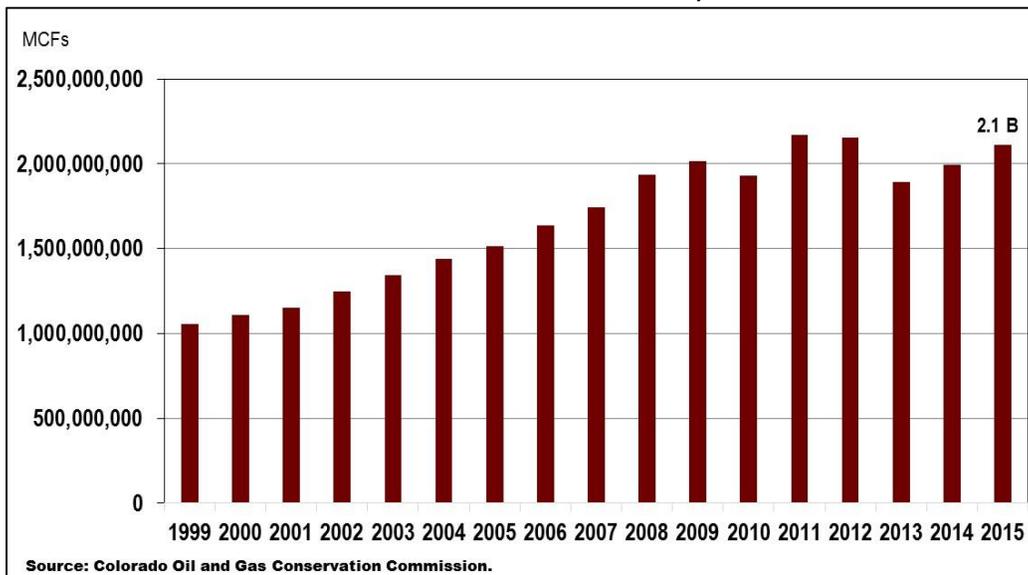
FIGURE 5: COLORADO GAS PRODUCTION, 2015



Source: COGCC.

Gas (natural gas and CO₂) production in Colorado recorded a steady ascent, to 2.2 billion MCFs (thousand cubic feet) of production, between 1999 and 2011. After peaking in 2011, production has hovered around 2 billion MCFs.

FIGURE 6: COLORADO GAS PRODUCTION, 1999–2015



Like oil wells, natural gas wells perform differently basin to basin and well to well. Examining the population of wells imbedded in total Colorado production from 1970 forward illustrates well production in aggregate and allows for analysis on the pace of production depletion.

DEPLETING NATURAL GAS WELL PRODUCTION

Natural gas production proves more volatile than oil production. Like oil production, natural gas wells typically record the greatest volume of production in year 1 and decrease at a slower rate with each successive year. Presented on a semi-logarithmic chart, the production curves appear linear. Three critical observations:

- 1) The depletion curves are more stable for natural gas than for oil from decade to decade.
- 2) The D-J Basin has primarily been an oil play, but associated natural gas propelled Weld County to the number one gas-producing county in Colorado in 2015.
- 3) Prior to the associated gas from oil wells in Weld County, natural gas historically was concentrated in western Colorado.

Through 2011, Colorado gas production continued a fairly steady pace of growth that began in the early 1990s. Total production leveled after peaking in 2011. If new production ceased in 2017, total production would deplete at a rate of 17% in year 1, 12% in year 2, and 10% in year 3, settling at about 8.2% per year by year 15. Production from wells started in 2010 would deplete at 23% in year 1, 15% in year 2, and 12% in year 3 before settling at 8.2% by year 15.

RIG COUNT

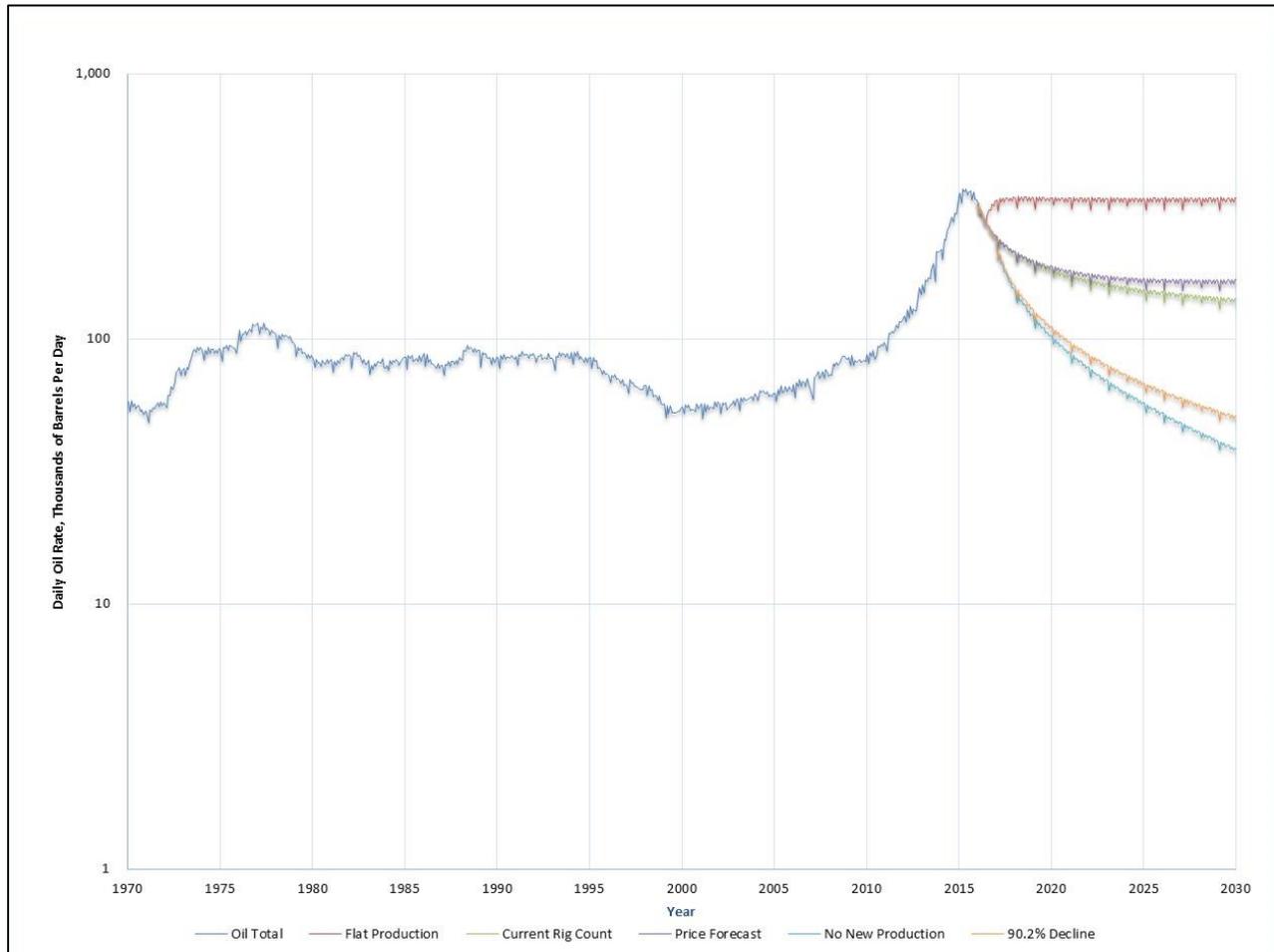
The Colorado rig count reported by Baker Hughes averaged 72 in 2011, 61 in 2012, 63 in 2013, 68 in 2014, and 39 in 2015. The number of rigs in Colorado continues to drop in 2016, with an average of 18 rigs operating June 17 year-to-date. There is typically a positive correlation between price and the rig count with a three-month lag. However, the price of oil began to increase in February 2016 but the state rig count has not yet adjusted to the price increase. The rig count has stayed fairly constant since March, at about 16 rigs. Assuming drilling rigs can produce 2.8 wells per month (approximately one well per 11 days), 16 rigs should produce about 40 wells per month—not enough to maintain current production. Based on current (depressed) production, Colorado would need at least 45 rigs to keep oil production constant. Most of the new oil production currently resides in the D-J Basin.

OIL PRODUCTION FORECAST

Oil production will depend on the wells drilled, which, in turn, will depend on active rigs in Colorado. The figure below illustrates scenarios based on (1) the current rig count, (2) the rig count necessary to keep

production flat, (3) the rig count forecast based on the long-term price forecast from Moody’s Analytics, (4) no new production, and (5) a 90.2% decrease in new production.

FIGURE 7: COLORADO OIL WELL DEPLETION, 1970–2030 (WITH FORECAST SCENARIOS)



Source: Rich McClure using historical COGCC data; forecast from BRD.

Under the current rig count scenario, production has peaked in the state, and the decline in production is established in data published by the COGCC.

The second scenario projects the number of wells (and thus rigs) necessary to keep current production flat—estimated at 46 rigs, or about 30 more than are currently active in Colorado.

The third scenario uses the Moody’s price forecast for West Texas Intermediate (WTI). This scenario projects a short-term drop in production in Colorado, followed by a long-term production stabilization with a rebounding rig/well count.

The fourth and fifth scenarios illustrate the continued declining production curves associated with no new production, or a steep decline in new production caused by policy changes.

COMMODITY PRICES

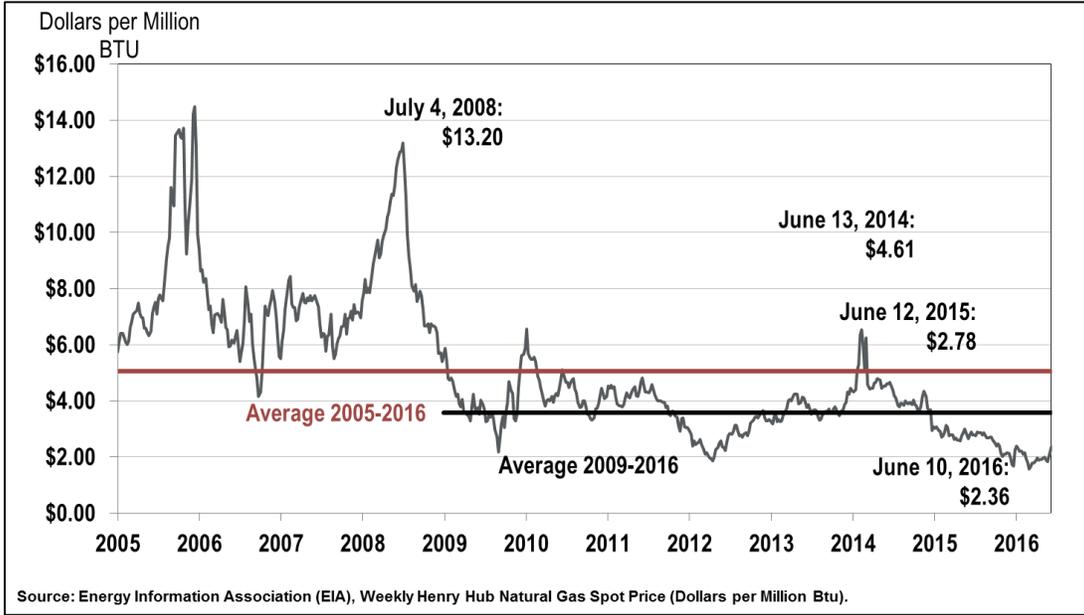
Oil and gas prices recorded a precipitous decline in 2014 with prices hitting their lowest point in February 2016. Crude oil prices were \$26.19 per barrel. As of mid-June 2016, the WTI spot price was 55% below the June 20, 2014, cycle peak. Prices are 39% below the five-year average. The WTI has now recorded 24 months of year-over-year declines. Drilling permits and starts are down for the first five months of 2016 year-over-year in Colorado, and the rig count is down 59% year-over-year. However, since reaching their lowest point, prices have shown signs of rebounding, with four consecutive months of month-over-month increases beginning in March 2016.

FIGURE 8: WTI SPOT PRICE



Natural gas prices as of June 10, 2016, were \$2.36 per million BTUs, the highest they have been since January 2016. The average monthly price topped out at \$6.00 per million BTUs in February 2014 before falling to \$2.36 in June 2016 (average as of June 13).

FIGURE 9: HENRY HUB NATURAL GAS SPOT PRICE



The impact of gasoline prices is readily observable to consumers. Prices topped \$3.71 per gallon on August 18, 2014, before falling 56%, to \$1.64, in Colorado on February 22, 2016, according to the EIA. Despite prices rebounding 44%, the average of \$2.36 in Colorado on June 20, 2016, remains 13% below the same period a year ago and 18% below average since 2005.

FIGURE 10: COLORADO GASOLINE PRICE

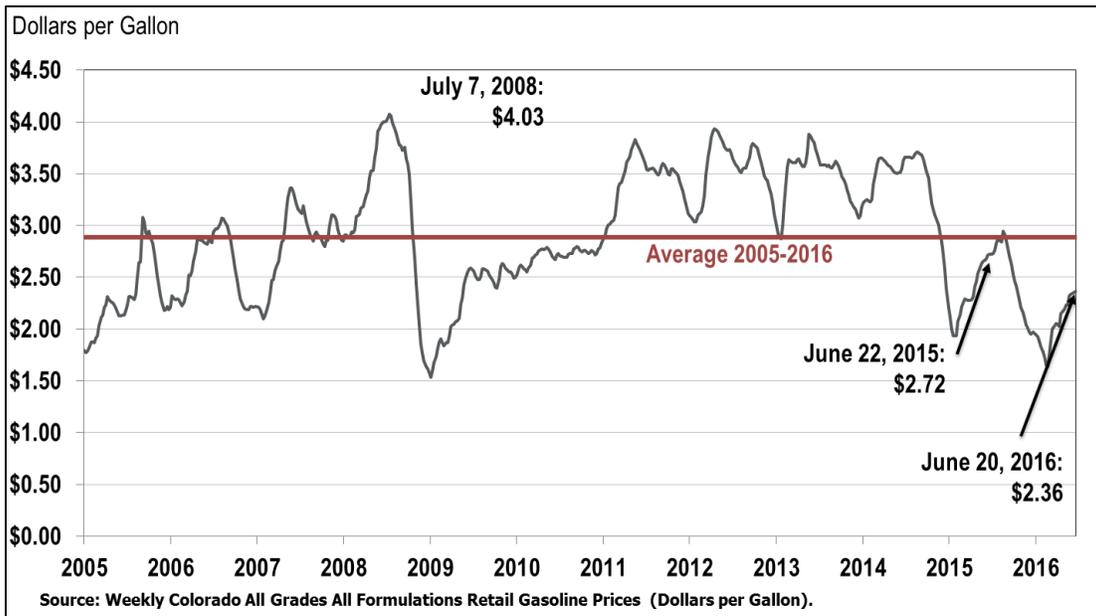


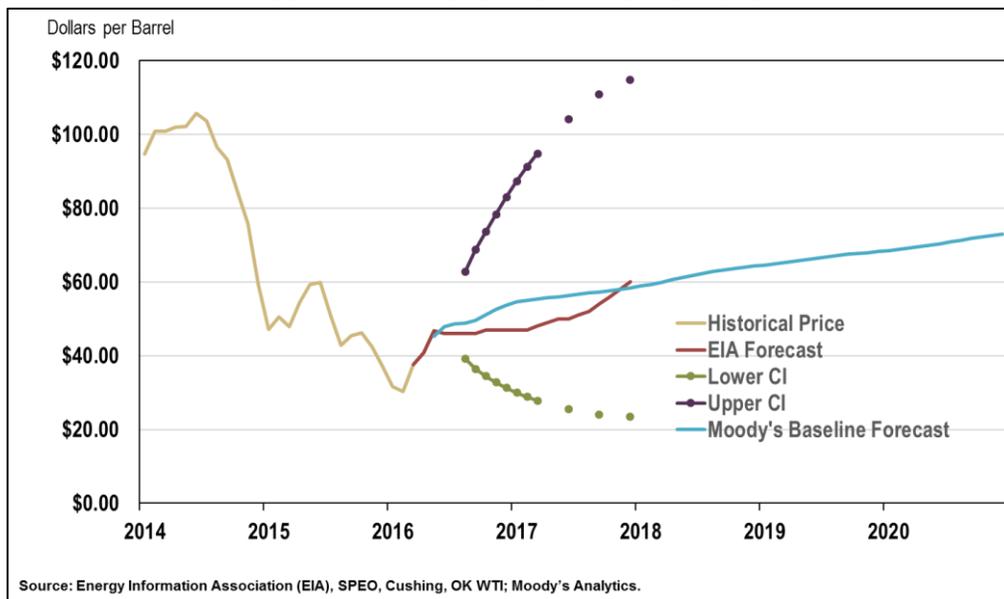
TABLE 1: YEAR-OVER-YEAR PERCENTAGE CHANGES

Month	WTI Oil	Henry Hub Natural Gas	Colorado Gasoline	Colorado Baker Hughes Rig Count
January 2014	0%	42%	11%	17%
February 2014	6%	80%	-3%	9%
March 2014	8%	29%	1%	9%
April 2014	11%	12%	0%	3%
May 2014	8%	13%	-6%	7%
June 2014	10%	20%	-5%	8%
July 2014	-1%	12%	2%	1%
August 2014	-9%	14%	3%	6%
September 2014	-12%	8%	1%	10%
October 2014	-16%	3%	-4%	6%
November 2014	-19%	13%	-6%	6%
December 2014	-39%	-18%	-18%	8%
January 2015	-50%	-36%	-38%	4%
February 2015	-50%	-52%	-37%	-20%
March 2015	-53%	-42%	-37%	-39%
April 2015	-47%	-44%	-34%	-42%
May 2015	-42%	-38%	-26%	-40%
June 2015	-43%	-39%	-24%	-43%
July 2015	-51%	-30%	-23%	-45%
August 2015	-56%	-29%	-22%	-50%
September 2015	-51%	-32%	-27%	-57%
October 2015	-45%	-38%	-28%	-60%
November 2015	-44%	-49%	-30%	-58%
December 2015	-37%	-45%	-23%	-63%
January 2016	-33%	-24%	-5%	-66%
February 2016	-40%	-31%	-18%	-59%
March 2016	-21%	-39%	-13%	-55%
April 2016	-25%	-26%	-11%	-54%
May 2016	-21%	-33%	-13%	-60%
June 2016	-18%	-18%	-13%	-58%

Source: Energy Information Administration, Henry Hub Natural Gas Spot Price (Dollars per Million Btu; Cushing, OK WTI Spot Price FOB (Dollars per Barrel); Weekly Colorado All Grades All Formulations Retail Gasoline Prices (Dollars per Gallon). Baker Hughes Rig Count. Data as of June 20, 2016.

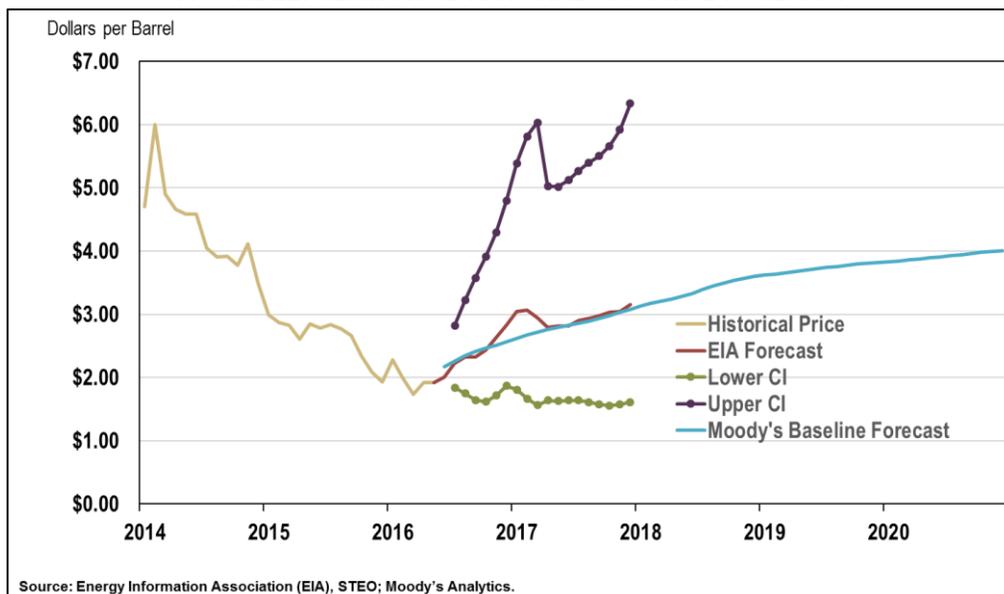
The June 2016 short-term forecast for WTI from the EIA projects the 2016 average at \$42.83 per barrel and the 2017 average at \$51.82 per barrel. Moody's Analytics forecasts 2016 prices at \$44.89 per barrel, 2017 prices at \$56.50 per barrel, and 2020 prices at \$70.72.

FIGURE 11: WTI CRUDE OIL PRICE FORECAST



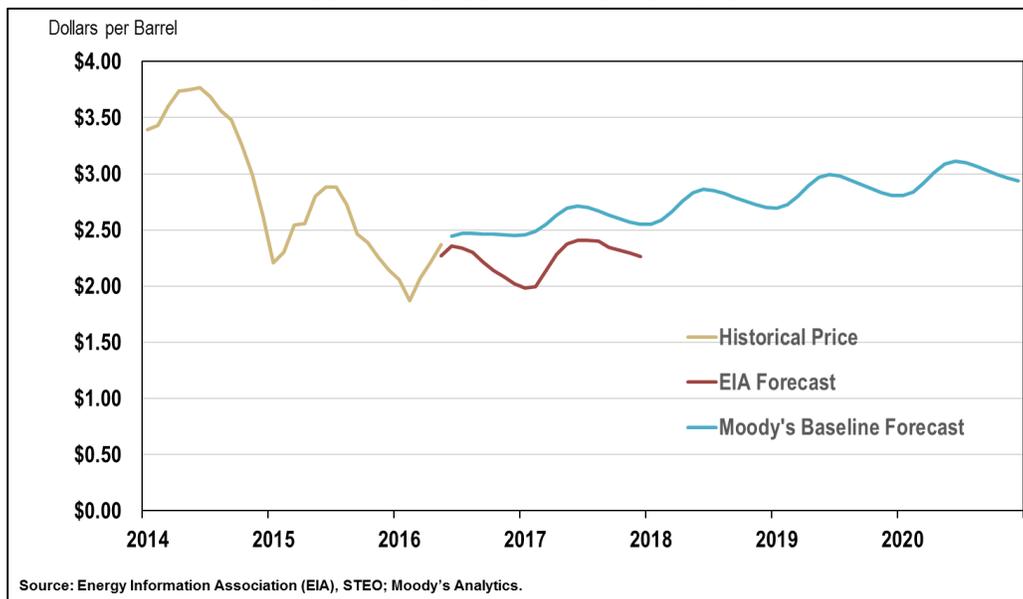
The June 2016 short-term price forecast for Henry Hub natural gas from the EIA projects the 2016 average at \$2.22 per million BTUs and the 2017 average at \$2.96 per million BTUs. Moody's Analytics forecasts (NYMEX Natural Gas Futures Prices: Contract 1, [\$ per MMBtu] for United States) 2016 prices at \$2.23 per million BTUs, 2017 prices at \$2.85 per million BTUs, and 2020 prices at \$3.92 per million BTUs.

FIGURE 12: HENRY HUB NATURAL GAS PRICE FORECAST



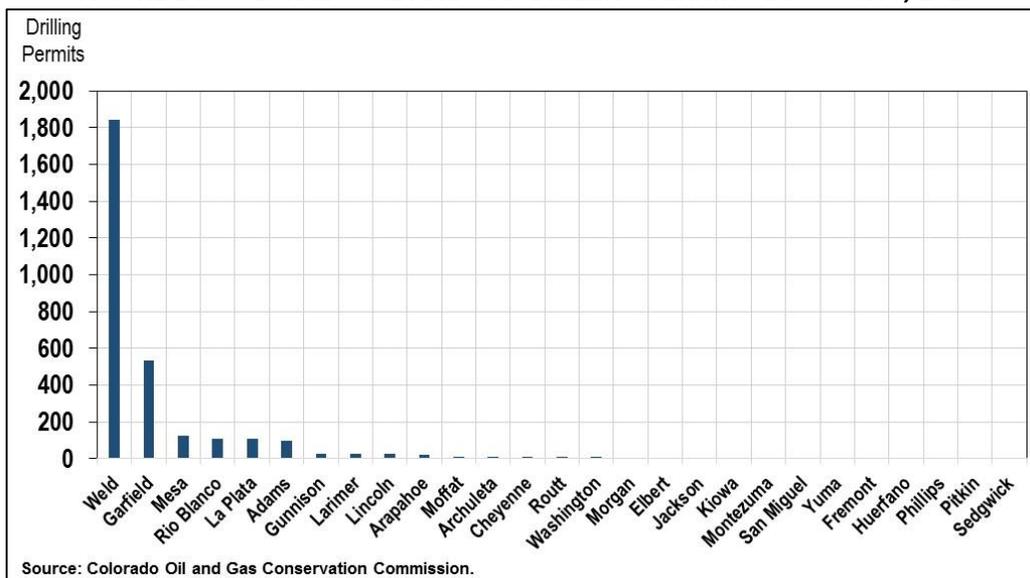
The June 2016 short-term forecast for gasoline from the EIA projects the 2016 average at \$2.13 per gallon and the 2017 average at \$2.27 per gallon. Moody's Analytics forecasts an average price of \$2.31 per gallon in 2016, an average of \$2.61 per gallon in 2017, and an average of \$2.99 per gallon in 2020.

FIGURE 13: GASOLINE PRICE FORECAST



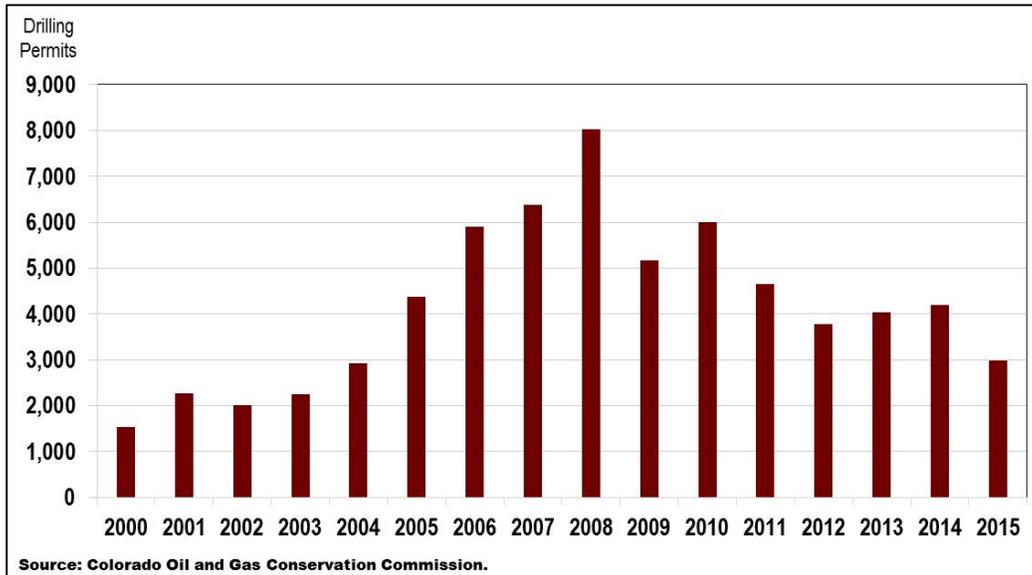
In 2015, Colorado oil and gas permits were highly localized to counties that recorded high production of oil and gas within the state. Weld County registered the highest number of drilling permits by far in 2015, with 61.6% of the total number. Of the six counties that recorded more than 90 permits, four (Weld, Garfield, Rio Blanco, and La Plata) were top five producers of oil and/or gas in 2015.

FIGURE 14: COLORADO OIL AND GAS DRILLING PERMITS BY COUNTY, 2015



From 2003 to 2008, oil and gas drilling permits in Colorado steadily increased to more than 8,000 before decreasing from 2009 to 2015. The 2,987 drilling permits approved in 2015 was the smallest number approved since 2004. This decrease was due to increased technology that increased the yield per drilling site as well as price fundamentals.

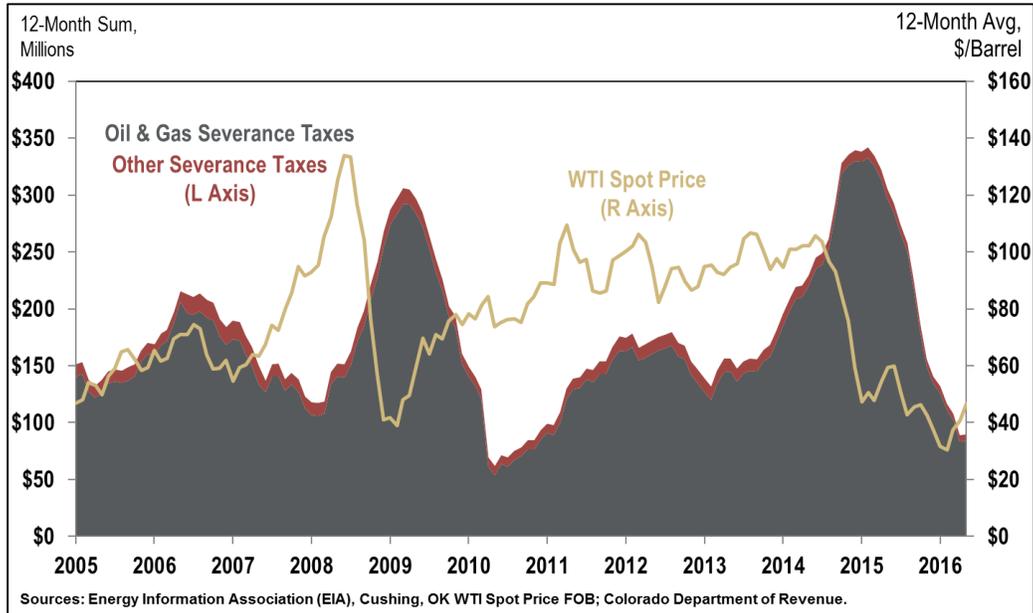
FIGURE 15: COLORADO OIL AND GAS DRILLING PERMITS, 2000–2015



SEVERANCE TAXES

Severance taxes are those that the state charges for the removal of nonrenewable natural resources and are reported by the Colorado Department of Revenue for oil and gas, coal, and metals and molybdenum. Severance taxes related to oil and gas in 2013 and 2014 were reported at \$170.6 million and \$330 million, respectively (Figure 16). In 2015, severance taxes dropped to \$134 million. The 12-month trailing sum fell to \$84.2 million in May 2016.

FIGURE 16: COLORADO OIL AND GAS SEVERANCE TAXES AND WTI AVERAGE SPOT PRICE



In June 2016, the Governor’s Office of State Planning and Budgeting (OSPB) estimated that severance taxes will decrease 77.6% in fiscal year 2016, to \$63.0 million. OSPB’s forecast for fiscal year 2017 is expected to rebound to \$89.2 million—an increase of 41.7%. Fiscal year 2018 is projected to increase to \$175.9 million. Colorado Legislative Council estimated fiscal year 2016 severance taxes (including interest earnings) at \$66.2 million, dropping 76.5% from 2015. Severance tax revenue is expected to rebound slightly, to \$77.1 million in fiscal year 2017, before increasing 112% in fiscal year 2018, to \$163.5 million.

For context, the BRD estimated the public revenue stream from the oil and gas industry totaled \$1.2 billion to state jurisdictions in 2014. The majority of public revenue comes in the form of property, income (personal), and severance taxes; public land leases; and royalties.² Oil and gas property taxes exceeded an estimated \$400 million in 2014. Severance taxes paid by the industry totaled \$330 million in 2014. The industry also paid \$315 million in royalties, rents, and bonus to the federal government in 2014 (less than half is returned to Colorado), and nearly \$160 million in state royalties, rents, and bonuses.

ASSUMPTIONS

This policy analysis is layered over a price-adjusted forecast through 2031. The price decrease is based on Moody’s projections, modeled as decreases in oil and gas industry sales.³ After setting the new baseline based on lower prices, an alternative scenario of decreased new production was applied to project the

²This excludes corporate income taxes and sales taxes.

³Industry sales modeled as Industry Sales/Exogenous Production (amount).

implications of increased oil and gas drilling setbacks proposed in 2016, modeled as a decrease in output in the oil and gas extraction industry.⁴ The price impact is expected to continue through the forecast horizon (2031).

ECONOMIC IMPACT

The oil and gas price decline has effectively created a new baseline expectation for economic growth. This analysis applies reductions in oil and gas extraction related to more rigorous setback rules that were proposed in 2016 in Colorado. The results illustrate the slowing effect of both low prices and setbacks, though neither are recessionary. The model produces forecasts in which output continues to grow in the state, but at a more modest pace due to reduction in energy industry activity.

The price environment provides a new baseline for expected industry growth. A reduction in new production would have a compounding impact on industry output. Given a 90.2% reduction in new production beginning in 2017, the compounding economic consequence would result in a lower real GDP by an average of \$7.1 billion and 54,000 fewer jobs in the first five years, and a lower GDP by an average of \$14.5 billion and 104,000 fewer jobs between 2017 and 2031.

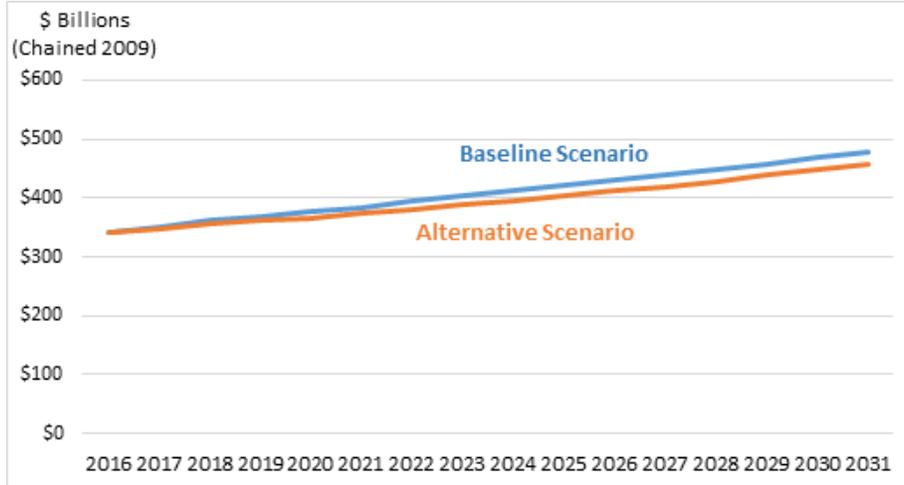
TABLE 2: 90.2% REDUCTION IN NEW PRODUCTION SCENARIO, SUMMARY OF IMPACTS, 2017–2031

Category	Units	Average Difference from Baseline Scenario			
		Year 1–5	Year 6–10	Year 11–15	Years 2017–2031 ^a
Total Employment	Individuals (Jobs)	-53,968	-115,891	-140,728	-103,529
	<i>Change from Baseline</i>	-1.5%	-3.2%	-3.8%	-2.8%
Private Non-Farm Employment	Individuals (Jobs)	-52,326	-109,624	-129,717	-97,222
	<i>Change from Baseline</i>	-1.7%	-3.5%	-4.1%	-3.1%
Gross Domestic Product	Billions of Fixed (2015) Dollars	-7.1	-15.8	-20.5	-14.5
	<i>Change from Baseline</i>	-1.9%	-3.8%	-4.5%	-3.4%
Personal Income	Billions of Fixed (2015) Dollars	-4.6	-11.7	-16.4	-10.9
	<i>Change from Baseline</i>	-1.4%	-3.1%	-3.7%	-2.8%
Real Disposable Personal Income	Billions of Fixed (2015) Dollars	-3.7	-9.0	-12.4	-8.3
	<i>Change from Baseline</i>	-1.3%	-2.7%	-3.3%	-2.5%

^aThis average impact over the 15-year period (2017–2031) indicates Colorado total employment, income, and GDP would be shifted lower on average over the entire 16-year horizon.

⁴Decrease in Industry Sales/Exogenous Production (amount).

Figure 17: Colorado GDP Growth, Baseline Scenario and Setback Scenario



CONCLUSION

The introduction of a 2,500-foot setback on oil and gas development activities would have a substantial effect on both Colorado’s oil and gas industry and the state economy as a whole. Results of the setback include prohibition of any oil and gas development on 90.2% of Colorado’s land, a compounding average annual reduction in total employment of 2.8% from 2017–2031, and a 3.4% average annual reduction in state GDP across the same period. Given the results of the COGCC report, which were gathered and analyzed without the inclusion of all the defined areas of special concern, the enactment of Ballot Initiative #78 would significantly impact Colorado oil and gas development and operations, specifically constraining new development opportunities.

BIBLIOGRAPHY

- Baker Hughes North American Rig Count (June 17, 2016). *Rigs by State – Current and Historical*.
<http://phx.corporate-ir.net/phoenix.zhtml?c=79687&p=irol-reportsother>, accessed June 22, 2016.
- Beran, Jackie et al. (2016). "Colorado 2016 ballot measures," *Ballotpedia*,
https://ballotpedia.org/Colorado_2016_ballot_measures, accessed June 20, 2016.
- Colorado Department of Local Affairs. May 2014. *2013 Forty-Third Annual Report*. Division of Property Taxation.
- Colorado Department of Revenue. *Severance Tax Collections*. January 2004-Current [April 2016].
- Colorado Oil and Gas Task Force, February 27, 2015. *Colorado Oil and Gas Task Force Final Report*,
<http://dnr.state.co.us/ogtaskforce/Documents/OilGasTaskForceFinalReport.pdf>.
- Colorado Legislative Council Staff: Economics Section (June 20, 2016). *Focus Colorado: Economic and Revenue Forecast*, accessed June 22, 2016.
- Colorado Office of State Planning & Budgeting (June 20, 2016). *The Colorado Economic Outlook: Economic and Fiscal Review*, accessed June 22, 2016.
- Colorado Oil and Gas Conservation Commission (June 6, 2016). *Staff Report for June 6, 2016*.
file:///Y:/Current%20Projects/2016%20-%20O&G%202500%20Setback%20Study/Data/201606_StaffReport.pdf, accessed June 22, 2016.
- Colorado Oil and Gas Conservation Commission (May 27, 2016). *2500' Mandatory Setback from Oil and Gas Development*
http://cogcc.state.co.us/documents/library/Technical/Miscellaneous/Init_78_Proposed_2500ft_Setback_Assessment_Report_20160527.pdf, accessed June 17, 2016.
- Colorado Secretary of State. Initiative 2015-2016 #62 (January 8, 2016).
<http://www.sos.state.co.us/pubs/elections/Initiatives/titleBoard/filings/2015-2016/62Final.pdf>, accessed June 20, 2016.
- Colorado Secretary of State. Initiative 2015-2016 #63 (January 8, 2016).
<http://www.sos.state.co.us/pubs/elections/Initiatives/titleBoard/filings/2015-2016/63Final.pdf>, accessed June 17, 2016.
- Colorado Secretary of State. Initiative 2015-2016 #75 (January 21, 2016).
<http://www.sos.state.co.us/pubs/elections/Initiatives/titleBoard/filings/2015-2016/75Final.pdf>, accessed June 17, 2016.
- Colorado Secretary of State. Initiative 2015-2016 #76 (January 21, 2016).
<http://www.sos.state.co.us/pubs/elections/Initiatives/titleBoard/filings/2015-2016/76Final.pdf>, accessed June 20, 2016.
- Colorado Secretary of State. Initiative 2015-2016 #77 (January 21, 2016).
<http://www.sos.state.co.us/pubs/elections/Initiatives/titleBoard/filings/2015-2016/77Final.pdf>, accessed June 20, 2016.
- Colorado Secretary of State. Initiative 2015-2016 #79 (January 21, 2016).
<http://www.sos.state.co.us/pubs/elections/Initiatives/titleBoard/filings/2015-2016/79Final.pdf>, accessed June 20, 2016.

- Colorado Secretary of State. Initiative 2015-2016 #80 (January 21, 2016).
<http://www.sos.state.co.us/pubs/elections/Initiatives/titleBoard/filings/2015-2016/80Final.pdf>,
accessed June 20, 2016.
- Colorado Secretary of State. Initiative 2015-2016 #81 (January 21, 2016).
<http://www.sos.state.co.us/pubs/elections/Initiatives/titleBoard/filings/2015-2016/81Final.pdf>,
accessed June 20, 2016.
- Colorado Secretary of State. Initiative 2015-2016 #82 (January 21, 2016).
<http://www.sos.state.co.us/pubs/elections/Initiatives/titleBoard/filings/2015-2016/82Final.pdf>,
accessed June 20, 2016.
- Colorado Secretary of State. Initiative 2015-2016 #83 (January 21, 2016).
<http://www.sos.state.co.us/pubs/elections/Initiatives/titleBoard/filings/2015-2016/83Final.pdf>,
accessed June 20, 2016.
- Colorado Secretary of State. Signature Requirements for Statewide Initiative Petitions (December 5, 2014).
<http://www.sos.state.co.us/pubs/elections/Initiatives/signatureRequirements.html>, accessed June 20,
2016.
- Energy Information Administration, Short-Term Energy and Summer Fuels Outlook. June 6, 2016.
<http://www.eia.gov/forecasts/steo/>. Retrieved June 20, 2016.
- Moody's Analytics, NYMEX Natural Gas Futures Prices: Contract 1, (\$ per MMBtu) for United States.
Retrieved June 20, 2016.
- Moody's Analytics, Petroleum Crude Oil Spot Price: West Texas Intermediate, (\$ per barrel, NSA) for United
States. Retrieved June 20, 2016.
- Moody's Analytics, U.S. All Grades All Formulations Retail Gasoline Prices, (USD per Gallon, SA) for United
States. Retrieved June 20, 2016.
- Titus, Elizabeth (January 2016). "Update on Proposed Anti-Oil and Gas Ballot Initiatives," COGA,
<http://www.coga.org/ogballotinitiatives/>, accessed June 17, 2016.
- U.S. Bureau of Labor Statistics. <http://www.bls.gov/data/>.
- U.S. Energy Information Administration. Cushing, OK WTI Spot Price FOB.
<http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=D>. Retrieved June 20,
2016.
- U.S. Energy Information Administration. Henry Hub Natural Gas Spot Price.
<http://www.eia.gov/dnav/ng/hist/rngwhhdm.htm>. Retrieved June 20, 2016.
- Wobbekind, Richard and Brian Lewandowski. March 2014. *Hydraulic Fracturing Ban: The Economic Impact
of a Statewide Fracking Ban in Colorado*. Business Research Division, Leeds School of Business,
University of Colorado Boulder.
- Wobbekind, Richard and Brian Lewandowski. September 2014. *Colorado Oil and Gas Industry: Updated
Economic Assessment of Colorado Oil and Gas Ballot Initiatives in 2014*. Business Research Division,
Leeds School of Business, University of Colorado Boulder.
- Wobbekind, Richard and Brian Lewandowski. August 2015. *Colorado Oil and Gas Industry: Updated
Economic Assessment of Colorado Oil and Gas Prices*. Business Research Division, Leeds School of
Business, University of Colorado Boulder.

Wobbekind, Richard and Brian Lewandowski. January 28, 2015. *Oil and Gas Prices – the Upside and the Downside*. Business Research Division, Leeds School of Business, University of Colorado Boulder.