The Economic Importance of New Mexico Oil and Natural Gas Infrastructure

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Acronyms and Definitions

Acronym	Definition
AEO	EIA Annual Energy Outlook
Bcf	Billion cubic feet of gas
BLS	U.S. Bureau of Labor Statistics
BOFY	Beginning of Fiscal Year (July 1st)
BTX	Benzene, Toluene, and Xylene
CAPEX	Capital expenditures
CO_2	Carbon Dioxide
CBOB	Conventional Blendstock for Oxygenate Blending into 87 octane gasoline
CIT	Corporate Income Tax
E0	Gasoline containing no ethanol
E10	Gasoline containing 10% ethanol
EIA	Energy Information Administration
EOFY	End of Fiscal Year (June 30th)
EOR	Enhanced Oil Recovery
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FY	Fiscal Year
gal/d	Gallons per day
GDP	Gross Domestic Product
GIS	Geographic Information System
gpm	Gallons per minute
GRT	Gross Receipts Tax
IMPLAN	Input-output model used for economic analysis in this study
kbpd	Thousand barrels per day
LDC	Local Distribution Company
LFC	Legislative Finance Committee
LGPF	Land Grant Permanent Fund
LPG	Liquefied Petroleum Gas
Mcf	Thousand standard cubic feet (volume measurement for natural gas)
MMbbl	Million barrels of oil or liquids
MMBOE	Million barrels of oil equivalent wherein each barrel contains 5.8 million Btus.
MMBtu	Million British Thermal Units. Equivalent to approximately one thousand cubic feet of gas
MMcf	Million standard cubic feet (of natural gas)
MMgal/d	millions of gallons per day
MPH	Miles per hour
MT	Metric ton
MTBE	Methyl Tertiary Butyl Ether
MTPA	Million metric tons per annum
MWh	Megawatt hour of electricity

NAICS	North American Industry Classification System
NEMS	National Energy Modeling System (used to prepare EIA's AEO)
NEPA	National Environmental Policy Act of 1970
NG	Natural gas
NGLs	Natural gas liquids (ethane, propane, butanes, pentanes plus)
NMTRI	New Mexico Tax Research Institute
O&G	Oil and Gas
O&M	Operating and maintenance cost
PADD	Petroleum Administration for Defense District
PDH	Propane Dehydrogenation Plant
PIT	Personal Income Tax
SIC	State Investment Council
SLO	State Land Office
STPF	Severance Tax Permanent Fund
Tcf	Trillion cubic feet (of natural gas)
TRD	Taxation and Revenue Department
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geologic Survey

Executive Summary

ES.1. Introduction

ICF was asked by the American Petroleum Institute (API) and the New Mexico Oil and Gas Association (NMOGA) to prepare this report highlighting:

- The New Mexico oil and gas industry's contributions to the state's economy in terms of income, jobs, tax revenues, and changes in stated GDP.
- The needs for new oil and gas infrastructure to sustain and grow New Mexico's oil and gas production and its contribution to the state economy, and
- The potential economic losses to the state if that needed infrastructure were not to be built.

ES.2. Study Methodology and Scope

The study reviews recent oil and gas production, infrastructure utilization, and plans for future infrastructure construction. The report then presents two scenarios for future infrastructure development in New Mexico:

- A "Base Case" that assumes that infrastructure needed over the next twelve years to accommodate projected oil and gas production is built.
- A "Constrained Infrastructure Development Case" (also called the "Alternative Case") that limits major gathering line and pipeline infrastructure development in New Mexico. This scenario (a) includes only future pipeline projects that are currently under construction and (b) limits gas flaring in New Mexico to maximum observed historic levels (which constrains crude oil production).

The study estimates the implications for New Mexico through the year 2030 of the Base Case and the Alternative Case for the following items:

- Levels of capital investment in oil- and gas-related infrastructure,
- Oil and gas prices in the state,
- The level of oil and gas production,
- The oil and gas industry's contributions to state income,
- State and local tax revenues derived from oil and gas economic activity,
- The number of jobs in the state that are supported by oil and gas economic activity.

ICF estimated the energy market impacts using energy-sector forecasting models that ICF built and maintains. ICF estimated the direct, indirect and induced impacts on income and jobs using the IMPLAN model of the New Mexico economy.

ES.3. Key Findings of the Study: Base Case

The overarching conclusion of the study is that New Mexico will need a considerable amount ($174 billion through 2030) of new infrastructure to accommodate growing oil and gas

production under the Base Case (see Exhibit ES-1) and that policies that limit how much infrastructure can be built could have a devastating effect on the New Mexico economy.

Exhibit ES-1: Summary of Capital Expenditures for Base Case and Alternative Case

		Actual 2017	Actual 2018	Base Case Annual Aver. 2019-30	Base Case Cumulative 2019-30	Alternative Case Annual Ave. 2019-30	Alternative Case Cumulative 2019-30	Alternative vs. Base Case: Impact as %
Capital Expenditures (million 2017$)	Well Drilling, Completion, and Equipment	$5,160	$9,982	$12,803	$153,641	$8,223	$98,671	*-35.8%*
	New Natural Gas Infrastructure	$366	$688	$495	$5,934	$142	$1,710	*-71.2%*
	New Crude Oil Infrastructure	$91	$169	$226	$2,706	$120	$1,445	*-46.6%*
	New NGL Infrastructure	$98	$27	$72	$859	$22	$263	*-69.3%*
	New CO2 Pipeline	$25	$0	$102	$1,220	$0	$0	*-100.0%*
	Replacement and Refurbishment for NG, Oil, NGLs & CO2	$694	$682	$781	$9,377	$715	$8,586	*-8.4%*
	Sum of Capital Expenditures	**$6,434**	**$11,547**	**$14,478**	**$173,738**	**$9,223**	**$110,675**	***-36.3%***

The specific findings of this study related to the historical period and the Base Case forecast can be summarized as follows:

- In 2017 the oil and gas industry in New Mexico contributed $13.5 billion to state GDP from the production, processing, transportation, distribution and retailing of crude oil, natural gas, natural gas liquids and petroleum products. The state GDP generated by this activity within the state represents approximately 14% of the state GDP. These values include direct, indirect and induced impacts. (See Exhibit ES-2)
- New Mexico employment supported by oil and gas activity in 2017 totaled 77,000 private sector jobs paying wages or salaries. These represent 8.9% of all (public plus private sector) jobs paying wages and salaries in the state and, again, include direct, indirect and induced impacts. Additionally, there were approximately 11,600 jobs among independent contractors, on-call workers, temporary help agency workers, and workers provided by contract firms in the oil and gas industry for a total of 88,600 jobs supported by the industry.
- Oil and gas production in the state has benefited from technological improvements that have increased well productivity, reduced the per-unit cost of oil and gas development, and reduced environmental footprints and impacts.
- ICF expects that under the national and regional oil and natural gas prices assumed for this study, these existing and expected future technological advances will allow oil and gas production in the state to increase. Compared to 2017, production in the state in 2030 under the Base Case will be higher by 358% for crude oil, 106% for natural gas and 136% higher for natural gas liquids. The value of this production in 2030 would be $64.0 billion, or 424% more than the corresponding value in 2017 and the percentage of state GDP supported by the oil and natural gas industry would increase from 14% to 45%
- The major kinds of infrastructure needed to accommodate these increases in production volumes and values include new construction and refurbishment of crude oil, petroleum product, NGL, natural gas and carbon dioxide pipelines. Additional investments will be needed for well construction (drilling and completion, access roads, drilling, pads, and

lease equipment), gathering system, gas processing plants, and refineries. The total value of such infrastructure investment in New Mexico under the Base Case is shown by type of investment in Exhibit ES-1.

Exhibit ES-2: Summary of Key Results for Base Case and an Alternative Case with Restrictions on New Infrastructure

		Actual 2017	Actual 2018	Base Case 2030	Base Case Cumulative 2019-2030	Alternative Case 2030	Alternative Case Cumulative 2019-2030	Alternative vs. Base Case: Impact in 2030 as %	Alt. vs. Base Case: Cum. Impact for 2019-2030 as %
Production Volumes	Natural Gas (billion cubic feet)	1,194	1,366	2,466	24,816	1,520	18,202	*-38.4%*	*-26.7%*
	Natural Gas Liquids (million barrels)	66	76	156	1,514	93	1,077	*-40.2%*	*-28.9%*
	Crude Oil (million barrels)	171	247	785	7,083	563	6,063	*-28.2%*	*-14.4%*
Value of Output (Million 2017$)	Production	$12,225	$19,649	$64,047	$504,098	$41,404	$381,475	*-35.4%*	*-24.3%*
	Gathering & Processing	$983	$1,203	$2,704	$25,929	$1,778	$20,248	*-34.3%*	*-21.9%*
	Pipeline Transmission	$2,017	$2,204	$3,897	$39,429	$2,923	$33,635	*-25.0%*	*-14.7%*
	Gas Distribution	$327	$377	$336	$4,029	$336	$4,029	*0.0%*	*0.0%*
	Other	$1,592	$1,594	$1,587	$19,081	$1,587	$19,081	*0.0%*	*0.0%*
	Total	**$17,144**	**$25,025**	**$72,571**	**$592,566**	**$48,027**	**$458,467**	***-33.8%***	***-22.6%***
Income/Value Added (Million 2017$)	O/G NM Income (direct & indirect)	$10,390	$15,499	$46,175	$373,375	$30,403	$287,466	*-34.2%*	*-23.0%*
	Related Induced Income	$3,117	$4,650	$13,853	$112,012	$9,121	$86,240	*-34.2%*	*-23.0%*
	O/G D,I, & Induced Income	**$13,507**	**$20,149**	**$60,028**	**$485,387**	**$39,524**	**$373,705**	***-34.2%***	***-23.0%***
	Total State GDP	$94,211	$96,474	$132,181	$1,351,051	$116,409	$1,265,142	*-11.9%*	*-6.4%*
	Non-oil/gas State GDP	$80,704	$76,325	$86,005	$977,676	$86,005	$977,676	*0.0%*	*0.0%*
	D,I,&I O/G Income as % of NM GDP	14.3%	20.9%	45.4%	35.9%	34.0%	22.7%	*-25.2%*	*-36.8%*
"Wages & Salary" Jobs and Wages	Oil and Gas Sector Jobs	31,306	34,941	37,775	450,141	31,854	394,983	*-15.7%*	*-12.3%*
	Other Related Direct and Indirect Jobs	18,582	20,692	22,335	266,272	18,895	234,156	*-15.4%*	*-12.1%*
	Total Direct and Indirect Jobs	49,888	55,634	60,111	716,413	50,750	629,139	*-15.6%*	*-12.2%*
	Induced Jobs	27,125	30,173	32,544	388,055	27,573	341,599	*-15.3%*	*-12.0%*
	Direct, Indirect, and Induced Jobs	**77,013**	**85,806**	**92,654**	**1,104,467**	**78,323**	**970,737**	***-15.5%***	***-12.1%***
	Direct, Indirect, and Induced Wages (million 2017$)	**$3,799**	**$4,350**	**$4,802**	**$56,815**	**$3,958**	**$49,152**	***-17.6%***	***-13.5%***
Other Jobs	**Independent Contractors, On-call Workers, Temporary Help, etc.**	**11,617**	**11,767**	**14,087**	**160,926**	**11,477**	**140,131**	***-18.5%***	***-12.9%***
Tax Revenues (Million 2017$)	State General Funds Attributed to All O&G Segments	$2,014	$2,522	$6,440	$53,516	$4,692	$44,616	*-27.1%*	*-16.6%*
	Local Revenues Attributed to All O&G Segments	$398	$535	$1,611	$12,908	$1,083	$10,204	*-32.8%*	*-20.9%*
	Sum of State Gen. Funds & Local Revenues	**$2,413**	**$3,057**	**$8,051**	**$66,424**	**$5,775**	**$54,820**	***-28.3%***	***-17.5%***

Source: Historical data for 2017 are from Bureau of Labor Statistics, Energy Information Administration, Bureau of Economic Analysis, Tax Policy Center, and ICF estimates. Forecasts are ICF estimates.

ES.4. Key Findings of the Study: Alternative Case

The Alternative Case is based on an assumption of constrained infrastructure development for new pipelines and gathering systems. Such constraints do not generally exist now but might come about or be more widely applied due to new environmental laws and regulations; delays in permitting processes; land rights and land use disputes; and political conflicts and indecision. Similar kinds of constraints could also come about on upstream activity (e.g., less leasing of new lands for drilling; new laws and regulation affecting drilling, completion and production; delayed drilling permits). A scenario developed from such upstream constraints could have similar economic results to the Alternative Case shown here, provided that it led to a similar decline in oil and gas production.

The kinds of economic impacts that come about by restricting new pipeline and gathering system infrastructure in the Alternative Case include:

1. Initial impacts come about through less capital expenditures for the affected infrastructure and fewer construction-related jobs.
2. Transportation bottlenecks can directly lead to shut-in oil and gas production, where alternative transportation methods do not exist or are economically infeasible.
3. To the extent alternative transportation modes can be used, they are typically more expensive and cause the netback [i.e. the wellhead price minus transportation costs] to fall. This causes wellhead prices to fall for both new and existing wells. Royalty and most tax payments are also reduced.
4. The combined effects of transportation bottlenecks and reduced wellhead prices reduces the incentive for new drilling and so upstream expenditures and jobs are reduced leading to less long-term oil and gas production.

In the Alternative Case, natural gas production is bottlenecked earlier than crude oil because there are more crude oil pipelines that are now under construction (and are assumed to be completed) compared to natural gas pipelines. The constrained take-away capacity from the New Mexico Permian causes the natural gas prices in New Mexico Permian to decline in a manner similar to what happened to the Waha Hub price, which was negative for part of 2017 due to temporary takeaway capacity. These low gas prices will reduce gas drilling, lead to a shift to drilling less gassy crudes and an increase in gas flaring up to whatever level is permitted by New Mexico regulatory agencies.

Eventually in the Alternative Case, oil production will also hit the capacity limits of existing and under-construction pipelines, at which point rail transportation will have to be used. This will cause the crude oil price to be discounted relative to the Base Case. Total crude production in the New Mexico Permian will be limited to whatever amount of flaring is allowed or by what is economic to drill given the depressed gas and oil prices.

Thus, the Alternative Case leads to both lower production volumes and lower prices for oil, natural gas and natural gas liquids, which have severe effects on state product (value added) and tax revenues. The specific finding of this study related to the Alternative Case can be summarized as follows:

- Infrastructure investment from 2019 to 2030 in the Alternative Case is $111 billion or 36% lower than the Base Case. (See Exhibit ES-1).

- Because of bottlenecked production and the adoption of higher-cost alternative transportation modes, the average 2019-2030 New Mexico Permian wellhead prices in the Alternative Case are lower by $3.26/bbl for crude oil, $3.03/bbl for natural gas plant liquids and $0.50/Mcf for natural gas. (See Exhibit ES-3).
- Total New Mexico crude oil production during the 2019-2030 period is reduced by 1 billion barrels or 14% of the Base Case amount.
- Total New Mexico natural gas liquids oil production during the 2019-2030 period is reduced by 440 million barrels or 29% of the Base Case amount.
- Total New Mexico dry natural gas production during the 2019-2030 period is reduced by 6,600 billion cubic feet or 27% of the Base Case amount.
- The value of crude, NGL and natural gas production declines by $123 billion or 24% during the 2019-2030 period compared to the Base Case.
- Overall value of output (including crude, NGL, and natural gas production) declines by $134 billion or 23% during the 2019-2030 period compared to the Base Case.
- State GDP declines by $112 billion or 23% compared to the Base Case during the forecast period.
- The direct, indirect, and induced jobs supported by the oil and gas industry in New Mexico fall by 14,900 (-16%) by 2030.
- Because of the lower levels of value added and fewer jobs, the cumulative state general fund and local tax revenue generated by oil and gas activity falls by $12 billion (-17.5%) over the 2019-2030 period in the Alternative Case as compared to the Base Case.

Exhibit ES-3: Key Price Impacts for Base Case and an Alternative Case

		Actual 2017	Base Case Annual Aver. 2019-30	Alternative Case Annual Ave. 2019-30	Alternative vs. Base Case: Impact as %
Permian Wellhead Prices	Natural Gas ($/Mcf)	$2.13	$1.90	$1.40	*-26.2%*
	Natural Gas Liquids ($/bbl)	$23.19	$28.35	$25.32	*-10.7%*
	Crude Oil ($/bbl)	$46.40	$56.15	$52.89	*-5.8%*

ES.5. Conclusions

This report highlights the major role played currently by the oil and gas industry in New Mexico economy and the even larger potential role it can take on in the future due to increasing production, particularly from the Permian Basin. To realize this larger role, the industry will need to undertake large capital expenditures for well construction; gathering systems; gas processing plants; refineries; and crude oil, petroleum product, NGL, natural gas and carbon dioxide pipelines. To the extent that such infrastructure is not built, the expected levels of production will not be realized and the wellhead prices for products will be reduced. This would reduce the value added by the oil and industry, its support of jobs in New Mexico and its contributions to state and local tax revenues.

1. Introduction

1.1 Purpose of Report

ICF prepared this report at the request of the American Petroleum Institute (API) and the New Mexico Oil and Gas Association (NMOGA). The report presents historical data and alternative energy market forecasts for New Mexico in order to demonstrate the economic importance of oil and gas infrastructure in the state. More specifically, the report highlights:

- The oil and gas industry's historical contributions to New Mexico's economy in terms of income, jobs, tax revenues, etc.
- The role new oil and gas infrastructure will play in sustaining and growing New Mexico's oil and gas value chain and the resulting contribution to the future state economy, and
- The potential negative economic impacts to the state if the required oil and gas infrastructure were not to be built.

New Mexico has been producing oil and gas since hydrocarbons were first discovered in the state in 1924. In 2017, New Mexico produced 171 million barrels of crude oil and lease condensate, 1,194 billion cubic feet of dry (pipeline quality) natural gas, 67 million barrels of natural gas plant liquids and 94 billion cubic feet of naturally occurring carbon dioxide. The value of this production at the point of first sale was $13.2 billion. Adding in the other links in the value chain (refining, transportation, distribution and retailing) results in a total value of output of $17.1 billion in 2017. This economic activity led to an estimated direct, indirect and induced income in the state of $13.5 billion or 14.3% of total state income.

ICF assessed the economic impacts on three levels: direct, indirect, and induced impacts. Direct industry expenditures (e.g., natural gas drilling and completion expenditures) produce a domino effect on other industries and aggregate economic activity, as component industries' revenues (e.g., cement and steel manufacturers needed for well construction) are stimulated along with the direct industries. Such secondary economic impacts are defined as "indirect." In addition, further economic activity, classified as "induced," is generated in the economy at large through consumer spending by employees and business owners in direct and indirect industries.

Oil and gas production has been increasing in the state in recent years due to the application of new horizontal drilling and hydraulic fracturing technologies. ICF expects that this trend will continue in the future and lead to substantially higher oil and gas production. In 2030 state direct, indirect and induced income in the state stemming from the oil and gas value chain could be as high as $60.0 billion, representing over 45% of total state income in that year.

To realize this larger role, the industry will need to undertake large capital expenditures for well construction; gathering systems; gas processing plants; refineries; and crude oil, petroleum product, NGL, natural gas and carbon dioxide pipelines. To the extent that such infrastructure is not built, the expected levels of production will not be realized and the wellhead prices for products will be reduced. This would reduce the value added by the oil and industry, its support of jobs in New Mexico and its contributions to state and local tax revenues.

1.2 Background

The Permian Basin of New Mexico and Texas has seen a rapid rise in oil production over the last four years from 1.5 million barrels per day (bpd) in early 2014 to 3.1 million bpd in early 2018. In the same time natural gas production increased by 84% and is expected to continue to grow rapidly. Gross gas production in the Permian was 5.4 Bcfd in early 2014 and reached approximately 10.0 billion cubic feet per day (Bcfd) in early 2018. Much of the growth has been in the form of associated-dissolved gas from horizontal tight oil wells. Associated-dissolved gas from oil wells is now 50% of Permian gas production versus 31% in 2014.

The rapid growth in natural gas production has led to pipeline bottlenecks and growing differences between natural gas spot prices in the Permian Basin's Waha Hub and at Henry Hub. From early 2014 through early 2017, the spot price basis differential was $0.13/MMBtu between the Permian Waha Hub and Henry Hub, with Waha selling at a discount. Since then, the basis has widened to an average of over $0.40/MMBtu in 2017 and an average that exceeds $0.90/MMBtu in 2018.

New natural gas pipelines are now planned to move gas from the Permian to both Corpus Christi/Agua Dulce and Houston markets on the Gulf Coast. These planned gas pipelines include Gulf Coast Express Pipeline (2.0 Bcfd), Permian-Katy Pipeline (1.7 to 2.3 Bcfd), Pecos Trail Pipeline (1.9 Bcfd), and Permian Global Access Pipeline (2.0 Bcfd). These new pipelines are expected to reduce the basis difference between Waha and Henry Hub as they come online in the 2020 to 2023 period.

Infrastructure needed to move oil out of the Permian Basin also has been strained and several infrastructure projects have been built, are under construction and are planned for the future. Publicly announced expansions and new pipelines (Magellan's BridgeTex, Sunoco Logistics' Permian Express, Plains All American's Cactus, Enterprise Product Partners Midland-to-Houston pipeline, intra-Permian pipeline infrastructure, and gathering lines) are intended to connect Permian production to various Gulf Coast refinery centers and export terminals.

Beyond the large-scale infrastructure of gathering systems and pipelines, new infrastructure will be needed in New Mexico for drilling pads, production facilities, storage, processing plants and refineries. Infrastructure development of all types could be delayed or halted by several kinds on ongoing and potential future events and trends:

- **Major delays in state and federal permitting**. Permitting of wells and other facilities can take up to 45 days at the state level and between three and twelve months at the federal level. These timelines are much longer than those in Texas and other states.
- **Statewide environmental policy review**. There is currently no statewide process in New Mexico to conduct broad environmental reviews that mirrors what is done at the federal level under NEPA. There is an effort to create such a statewide NEPA-like process that could make delays in the permitting process even longer.
- **Rights of land tenants**: Under current regulation, grazing tenants do not have to be compensated for economic losses when their land is used for infrastructure development. Therefore, grazing tenants/ranchers sometime oppose new infrastructure. In addition, grazing tenants are now seeking direct access to companies operating on their land (as opposed to construction contractors/subcontractors) to obtain

compensation for economic losses and attorney fees for issues arising from fence cutting, rights of way, etc.

- **Environmental activism**: There has been a recent increase in trespassing and vandalizing of midstream infrastructure by activists.
- **Regulatory conflicts**: Not all operators are fully aware of the political sensitivities that exist in New Mexico, which can cause tensions with some state regulatory agencies.
- **New environmental regulations**. Environmental groups are promoting statewide methane reduction regulations patterned after those in Colorado. If implemented, such measures would increase costs and cause greater permitting delays.
- **More constrained site/route selection**: Selection of sites for drilling pads/facilities or selection of routes for linear infrastructure can be difficult in environmentally sensitive areas. The risk in New Mexico is that environmentally sensitive areas will expand through more designations of endangered species under Endangered Species Act (ESA) guidelines and other measures.

To simplify the construction, estimation, and explanation of the market and economic impacts of constrained infrastructure development, ICF chose to vary infrastructure development specifically for new pipelines and gathering systems in its forecast scenarios. Such constraints might come about due to factors listed above related to new or expanded environmental laws and regulations; delays in permitting processes; land rights and land use disputes; and political conflicts and indecision. Other kinds of constraints could also come about affecting upstream activity (e.g., less leasing of new lands for drilling; new laws and regulation affecting drilling, completion and production; delayed drilling permits). Such scenarios developed from upstream constraints could have similar economic results to those shown in this report, provided that they led to similar declines in oil and gas production and other activities in the value chain.

1.3 Methodology and Scope

The study uses data from the New Mexico state government, the federal government and other sources to characterize oil and gas infrastructure in the state, how that infrastructure was used in recent years, and the economic contributions of the oil and gas value chain in the state. The economic contributions are measured in terms of the value of output, contributions to the state GDP (or income), number of jobs supported, and resulting tax revenue to state and local governments. The report also presents alternative energy market forecasts through 2030 prepared by ICF using our proprietary energy-sector forecasting models. The report's estimates of the direct, indirect and induced impacts on income and jobs in the historical and forecast periods come from the aforementioned state and federal data sources and ICF analyses using the IMPLAN model of the New Mexico economy.

The report presents information on recent additions to Mexico's oil and infrastructure, major infrastructure projects now under construction and plans for future projects. Starting from ICF's Base Case forecast of national energy markets, the report develops two scenarios for what future infrastructure are built and the implications of that construction for the economy of New Mexico. The two scenarios are:

- A "Base Case" that assumes that infrastructure is built over the next twelve years to accommodate projected oil and gas production most economically. This case is consistent with ICF's national 4th Quarter 2018 "Base Case" forecast.

- A "Constrained Infrastructure Development Case" (also called the "Alternative Case") that limits infrastructure development in New Mexico. This scenario (a) includes only future projects that are currently under construction and (b) limits gas flaring in New Mexico to the historically observed maximum, which can also limit crude oil production.

The study estimates the implications through the year 2030 of the Base Case and the Alternative Case for the following items:

- Infrastructure and other types of oil- and gas-related **capital investment** in the state. The initial impacts of constraints on new infrastructure would be less capital expenditures for the affected infrastructure and fewer construction-related jobs.
- **Oil and gas prices** in the state. Lack of new transportation infrastructure may lead to bottlenecks and the use of more expensive alternative transportation modes which and cause the netback wellhead prices to fall. This reduces the wellhead value of production from both new and existing wells.
- The **level of oil and gas production**. The combined effects of transportation bottlenecks and reduced wellhead prices reduces the incentive for new drilling and so upstream expenditures and jobs are reduced leading to less long-term oil and gas production.
- The oil and gas industry's **contributions to state income**. The majority of the economic activity related to New Mexico's oil and gas value chain stays in the state to contribute to income in the forms of employee compensation, lease bonus and rent payments, production royalty payments, investment income, severance taxes, property taxes and state income taxes.
- **State and local tax revenues** derived from oil and gas economic activity. These change along with the value of oil and gas production and state income.
- The **number of jobs** in the state that are supported by oil and gas economic activity. Jobs are affected by the value of output in each part of the value chain.

The values forecasted for these items in Base Case highlight how the major role played currently by the oil and gas industry in New Mexico economy could be even larger in the future due to increasing production, particularly crude oil, natural gas and NGLs from the Permian Basin. To realize this larger role, the industry will need to undertake large capital expenditures for well construction, gathering systems, pipelines and other assets. The Alternative Case shows that when the needed infrastructure is not built, the expected levels of production will not be realized and the wellhead prices for products will be reduced. This would significantly reduce the value added by the oil and industry, its support of jobs in New Mexico and its contributions to state and local tax revenues.

1.4 Organization of Report

The next section of this report, Chapter 2, describes the characteristics and recent use of existing infrastructure in New Mexico. Topics covered include oil and gas resources and drilling activity, crude oil markets and infrastructure, refineries, petroleum product markets and infrastructure, natural gas markets and infrastructure, NGL markets and infrastructure, and carbon dioxide markets and infrastructure. Chapter 3 describes the methodology used for the report including the models employed to prepare the forecasts of energy markets and economic impacts. Chapter 4 describes how the Base Case and Alternative Case were constructed and

presents the key market results along the oil and gas value chain in New Mexico for capital expenditures, energy prices, and production volumes. Chapter 5 presents the economic impact result of the two scenarios including value of output, state GDP (value added, state income), jobs, wages, and state and local tax revenues. The final section of the main report, Chapter 6, summarizes the key conclusions of the report.

2. Characteristics of Existing Oil and Gas Markets and Infrastructure in New Mexico

2.1 Introduction

New Mexico's large volumes of oil, natural gas, natural gas liquids and carbon dioxide reserves and the production, distribution and retailing of raw and finished petroleum products plays a significant role in the state economy. The state was the 6th largest producer of crude oil and 9th largest producer of natural gas in the U.S. in 2016[1]. Crude oil and petroleum product production outpaces in-state demand and as such, New Mexico is a net exporter of crude oil, petroleum products, natural gas and natural gas liquids. The exported petroleum volumes are delivered to out of state markets primarily by pipeline, although cross-border trade also occurs via truck or rail movements. Crude oil is largely produced from the Delaware Basin portion of the Permian Basin. Also located within the state, the San Juan basin is primarily natural gas producing although the area also supplies smaller volumes of crude oil to relevant markets. There are two refineries located in the state, one in the northwest in Gallup and one in the southeast in Artesia. An additional refinery in nearby El Paso, Texas receives volumes of New Mexican and other crudes and produces petroleum products that are largely shipped by pipeline into New Mexico to satisfy demand in New Mexico, Arizona and California. Demand for petroleum products within the state is primarily concentrated in the Albuquerque, Santa Fe, and Las Cruces metropolitan areas.

This chapter describes the infrastructure that supports the oil and gas industry in New Mexico and explains how it is utilized to facilitate New Mexico's wellhead production, processing and refining; to supply in-state consumers; and to transship products among other states.

2.2 Oil and Gas Resources and Drilling Activity

Ever since hydrocarbons were first discovered in New Mexico in 1924, the state has been a major producer of oil and natural gas. In 2017, New Mexico produced 171 million barrels of crude oil and lease condensate, 1,194 billion cubic feet of dry (pipeline quality) natural gas, 67 million barrels of natural gas plant liquids and 94 billion cubic feet of naturally occurring carbon dioxide. The value of this production at the point of first sale was $13.2 billion. The primary producing basins of the State are shown in Exhibit 2-1. The San Juan Basin in the northwest portion of the state primarily produces natural gas from low-permeability sandstone and carbonate reservoirs and from coalbeds. The Permian Basin is in the southeast portion of the state and is where New Mexico's crude oil production mostly occurs. Oil production in both the New Mexico and Texas portions of the Permian Basin has been increasing in recent years due to the application of new horizontal drilling and hydraulic fracturing technologies. The Permian Basin also produces associated-dissolved natural gas from the (mostly carbonate) oil reservoirs and natural gas from non-associated reservoirs. The Raton Basin in the northeast part of the

[1] U.S. Energy Information Administration (EIA); https://www.eia.gov/state/seds/sep_prod/pdf/P4.pdf

state produces natural gas from coalbeds. Production of natural carbon dioxide occurs in the Bravo Dome area (see Exhibit 2-30 for map of CO_2 production areas in the state).

Exhibit 2-2 show estimates of remaining reserves in New Mexico at the end of 2017 as published by the U.S. Department of Energy's Energy Information Administration. Remaining reserves represent the quantities "which geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions …"

Exhibit 2-2 shows reserves divided into the "West" region, which consists primarily of the San Juan Basin and "East" Region made up of the Permian Basin and Raton Basin. The Permian Basin contains 97% of New Mexico's crude oil reserves and 95% of its associate-dissolved natural gas. On average, there are 3,716 cubic feet of wet associated-dissolved natural gas reserves for each barrel of crude oil reserves in the state. The San Juan Basin has 86% of the state's non-associated gas. The gas produced from the San Juan Basin is "drier" than that of the Permian in that it has a lease condensate ratio of 2.8 versus 50.8 barrels per million cubic feet and a gas plant liquids ratio of 33.7 versus 65.5 barrels per million cubic feet.

Exhibit 2-1: Geologic Basins in New Mexico

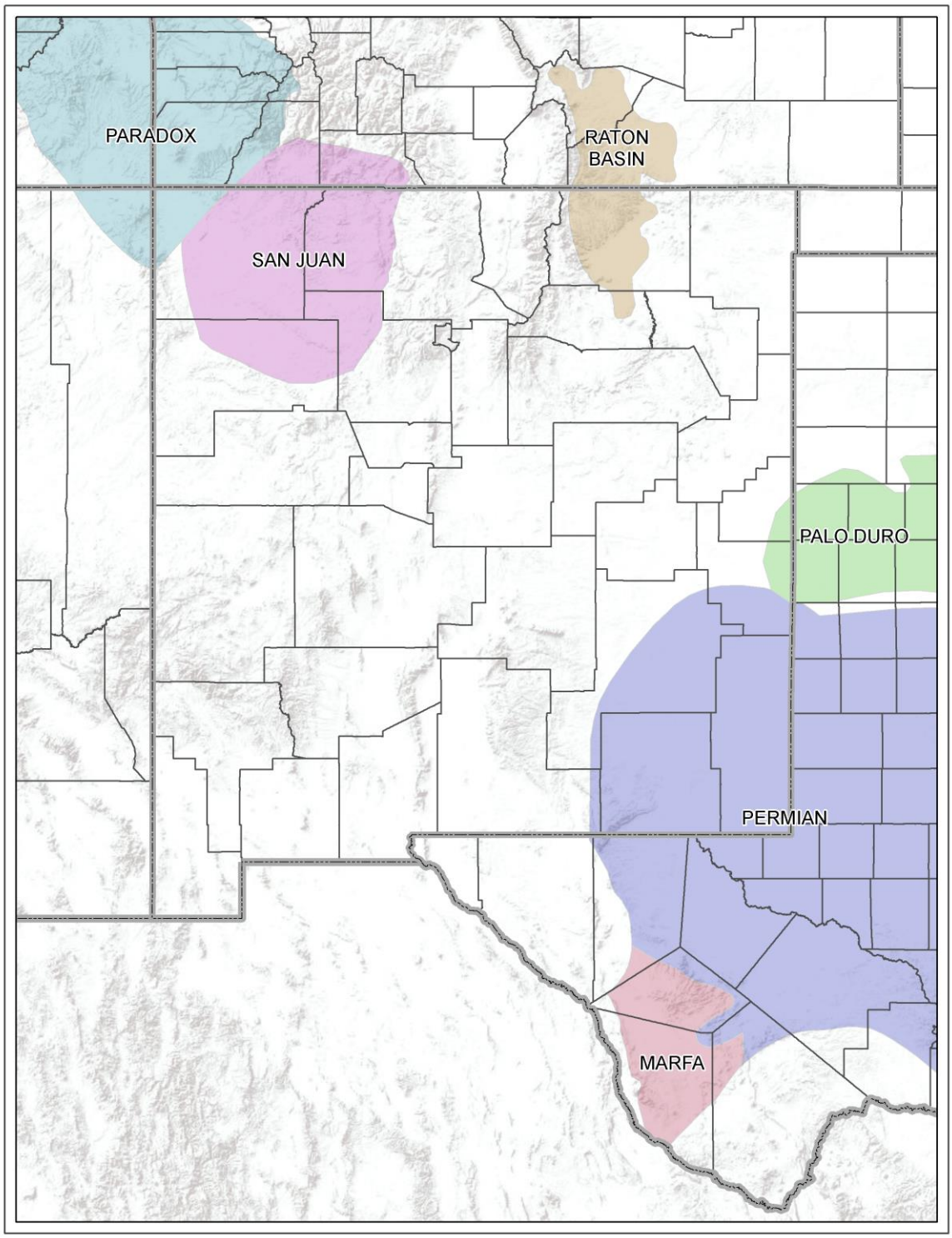


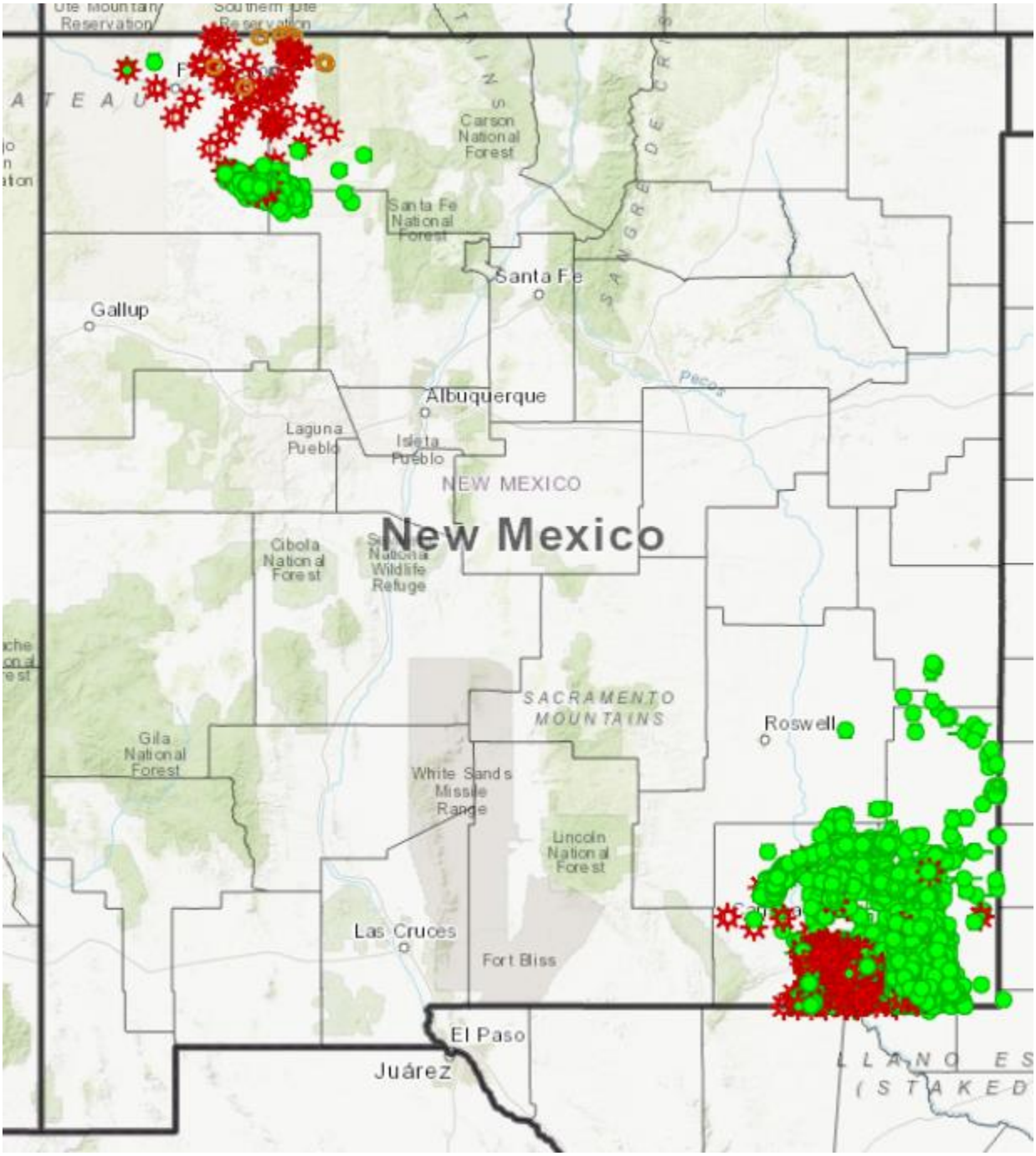
Exhibit 2-2: 2017 Oil and Gas Reserves in New Mexico

Resource	Area	2017 Production	Reserves 12/31/2017	*Reserves to Production Ratio*
Crude Oil (million barrels)	**New Mexico**	**160**	**2,581**	***16.1***
	East (Permian Basin, etc.)	154	2,503	*16.3*
	West (San Juan Basin, etc.)	6	78	*13.0*
Wet Associated-dissolved Natural Gas (bcf)	**New Mexico**	**568**	**9,592**	***16.9***
	East (Permian Basin, etc.)	529	9,138	*17.3*
	West (San Juan Basin, etc.)	39	454	*11.6*
Wet AD Gas to Crude Oil Ratio (cf/bbl)	***New Mexico***	***3,550***	***3,716***	
	East (Permian Basin, etc.)	*3,435*	*3,651*	
	West (San Juan Basin, etc.)	*6,500*	*5,821*	
Wet Nonassociated Natural Gas (bcf)	**New Mexico**	**751**	**11,266**	***15.0***
	East (Permian Basin, etc.)	189	1,596	*8.4*
	West (San Juan Basin, etc.)	562	9,670	*17.2*
Lease Condensate (million barrels)	**New Mexico**	**12**	**108**	***9.0***
	East (Permian Basin, etc.)	10	81	*8.1*
	West (San Juan Basin, etc.)	2	27	*13.5*
Lease Condensate to Wet Non-associated Gas Ratio (bbl/MMcf)	***New Mexico***	***16.0***	***9.6***	
	East (Permian Basin, etc.)	*52.9*	*50.8*	
	West (San Juan Basin, etc.)	*3.6*	*2.8*	
Natural Gas Plant Liquids (million barrels)	**New Mexico**	**67**	**1,044**	***15.6***
	East (Permian Basin, etc.)	47	703	*15.0*
	West (San Juan Basin, etc.)	20	341	*17.1*
NG Plant Liquids to Wet Gas Ratio (bbl/MMcf)	***New Mexico***	***50.8***	***50.1***	
	East (Permian Basin, etc.)	*65.5*	*65.5*	
	West (San Juan Basin, etc.)	*33.3*	*33.7*	

Source: U.S. Energy Information Administration, Form EIA-23L, Annual Report of Domestic Oil and Gas Proved Reserves.

The location of new oil and gas wells starting production from 2013 to 2018 are shown in Exhibit 2-3 (horizontal wells) and Exhibit 2-4 (vertical wells). Of the 3,937 horizontal wells shown in Exhibit 2-3, some 3,603 or 92% are in the Permian Basin. These are predominantly (91%) oil wells producing from the Bone Spring and Wolfcamp formations. The horizontal wells in the San Juan Basin are a mixture of oil (78%), non-CBM gas (19%) and CBM (4%) wells and produce mostly from the Mancos Shale, Gallup Sandstone, Mesaverde and Fruitland Coal formations.

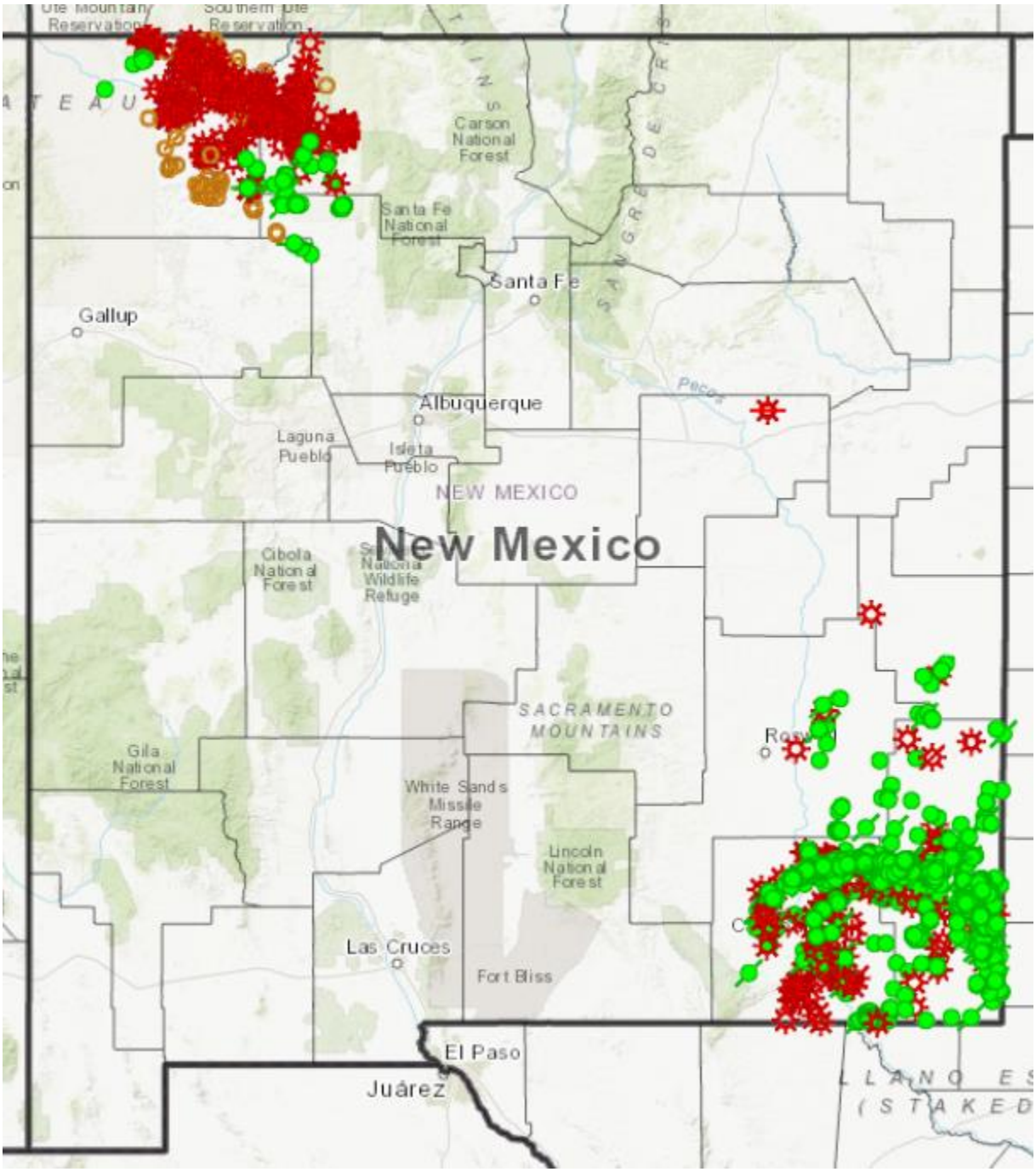
Exhibit 2-3: Oil and Gas Horizontal Drilling Activity 2013 to 2018



Source: DrillingInfo. Well vintage is based on date of first production. Green symbols represent oil wells, red represents gas wells and orange are coalbed methane wells.

Exhibit 2-4 shows 1,276 vertical and directionally drilled wells that started production from 2013 to 2018. The Permian Basin had 1,133 of these vertical/directional wells, of which 98% were oil wells producing from a variety of formations. The San Juan Basin had 172 vertical/directional wells starting production from 2013 to 2018. Of these 28% were oil wells, 44% were non-CBM gas wells and 28% were coalbed methane wells. Also in this period, two vertical wells started production from the Vermejo coal formation in the Raton Basin.

Exhibit 2-4: Oil and Gas Vertical/Directional Drilling Activity 2013 to 2018



Source: DrillingInfo. Well vintage is based on date of first production. Green symbols represent oil wells, red represents gas wells and orange stars are coalbed methane wells.

Additional information on the wells starting production from 2013 to 2018 can be seen in Exhibit 2-5, which shows the wells counts by year of first production and average measured depths in feet. Note that the measured depths of horizontal wells has been increasing as operator have adopted well designs with longer lateral lengths, which tends to increase production per well.

Exhibit 2-5: Count of New Wells and Their Average Measured Drilling Depths

Average Measured Depth (Feet)									
Year	Horizontal			Vertical			Directional		
	OIL	GAS	CBM	OIL	GAS	CBM	OIL	GAS	CBM
2013	13,180	9,218	-	5,622	7,279	1,477	6,006	7,638	-
2014	13,402	12,648	4,317	5,825	7,354	1,535	5,903	8,271	-
2015	13,841	14,289	6,824	6,003	7,666	2,595	6,167	7,332	-
2016	14,248	15,631	8,554	7,117	-	990	6,077	11,189	-
2017	15,615	15,575	-	6,048	7,635	880	5,515	-	-
2018	16,888	16,465	8,828	6,300	9,110	1,037	5,763	12,961	-

Well Count									
Year	Horizontal			Vertical			Directional		
	OIL	GAS	CBM	OIL	GAS	CBM	OIL	GAS	CBM
2013	638	37	-	404	22	15	74	13	-
2014	761	23	4	286	14	12	108	5	-
2015	652	35	4	88	12	3	37	9	-
2016	364	53	1	18	-	3	19	1	-
2017	495	94	-	36	14	13	16	-	-
2018	705	194	3	24	3	5	23	1	-

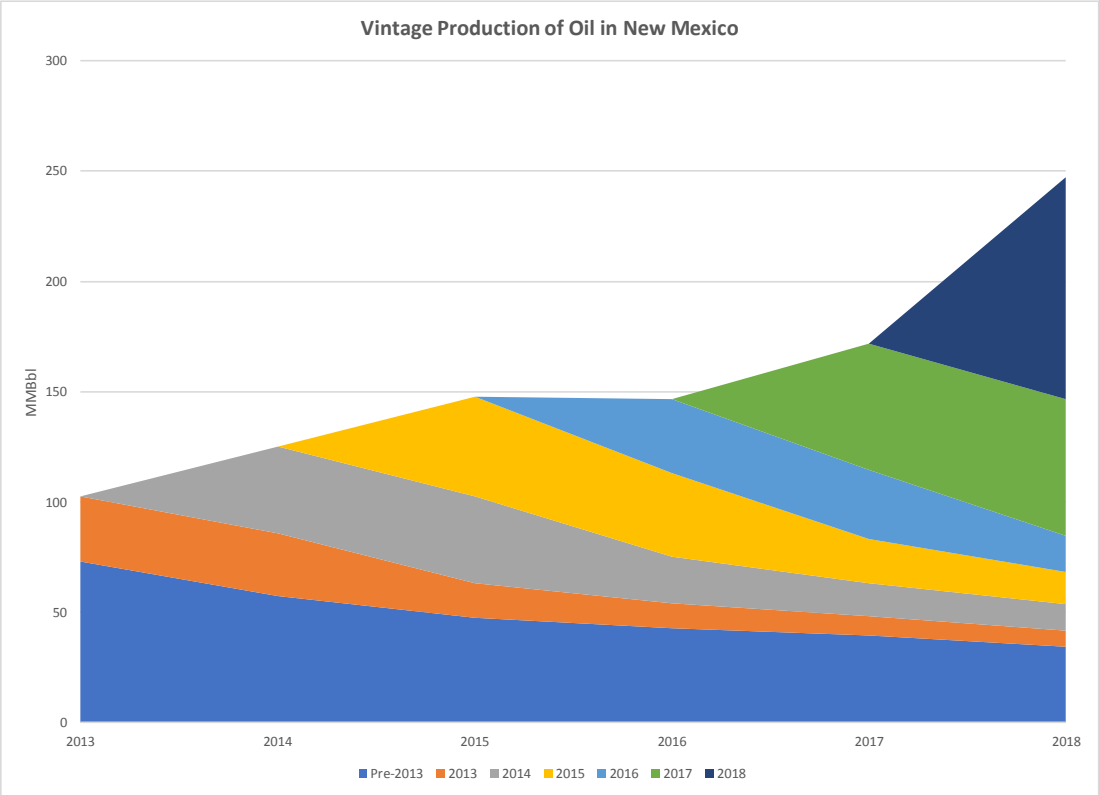
Source: DrillingInfo. Well vintage is based on date of first production. Note that conventions for counting wells differ among sources (e.g., date of completion versus date of first production and when drilled but uncompleted wells (DUCs) are counted).

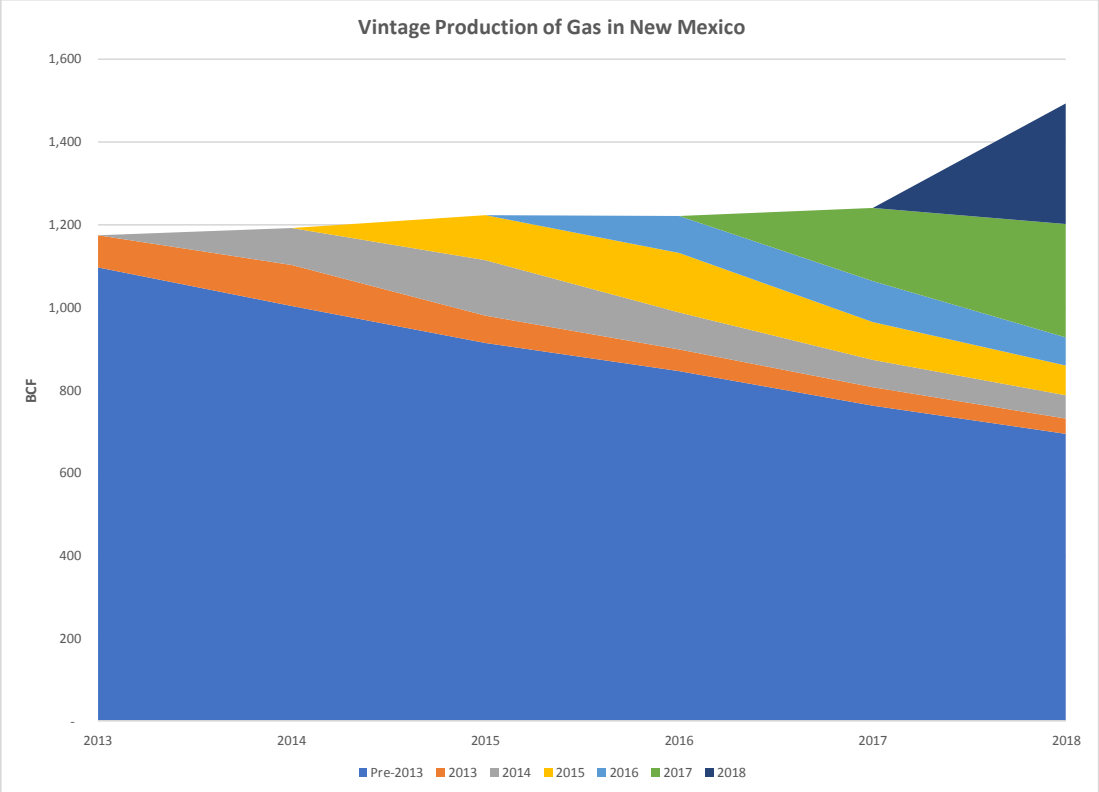
The annual volumes of wet gas and liquids (crude oil and lease condensate) production by well vintage is shown Exhibit 2-6 for the last six years of production data. (Note that production data for the year 2018 has been adjusted upward to account for missing data for the last two months of the year.) The table sums all wells drilled through 2012 into one category and has individual vintage categories for wells starting production in each year from 2013 to 2018.

Because production from most wells[2] declines steadily after the first few months of production, the vintage production table indicates that the contribution of each vintage declines over time and the contribution of new wells is required to maintain or increase production levels. Exhibit 2-6 shows that by 2018 some 86% of the oil production and 54% of wet gas production came from new wells drilled in the last six years.

[2] The exception is coalbed methane wells, which can exhibit increasing methane production through the first part of their lives as the wells are being dewatered.

Exhibit 2-6: Oil and Gas Annual Production by Well Vintage 2013 to 2018



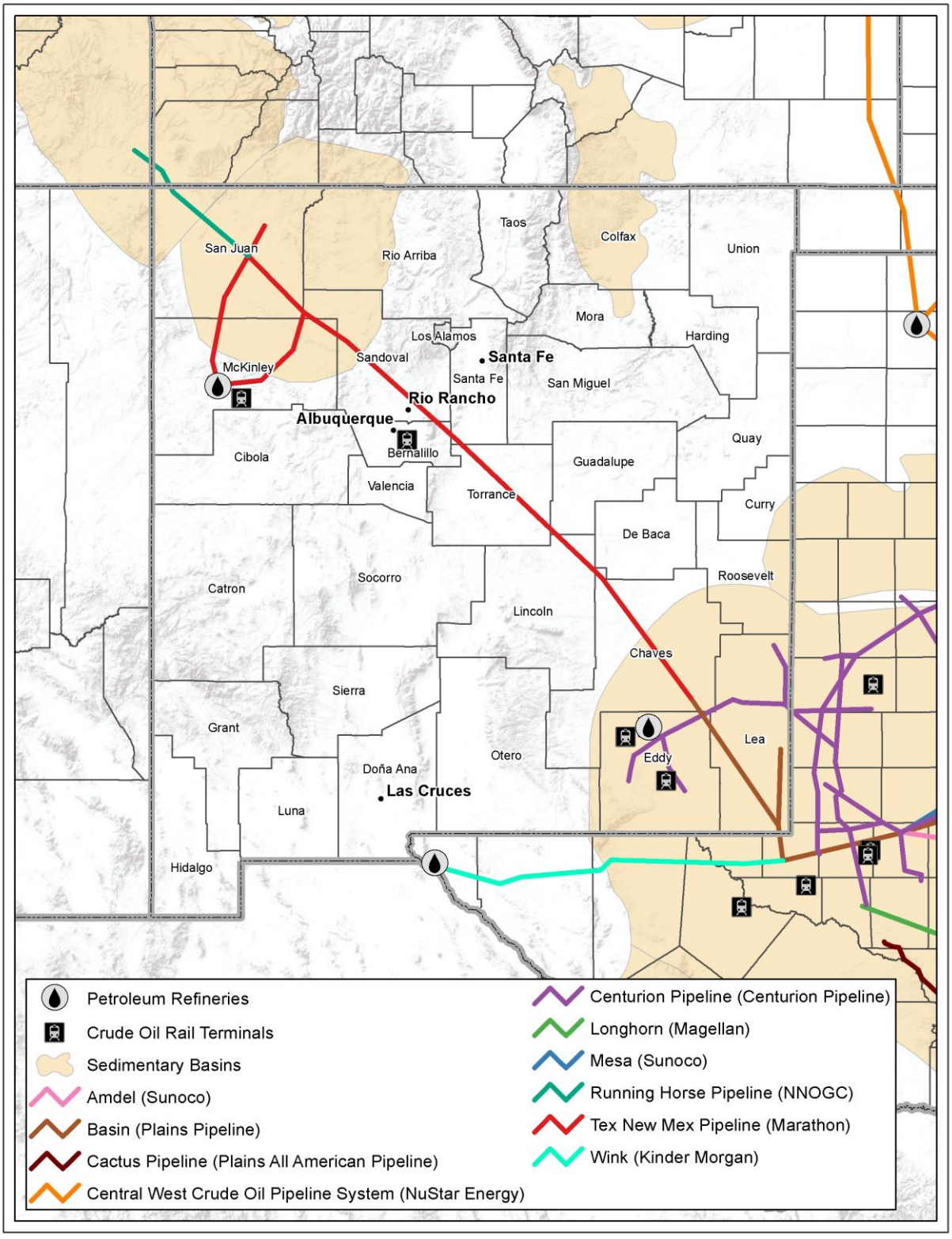


2.3 Crude Oil Markets and Infrastructure

Exhibit 2-7 shows the major crude oil pipelines, refineries, and terminals in the state. Within New Mexico in 2016 (the last year with comprehensive crude oil transportation flow data), the Permian Basin produced 380,400 b/d and the San Juan basin produced 19,300 b/d of crude oil[3]. Of the 400,000 b/d total production, 121,000 b/d was consumed by in state refineries[4]. Remaining crude oil volumes left the state via pipeline into Texas to be refined in Texas or exported to other states or to foreign markets.

[3] New Mexico Energy, Minerals and Natural Resources Department 2017 Annual Report; http://www.emnrd.state.nm.us/ADMIN/documents/Final_2017_Annual_Report.pdf
[4] U.S. Energy Information Administration (EIA); https://www.eia.gov/state/seds/

Exhibit 2-7: New Mexico Crude Oil Pipelines and Assets



Located in the northwest, Marathon Petroleum Corporation's Gallup refinery primarily receives crude oils from the San Juan Basin in New Mexico and the Paradox Basin in Utah, mainly "Four Corners Sweet" light crude. The Navajo Nation owned Running Horse pipeline delivers Utah crude to the Gallup refinery via Colorado. Additional crude oil is delivered to Gallup from the Permian Basin via the Marathon owned TexNewMex pipeline.

The Navajo Artesia refinery, the larger of the two, is owned and operated by Holly Frontier and is found in the southeast of the state. This refinery is primarily supplied by oil produced from the New Mexico portions of the Permian Basin. The refinery can process both light and heavy crude types and also receives smaller volumes from domestic pipeline shipments from Texas. Additionally, the refinery receives imports of crude oil from Canada delivered by pipeline through Cushing, Oklahoma although these volumes have declined in recent years. The following exhibits show the supply, disposition, and movements of crude oil volumes in New Mexico.

Exhibit 2-8: New Mexico Crude Oil Supply Movements (barrels per day)

Year	New Mexico Production	Imports from Other U.S. States	Foreign Imports	Total Supply
2014	343,000	27,533	12,504	383,037
2015	405,000	26,760	3,397	435,158
2016	400,000	24,355	0	424,355
2017	470,000	24,422	260	494,682

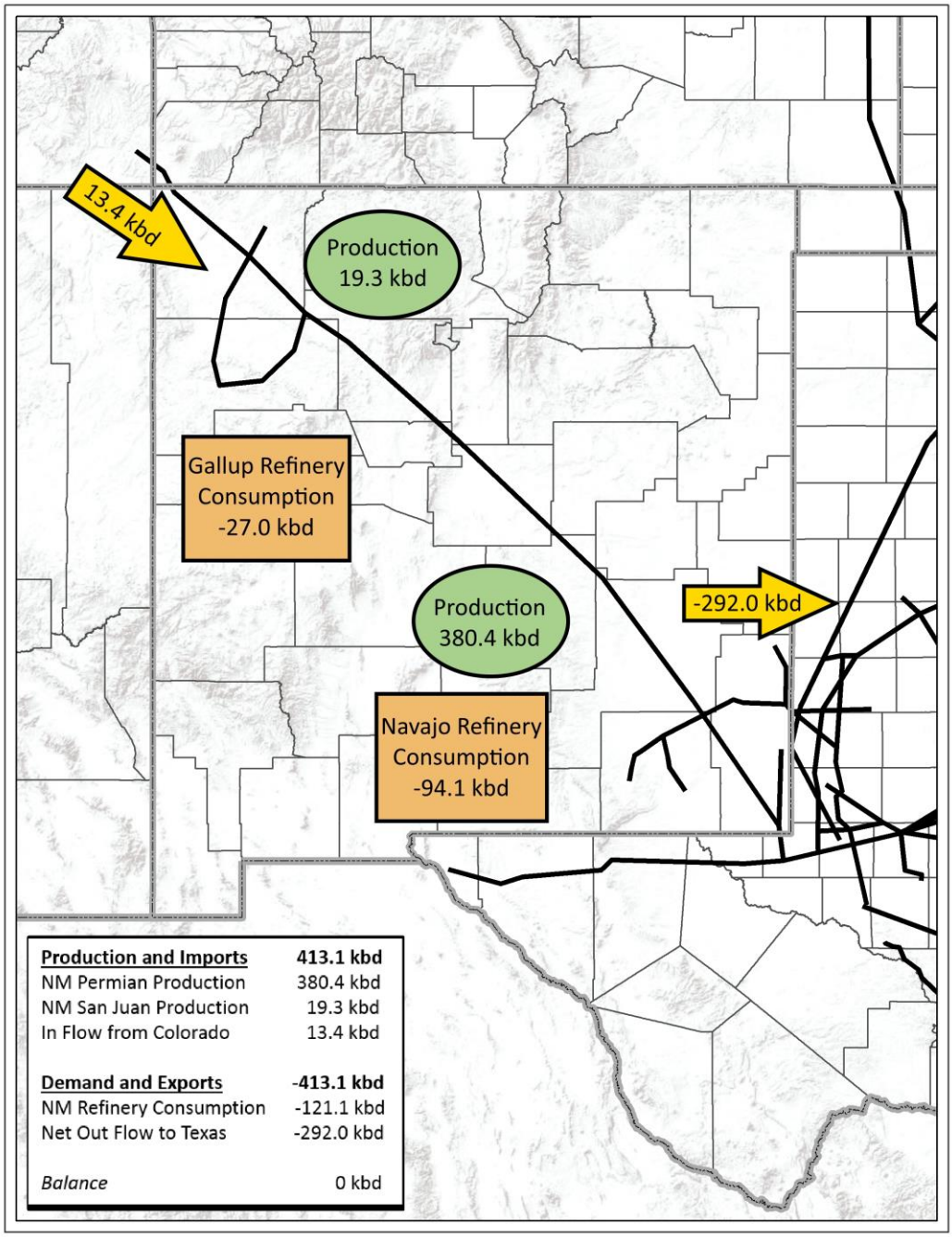
Sources: EIA, ICF analysis of Freight Analysis Framework (FAF), Company Websites

Exhibit 2-9: New Mexico Crude Oil Disposition by Year (barrels per day)

Year	Input to New Mexico Refineries	Exports to Other U.S. States	Total Disposition
2014	123,334	259,699	383,037
2015	124,526	310,632	435,158
2016	121,057	303,298	424,357
2017	125,619	369,063	494,684

Sources: EIA, ICF analysis of Freight Analysis Framework (FAF), Company Websites

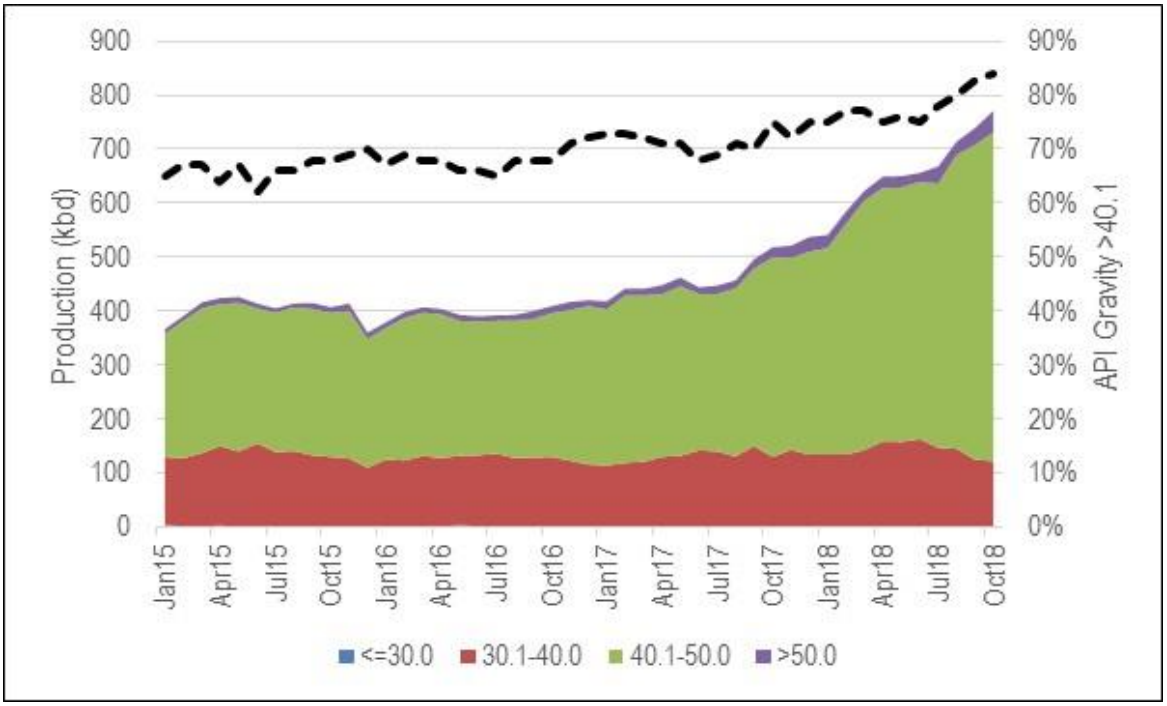
Exhibit 2-10: New Mexico Crude Oil Flows (1,000 barrels per day)



Volumes of crude oil production within New Mexico are increasing over time and the proportions of lighter crudes associated with horizontal wells is increasing. Exhibit 2-11 shows historic production volumes of crude oil by API gravity in New Mexico[5]. In January 2015, crude oil grades with an API gravity greater than 40.1° accounted for 65% of the 367,000 b/d total production. By October 2018, this proportion increases to account for over 84% of the total 772,000 b/d produced in that month.

[5] U.S. Energy Information Administration (EIA); https://www.eia.gov/petroleum/production/

Exhibit 2-11: New Mexico Crude Oil Production by API Gravity



Source: U.S. Energy Information Administration.

Pinion Pipeline Controversy

An example of the difficulties faced by infrastructure projects is the Pinion crude oil pipeline, a project first proposed in 2014 by Saddle Butte San Juan LLC. The project included constructing an approximately 50 mile gathering line with the capability of receiving crude oil produced by the San Juan Basin, primarily from the emerging Gallup Formation horizontal oil well play. These volumes would then be transported and connected with a larger, 100-mile line in Lybrook, New Mexico with the capability of delivering 50,000 b/d to a rail terminal near Gallup. Opponents argued that the environmental concerns from pipeline leaks and the implied increase in drilling by more widely available capacity would adversely impact affected federal and tribal lands. This pressure, combined with oil price declines in 2014, which resulted in decreased drilling, ultimately ended interest in construction. The project was officially withdrawn in December 2016.[6]

Oil Transportation Cost

Crude oil is typically taken away by truck or gathering line from the lease to an oil terminal or, if one is located nearby, a refinery. Most frequently, the oil terminal is part of an oil pipeline system that will transport the crude oil to a refinery or to another terminal that connects to other

[6] https://www.daily-times.com/story/news/local/new-mexico/2016/12/19/blm-receives-withdrawal-pipeline-project/95623166/

pipeline, waterborne or rail transportation infrastructure. Examples of the cost of transporting crude oil are shown in Exhibit 2-12 for trucks, Exhibit 2-13 for pipelines and Exhibit 2-14 for rail. Each of these exhibits show costs for distances from 25 to 1,600 miles in units of dollars per barrel, cents per barrel-mile, and cents per metric-ton-mile.

The truck transportation cost are based on assumptions of $80.00/hour non-fuel truck and driver costs, a truck fuel efficiency of 136 metric ton-miles per gallon of diesel fuel, diesel fuel cost of $3.00 per gallon including federal and state taxes, 40 MPH average on-road speed, and an oil density of 815 kg per cubic meter (approximately 42 API gravity[7]). Given these assumptions, transportation cost range from about six cents per barrel-mile for a distances of 25 miles down to about three cents per barrel-mile for the longer distances of 400 to 1,600 miles.

Exhibit 2-12: Representative Costs for Crude Oil Transport by Truck

One-Way Distance (miles)	25	50	100	200	400	800	1600
Truck Cargo Capacity (gallons)	6,471						
Truck Cargo Capacity (barrels)	154						
Truck Cargo Capacity (cubic meters)	24.5						
Truck Cargo Capacity (metric tons)	20.0						
Truck Cargo Capacity (pounds)	44,000						
Loading + Unloading Times in Hours	1.5						
Two-Way Loading, Travel & Unloading Time (hours)	2.8	4.0	6.5	11.5	21.5	41.5	81.5
Fuel Gallons per Trip	5	11	21	43	85	170	340
Truck & Driver Cost per Trip	$220	$320	$520	$920	$1,720	$3,320	$6,520
Fuel Costs per Trip	$16	$32	$64	$128	$255	$510	$1,021
Total Costs per Trip	$236	$352	$584	$1,048	$1,975	$3,830	$7,541
Total Costs in $ per Barrel	**$1.53**	**$2.28**	**$3.79**	**$6.80**	**$12.82**	**$24.86**	**$48.94**
Total Costs in Cents per Barrel-Mile	6.13¢	4.57¢	3.79¢	3.40¢	3.21¢	3.11¢	3.06¢
Total Costs in Cents per Metric Ton-Mile	47.28¢	35.25¢	29.24¢	26.24¢	24.73¢	23.98¢	23.61¢

The cost shown in Exhibit 2-13 for transportation by pipeline are based on the same crude type and travel distances as the truck transportation examples. The costs examples were constructed to approximate the recent revenues reported in FERC Form 6 by crude oil pipelines. Including terminal services (loading, unloading, and storage), pipeline transportation cost range from 1.5 cents per barrel-mile for the short distance example to about 0.5 cents per barrel-mile for the longer distances. Actual cost will vary around these numbers based on several factors including the length of contract signed with the pipeline (longer terms lead to lower rates), crude gravity (lighter crudes can be less costly to transport), cost/age of the pipeline, and the geography of the origin/destination points or “groups” set up in the pipeline tariff.

Exhibit 2-13: Representative Costs for Crude Oil Transport by Pipeline

One-Way Distance (miles)	25	50	100	200	400	800	1600
Cost in $/barrel of Crude Transported							
Receipt Terminal Services	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09
Delivery Terminal Services	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07
Transportation Tariff	$0.20	$0.30	$0.50	$0.89	$1.67	$3.24	$6.38

[7] The weighted average gravity of crude oil and lease condensate of New Mexico wells starting production from 2013 to 2018 (weighted by cumulative production of each well) is 42.6 degrees API.

Total Costs in $ per Barrel	$0.36	$0.46	$0.66	$1.05	$1.83	$3.40	$6.54
Total Costs in Cents per Barrel-Mile	1.45¢	0.92¢	0.66¢	0.52¢	0.46¢	0.43¢	0.41¢
Total Costs in Cents per Metric Ton-Mile	11.19¢	7.11¢	5.07¢	4.05¢	3.54¢	3.28¢	3.16¢

Notes: The table reflects national average revenues for crude oil pipelines of 0.52 cents per barrel-mile. These averages correspond roughly to transportation of a medium crude oil under a medium-term contract (5-year commitment). Rates could be discounted by 8% to 11% for commitments of larger volumes or for longer terms (10 years). Uncommitted volumes could be charged 25% to 75% more. Where differing tariffs among crude grades are specified in tariffs, light crudes could get a discount of ~7% and heavy crude would be charged ~11% more. Tariffs for new crude oil pipeline would be zero to 31% higher than these averages depending on construction costs.

The crude-by-rail transportation costs shown in Exhibit 2-14 use the same crude type and distance assumptions as the truck and pipeline examples. Component costs for rail transportation include the lease of a tank car, terminal services, and transportation by the railroad (which can be quoted as inclusive of all fuel costs or involve extra fuel surcharges). Because of the significant terminal service costs, the cost of rail transportation is the highest for short distances among the three mode options examined. At nearly thirteen cents per barrel-mile, short distance rail service is over twice the cost of truck transportation. However, at the longest distances examined, rail transportation costs fall significantly per barrel-mile and are about one-third the transport cost of trucks. However, even at longest distances rail costs are twice the cost of pipelines.

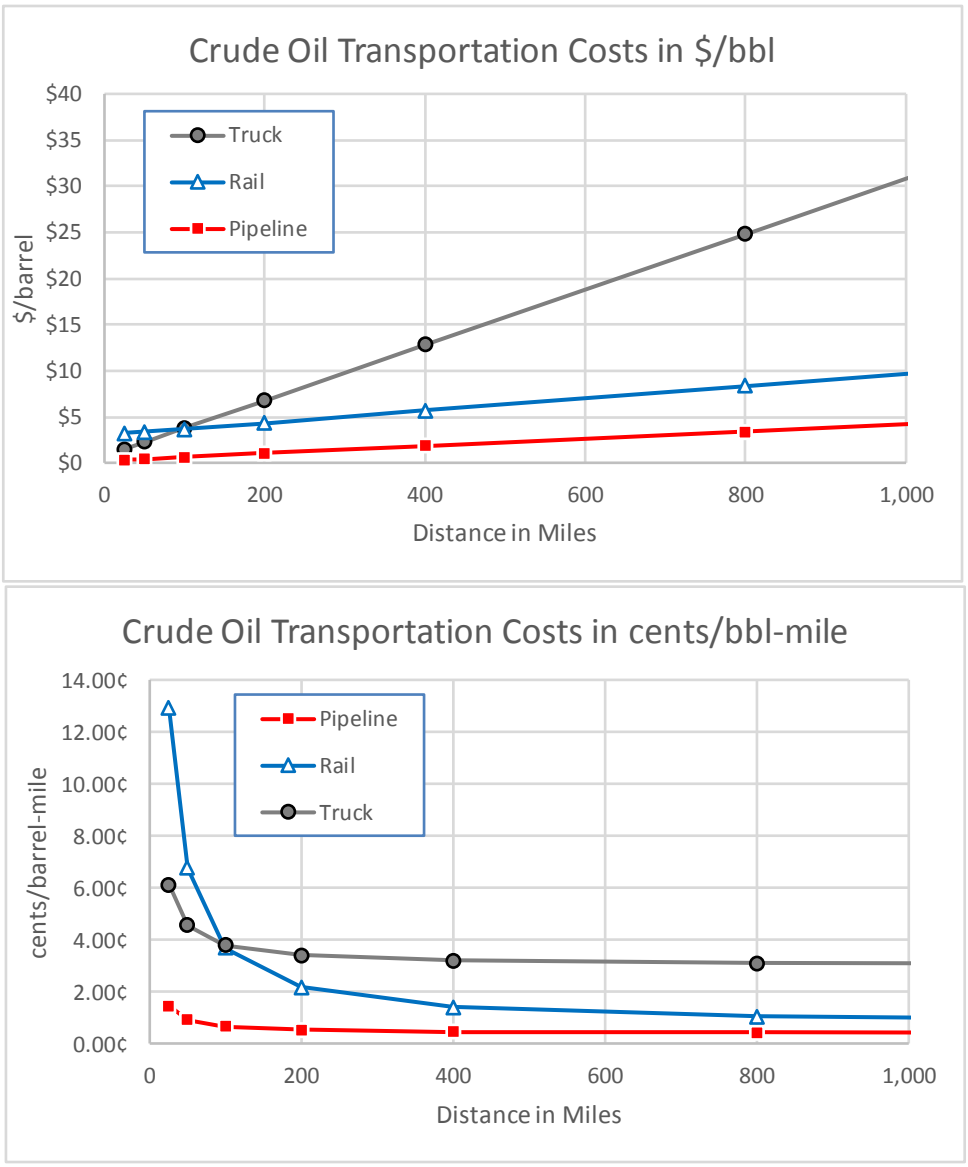
Exhibit 2-14: Representative Costs for Crude Oil Transport by Rail

One-Way Distance (miles)	25	50	100	200	400	800	1600
Tank Car Cargo Capacity (gallons)	29,700						
Tank Car Cargo Capacity (barrels)	707						
Tank Car Cargo Capacity (cubic meters)	112.4						
Tank Car Cargo Capacity (metric tons)	91.6						
Tank Car Cargo Capacity (pounds)	201,948						
Cost in $/barrel of Crude Transported							
Tanker Car Lease	$0.08	$0.08	$0.08	$0.15	$0.29	$0.58	$1.16
Transport Service (ex. fuel)	$0.13	$0.26	$0.52	$1.04	$2.09	$4.18	$8.35
Fuel Cost	$0.02	$0.04	$0.07	$0.15	$0.29	$0.59	$1.18
Loading Terminal Services	$1.50	$1.50	$1.50	$1.50	$1.50	$1.50	$1.50
Unloading Terminal Services	$1.50	$1.50	$1.50	$1.50	$1.50	$1.50	$1.50
Total Costs in $ per Barrel	**$3.23**	**$3.38**	**$3.68**	**$4.34**	**$5.67**	**$8.35**	**$13.69**
Total Costs in Cents per Barrel-Mile	12.93¢	6.76¢	3.68¢	2.17¢	1.42¢	1.04¢	0.86¢
Total Costs in Cents per Metric Ton-Mile	99.77¢	52.18¢	28.39¢	16.73¢	10.95¢	8.05¢	6.61¢

The comparison of crude oil transportation costs among the three modes examined here are shown graphically in Exhibit 2-15. Where pipelines are available, they would be expected to be the least expensive alternative for transporting crude oil at all distances. Since many oil wells are not connected directly to crude oil gathering system or to crude pipelines, the initial, short-distance movement of crude oil from oil leases is often done by truck and the oil is delivered to a terminal that connects to another form of long-distance transportation. In New Mexico, this long-distance transportation mode is most frequently crude oil pipelines, but it can also be rail where there are no crude oil pipelines or where insufficient pipeline capacity exists. Pipelines are preferred over rail primarily because of pipelines' lower per-unit costs and the fact that rail transportation involves the added hassles of arranging for tank cars (which periodically are in short supply and high-priced), the need for large rail terminals to achieve the best economies of

scale and loading/unloading speeds, and the sometimes uncertain scheduling of rail traffic. On the other hand, the main advantages crude-by-rail enjoys over pipelines are that it provides more flexible destination points (compared to a pipeline that goes only from point A to point B), uses existing rail networks and usually does not require new permitting along the transportation corridor, and can more quickly be scaled up or down as needed.

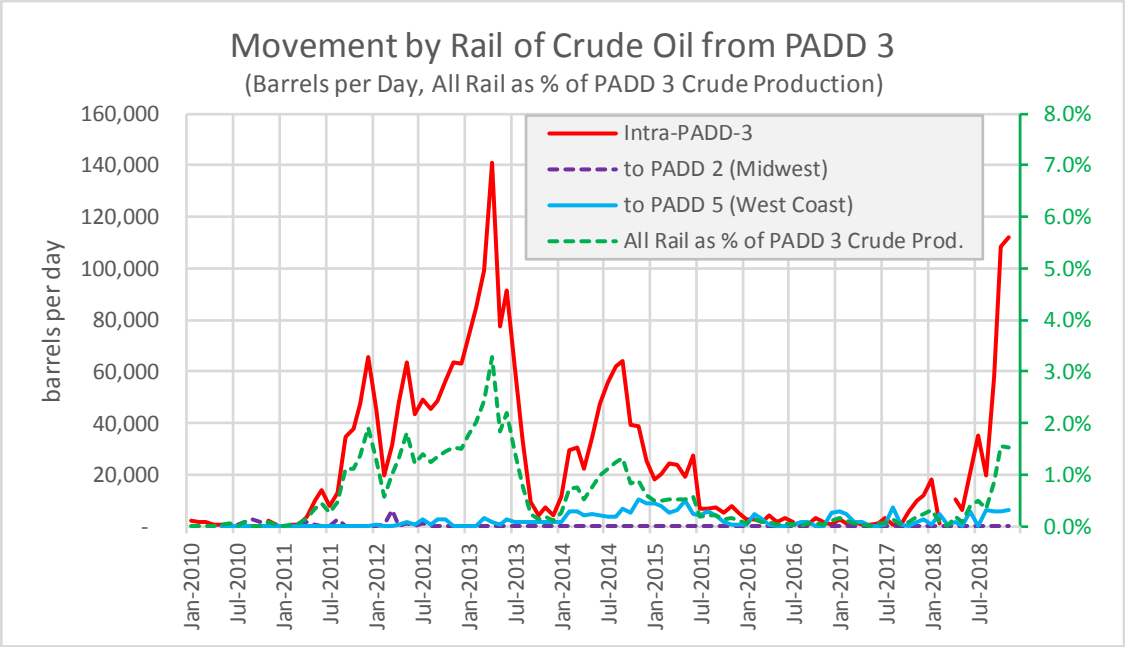
Exhibit 2-15: Comparison of Alternative Crude Oil Transportation Modes



The Energy Information Administration tracks crude oil movements by rail between Petroleum Administration for Defense Districts (PADD) and, intra-PADD movements within each district. State-level data are not reported. Exhibit 2-16 shows monthly movements of crude oil by rail in units of barrels per day from PADD-3 (Gulf Coast: Alabama, Arkansas, Louisiana, Mississippi, New Mexico, and Texas). The chart covers the period of January 2010 to November 2018. The largest portion (91%) of crude oil movement from PADD 3 are intra-PADD movements to locations within the same PADD. These are primarily New Mexico and Texas Permian Basin

crudes and Texas Eagle Ford crudes and condensates being shipped to Gulf Coast refineries. The other destinations for PADD 3 crudes shipped by rail are the West Coast (8%) and the Midwest (1%).

Exhibit 2-16: Movements of Crude Oil by Rail from PADD 3



Source: Energy Information Administration. PADD 3 is the Gulf Coast district and includes Alabama, Arkansas, Louisiana, Mississippi, New Mexico, and Texas.

The movements by rail from PADD 3 show considerable monthly variations, with the months of highest use of rail transportation corresponding to periods when pipeline constraints were most acute. Rail movements out of PADD 3 peaked in April 2013 at 142,667 barrels per day (sum of red, blue and purple lines on chart) and represented 3.3% of PADD 3 crude production in that month (dashed green line on chart). Rail use declined as new pipeline from the Permian and Eagle Ford came online but have moved up again in recent months as the increase in crude production in the Permian has outpaced the addition of new pipeline capacity.

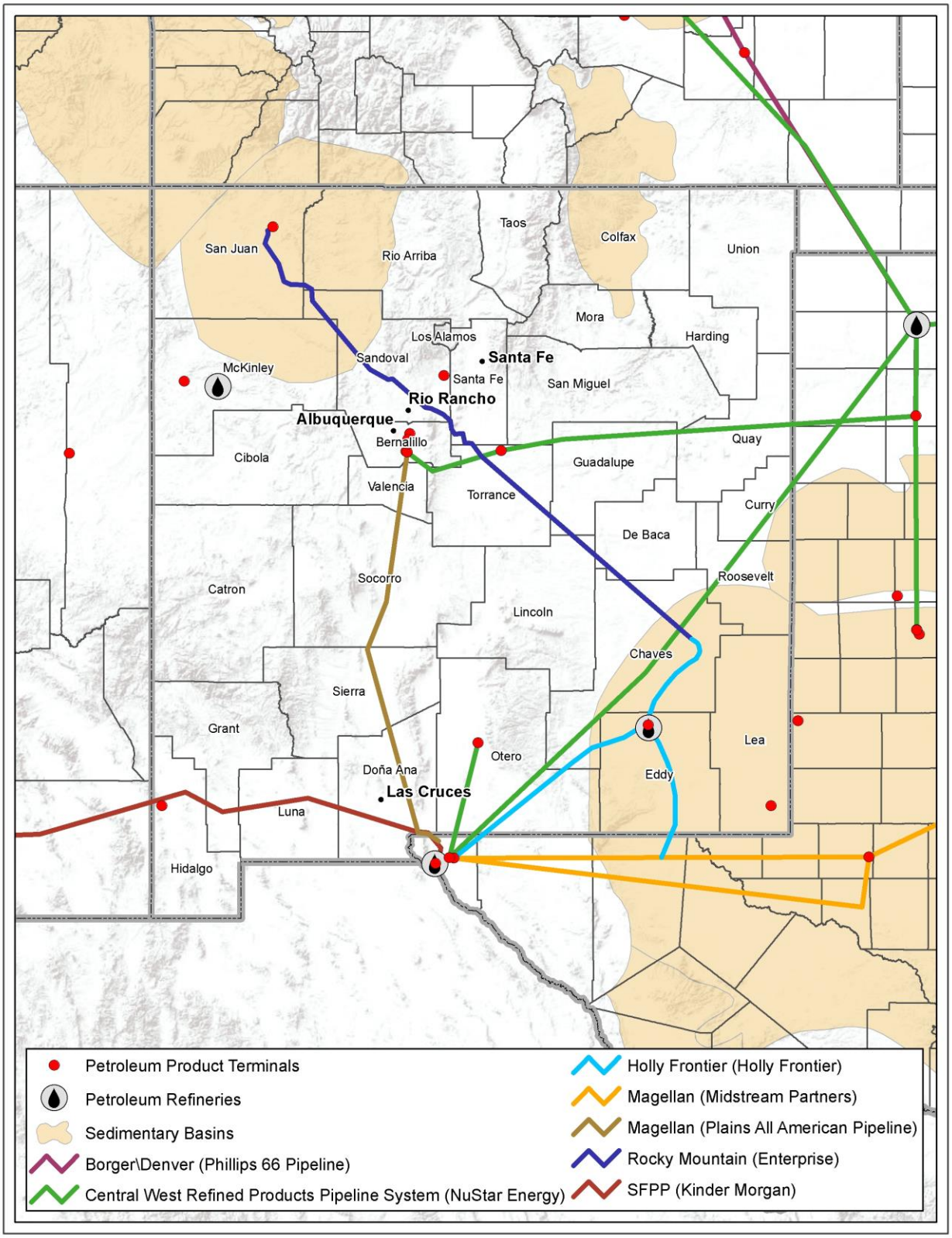
2.4 Petroleum Product Markets and Infrastructure

Petroleum products are produced by processing crude oil and other inputs at refineries. All end-use markets (residential, commercial, industrial and transportation) rely on these products for every day energy, feedstock and material needs. Petroleum products include fuels for use in transportation, heating oils, liquefied petroleum gases, asphalt used in road paving, waxes, lubricants, and petrochemical feedstocks. Petroleum products are defined by the mixture of various hydrocarbon liquids they contain and various physical characteristics, which are controlled by the numerous processes located at the refinery. Refinery operators select feedstocks and control these refinery processes to create products meeting strict product specifications including those for motor gasolines, aviation gasolines, diesel fuels, distillate fuel oils, jet fuels, residual fuel oils, and propane/LPG.

The Marathon Gallup and Holly Frontier Navajo are the only two refineries currently producing petroleum products within New Mexico. These refineries have a crude capacity of 27,100 b/d and 111,000 b/d respectively and in total produced 129,000 b/d of petroleum products in 2016[8]. State consumption of petroleum products totaled 110,000 b/d during this year[9], indicating that that New Mexico is a net exporter of petroleum products. Additional large volumes of transshipments enter and leave the state by pipeline. Exhibit 2-17 below shows the refineries, petroleum product pipelines, and major product terminals in New Mexico.

[8] Company 10k's and website research.
[9] Production and consumption volumes do not include asphalt, road oil, lubricants, petroleum coke, or unfinished oils.

Exhibit 2-17: Petroleum Product Assets in New Mexico



The Gallup refinery produces both gasoline and distillate and delivers these petroleum products to nearby local markets, such as Albuquerque, via truck loading racks. Additional, smaller volumes of products are also delivered to western Arizona by truck from this refinery. The Navajo refinery also primarily produces gasolines and distillates. These products are delivered to in-state markets such as Albuquerque or Bloomfield or into Texas via pipelines also owned by Holly Frontier. The Navajo refinery also delivers small volumes by pipeline to the Roswell, NM market. No jet fuel is produced in New Mexico, so demand is met entirely by pipeline movements into the state.

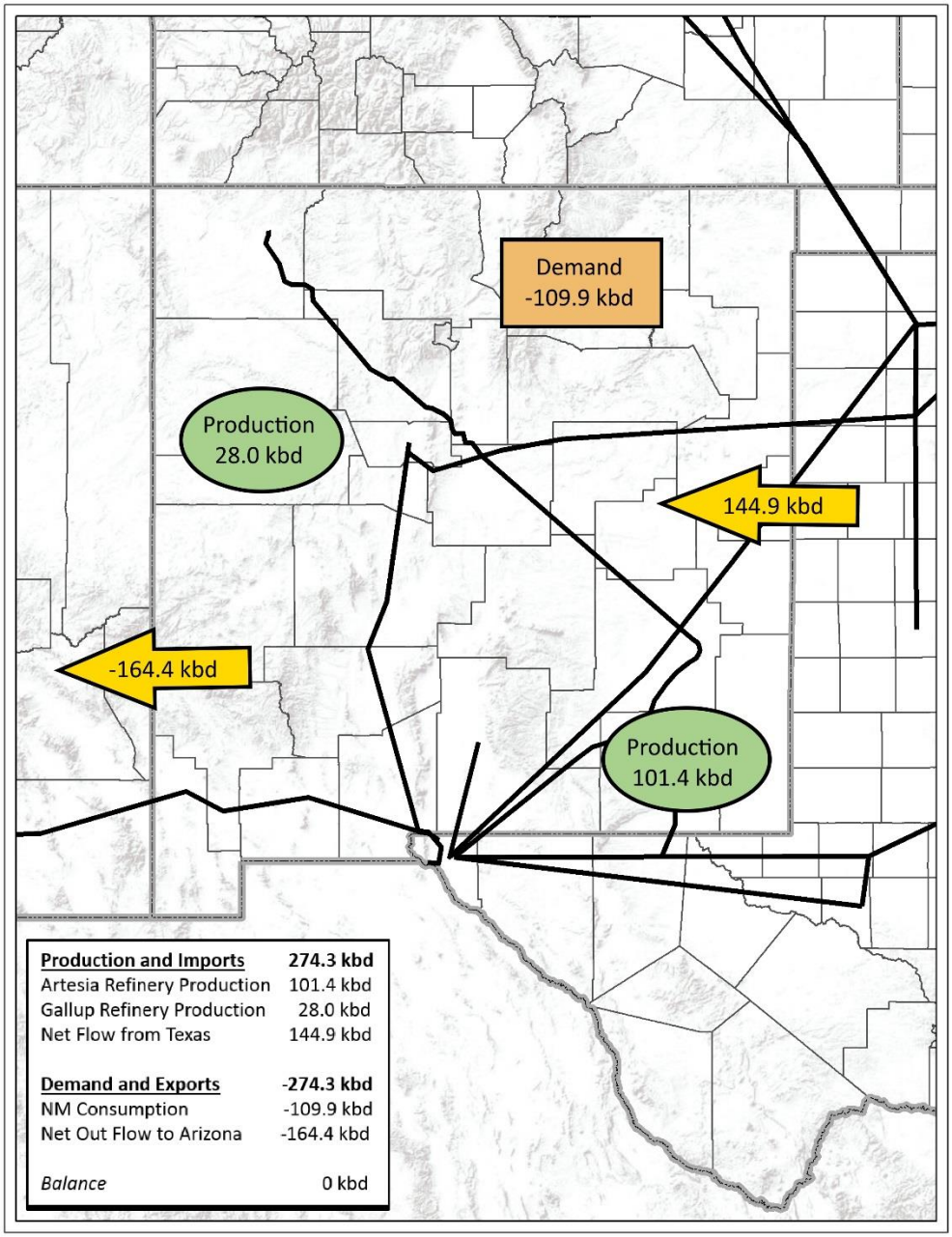
In addition to supplying volumes consumed in New Mexico, the Navajo refinery uses two interstate pipelines to deliver petroleum products to a pipeline hub in El Paso, Texas. This El Paso hub connects to inland Texas refinery production via the Magellan pipeline and additional Holly Frontier pipelines, as well as a NuStar owned pipeline, which originates in McKee Texas and crosses through New Mexico before re-entering Texas. The El Paso hub delivers products into New Mexico through an additional Magellan owned pipeline going to Albuquerque. The El Paso hub also supplies Kinder Morgan's SFPP East Pipeline, which delivers products into Arizona and California and has a capacity of 200,000 b/d, making it the largest petroleum product pipeline in the state.

The following two exhibits show the movements of petroleum products throughout New Mexico.

Exhibit 2-18: Petroleum Product Movements in New Mexico (barrels per day)

Petroleum Product Volume	2016
Produced in State	129,365
Net Flow from Texas	144,873
Consumed in State	(109,882)
Exiting State to Arizona	(164,355)
Balance	0

Exhibit 2-19: New Mexico Petroleum Product Flows



Note: kbd means thousand barrels per day

2.5 Natural Gas Markets and Infrastructure

The major gas pipeline systems and other gas-related infrastructure in New Mexico are shown in Exhibit 2-20. Estimated 2017 production, consumption and flows to and from the state are shown in Exhibit 2-21.

In 2017, New Mexico produced 3.27 Bcf/d of dry natural gas, of which 1.65 Bcf/d was produced in the Permian Basin and the majority of the remainder coming from the San Juan Basin. In that same year 2.98 Bcf/d of interstate pipeline gas flowed into the state. Of the interstate inflows, 0.83 Bcf/d came from Colorado on the Northwest Pipeline and TransColorado Gas

Transmission Pipeline. In addition, a net of 1.09 Bcf/d of natural gas flowed into New Mexico from Texas on El Paso Natural Gas Pipeline, Natural Gas Pipeline of America, Northern Natural Gas Pipeline, and Transwestern Pipeline. Altogether, supplies from New Mexico Natural gas production and interstate inflows totaled 6.31 Bcf/d in 2017.

Gas outflows from New Mexico to Arizona on El Paso Natural Gas pipeline, Southern Trails pipeline, and Transwestern Pipeline were 3.47 Bcf/d. In addition, 0.74 Bcf/d of gas flowed from New Mexico the Texas on pipelines and gathering pipeline systems.

As shown in Exhibit 2-22, New Mexico statewide demand for natural gas was 0.66 Bcf/d in 2017. New Mexico has approximately 640,000 natural gas customers in all sectors. The majority of customers are in residential sector where demand is made up of space heating (51%), water heating (30%), cooking (8%), space cooling (1%), and other uses (10%). New Mexico also has 51,000 commercial customers who use for gas space heating (52%), 16 percent for water heating (16%), cooking (12%), cogeneration (5%), and other uses (15%).

Industrial customers in New Mexico made up 6.4% of 2017 natural gas consumption in 2017. The top industries for gas consumption were Food (NAICS Code 311), Chemicals (325), Petroleum and Coal Products (324), Mining (21), and Non-metallic Mineral Products (327) representing 75 percent of industrial demand. New Mexico power plants consumptio6n made up 31.5% of the state total and all supply chain uses (lease fuel, gas processing plant fuel, pipeline fuel, distributor uses) added up to 39.7% of consumption.

Exhibit 2-20: Natural Gas Assets in New Mexico

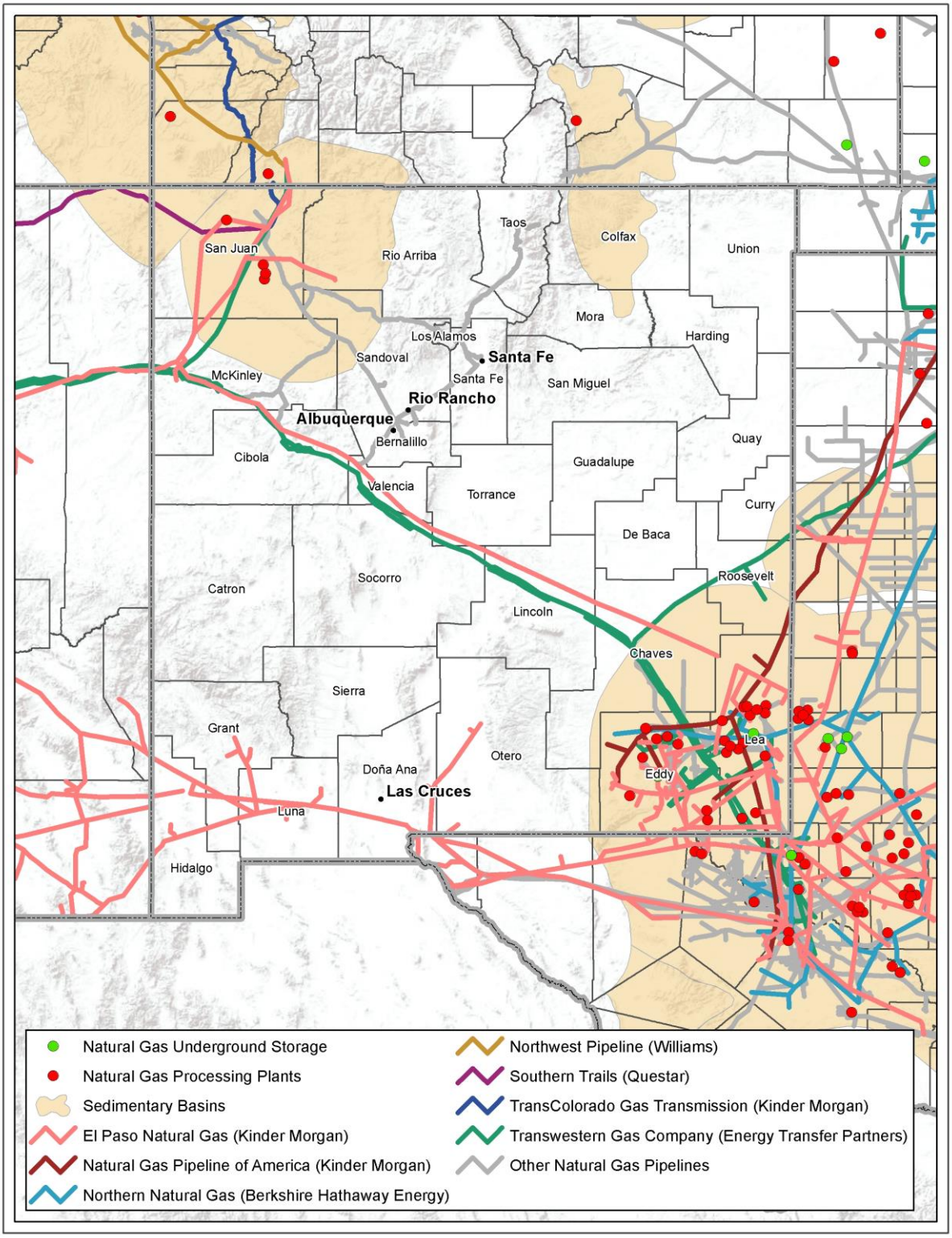
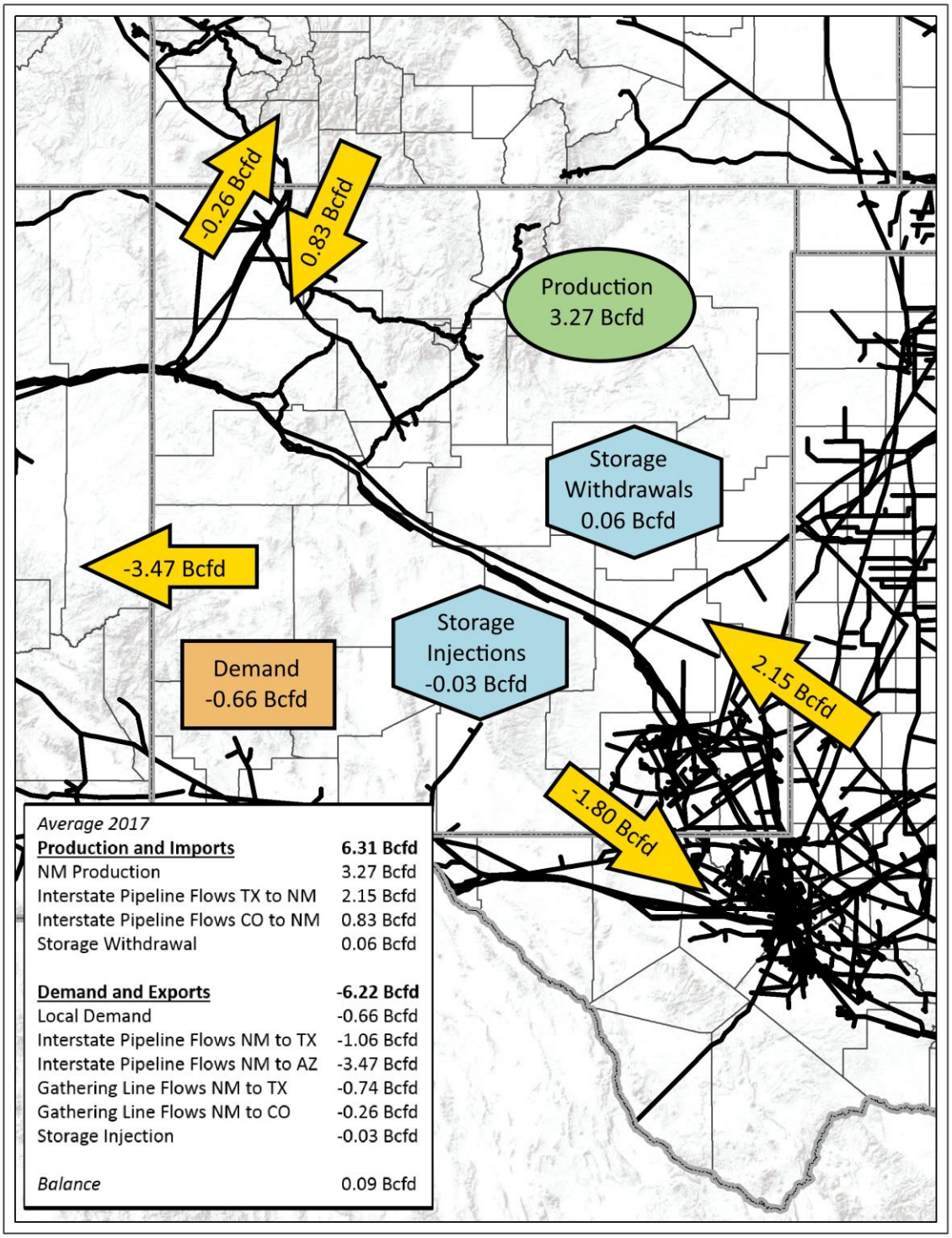


Exhibit 2-21: New Mexico Natural Gas Flows



Note: bcfd means billion cubic feet per day

Exhibit 2-22: Natural Gas Consumption in New Mexico 2017

Sector	Count of Customers	Consumption Bcf/d	% of Consumption
Residential	586,688	0.08	12.5%
Commercial	51,029	0.06	9.8%
Industrial	692	0.04	6.4%
Vehicle	15	0.00	0.1%
Power	26	0.21	31.5%
Subtotal End-Use Consumption	**638,450**	**0.40**	**60.3%**
Lease Fuel		0.12	17.8%
Processing Plant Fuel		0.12	18.2%
Pipeline & Distribution Uses		0.02	3.6%
Subtotal Supply Chain Consumption		**0.26**	**39.7%**
Total Consumption Uses		**0.66**	**100.0%**

Source: EIA Natural Gas Annual 2017, ICF estimates of industrial, vehicle and power customer counts.

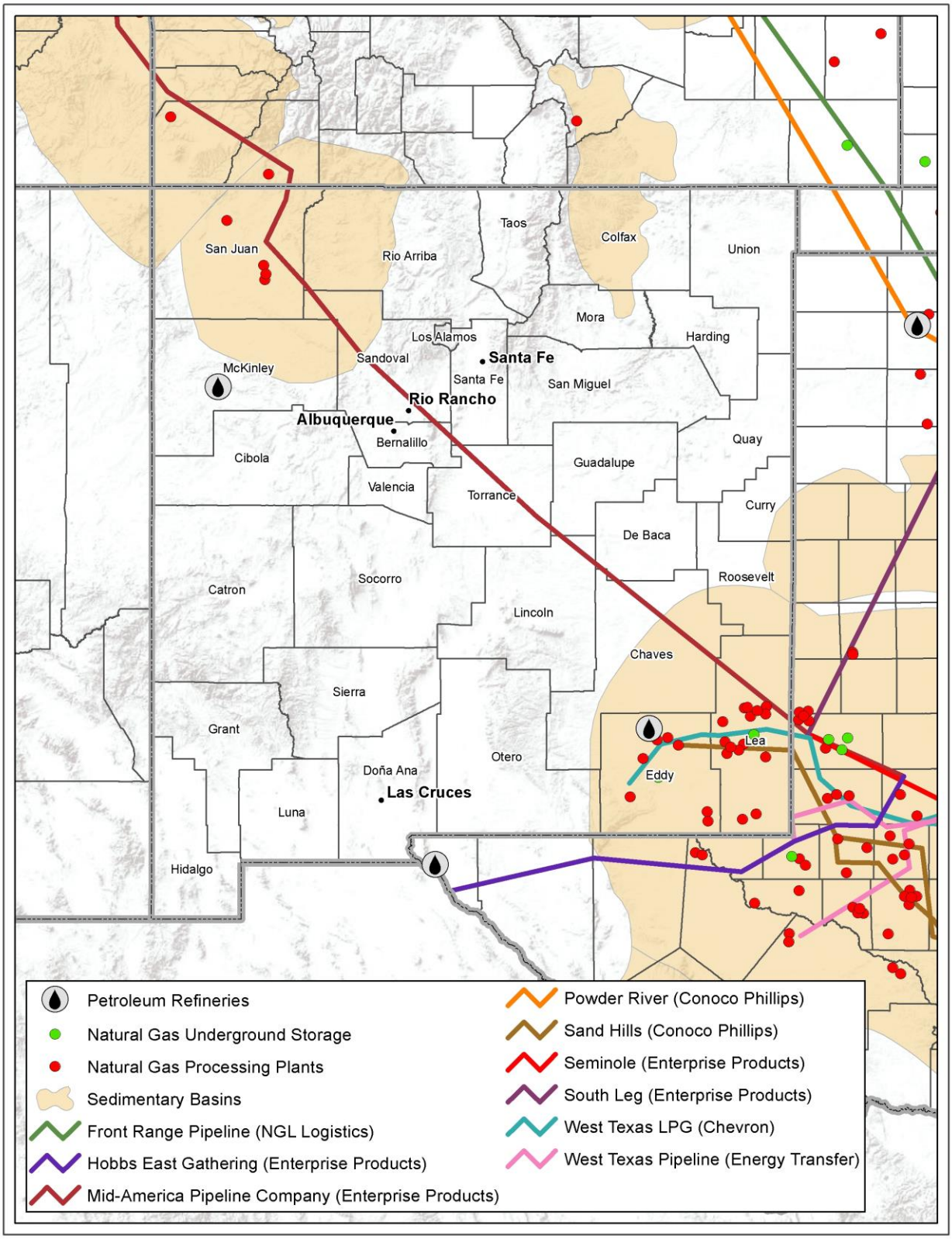
2.6 Natural Gas Liquids Markets and Infrastructure

When raw natural gas is first extracted from the ground, it contains various mixed hydrocarbon liquids and impurities which must be removed at gas processing plants prior to sale for end use. Gas processing plants are often found near the site of production and may remove water, hydrogen sulfide, carbon dioxide, nitrogen, and natural gas liquids (NGLs). The NGL products are sold to residential, commercial, industrial, and transportation consumers for various uses. These products include:

- Odorized propane, butane or LPG (a mix of propane and butane) used by all sectors as fuels
- Natural gasoline/pentanes-plus, isobutene, and normal butane used as inputs to petroleum refineries, and
- Feedstocks to the petrochemical industry (primarily ethane, propane, butane).

Enterprise's Mid-America pipeline brings NGLs from Wyoming, Utah, and Colorado into New Mexico and picks up NGL's from the state's gas processing plants. Mid-America pipeline volumes that are not consumed in New Mexico are transported to Texas, primarily through the Seminole NGL pipeline. This and other NGL pipelines provide New Mexico NGL producers and marketers with access to domestic and export markets including the major NGL storage, fractionation and trading hub at Mont Belvieu, Texas.

Exhibit 2-23: NGL Product Pipelines and Assets in New Mexico



Natural gas processing plants are the primary supplier of NGL products. Additional volumes of propane and LPG come from petroleum refineries. Exhibit 2-24 shows New Mexico gas processing plant capacity information for 2014[10], the latest year of EIA data.

Exhibit 2-25 shows the portion of New Mexico gas processed in New Mexico versus the amounts shipped as wet gas into Texas and processed there. The processing plants produce ethane, propane, butane, isobutene, and pentanes plus in the volumes shown in Exhibit 2-26.[11]

Exhibit 2-24: New Mexico Processing Plant Capacity Information (2014)

Plant Count	Plant Capacity (MMcfd)	Plant Flow (MMcfd)	BTU Content (btu/cf)	NG Liquid Storage Capacity (bbl)
26	3,268	2,198	1,158	58,738

Exhibit 2-25: New Mexico Natural Gas Processed by State (2017)

	Gas Processed (million cubic feet)	Liquids Extracted (thousand barrels)	Mcf Shrinkage (million cubic feet)	Mcf Shrinkage cf/bbl	Shrinkage as %
Total New Mexico Gas Processed	852,796	67,249	96,526	1,435	11.3%
Processed in New Mexico	825,186	64,714	92,997	1,437	11.3%
Processed in Texas	27,610	2,535	3,529	1,392	12.8%

Source: EIA Natural Gas Annual 2017

Exhibit 2-26: New Mexico Gas Plant Production by Product (1,000 barrels per day)

NGL Product	2014	2015	2016	2017
Ethane	68	66	65	71
Propane	48	53	56	60
Normal Butane	17	18	18	18
Isobutane	8	9	12	13
Pentanes Plus	24	22	20	22
All Natural Gas Liquids	165	168	171	185

Source: EIA Natural Gas Annual 2017and prior years

Smaller volumes of NGL products (mostly propane and LPG) can also be produced for sale at petroleum refineries. Additionally, refineries use certain NGL products as feedstocks or gasoline blending components. One input is normal butane, which is often purchased by refineries for use in gasoline blending during the winter. Another gas processing plant product that is a common refinery input is isobutane, which is used in the alkylation process to make an octane-boosting gasoline blending component called alkylate. Exhibit 2-27 below shows the inputs and output of NGL products at New Mexico refineries.

[10] U.S. Energy Information Agency (EIA); https://www.eia.gov/naturalgas/ngqs/#?report=RP9&year1=2014&year2=2014&company=Name
[11] U.S. Energy Information Agency (EIA); https://www.eia.gov/dnav/pet/pet_pnp_gp_dc_r3e_mbblpd_a.htm

Exhibit 2-27: Uses and Production of NGLs at New Mexico Refineries (1,000 barrels per day)

Flow	NGL Product	2014	2015	2016	2017
Input	Normal Butane	1	1	0	0
Input	Isobutane	5	5	6	5
Input	Pentanes Plus	0	1	0	0
Output	Propane	2	2	1	1

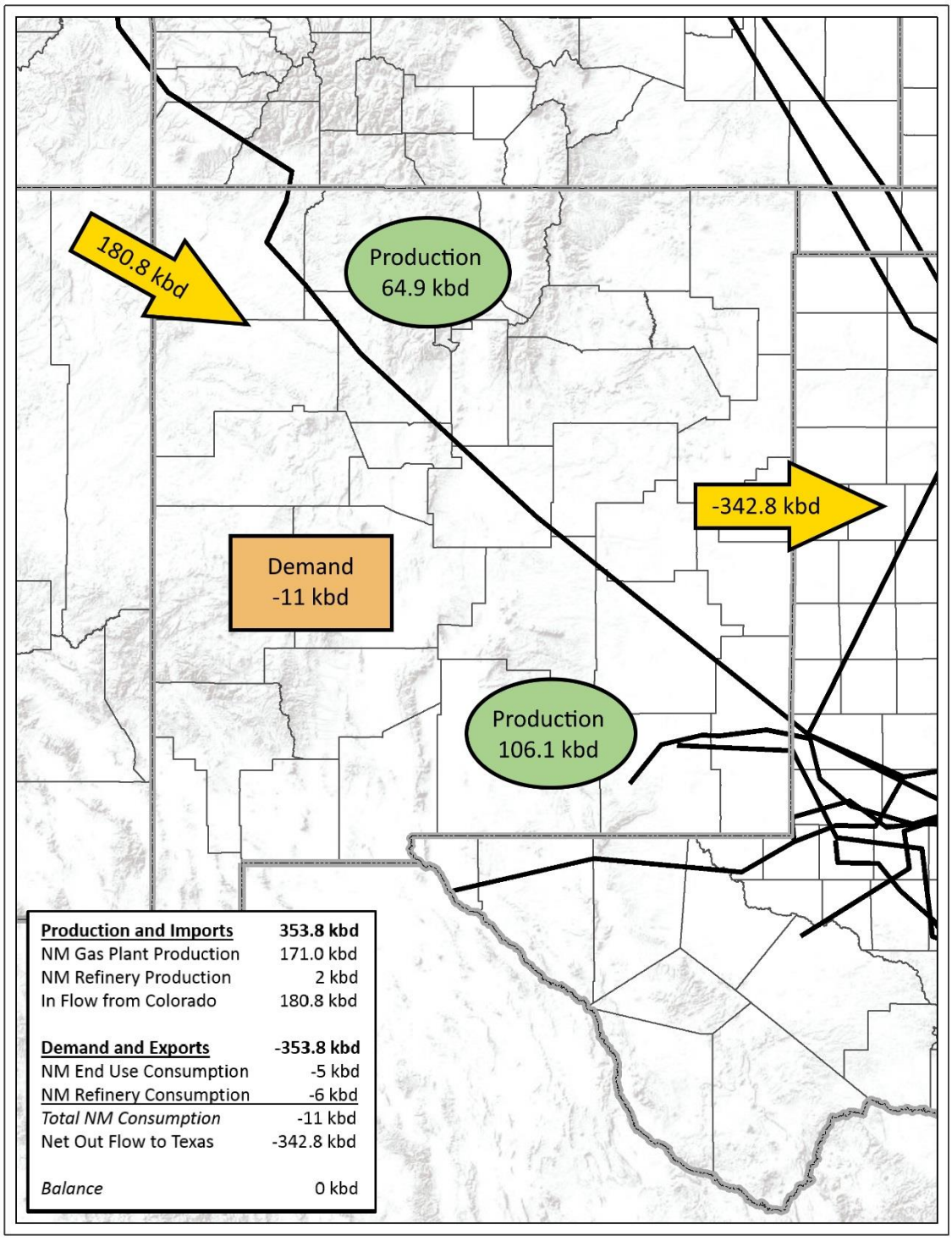
Exhibit 2-28 and Exhibit 2-29 below show the flow of NGL products in terms of total volume. Most end use consumption listed can be associated with propane.

Exhibit 2-28: New Mexico NGL Balance (1,000 barrels per day, unless otherwise noted)

	2014	2015	2016	2017
Raw Gas Processed (MMcf)	802,343	845,333	815,852	852,796
Gas Plant Production	165.0	168.0	171.0	185.0
Refinery Production	2.0	1.0	2.0	2.0
Total Production	167.0	169.0	173.0	187.0
Consumption by Sector				
Transportation Sector	0.1	0.1	0.1	*0.1*
Commercial Sector	1.0	0.8	0.8	*0.8*
Industrial Sector	0.9	1.0	0.7	*0.7*
Residential Sector	3.5	3.1	3.4	*3.4*
All End-use Sectors	5.5	5.0	5.0	*5.0*
Refineries	6.0	7.0	6.0	6.0
All Consumption	11.5	12.0	11.0	11.0
Implied Net Flow Out of State	155.5	157.0	162.0	176.0

Note: Consumption in end-use sectors in 2017 is shown in red to indicate these are estimated to be the same as in 2016.
Source: EIA Natural Gas Annual and State Energy Data System (SEDS).

Exhibit 2-29: New Mexico Natural Gas Liquid (NGL) Flows



Note: kbd means thousand barrels per day

2.7 Carbon Dioxide (CO2) Markets and Infrastructure

Naturally occurring CO_2 is produced from underground reservoirs (by itself and in various mixtures of methane, other hydrocarbon gases, and non-hydrocarbon gases) and transported by pipeline for various purposes. The largest market for CO_2 in the U.S. is for enhanced oil recovery projects. Enhanced oil recovery (EOR) is a process in which CO_2 gas is injected into a mature reservoir to increase production flow rates and reservoir recovery factors. Enhanced recovery occurs because the CO_2 is miscible with oil at high pressures, causing the oil to swell in size and lighten in density. The lighter oil can more easily flow through the porous reservoir rock. The other cause of increased recovery is that the injected CO_2 adds drive energy to the reservoir, physically pushing the oil away from the CO_2 injection wells toward the producing wells. The EOR process extends the life of oil fields and allows more crude oil production to occur using existing infrastructure, reducing the need for new construction and surface disturbances.

Colorado has three major sources of natural CO_2: the McElmo Dome, Doe Canyon and Sheep Mountain fields. Volumes of CO_2 from these fields are transported from Colorado through New Mexico to the Permian Basin along the Cortez and Sheep Mountain Pipelines. The most predominant source of natural CO_2 in New Mexico is the Bravo Dome and West Bravo Dome fields, from which the Bravo and TransPetco pipelines transport CO_2. New Mexico currently has two EOR projects which utilize CO_2 injection at the Vacuum and Hobbs oil fields. Exhibit 2-30 shows CO_2 assets which provide supply for EOR projects. Exhibit 2-31 shows more detailed CO_2 pipeline information in New Mexico including length, diameter, and estimated flow capacity.

Exhibit 2-30: CO_2 Pipelines and Assets in New Mexico

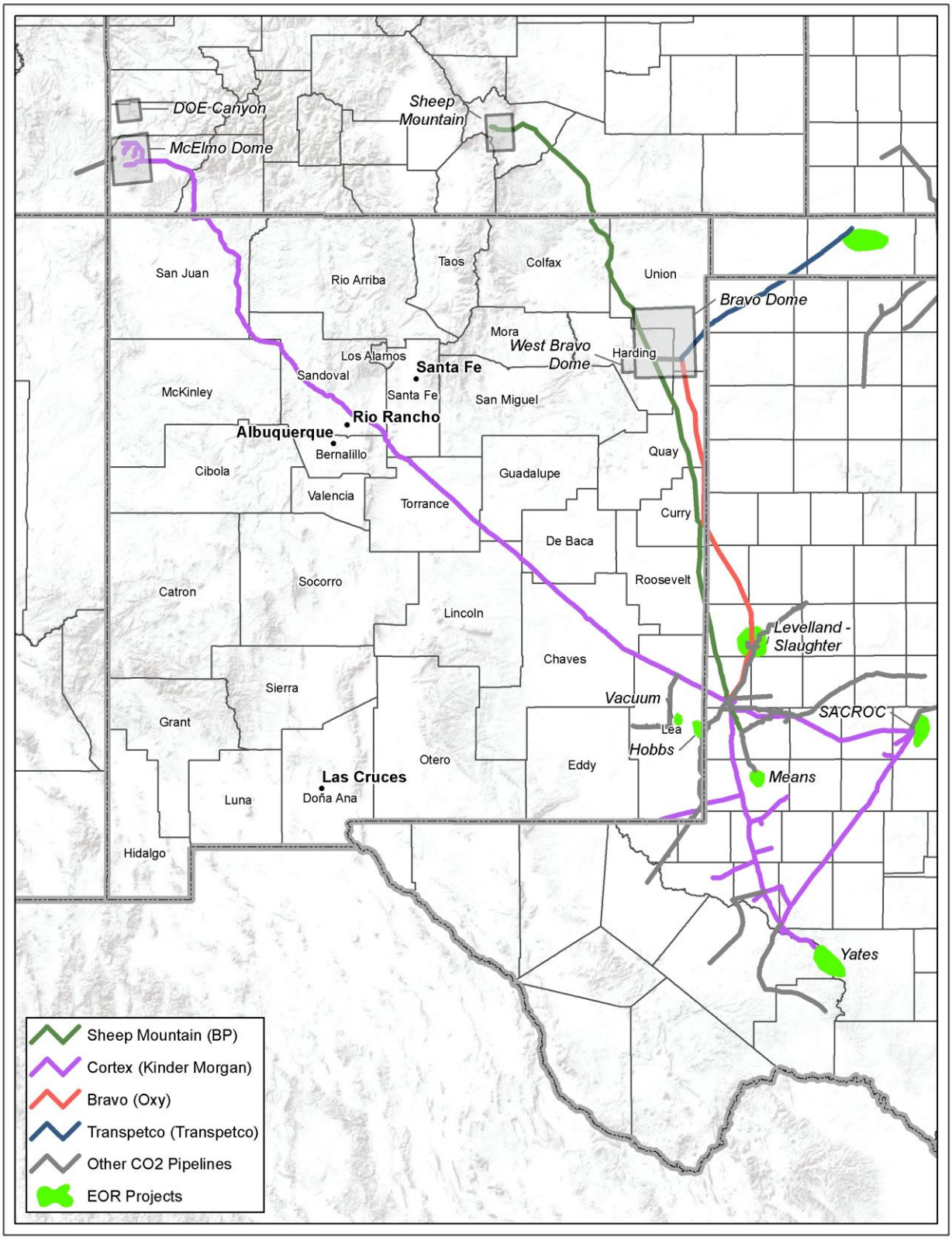


Exhibit 2-31: Detailed CO_2 Pipeline Information with Capabilities in New Mexico

Scale	Pipeline	Operator	Location	Length (mi)	Diameter (in)	Estimated Flow Capacity (MMcfd)
Large-Scale Trunklines	Cortez	Kinder Morgan	CO, NM, TX	502	30	1,300
	Sheep Mountain	Oxy Permian	CO, NM, TX	408	24	590
	Bravo	Oxy Permian	NM, TX	218	20	380
Smaller-Scale Distribution Systems	Rosebud	Hess	NM	50	12	100
	Dollarhide	Chevron	NM, TX	23	8	80
	Llano	Trinity CO2	NM	53	12	80
	W. Texas	Trinity CO2	TX, NM	60	12	80
	TransPetco	TransPetco	NM, TX, OK	110	8	80

Source: NETL, "A Review of the CO2 Pipeline Infrastructure in the U.S.," April 2015, DOE/NETL-2014/1681

The exhibits below illustrate in more detail the flows of CO_2. Exhibit 2-32 shows the amount of production occurring from each field in Colorado and New Mexico. Exhibit 2-33 and Exhibit 2-34 show the volume of CO_2 movements through New Mexico.

Exhibit 2-32: Carbon Dioxide (CO_2) Production (MMcf per day)

State	Field	2014	2015	2016	2017
Colorado	Doe Canyon	132	118	142	116
Colorado	McElmo Dome	811	975	1,053	1,163
Colorado	Sheep Mountain	18	19	19	19
Colorado	**Sum**	**961**	**1,112**	**1,214**	**1,297**
New Mexico	Bravo Dome	263	247	224	220
New Mexico	West Bravo Dome	56	45	41	36
New Mexico	**Sum**	**320**	**292**	**265**	**257**
CO & NM	**All**	**1,281**	**1,403**	**1,480**	**1,554**

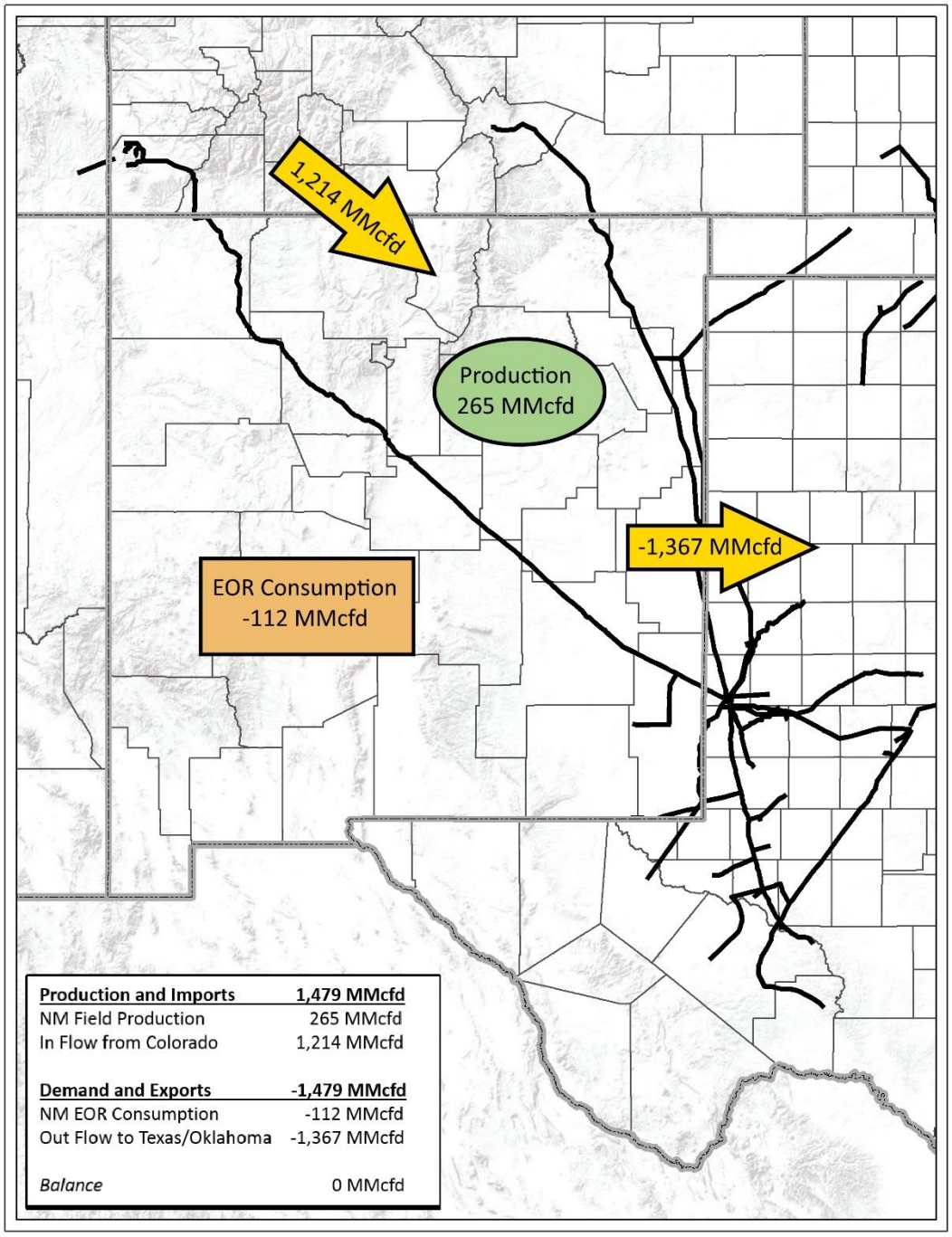
Source: COGIS Production Data, New Mexico Oil Conservation Division

Exhibit 2-33: Carbon Dioxide (CO_2) Balance (MMcf per day)

	2014	2015	2016	2017
Entering State from CO	961	1,112	1,214	1,297
Produced in State	320	292	265	257
Used in State for EOR	(97)	(107)	(112)	(118)
Exiting State to TX and OK	(1,184)	(1,297)	(1,367)	(1,436)
Balance	0	0	0	0

Source: ICF estimates developed using data from COGIS Production Data, New Mexico Oil Conservation Division, Oil and Gas Journal

Exhibit 2-34: New Mexico CO2 Flows



Note: MMcfd means million cubic feet per day

Lobos Pipeline Suspension

In 2013, Kinder Morgan proposed a project to construct the Lobos CO_2 pipeline. The project intended to develop the St. Johns carbon dioxide field in Apache County, Arizona and expand the Cortez pipeline. The project would have included 213 additional miles of CO_2 pipeline through Arizona and New Mexico and would have provided another source for EOR projects in the Permian region. However, in January 2015, Kinder Morgan delayed progress on the project by withdrawing the right-of-way application. At the time, the company attributed the withdrawal

to current market conditions, and stated that the project was delayed but not permanently canceled.[12]

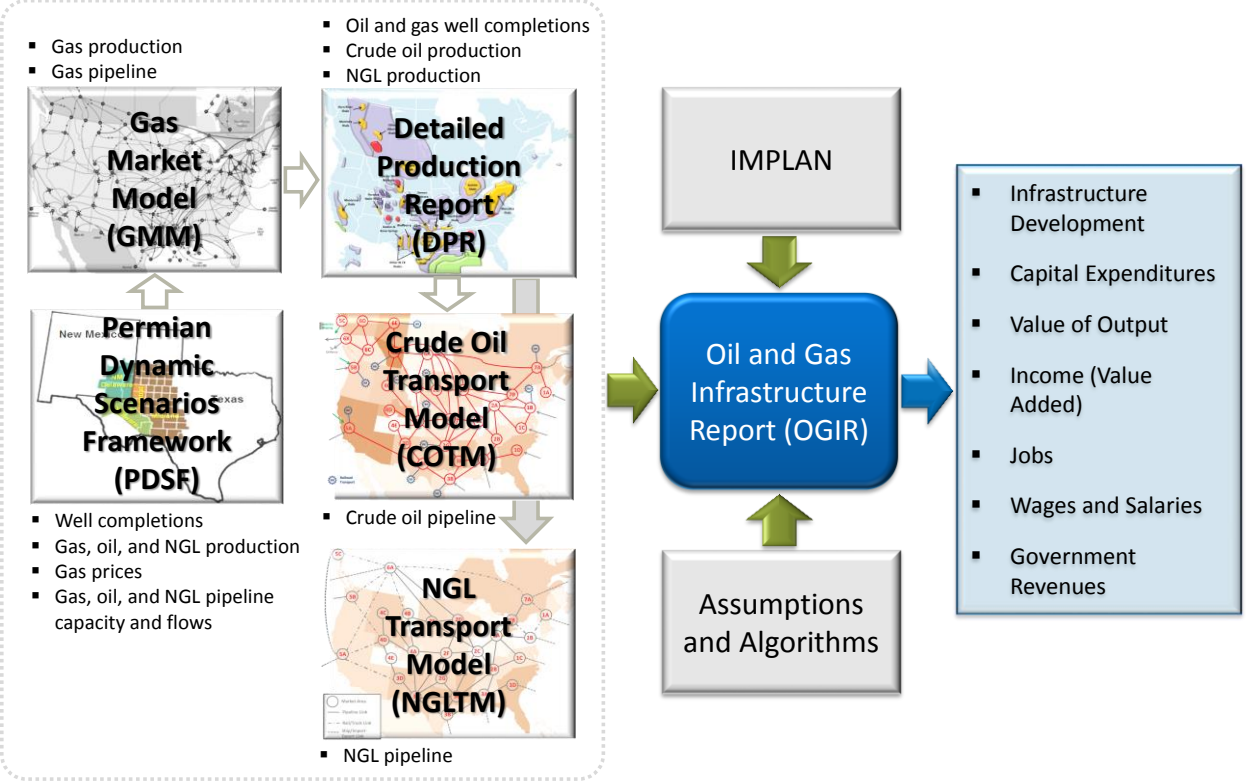
[12] https://www.abqjournal.com/530879/kinder-morgan-withdraws-co2-pipeline-application.html

3. Methodology and Key Assumptions

3.1 Modeling Framework

This study determines New Mexico oil and gas infrastructure development, capital expenditure requirements, value of output, income (value added), and economic impacts based on ICF's Oil and Gas Infrastructure Report (OGIR) process, shown in Exhibit 3-1. ICF's OGIR uses five proprietary modeling tools, namely ICF's Gas Market Model (GMM), Permian Dynamic Scenarios Framework (PDSF), the Detailed Production Report (DPR), a Natural Gas Liquids (NGL) Transport Model (NGLTM) and a Crude Oil Transport Model (COTM). Appendix A has detailed descriptions of these modeling tools. The OGIR relies on IMPLAN (a commercial economic impact analysis system) to estimate jobs, wages and salaries, and government revenues in New Mexico.

Exhibit 3-1: Modeling Tools for ICF's Oil and Gas Infrastructure Report



The GMM, a full supply-demand equilibrium model of the North American gas market, is a widely used model applied to assess North American gas supply, demand, transport and prices. It determines natural gas prices, production and demand by sector and region. The GMM projects gas transmission capacity development, based on gas market and supply dynamics.

The PDFS, is a new ICF's product and service that estimates impact of drilling activity, well completions, and E&P technology on Permian natural gas, crude oil, and NGL production. It also asses impact of pipeline changes, LNG and Mexican export activity, and changes in consumption on Henry Hub and Permian gas prices and basis. The PDFS covers four Permian

production areas (New Mexico Delaware, Texas Delaware, Central Texas, and Midland Texas) and is benchmarked to current market conditions. The Permian gas output is an input to GMM.

ICF's DPR, a vintage production model, estimates the number of oil and gas well completions and well recoveries based on levels of gas production, that the GMM calculates and projects oil and gas prices, gas-directed versus oil-directed drilling, and well productivity. The model estimates crude oil and NGLs production for over 50 regions, based on assumed liquids-to-gas ratios.

ICF's NGLTM and COTM evaluate NGL and crude oil transport requirements to estimate pipeline capacity requirements. The models rely on regional NGL and crude oil production from the DPR, and consider pipelines, railways, trucking routes and marine channels as means of transporting raw (y-mix) and purity NGLs and crude oil from production areas to refineries, export terminals, and processing and industrial facilities that use the hydrocarbons either as a fuel or feedstock. The model estimates refinery enhancements and output as well as oil product transport and crude oil and oil products exports.

IMPLAN, a widely used economic impact analysis system, assesses economic benefits that result from the oil and gas activity discussed above. IMPLAN considers both multiplier effects and leakage to markets elsewhere, as it estimates impacts across three different categories:

- **Direct Employment and Investment** – represents economic impacts (e.g., employment or output changes) due to the direct investments, such as payments to companies in the relevant industries for asset categories that apply directly to this study.
- **Indirect Employment and Expenditures** – represents economic impacts due to the industry inter-linkages caused by the iteration of industries purchasing from other industries, brought about by changes in final demands (e.g., when pipeline manufacturers purchase steel from another company).
- **Induced Employment and Expenditures** – represents the economic impacts on local industries due to consumers' consumption expenditures arising from the new household incomes that are generated by the direct and indirect effects of the final demand changes (e.g., a worker purchases new clothing or purchases food in restaurants).

3.2 Infrastructure Methodology and Criteria

ICF's OGIR projects New Mexico natural gas, NGL and crude oil infrastructure requirements by considering:

- Natural gas, crude oil, and NGL supply-demand growth based on scenario market trends;
- Drilling activity and production;
- Gas processing requirements;
- Changes in transportation of natural gas, NGL, and oil brought on by supply-demand balances;
- Crude oil storage, petroleum product pipeline, and refinery requirements.

3.2.1 Estimating the Amount of Infrastructure Development

Exhibit 3-2 lists the criteria applied to estimate new infrastructure development and the capital expenditures associated with it. Near-term infrastructure development includes projects that are currently under construction or are sufficiently advanced in the development process. Unplanned projects are also included in the projection when the market signals need of new capacity.

The infrastructure assessment includes well drilling, completion, and equipment, gathering and processing projects. Natural gas, crude oil, and NGL transport capability adds to the infrastructure stack based on projections from the GMM, PDFS, NGLTM, and COTM. Supply growth and market evolution within and across geographic areas create the base for the decision to add pipeline capacity. Included are projects that are currently under development (including projects characterized as new pipeline, expansion projects, repurposing projects and reversals of pipelines), as well as unplanned or "generic" projects. If unknown for a specific project, the project's pipeline mileage and compression calculations use rule-of-thumb estimates based on historical capacity expansion data along various pipeline corridors.

Well drilling and completion requirements are computed in the PDFS for the New Mexico Permian Delaware basin and in the DPR for the San Juan and Raton basin based on gas and oil production projection and well productivity.

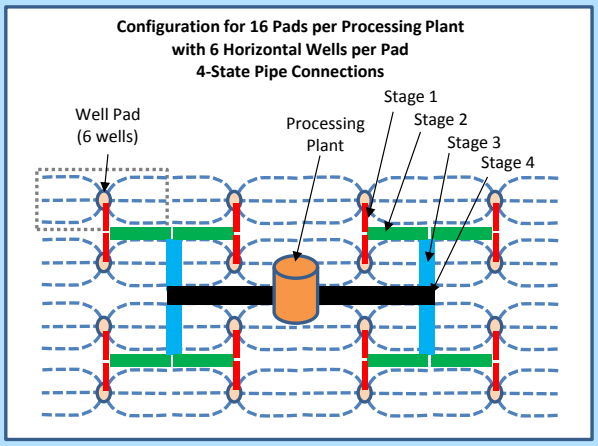
Computations for the mileage for gas gathering lines considers well spacing and configuration, the number of wells in multi-well pad configuration, and the number of pads per processing plant. The core calculations assume a certain amount of gathering line mileage per well. Estimates for compression requirements for gas gathering lines rely on production levels and by assuming a pre-defined horsepower-to-production ratio, estimated from historical data.

Gas processing plant capacity assumes that a portion of the production growth requires new processing capacity. The estimated number of processing plants needed relies on the required total incremental processing capacity and assumes an average plant size. Calculations for pipeline lateral requirements for connecting processing plants with pipeline mainlines rely on the number of new plants required, with an assumed mileage for each lateral. The estimated diameter of the laterals relies on the size of the gas processing plants.

NGL pipeline capacity develops based on supply development, market growth, and export activity. Infrastructure tallies include announced NGL pipeline projects that are under construction or deemed far enough along in the development process to see completion. This includes NGL raw-mix pipelines and pipelines built to transport a single liquid (for example, ethane or propane) or a mix of condensate products (for example, pentanes-plus) used as a diluent for oil transport.

Additionally, the NGL pipeline capacity includes new NGL pipeline projects to support future supply development and market growth. NGLs produced in relatively constrained areas, such as New Mexico, require new pipelines to foster transport of the liquids to market areas or export facilities. If unknown, pipeline mileage for new capacity estimates rely on the distance between geographic areas, and the size of the pipeline and pumping requirements consider expected throughput.

Exhibit 3-2: Criteria for New Infrastructure Development

Metric	Criteria
Gas gathering line miles per well (for gathering gas both from gas wells and oil wells)	Gathering line mileage requirements calculations assume the number of wells per pad and number of pads per processing plant. The configuration below is an example of a system with 16 pads per processing plant, six horizontal wells per pad, and 120 acres well spacing. This configuration requires a total of about 0.24 miles of gathering line per well with a combination of four different pipe sizes. 
Share of new wells that are pad drilled	The share of new wells that are pad drilled in Permian Delaware basin was only about 20 percent in 2012, growing rapidly to 65 percent by 2017 and is assumed to reach 95 percent by 2030.
Average number of wells per pad	The average in the Permian is about 4 wells per pad and is assumed to increase to 12 wells per pad by 2030. An increasing number of wells per pad will reduce the total mileage but increase the average diameter for gathering pipelines.
Oil gathering line miles per oil well (only applies to high-productivity wells)	0.25 miles/well for four-well pads and 0.2 miles/wells for eight-well pads. High productivity oil well is defined as wells with EUR greater than 30,000 barrels. Most of Permian oil wells is considered as high productivity wells.
Gas gathering line compression requirement	141 horsepower for every 1 million cubic feet per day of production.

Portion of gas production growth that requires new processing capacity	70% for Permian and 40% for San Juan and other.

Criteria for New Infrastructure Development (Continued)

Metric	Criteria
Gas processing plant size	150 million cubic feet per day.
Gas laterals for processing plant	Average 20 miles per plant.
Gas lateral diameters for processing plant	Average 20 inches.
NGL Laterals for Fractionation and Petrochemical Facilities	Average 50 miles per 100,000 barrels per day of NGLs.
NGL lateral diameter	Average 14 inches.
Crude oil storage tank capacity	Average of 5,000 barrels per tank.
Crude oil storage tank farm size	Average of 750 tanks per farm.
Crude oil tank farm laterals	Average 20 miles per tank farm with diameters ranging between 12 and 24 inches.

NGL lateral mileage from gas processing and fractionation facilities to an NGL transmission line is calculated based on the amount of NGLs processed (i.e., removed from the gas stream). Lateral mileage and the diameter of each lateral estimates rely on an assumed number of miles per volume of NGLs processed and based on an average processing-fractionation plant size.

Required oil gathering line connections arise only for high-productivity oil wells. Wells with low productivity do not require gathering lines, as local tank storage and field trucking handles oil production. An assumed "cutoff" for estimated ultimate recovery (EUR) per well helps to separate high and low productivity wells. Oil gathering line mileage is then derived based on the number of wells per drill site, if an average mileage of gathering line needed for each high-productivity well.

The need for crude oil transmission capacity derives from supply development and import/export activity. The pipeline stack includes announced pipeline projects. If unknown for a project, pipeline mileage estimates based on the distance between the relevant geographic areas for each project are used. The study estimates sizing of a pipeline and pumping requirements based on throughput.

Additions of crude oil storage rely on oil production growth. The number of crude oil tanks develops from the required storage capacity for fields, assuming an average tank size. The required number of tank farms develops based on an average number of storage tanks per tank farm. The lateral mileage for oil storage capacity estimations derive from assumptions of required needed miles of lateral per tank farm.

Replacement and refurbishment (including enhancements and upgrades) of existing infrastructure are estimated based on an annual percent that has been derived from historical replacement information and expert judgement. Effectively, the measures have been calculated by applying an estimated lifespan for different types of infrastructure. For example, gathering line compressors have historically had a lifespan of roughly 20 years. So, the assigned replacement and refurbishment percent for gathering line compressor is 5 (i.e., 1 divided by 20 years). That means that each year, 5 percent of the installed gathering line compressors will require refurbishment and replacement. All of the replacement and refurbishment criteria for existing infrastructure are summarized in Exhibit 3-3.

Exhibit 3-3: New Mexico Refurbishment and Replacement Criteria

Infrastructure Type	Annual Replacement and Refurbishment (%)	Installed Units	
		Amount	Year
Gathering Line Pipe (Miles)	1.8%	18,000	2015
Gathering Line Compressor (1000 Horsepower)	5.0%	445	2015
Oil, Gas, NGL, CO2, and Petroleum Product Pipeline (Miles)	1.3%	13,661	2017
Gas Pipeline Compressor (1000 Horsepower)	1.3%	1,455	2017
Oil, NGL, and CO2 Pump (1000 Horsepower)	1.3%	330	2017
Gas Processing Plant Capacity (Million cubic feet per day)	2.9%	3,268	2014
Crude Oil Storage (thousand barrel)	2.9%	21,603	2017
Crude Oil Refining Capacity (thousand barrel per day)	4.1%	138	2014

3.2.2 Estimating Capital Requirements for Oil and Gas Infrastructure Development

Unit cost measures that have been derived for each type of infrastructure by using historical expenditure information provided by various sources are applied to estimate total expenditures for new oil and gas infrastructure development.

Historical well drilling, completion, and equipment costs are based on API Joint Association Survey (JAS) on Drilling Costs and ICF estimates. Average cost in New Mexico is $520 per foot for the Permian wells and $440 per foot for San Juan and other wells in 2018. The study assumes the unit costs for all assets remain constant in real terms throughout the projection.

Historical unit costs of pipeline and compressor construction rely on Oil & Gas Journal survey of U.S. pipeline and compressor station projects completed between 1980 through June 2018. The average unit cost for pipeline and compressor station constructions in New Mexico in 2018 is about $123,000 per inch-mile and $1,800 per HP, respectively.

Smaller-diameter pipes used in gathering systems have lower unit costs that vary by diameter. Average gathering line costs for pipes between 2 and 16 inches in diameter range from $46,500 to $164,000 per inch-mile in 2018.

Gas processing costs (not including compression) are about $650,000 per million cubic feet per day of processed capacity. Compression requirements for gas processing plants are 100 horsepower per million cubic feet per day of capacity, and the costs associated with it add to the cost of capacity directly above.

The unit cost for crude oil storage tanks in New Mexico is assumed to be about $13 per barrel of oil.

The same unit cost measures are also applied to estimate total replacement and refurbishment expenditures. Replacement and refurbishment cost for refinery is $380 per barrel per day.

As mentioned above, the study assumes the unit cost projection for these assets to remain constant in real terms in the projection.

3.3 Value of Output from Oil and Gas Activities

Value of output from oil and gas activities include revenues from production, gathering and processing, pipeline transmission, gas distribution, NGL storage and fractionation, NGL wholesale and retail, petroleum products wholesale and retail, and refinery.

Production revenue is the biggest contributor to the value of output in New Mexico and is based on commodity price projections for oil, gas, NGL, and CO2. The commodity price assumption in the Base is shown in Exhibit 3-4.

Revenues from other oil and gas activities are based on production (for oil and gas gathering and gas processing), import and export flows in/out of New Mexico (for natural gas, crude oil, petroleum product, NGLs, and CO2 pipeline transmission), consumption (for gas distribution, NGL wholesale/retail and storage, petroleum products wholesale/retail), and refinery output (for the refinery). The unit costs assumption for these activities are shown in Exhibit 3-5. The unit costs are assumed constant in real terms in the projection.

Exhibit 3-4: Commodity Prices for New Mexico Production Revenues in the Base Case (in 2017 Dollars)

	Permian Wellhead Gas Price ($/MMBtu)	San Juan Wellhead Gas Price ($/MMBtu)	Wellhead Oil Price ($/Bbl)	NGL Price at Plant Gate ($/Bbl)	CO2 Price Delivered to Pipeline ($/Mcf)
2013	$3.31	$3.43	$96	$34	$1.84
2014	$3.89	$4.05	$85	$35	$1.78
2015	$1.96	$2.07	$44	$16	$1.30
2016	$1.77	$1.88	$38	$16	$1.09
2017	$2.13	$2.23	$46	$23	$1.14
2018	$1.60	$1.98	$60	$31	$1.30
2019	$1.41	$1.92	$51	$26	$1.25
2020	$1.58	$2.01	$48	$24	$1.19
2021	$1.74	$1.93	$47	$24	$1.17
2022	$1.79	$2.01	$49	$24	$1.19
2023	$1.82	$2.08	$51	$26	$1.22
2024	$1.79	$2.05	$54	$27	$1.25
2025	$1.94	$2.19	$56	$28	$1.28
2026	$2.09	$2.32	$59	$30	$1.31
2027	$2.09	$2.33	$62	$31	$1.35
2028	$2.10	$2.37	$64	$32	$1.38
2029	$2.18	$2.46	$66	$34	$1.41
2030	$2.24	$2.53	$67	$34	$1.43

Exhibit 3-5: Unit Cost Assumptions for New Mexico Value of Output from Oil and Gas Activities

Product	Value of Output Component	Value	Units (2017 Dollars)
Natural Gas	Gas gathering	$0.30	$/Mcf
Natural Gas	Gas processing (vol. going through plants)	$0.25	$/Mcf
Crude	Crude oil gathering	$1.50	$/Bbl
Natural Gas	Gas transmission line	$1.33	$/Mcf/1000 miles
Crude	Crude transmission line	$5.14	$/Bbl/1000 miles
Petroleum Products	Petroleum product transmission line	$2.53	$/Bbl/1000 miles
NGLs	NGLs transmission line	$5.79	$/Bbl/1000 miles
CO2	CO2 transmission line	$1.10	$/Mcf/1000 miles
Natural Gas	Residential P/L Revenue	$0.53	$/Mcf
Natural Gas	Residential LDC Revenue	$5.40	$/Mcf
Natural Gas	Commercial P/L Revenue	$0.89	$/Mcf
Natural Gas	Commercial LDC Revenue	$2.26	$/Mcf
Natural Gas	Industrial P/L Revenue	$0.53	$/Mcf
Natural Gas	Industrial LDC Revenue	$0.28	$/Mcf
Natural Gas	Vehicle P/L Revenue	$1.00	$/Mcf
Natural Gas	Vehicle LDC Revenue	$5.74	$/Mcf
Natural Gas	Power Sector P/L Revenue	$0.65	$/Mcf
Natural Gas	Power Sector LDC Revenue	$0.16	$/Mcf
Natural Gas	ALL Sector P/L Revenue	$0.65	$/Mcf
Natural Gas	ALL Sector LDC Revenue	$1.52	$/Mcf
Petroleum Products	Wholesale markup petroleum products	$10.61	$/Bbl
Petroleum Products	Retail markup petroleum products	$6.30	$/Bbl
NGLs	Storage & Fractionation Fees at Market Centers	$1.26	$/Bbl
NGLs	Wholesale markup NGLs	$11.73	$/Bbl
NGLs	Retail markup NGLs	$6.43	$/Bbl
Refinery	Refinery Margin for all products (value added at refineries is margin x annual barrels of all refinery outputs)	$17.27	$/Bbl

3.4 Economic Impacts (Value Added, Jobs, Wages and Salaries, and Government Revenues)

Estimates for value added, private-sector jobs and wages related to the New Mexico oil gas value chain were made using data from both the Bureau of Labor Statistics' Quarterly Job and Wage Report[13] and input-output relationships developed with the Impact Analysis for Planning (IMPLAN)[14] models of the U.S. and New Mexico economy. This input-output (I-O) model is

[13] For information of the Quarterly Census of Employment and Wages (QCEW) see https://www.bls.gov/cew/home.htm
[14] For more information on IMPLAN see http://www.implan.com/

based on a social accounting matrix that incorporates all flows within the U.S. economy and is used to assess the aggregate economic impacts associated with a given level of an industry's output. For example, natural gas production requires oil and gas drilling and support services, equipment, and materials. Those direct impacts will lead to indirect impacts as intermediate inputs for those items (e.g., steel production to make casing and iron mining to make steel) also will see higher demand. The IMPLAN model also estimates induced impacts due to consumers' expenditures rising due to higher household incomes that are generated by the direct and indirect effects flowing through to the general economy. The term "induced impacts" is used in industry-level input-output modeling and is similar the Multiplier Effect concept used in macroeconomics.

These I-O relationships can be extracted into matrices that indicate the number of direct and indirect jobs in sector X per million dollars of output in sector Y. A matrix can also be defined as the number of direct and indirect jobs in sector X per physical unit of output in sector Y. Similar matrices can be constructed showing the value added in sector X per million dollars or per unit of production in sector Y. By multiplying these matrices by a base year or forecast year level of output in sector X (that is to say a given level of capital or O&M expenditures that lead to that sector X output) direct, indirect and induced jobs and wages can be estimated.

Direct Impacts represent the immediate impacts (e.g., employment or output changes) in Sector X due to greater demand for and output from Sector X.

Indirect Impacts represent the impacts outside of Sector X in those industries that supply or contribute to the production of intermediate goods and services demanded by Sector X.

Induced or "Multiplier Effect" Impacts represent the cumulative impacts of the spending of income earned in the direct and indirect sectors and subsequent spending of income in each successive round. Examples include a restaurant worker who takes a vacation to Florida, or a storeowner who sends children to college, based on higher income that arises from the initial activity in Sector X.

Data provided in this report through 2017 for jobs and wages in New Mexico generally come directly from the BLS and refer to "traditional jobs" paying wages or salaries. The exception is that in some cases (e.g., New Mexico refineries) the BLS withholds data to preserve proprietary information when the number of reporting companies is small. In those cases, ICF had to estimate jobs and wages using alternative government or private data sources.

ICF also estimated "nontraditional/other" jobs representing independent contractors, on-call worker, temporary help agency workers, and workers provided by contract firms. These jobs are not counted in the standard employee estimates published by BLS and the Bureau of Economic Analysis (BEA, SAEMP27N Full-Time and Part-Time Wage and Salary Employment by NAICS Industry). However, the BEA has included such jobs in a different data series (SAEMP25N Total Full-Time and Part-Time Employment by NAICS Industry). These jobs are shown in Exhibit 3-6 under the column labeled "Upper Estimate of Total Jobs" for NAICS code 211, Oil and Gas Extraction. For most other NAICS sectors in the oil and gas value chain the difference between the two data series is generally small with the count of total jobs being only 1% to 14% higher than the count of traditional jobs paying wages or salaries. For the Oil and Gas Extraction sector, the difference is much higher at over 300% nationally in recent years.

Exhibit 3-6: New Mexico Jobs in Oil and Gas Extraction (NAICS Code 211)

Year	Full Time and Part Jobs for Workers Earning Wages & Salaries	Upper Estimate of Nontraditional/Other Jobs	Upper Estimate of Total Jobs	Lower Estimate of Nontraditional/Other Jobs	Lower Estimate of Total Jobs
2013	5,209	9,212	14,421	8,138	13,347
2014	5,468	8,758	14,226	7,558	13,026
2015	5,346	9,358	14,704	8,032	13,378
2016	4,711	10,021	14,732	8,569	13,280
2017	4,299	10,587	14,886	9,009	13,308

Notes: The category of "nontraditional jobs" represent independent contractors, on-call worker, temporary help agency workers, and workers provided by contract firms. These jobs are not counted in the standard employee estimates published by BLS and BEA (SAEMP27N Full-Time and Part-Time Wage and Salary Employment by NAICS Industry).The upper estimate for total workers comes from another BEA data series (SAEMP25N Total Full-Time and Part-Time Employment by NAICS Industry) which attempts to count such workers. The lower estimate for total jobs removes ICF's estimate of "nontraditional jobs" that appear to be related to investor income from oil and gas properties. This was estimated by a regression analysis of data from all states for 2013 to 2017. The lower estimate is used in this report.

ICF analysis of the “all jobs” data series by state suggests that the job count may include people receiving royalty or investment income from the oil and gas sector, not just labor income. This appears to be the case given that there are large numbers of people added to the “total jobs” counts in states with little or no oil and production. The lower estimate for total jobs shown in Exhibit 3-6 removes ICF's estimate of "nontraditional/other jobs" that appear to be related to mineral rights and investor income from oil and gas properties. This was estimated by a regression analysis of data from all states for 2013 to 2017. This “lower estimate” of “nontraditional/other” jobs is used for this report.

The level of output in an industry is often measured in terms of “value of output” (a.k.a. “value of shipments”) and “value added.” Value of output is the total value (price x quantity) of what an industry produces in terms of goods or services. Value added can be computed as value of shipment minus the value of imported intermediate goods and services (all along the supply chain) and is a measure of contribution to Gross Domestic Product (GDP). Calculating the value added to the U.S. economy in this way differs from calculating value added of just one specific industry whereby the costs of the intermediate goods and services are deducted whether imported or domestic. On the other hand, the value added for the aggregate GDP includes domestic intermediate goods and services (all along the supply chain) because they also are part of U.S. GDP, and so, only imported intermediate goods are subtracted.

From the point of view of a single state, the concept of imports includes not only foreign imports, but also imports from other U.S. states. Therefore, the ratio of value added to value of output is lower at the state level than it is at the national level.

State and local tax calculation for this report assumes that current tax rates in New Mexico remain at current levels. See Appendix A for details on historical taxes paid by the oil and gas industry and how ICF projected such taxes in the forecast period.

4. Scenario Results: Oil and Gas Markets

This report presents two energy market forecasts through 2030 prepared by ICF using our proprietary energy-sector forecasting models. Starting from ICF's Base Case forecast of national energy markets, the report develops two scenarios for what future infrastructure are built and the implications of that construction for the economy of new Mexico. The two scenarios are:

- A "Base Case" that assumes that infrastructure is built over the next twelve years to accommodate projected oil and gas production most economically. This case is consistent with ICF's national 4th Quarter 2018 "Base Case" forecast.
- A "Constrained Infrastructure Development Case" (also called the "Alternative Case") that limits infrastructure development in New Mexico. This scenario (a) includes only future projects that are currently under construction and (b) limits gas flaring in New Mexico, which can also limit crude oil production.

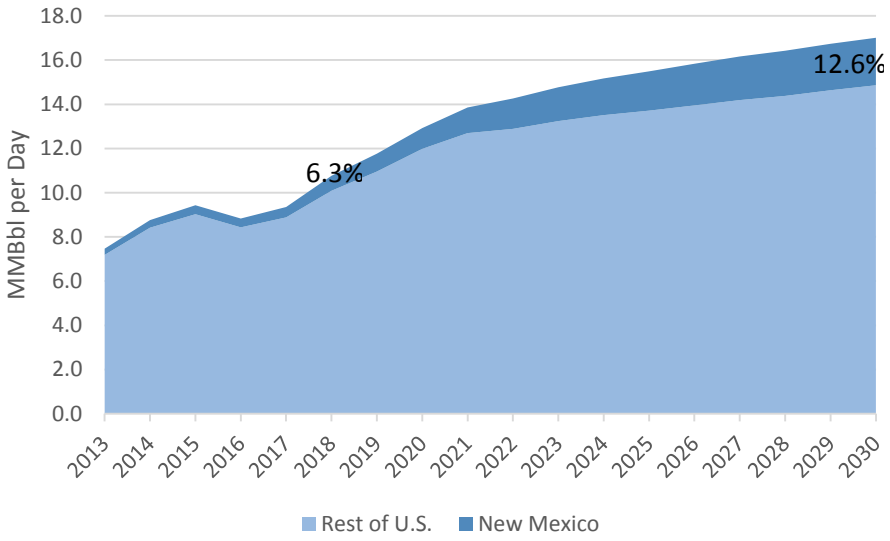
This chapter begins by introducing the Base Case and its key forecast results for New Mexico. Then the construction of the Alternative Case is discussed followed by a presentation of the differences in the energy market results for the two cases.

4.1 Base Case Overview

4.1.1 Crude Oil

U.S. crude oil production has been rising rapidly since 2016 reaching 10.8 MMBbl/d in 2018. The Base Case projects 17 MMBbl/d of production by 2030 (Exhibit 4-1). New Mexico crude oil production in 2018 accounts for 6.3% of the U.S. total or about 0.7 MMBbl/d and the share is expected to grow to 12.6% or 2.1 MMbbl/d by 2030 in the Base Case. Almost all of New Mexico crude oil production is from the Permian basin in the southeast corner of the state.

Exhibit 4-1: U.S. Crude Oil Production in the Base Case



In 2018, about 18% of the total U.S. crude production, or 1.9 MMBbl/d, was exported to other countries (Exhibit 4-2). Most of the exported volume is light crude produced from tight oil plays such as the Permian, Eagle Ford, and Niobrara, as the U.S. refineries can only run at limited volume of light crude. As tight oil crude production is expected to grow rapidly in the future, with modest growth in refinery processing capacity, the export volume will continue to rise. The Base Case projects the crude exports to reach 5.1 MMBbl/d by 2030.

The U.S. refineries consumed 17.3 MMBbl/d in 2018 with 45% of the supply, 7.8 MMBbl/d, imported from other countries. With growing domestic crude production, the Base Case projects declining crude imports down to 5.7 MMBbl/d by 2030.

Exhibit 4-2: U.S. Crude Oil Balance in the Base Case (MMBbl/d)

	Supply				Demand		
	Production	Imports	Other Crude Supplies*	Total	Exports	Refinery Runs	Total
2015	9.4	7.4	0.1	16.9	0.5	16.4	16.9
2016	8.8	7.9	0.4	17.1	0.6	16.5	17.1
2017	9.4	8.0	0.7	18.1	1.2	16.9	18.1
2018	10.8	7.8	0.6	19.2	1.9	17.3	19.2
2019	11.8	7.3	0.4	19.5	2.1	17.4	19.5
2020	12.9	7.0	0.4	20.3	2.8	17.5	20.3
2021	13.9	6.7	0.4	20.9	3.3	17.7	20.9
2022	14.3	6.5	0.4	21.1	3.4	17.8	21.1
2023	14.8	6.3	0.5	21.5	3.7	17.8	21.5
2024	15.2	6.1	0.5	21.8	3.9	17.8	21.8
2025	15.5	6.0	0.4	21.9	4.0	17.9	21.9
2026	15.8	5.9	0.4	22.1	4.2	17.9	22.1
2027	16.2	5.8	0.4	22.3	4.4	17.9	22.3
2028	16.4	5.8	0.3	22.5	4.6	17.9	22.5
2029	16.7	5.7	0.3	22.8	4.9	17.9	22.8
2030	17.0	5.7	0.3	23.0	5.1	17.9	23.0
Avg 2018-2030	14.7	6.3	0.4	21.5	3.7	17.8	21.5

**Changes to storage and balancing items.*

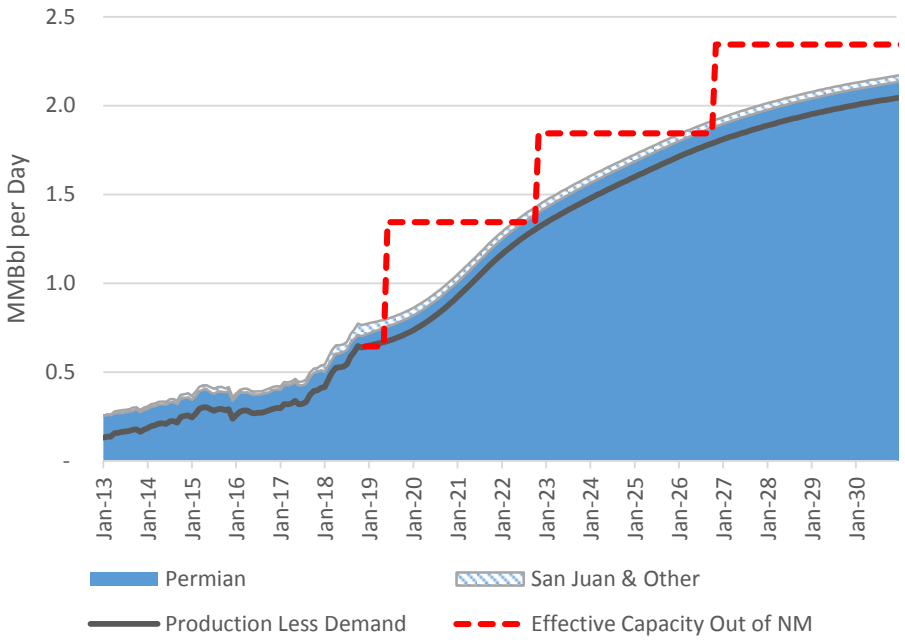
New Mexico crude oil demand (input to the two refineries in the state) is projected flat at 126 MBbl/d in the Base Case. As local crude production from the Permian is expected to grow more than three times the 2018 level by 2030, most of the crude will be exported via pipeline, or other means of transportation such as rails and trucks, to be refined in Texas and other states or exported out of the country.

Effective pipeline takeaway capacity out of New Mexico is currently estimated at about 0.6 MMBbl/d (Exhibit 4-3). A crude oil pipeline project, Oryx Midstream Regional Pipeline, with a capacity of 0.7 MMBbl/d is currently under construction and is scheduled to come online in June 2019. The project will add a 500 miles of crude oil gathering and transportation pipeline in a system that will provide additional capacity across the northern Delaware Basin through Lea and Eddy Counties in New Mexico and into Texas.

The Base Case includes two generic projects in 2022 and 2026 each with 0.5 MMBbl/d capacity. As an alternative to the Base Case, the crude oil could be transported via other means

(e.g. rails or trucks). These new pipeline projects will increase New Mexico crude takeaway capacity to 1.3 MMBbl/d by June 2019, to 1.8 MMBbl/d by 2022, and to 2.3 MMBbl/d by 2026.

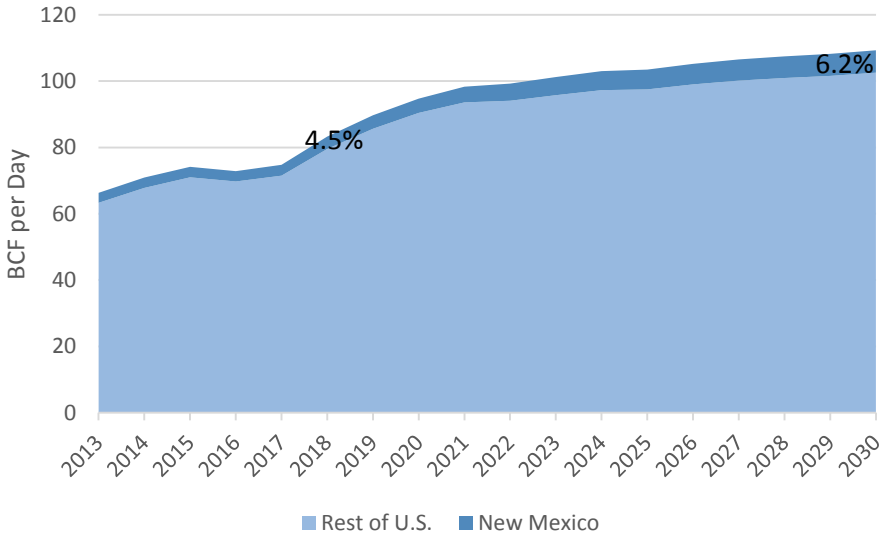
Exhibit 4-3: New Mexico Crude Oil Production and Pipeline Takeaway Capacity in the Base Case



4.1.2 Natural Gas

U.S. natural gas production has been relatively flat during 2015 through 2017 at an average rate of 74 Bcf/d. A surge in production from the Marcellus/Utica, Permian, and Anadarko basin set the average production level at 83 Bcf/d in 2018. The Base Case projects 109 Bcf/d of dry gas production by 2030, an increase of 26 Bcf/d from 2018 level (Exhibit 4-4).

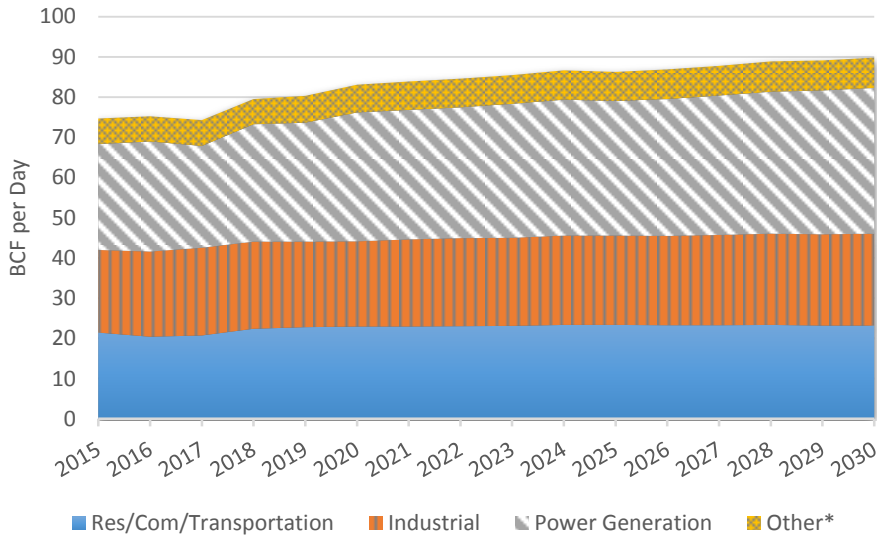
Exhibit 4-4: U.S. Dry Gas Production in the Base Case



New Mexico produced 3.7 Bcf/d of gas in 2018 or 4.5% of the total U.S. production. About 60%, or 2.1 Bcf/d, of the production was from the Permian basin and the remaining 40% was from the San Juan and Raton basin. The Base Case projects a 260% increase in New Mexico Permian production to over 5.5 Bcf/d by 2030. Gas production from the San Juan and Raton have been declining and is projected to continue to decline in the future. In total, New Mexico gas production will be 6.8 Bcf/d or 6.2% of total U.S. gas production by 2030.

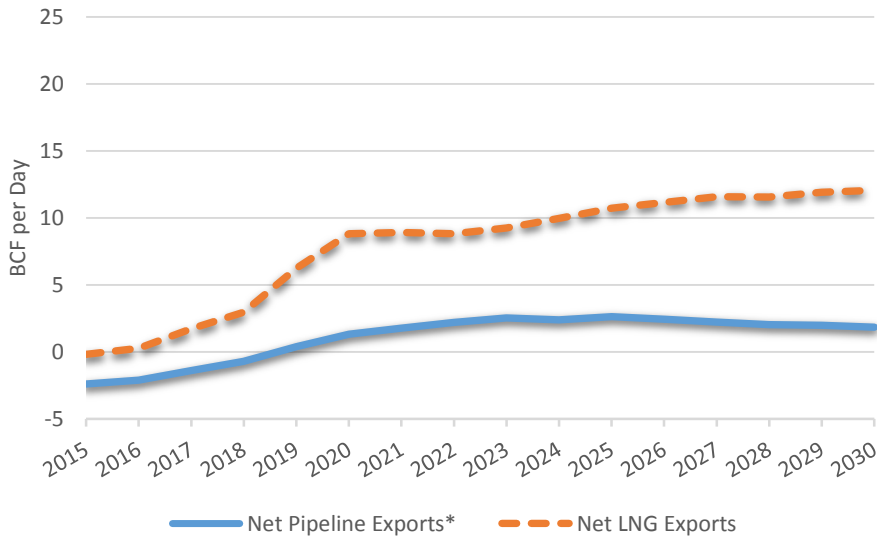
The U.S. consumed almost 80 Bcf/d of natural gas in 2018 and is projected to grow to about 90 Bcf/d by 2030 in the Base Case (Exhibit 4-5). About 70% of the growth is in the power sector. Net exports (net pipeline exports to Mexico and Canada and net LNG exports) was 2.3 Bcf/d in 2018. The Base Case projects 12.1 Bcf/d of net LNG exports and 1.8 Bcf/d of net pipeline exports by 2030 (Exhibit 4-6).

Exhibit 4-5: U.S. Natural Gas Consumption in the Base Case



**Lease & Plant and Pipeline Fuel*

Exhibit 4-6: U.S. Natural Gas Net Exports in the Base Case



**Net pipeline exports to Mexico and Canada*

Total natural gas pipeline takeaway capacity out of New Mexico is currently estimated at about 6.2 Bcf/d which includes gathering line to Texas with an estimated capacity of 0.9 Bcfd. However, effective natural gas pipeline capacity out of New Mexico is limited to 3.3 Bcfd, which is estimated by netting out Texas and Colorado gas transport into New Mexico.

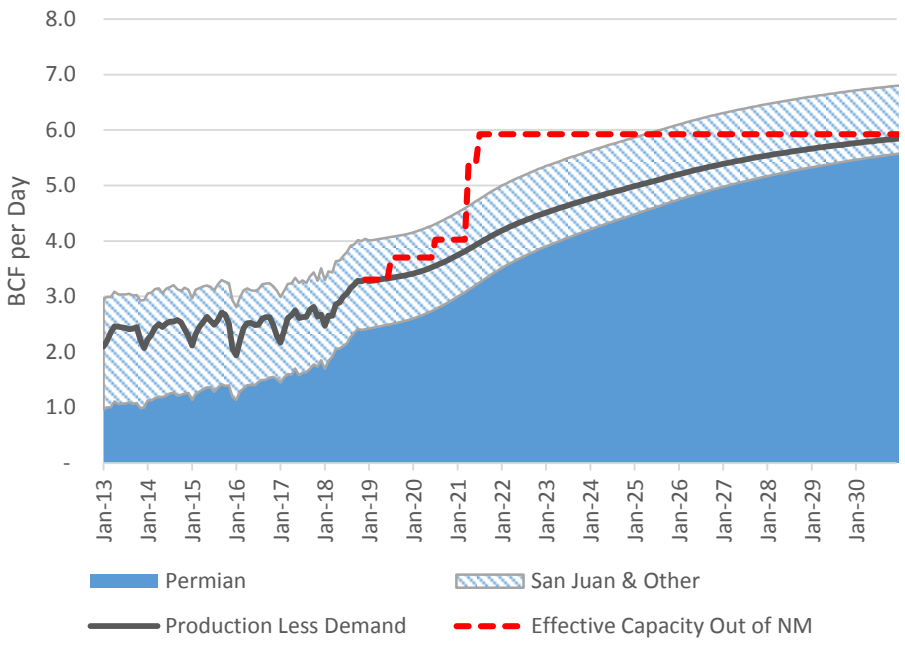
The Base Case projection includes four proposed Permian pipeline (i.e. header lines), with a total capacity of 2.6 Bcf/d (Exhibit 4-7), that will increase transport capacity out of the New Mexico Permian to Texas. The Sendero Gateway project, which received a positive environmental assessment from FERC in January 2019, consists of 23 miles of new pipeline from Sendero's Carlsbad Plant in Eddy County, New Mexico to Agua Blanca pipeline in

Culberson County, Texas. El Paso Natural Gas' South Mainline Expansion project, which received a positive environmental assessment from FERC in November 2018, consists of 17 miles of new pipeline loop and two new compressor stations in order to increase the system's capacity to transport gas from Texas and New Mexico to Arizona. Summit Midstream Partners' Double E pipeline, which is currently undergoing its FERC environmental review, would add 120 miles of pipeline from receipt points in Eddy and Lea Counties in New Mexico and Loving, Pecos, Reeves and Ward Counties in Texas to the Waha Hub in Reeves County, Texas. Finally, WhiteWater Midstream's Steady Eddy project, which commenced an open season to solicit interest in January 2019, would run from Eddy County, New Mexico to Culberson County, Texas. These new capacity additions will remove natural transportation bottleneck and will provide enough capacity through 2030.

Exhibit 4-7: Proposed Permian Natural Gas Pipeline in the Base Case

Date	Project Name	Company Name	Status	Project Capacity (Bcfd)	Effective Capacity out of New Mexico (Bcfd)
Dec-18					3.3
Jul-19	Sendero Carlsbad Gateway	Sendero Midstream	FERC Application	0.4	3.7
Jul-20	South Mainline Expansion Project	El Paso Natural Gas	FERC Application	0.3	4.0
Apr-21	Double E Pipeline	Summit Midstream Partners LP	FERC Application	1.4	5.4
Jul-21	Steady Eddy Pipeline	WhiteWater Midstream	Announced	0.5	5.9

Exhibit 4-8: New Mexico Natural Gas Production and Pipeline Takeaway Capacity in the Base Case

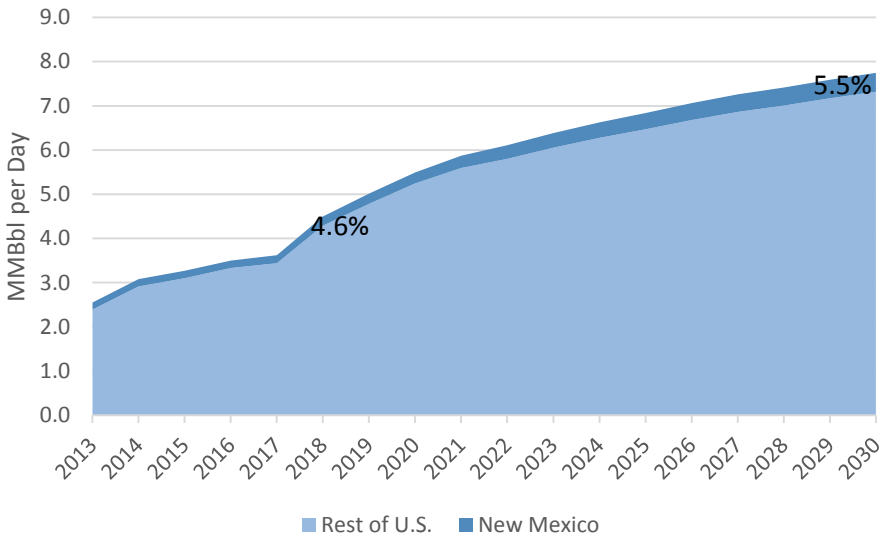


4.1.3 Natural Gas Liquids

The U.S. oil and gas fields produced an average of 4.5 MMBbl/d of natural gas liquids in 2018 (Exhibit 4-9). NGL from refinery output, about 0.6 MMBbl/d, brings the total U.S. NGL supply to 5.1 MMBbl/d in 2018 (Exhibit 4-10). Texas accounts for the large portion, almost 50%, of the

NGL production. The Base Case projects a 72% increase in U.S. NGL field production to 7.7 MMBbl/d by 2030.

Exhibit 4-9: U.S. NGL Production in the Base Case



New Mexico NGL production has been flat in the last 5 years at around 0.2 MMBbl/d, which account for 4.6% of the U.S. total in 2018. With the large gas production growth from the Permian, the Base Case projects the production to be more than double to over 0.4 MMBbl/d or 5.5% of the U.S. total by 2030.

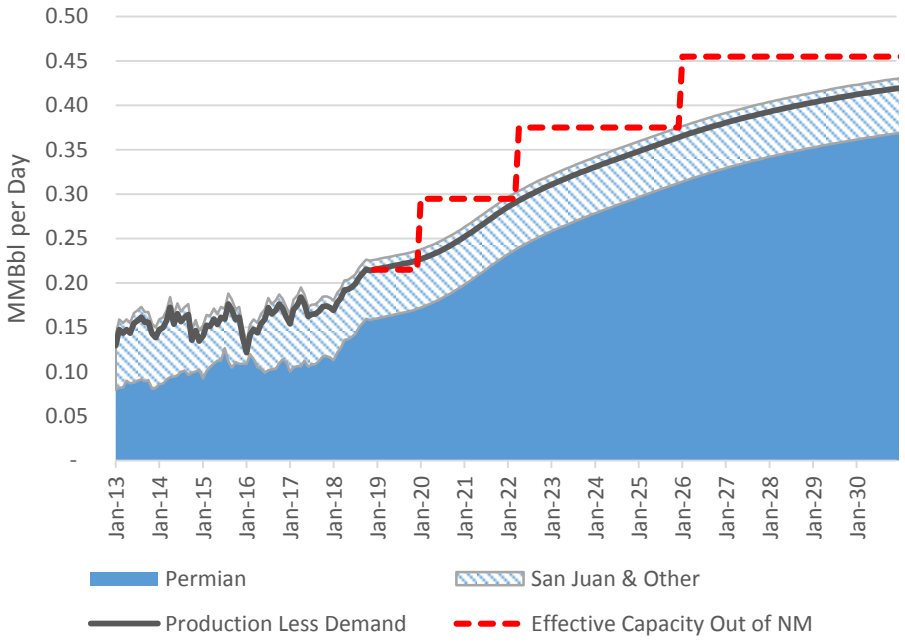
Almost all of the NGL consumed in the U.S. as feedstock for petrochemical plants but mostly, 3.2 MMBbl/d, for non-petrochemical consumption. NGL exports, about 0.7 MMBbl/d in 2018, accounts for 14% of the total demand. The Base Case projects a large increase in NGL exports to 3.1 MMBbl/d by 2030 or 37% of the U.S. total.

Exhibit 4-10: U.S. NGL Balance in the Base Case (MMBbl/d)

	Supply			Demand				
	Field Production	Refinery Products	Total	Ethylene Crackers	PDH Facilities	Exports	Domestic Non-Petrochemical Consumption	Total
2015	3.34	0.59	3.93	0.67	0.03	0.46	2.78	3.93
2016	3.48	0.60	4.08	0.67	0.06	0.58	2.77	4.08
2017	3.62	0.60	4.22	0.88	0.06	0.47	2.81	4.22
2018	4.50	0.59	5.09	1.11	0.10	0.72	3.16	5.09
2019	5.01	0.60	5.62	1.27	0.10	0.94	3.32	5.62
2020	5.49	0.61	6.10	1.27	0.10	1.32	3.41	6.10
2021	5.87	0.61	6.48	1.37	0.10	1.61	3.41	6.48
2022	6.11	0.61	6.72	1.46	0.12	1.73	3.41	6.72
2023	6.38	0.61	6.99	1.46	0.12	2.01	3.40	6.99
2024	6.63	0.60	7.23	1.46	0.12	2.25	3.40	7.23
2025	6.84	0.60	7.44	1.52	0.12	2.40	3.39	7.44
2026	7.06	0.60	7.66	1.58	0.12	2.50	3.46	7.66
2027	7.26	0.60	7.86	1.58	0.15	2.68	3.45	7.86
2028	7.41	0.60	8.02	1.58	0.15	2.83	3.45	8.02
2029	7.59	0.60	8.19	1.58	0.15	3.01	3.44	8.19
2030	7.75	0.60	8.35	1.65	0.15	3.11	3.44	8.35
Avg 2018-2030	**6.45**	**0.60**	**7.06**	**1.45**	**0.12**	**2.08**	**3.40**	**7.06**

NGL pipeline takeaway capacity out of New Mexico is currently estimated at 0.21 MMBbl/d. The Base Case projection includes 0.4 MMbpd new EPIC NGL pipeline project that is currently under construction and is expected to come online in January 2020. The EPIC NGL pipeline will run 700 miles from the Permian to the Gulf Coast and portions of the project will operate as a crude oil pipeline until the project is completed in 2020. Only 20% of the EPIC capacity, 0.08 MMBbl/d, is dedicated for New Mexico Permian NGL volume to be transported to Texas. The Base Case also includes two generic projects similar to the EPIC pipeline projects to come online in 2020 and 2026 (Exhibit 4-11).

Exhibit 4-11: New Mexico NGL Production and Pipeline Takeaway Capacity in the Base Case



4.2 Alternative Case Overview

The Alternative Case or Constrained Infrastructure Development Case limits major gathering line and pipeline infrastructure development in New Mexico. This scenario (a) includes only future pipeline projects that are currently under construction and (b) limits gas flaring in New Mexico (which can constrain crude oil production).

The Alternative Case restricts new crude transportation in New Mexico to include only the 0.7 MMBbl/d Oryx Midstream Regional Pipeline project to come online in June 2019 and a small 0.05 MMBbl/d rail capacity addition at around the same time period (Exhibit 4-12). No new natural gas pipeline projects will be built in New Mexico in the Alternative Case (Exhibit 4-13). However, the case allows for a small volume of New Mexico gas production to be vented and flared. The flaring limit is set to historical maximum of 3.1 Bcf/month or 0.1 Bcf/d.[15] The Alternative Case includes only the new EPIC NGL pipeline to come online in January 2020 (Exhibit 4-14).

[15] This historical peak as reported by EIA was in July 2015. See https://www.eia.gov/dnav/ng/hist/n9040nm2m.htm

Exhibit 4-12: New Mexico Crude Oil Production and Pipeline Takeaway Capacity in the Alternative Case

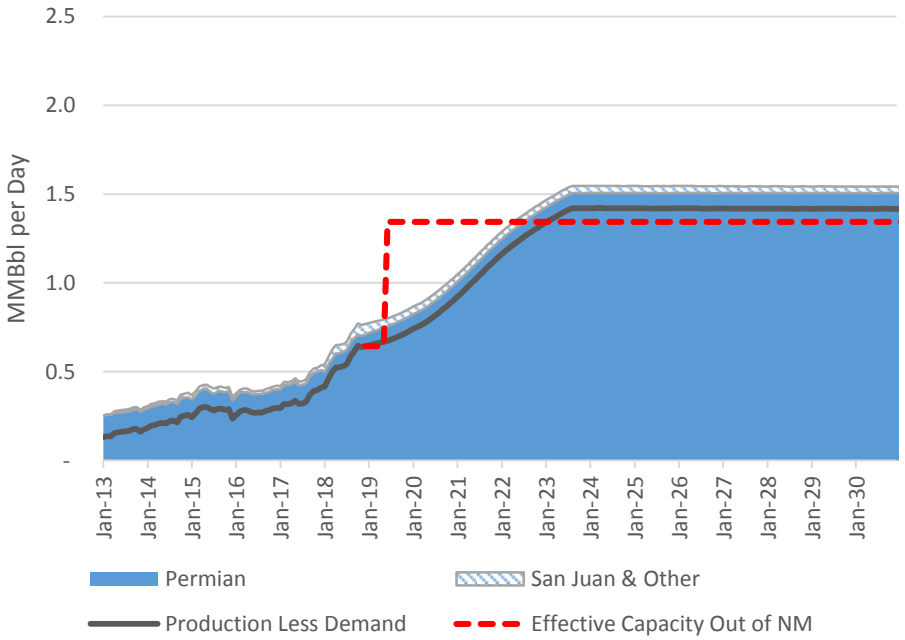


Exhibit 4-13: New Mexico Natural Gas Production and Pipeline Takeaway Capacity in the Alternative Case

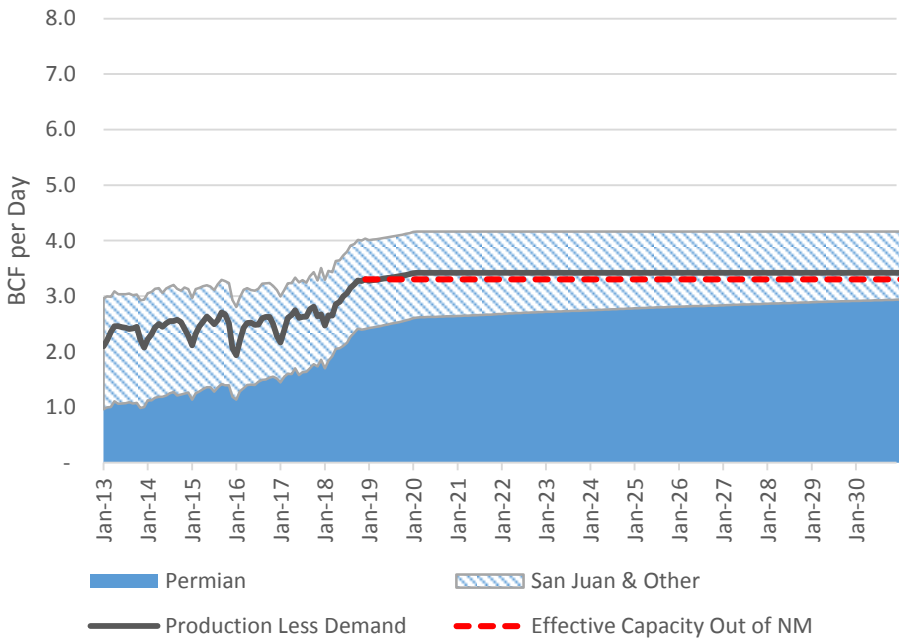
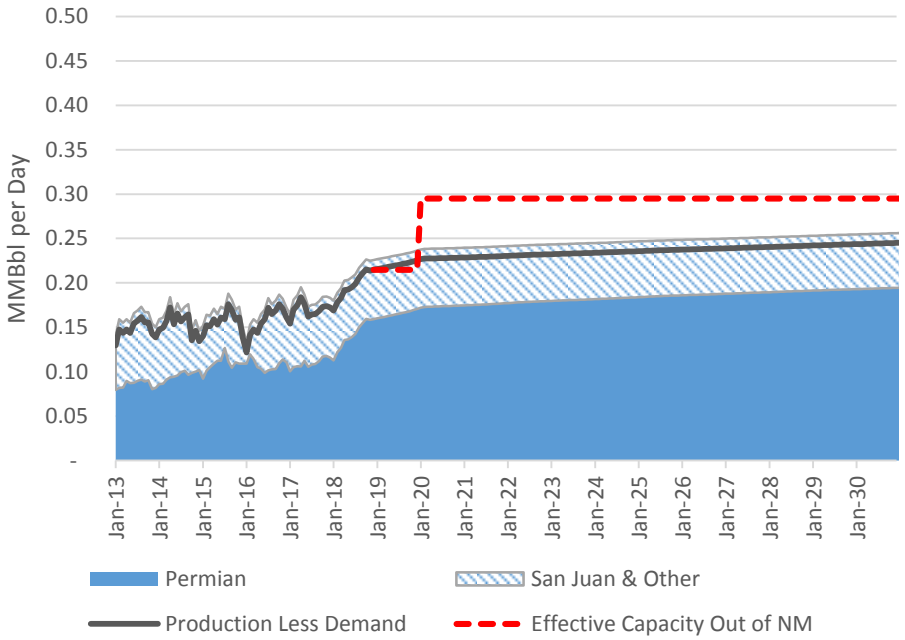


Exhibit 4-14: New Mexico NGL Production and Pipeline Takeaway Capacity in the Alternative Case

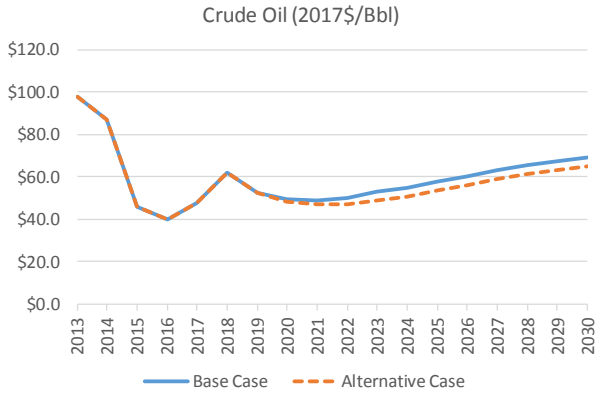


In the Alternative Case, natural gas production is bottlenecked earlier than crude oil and NGL because of the new Oryx crude pipeline and EPIC NGL pipeline that allow for additional 0.7 MMBbl/d of crude transport and 0.08 MMBbl/day of NGL transport to Texas. This oil versus gas transportation projection capability in the Alternative Case leads to a shift in drilling less gassy crudes to limit associated gas production from the wells. As shown in Exhibit 4-12, crude oil production grows to 1.55 MMBbl/d through the mid of 2023 while natural gas production remains flat throughout the projection (Exhibit 4-13).

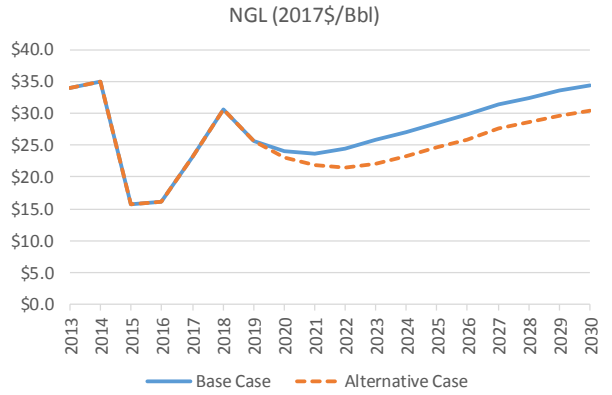
4.3 Comparison of Market Results

Production bottleneck in the Alternative Case, due to less pipeline and gathering systems development, leads to the adoption of higher-cost alternative transportation modes. This causes the average 2019-2030 New Mexico Permian wellhead prices in the Alternative Case to be lower by $3.26/bbl or 6% for crude oil, $3.03/bbl or 11% lower for NGL, and $0.50/Mcf or 26% lower for natural gas (Exhibit 4-15).

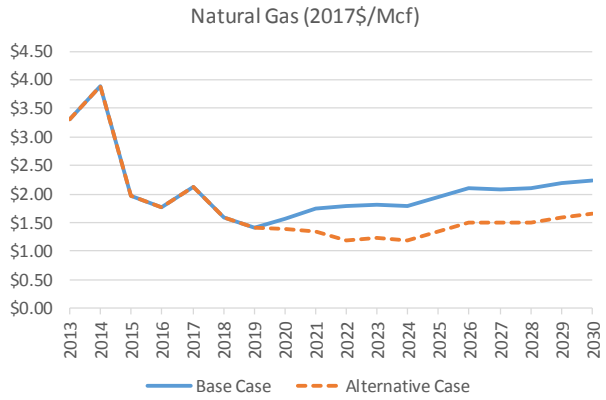
Exhibit 4-15: New Mexico Permian Wellhead Prices: Base Case versus Alternative Case



	2019	2025	2030	2019-2030
Change	$0.00	-$4.12	-$4.12	-$3.26
	0%	-7%	-6%	-6%



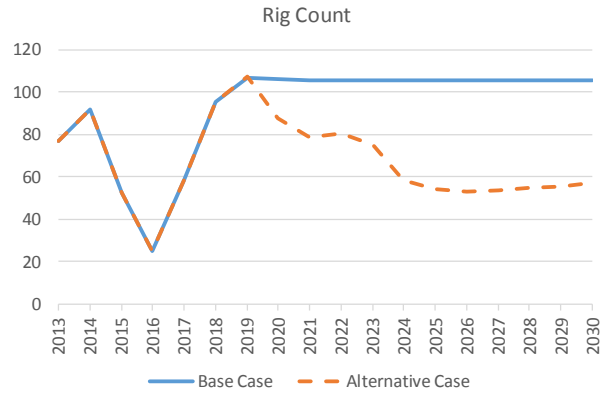
	2019	2025	2030	2019-2030
Change	$0.00	-$3.83	-$3.83	-$3.03
	0%	-13%	-11%	-11%

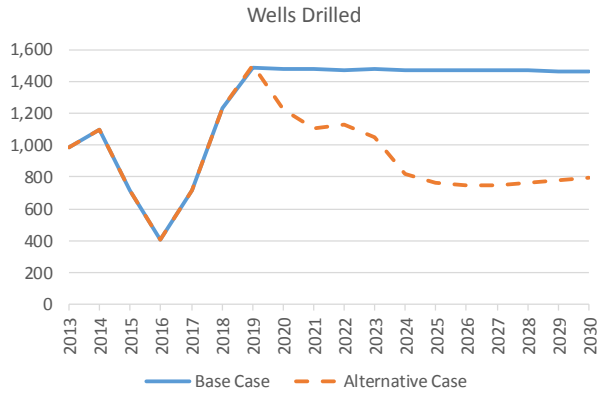


	2019	2025	2030	2019-2030
Change	$0.00	-$0.60	-$0.60	-$0.50
	0%	-31%	-27%	-26%

In the Alternative Case, drilling activity in New Mexico is about 35% lower between 2019 and 2030 compared to the Base Case (Exhibit 4-16) with average rig count is down by 38 rigs and average drilling is down by about 520 wells per year during the projection period. Average 2019-2030 production are lower by 14% (0.23 MMBbl/d) for crude oil, 27% (1.5 Bcf/d) for natural gas, and 29% (0.1 MMBbl/d) for NGL compared to the Base Case.

Exhibit 4-16: New Mexico Drilling Activity: Base Case versus Alternative Case





	2019	2025	2030	2019-2030
Change	1	-51	-48	-38
	1%	-48%	-46%	-36%

	2019	2025	2030	2019-2030
Change	15	-707	-670	-521
	1%	-48%	-46%	-35%

Lower drilling activity and production in the Alternative Case leads to lower midstream infrastructure developments as shown in Exhibit 4-17. The Base Case projects a total of about 8,200 miles of new oil and gas gathering line from 2019 to 2030 versus 5,525 miles in the Alternative Case, a 33% drop.

The Alternative Case only needs a small increase in new gas processing capacity to support a modest gas production growth from the Permian basin that replaces declining San Juan production. New gas processing capacity requirement in the Alternative Case is down by 77% compared to the Base Case.

New natural gas pipeline (and compressor station) construction in the Alternative Case, that includes interstate, intrastate, and laterals, will be over 80% lower compared to the Base Case. The Base Case projects a total of 675 miles new pipeline and 365,000 HP new compressor station versus 120 miles and 65,000 HP in the Alternative Case between 2019 and 2030.

Crude oil pipeline (and pumping station) construction between 2019 and 2030 is down from 523 miles and 31,000 HP in the Base Case to 220 miles (-58%) and 8,000 HP (-74%) in the Alternative Case. Crude oil storage requirement is down by 36% from a total of 27,800 in the Base Case to 17,900 in the Alternative Case.

New NGL pipeline (and pumping station) construction is down by about 70% from a total of 335 miles and 14,000 HP in the Base Case to 100 miles and 5,000 HP in the Alternative Case. This includes interstate, intrastate, and laterals to connect the gas processing and fractionation plants to the mainline.

The Base Case includes Kinder Morgan planned 216 miles Lobos CO2 pipeline to connect St. Johns Dome, a large natural CO2 source located on the border of Arizona and New Mexico, to Torrance County, New Mexico, where it will link with the Cortez Pipeline. As reported in the public filings, most of the construction, 211 miles, will be in New Mexico. The Base Case assumes the new Lobos CO2 pipeline will come online in 2025. The Alternative Case does not include the Lobos CO2 pipeline.

Exhibit 4-17: New Mexico New Infrastructure Builds: Base Case versus Alternative Case

	New Infrastructure Builds	2017	2018	Base Case Average 2019-2030	Alternative Case Average 2019-2030	Base Case Cumulative 2019-2030	Alternative Case Cumulative 2019-2030	Alt. vs. Base Case: Impact for 2019-2030 as %
Natural Gas	Gas Gathering Line Miles	241	318	354	241	4,247	2,891	-32%
	Gas Gathering Line Avg. Size (Inches)	5	6	7	7			
	Gas Gathering Line Compression (1000 HP)	33	69	40	9	477	112	-77%
	Gas Processing Capacity (MMcfd)	162	342	197	46	2,365	550	-77%
	Gas Processing Compression (1000 HP)	16	34	20	5	237	55	-77%
	Gas Processing Lateral Miles	22	46	26	6	315	73	-77%
	Gas Processing Lateral Size (Inches)	20	20	20	20			
	Intrastate Gas Pipeline Miles	5	29	17	4	203	47	-77%
	Intrastate Gas Pipeline Avg. Size (Inches)	12	24	24	24			
	Intrastate Gas Pipeline Compression (1000 HP)	16	6	4	1	43	10	-77%
	Interstate Gas Pipeline Miles	11	1	13	0	157	0	-100%
	Interstate Gas Pipeline Avg. Size (Inches)	30	20	30	0			
	Interstate Gas Pipeline Compression (1000 HP)	6	3	7	0	86	0	-100%
Crude Oil	Oil Gathering Line Miles	144	218	329	219	3,947	2,634	-33%
	Oil Gathering Line Avg. Size (Inches)	4	6	7	7			
	Crude Oil Lateral Miles	17	28	12	8	148	95	-36%
	Crude Oil Lateral Size (Inches)	18	18	18	18			
	Crude Oil Storage Capacity (MBbl)	3,125	5,229	2,318	1,491	27,816	17,897	-36%
	Interstate Crude Oil Pipeline Miles	0	0	31	10	375	125	-67%
	Interstate Crude Oil Pipeline Avg. Size (Inches)	0	0	24	24			
	Interstate Crude Oil Pumping (1000 HP)	0	0	3	1	31	8	-74%
NGL	NGL Lateral Miles	0	16	9	2	112	26	-77%
	NGL Lateral Size (Inches)	14	14	14	14			
	Interstate NGL Pipeline Miles	32	0	19	6	223	73	-67%
	Interstate NGL Pipeline Avg. Size (Inches)	24	0	24	24			
	Interstate NGL Pumping (1000 HP)	2	0	1	0	14	5	-67%
CO2	CO2 Pipeline Miles	10	0	18	0	211	0	-100%
	CO2 Pipeline Size (Inches)	20	0	16	0			
	CO2 Pipeline Pumping (1000 HP)	1	0	2	0	26	0	-100%

5. Scenario Results: Economic Impacts

This chapter presents estimates of the impacts on the New Mexico economy that would result from each of the two study scenarios being realized.

5.1 Capital Expenditures

Capital expenditures for new oil and gas infrastructures and for replacement and refurbishment of existing infrastructures in New Mexico are projected to total $173.7 billion in the Base Case between 2019 and 2030 or an average of $14.5 billion per year (Exhibit 5-1). Less investment in the Alternative Case drops the CAPEX by 36% to $110.7 billion total or $9.2 billion per year. The largest portion of the spending is for drilling (which includes completion and equipment) that accounts for about 89% of the total CAPEX in both cases. The projected annual average spending on drilling, completion, and equipment in New Mexico is $12.8 billion in the Base Case and $8.2 billion (-36%) in the Alternative Case.

The Alternative Case shows much larger drop in natural gas (and NGL) infrastructure CAPEX versus the oil, 71% lower than the Base Case for natural gas versus 47% lower for crude oil. The reason for this is that in the Alternative Case, natural gas production is bottlenecked earlier than crude oil, therefore, less new natural gas infrastructure is needed in the Alternative Case.

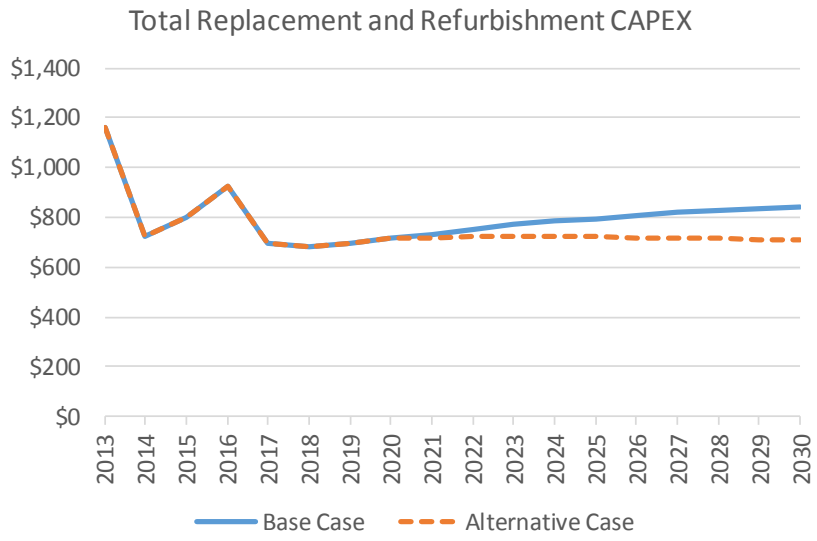
As mentioned in Chapter 4, the Base Case includes one CO2 pipeline project in 2025 which is not included in the Alternative Case. The cost of this project (pipeline and pumping stations) is estimated at $1.2 billion.

Projected spending for replacement and refurbishment (including enhancements and upgrades) of existing assets for the Base Case accounts for 5% of the total CAPEX or $9.4 billion between 2019 and 2030. This spending is $8.6 billion in the Alternative Case, slightly lower than the Base Case because the replacement/refurbishment activity will be similar in the short term between the two cases (Exhibit 5-2) as most of the activity will be for assets that are in-place through 2018. The incremental replacement/refurbishment spending for new assets is much less and the impact is not significant in the short term.

Exhibit 5-1: New Mexico Oil and Gas Capital Expenditures: Base Case versus Alternative Case

Capital Expenditures (Million 2017$)	Actual 2017	Actual 2018	Base Case 2030	Alternative Case 2030	Base Case Average 2019-2030	Alternative Case Average 2019-2030	Alternative vs. Base Case: Impact in 2030 as %	Alt. vs. Base Case: Impact for 2019-2030 as %
Drilling	$5,160	$9,982	$13,236	$7,177	$12,803	$8,223	-46%	-36%
Natural Gas	$366	$688	$483	$96	$495	$142	-80%	-71%
Crude Oil	$91	$169	$207	$36	$226	$120	-83%	-47%
NGL	$98	$27	$60	$1	$72	$22	-98%	-69%
CO2	$25	$0	$122	$0	$102	$0	-100%	-100%
Replacement/Refurbishment	$694	$682	$839	$711	$781	$715	-15%	-8%
Total	**$6,434**	**$11,547**	**$14,948**	**$8,021**	**$14,478**	**$9,223**	**-46%**	**-36%**

Exhibit 5-2: New Mexico Oil and Gas Replacement and Refurbishment Expenditures: Base Case versus Alternative Case (2017$)



	2019	2025	2030	2019-2030
Change	$0	-$75	-$128	-$66
	0%	-9%	-15%	-8%

5.2 Value of Outputs

Exhibit 5-3 compares the value of outputs or revenues from oil and gas activities between the Base Case and the Alternative Case. “Other” category includes revenues from NGL storage and fractionation, NGL wholesale and retail, petroleum products wholesale and retail, and refinery.

In the Base Case, New Mexico is projected to produce a total of 7.1 billion barrels of crude oil, 24.8 trillion cubic feet of dry (pipeline quality) natural gas, 1.5 billion barrels of NGLs, and 1.14 trillion cubic feet of naturally occurring carbon dioxide between 2019 and 2030. The value of these commodities at the point of first sale is $504 billion or an average of $42 billion per year which accounts for 85% of the total value of outputs. The Alternative Case has lower production with 2019-2030 total of 6.1 billion barrels of crude oil, 18.2 trillion cubic feet of dry gas, 1.1 billion barrels of NGLs, and 1.14 trillion cubic feet of carbon dioxide. The total value of this production will be $381 billion or 24% lower than the Base Case.

Gathering and processing revenues account for 4% of the total value of outputs, with a total 2019-2030 of $25.9 billion in the Base Case and $20.2 billion (-22%) in the Alternate Case.

Pipeline transmission for natural gas, crude oil, petroleum product, NGLs, and CO2 will contribute a total of $39.4 billion in the Base Case and $33.6 billion (-22%) in the Alternative Case between 2019 and 2030.

Gas distribution revenues will be the same in both cases, $4 billion between 2019 and 2030, as both have the same projection for New Mexico gas consumption. The same is true for value of outputs for “Other” category as it relates to demand related activities in New Mexico, which are

the same in both the Base Case and the Alternate Case. The total 2019-2030 revenue from these activities is $19.1 billion.

Exhibit 5-3: New Mexico Oil and Gas Value of Output: Base Case versus Alternative Case

Value of Output (Million 2017$)	Actual 2017	Actual 2018	Base Case 2030	Alternative Case 2030	Base Case Average 2019-2030	Alternative Case Average 2019-2030	Alternative vs. Base Case: Impact in 2030 as %	Alt. vs. Base Case: Impact for 2019-2030 as %
Production	$12,225	$19,649	$64,047	$41,404	$42,008	$31,790	-35%	-24%
Gathering & Processing	$983	$1,203	$2,704	$1,778	$2,161	$1,687	-34%	-22%
Pipeline Transmission	$2,017	$2,204	$3,897	$2,923	$3,286	$2,803	-25%	-15%
Gas Distribution	$327	$377	$336	$336	$336	$336	0%	0%
Other	$1,592	$1,594	$1,587	$1,587	$1,590	$1,590	0%	0%
Total	**$17,144**	**$25,025**	**$72,571**	**$48,027**	**$49,380**	**$38,206**	**-34%**	**-23%**

5.3 State GDP (Value Added)

Value added related to the New Mexico oil and gas activities is estimated based on oil and gas value of outputs and input-output relationships developed with the IMPLAN models of the U.S. and New Mexico economy.

Total direct, indirect, and induced value added from oil and gas activities in New Mexico is projected to total $485 billion in the Base Case between 2019 and 2030 or an average of $40.4 billion per year. Less oil and gas related activities in the Alternative Case results in lower value added down to a total of $374 billion or $39.5 billion per year, 23% lower than the Base Case. These incomes represent 36% of total New Mexico GDP in the Base Case and 23% of total GDP in the Alternative Case.

Total 2019-2030 oil and gas direct and indirect income in New Mexico is $373 billion in the Base Case and $287 billion (-23%) in the Alternate Case. This represents the value/income that stays in New Mexico which accounts for roughly 63% of the total value of outputs.

Exhibit 5-4: New Mexico Value Added from Oil and Gas Activity: Base Case versus Alternative Case

State GDP/Value Added (Million 2017$)	Actual 2017	Actual 2018	Base Case 2030	Alternative Case 2030	Base Case Average 2019-2030	Alternative Case Average 2019-2030	Alternative vs. Base Case: Impact in 2030 as %	Alt. vs. Base Case: Impact for 2019-2030 as %
Total O/G NM Income (direct & indirect)	$10,390	$15,499	$46,175	$30,403	$31,115	$23,955	-34%	-23%
Total NM Induced Income (30% of D&I)	$3,117	$4,650	$13,853	$9,121	$9,334	$7,187	-34%	-23%
Total O/G NM D,I & Induced Income	**$13,507**	**$20,149**	**$60,028**	**$39,524**	**$40,449**	**$31,142**	**-34%**	**-23%**
State GDP (from BEA to 2018) (2017$)	$94,211	$96,474	$132,181	$116,409	$112,588	$105,428	-12%	-6%

State GDP/Value Added (Million 2017$)	Actual 2017	Actual 2018	Base Case 2030	Alternative Case 2030	Base Case Average 2019-2030	Alternative Case Average 2019-2030	Alternative vs. Base Case: Impact in 2030 as %	Alt. vs. Base Case: Impact for 2019-2030 as %
State non-energy GDP (2017$)	$80,704	$76,325	$86,005	$86,005	$81,473	$81,473	0%	0%
ICF NM D,I,&I O/G Income as % of NM GDP	14.3%	20.9%	45.4%	34.0%	35.9%	22.7%	-25%	-37%

5.4 Jobs

In the Base Case, the oil and gas activities in New Mexico is expected to create an average 37,500 oil and gas sector jobs, another 22,200 for other related direct and indirect jobs, and 28,500 induced jobs each year between 2019 and 2030. The average for direct, indirect, and induced jobs is 92,000 each year. In the Alternative Case, the number of jobs is 12% lower than the Base Case. Each year, the Alternative Case will create 32,900 jobs in the oil and gas sector, 19,500 jobs for other related direct and indirect industries, and 28,500 induced jobs, with a total of 80,900 jobs.

Other jobs that are not in the "Wages & Salary" category include independent contractors, on-call workers, temporary help, etc. Number of jobs for this category will average 13,400 each year in the Base Case and 11,700 jobs (-13%) in the Base Case between 2019 and 2030.

Exhibit 5-5: New Mexico Jobs from Oil and Gas Activity: Base Case versus Alternative Case

"Wages & Salary" Jobs	Actual 2017	Actual 2018	Base Case 2030	Alternative Case 2030	Base Case Average 2019-2030	Alternative Case Average 2019-2030	Alternative vs. Base Case: Impact in 2030 as %	Alt. vs. Base Case: Impact for 2019-2030 as %
Oil and Gas Sector Jobs	31,306	34,941	37,775	31,854	37,512	32,915	-16%	-12%
Other Related Direct and Indirect Jobs	18,582	20,692	22,335	18,895	22,189	19,513	-15%	-12%
Total Direct and Indirect Jobs	49,888	55,634	60,111	50,750	59,701	52,428	-16%	-12%
Induced Jobs	27,125	30,173	32,544	27,573	32,338	28,467	-15%	-12%
Direct, Indirect, and Induced Jobs	**77,013**	**85,806**	**92,654**	**78,323**	**92,039**	**80,895**	**-15%**	**-12%**
Other Jobs								
Independent Contractors, On-call Workers, Temporary Help, etc.	**11,617**	**11,767**	**14,087**	**11,477**	**13,410**	**11,678**	**-19%**	**-13%**

5.5 Wages

In 2017, the oil and gas production and related support industries paid $1.94 billion in salaries or an average of $62,100 per employee per year. This is substantially greater than the average

compensation of $43,500 per employee per year for all sectors of the New Mexico economy. Across all segments of the oil and gas value chain plus induced activity, wages totaled $3.80 billion in 2017 and $4.35 billion in 2018.

In the Base Case, total direct, indirect, and induced wages for jobs in "Wages & Salary" category is projected to total $56.8 billion or an average of $4.7 billion per year between 2019 and 2030. The total wages in the Alternate Case will be lower by 13% or $49.2 billion.

Wages for oil and gas sector, $29 billion in the Base Case and $25 billion in the Alternative Case between 2019 and 2030 account for over 50% of the total.

Exhibit 5-6: New Mexico Total Wages from Oil and Gas Activity: Base Case versus Alternative Case

"Wages & Salary" Total Wages (Million 2017$)	Actual 2017	Actual 2018	Base Case 2030	Alternative Case 2030	Base Case Average 2019-2030	Alternative Case Average 2019-2030	Alternative vs. Base Case: Impact in 2030 as %	Alt. vs. Base Case: Impact for 2019-2030 as %
Oil and Gas Sector Total Wages	$1,943	$2,226	$2,459	$2,025	$2,424	$2,095	-18%	-14%
Other Related Direct and Indirect Total Wages	$907	$1,037	$1,144	$944	$1,128	$977	-17%	-13%
Total Direct and Indirect Total Wages	$2,850	$3,263	$3,604	$2,969	$3,552	$3,072	-18%	-14%
Induced Total Wages	$950	$1,087	$1,199	$989	$1,182	$1,024	-17%	-13%
Direct, Indirect, and Induced Total Wages	**$3,799**	**$4,350**	**$4,802**	**$3,958**	**$4,735**	**$4,096**	**-18%**	**-13%**

5.6 Tax Revenues

Oil and gas related activities in New Mexico will create a cumulative of $66.4 billion of state and local tax revenue in the Base Case throughout the 2019 and 2030 period, or an average of $5.5 billion per year. The tax revenue will be lower by 17% in the Alternative case with a total of $54.8 billion or an average of $4.6 billion per year. See Appendix A for more details on tax revenues.

Exhibit 5-7: New Mexico Tax Revenues from Oil and Gas Activity: Base Case versus Alternative Case

Tax Revenues (Million 2017$)	Actual 2017	Actual 2018	Base Case 2030	Alternative Case 2030	Base Case Average 2019-2030	Alternative Case Average 2019-2030	Alternative vs. Base Case: Impact in 2030 as %	Alt. vs. Base Case: Impact for 2019-2030 as %
State General Funds Attributed to All O&G Segments	$2,014	$2,522	$6,440	$4,692	$4,460	$3,718	-27%	-17%
Local Revenues Attributed to All O&G Segments	$398	$535	$1,611	$1,083	$1,076	$850	-33%	-21%
Sum of State Gen. Funds & Local Revenues	**$2,413**	**$3,057**	**$8,051**	**$5,775**	**$5,535**	**$4,568**	**-28%**	**-17%**

6. Conclusions

The oil and gas industry currently plays a major role in the New Mexico economy.

The oil and gas industry has played a significant role in the New Mexico since 1924 when hydrocarbons were first discovered in the state. By 2017, New Mexico was producing 171 million barrels of crude oil and lease condensate, 1,194 billion cubic feet of dry (pipeline quality) natural gas, 67 million barrels of natural gas plant liquids and 94 billion cubic feet of naturally occurring carbon dioxide. The value of these commodities at the point of first sale was $13.2 billion. The value of output from the oil and gas industry's full value chain (that is, adding in refining, transportation, distribution and retailing) was $17.1 billion in 2017. The income earned within in New Mexico in the forms of employee compensation, lease bonus and rent payments, production royalty payments, investment income, severance taxes, property taxes and state income taxes was $13.5 billion. This amount represents 14.3% of 2017 New Mexico GDP and accounts for direct, indirect and induced economic effects from activities along the full oil and gas value chain.

In the future, the oil and gas industry's contribution to New Mexico economy could be much larger.

Oil and gas production has been increasing in the state in recent years due to the application of new horizontal drilling and hydraulic fracturing technologies. ICF expects that under the national and regional oil and natural gas prices assumed for this study, these existing and expected future technological advances will allow oil and gas production in the state to further increase. Under Base Case assumptions, production in the state in 2030 compared to 2017 will be higher by 358% for crude oil, 106% for natural gas and 136% higher for natural gas liquids. In 2030 state direct, indirect and induced income in the state stemming from the oil and gas value chain could be as high as $60.0 billion, representing over 45% of total state income in that year.

Considerable investment in oil and gas infrastructure will be needed for the potential to be realized.

To realize this larger role, the industry will need to undertake large capital expenditures for well construction; gathering systems; gas processing plants; refineries; and crude oil, petroleum product, NGL, natural gas and carbon dioxide pipelines. Under Base Case assumptions, those investments would total $174 billion between 2019 and 2030. Upstream investments for items such as site preparation, well drilling, well completion and lease equipment make up 88% of this total investment amount. Investments in new natural gas, crude oil, NGLs and carbon dioxide pipelines and other processing or transportation infrastructure make up 6% of total investment. The replacement and refurbishment of existing infrastructure make up the remaining 5% of the Base Case investment expected through 2030.

Obstacles to infrastructure investment can take many forms.

Oil and gas infrastructure development could be delayed or halted by several kinds of action or inaction including:

- Adoption of new policies and procedures that lead to major delays in state and federal permitting of wells and other facilities,
- Imposition of a moratorium on hydraulic fracturing,
- Initiating a new statewide environmental policy review process,
- Escalation of disputes related to the rights of land tenants,
- Acts of civil disobedience and vandalism by environmental activists,
- Failure to resolve regulatory conflicts,
- Imposition of new environmental regulations such as statewide methane reduction rules, and
- Adoption of laws and regulations that further constrain selection of permissible sites for drilling pads/facilities or routes for linear infrastructure.

To illustrate in this report the potential economic impacts of constraints to new infrastructure, ICF chose to create forecast scenarios related specifically to investments in new pipelines and gathering systems. This was done to simplify the analysis as few high profile and well-defined projects could be subtracted to create the Alternative Case. The real-world factors that could lead to the Alternative Case being realized are new or expanded environmental laws and regulations; delays in permitting processes; land rights and land use disputes; and political conflicts and indecision listed above. Other kinds of constraints could also come about affecting upstream activity (e.g., less leasing of new lands for drilling; new laws and regulation affecting drilling, completion and production; delayed drilling permits; a moratorium on hydraulic fracturing). Other scenarios developed from hypothesizing new upstream constraints could have similarly severe energy market and economic results as those shown in this report.

Economic losses would be high if the needed infrastructure were not built.

Investment in oil and gas infrastructure leads to immediate economic activity as labor, equipment and materials are procured during the planning and construction phases. Once the infrastructure enters operation it contributes to economic activity through expenditures on operation and maintenance activities and by providing valuable products and services to the New Mexico and national economies. To the extent that such infrastructure is not built, the expected levels of commodity production will not be realized and the wellhead prices for products will be reduced. Similarly gathering, processing, refining, transportation, distribution and retailing services would be reduced. These reductions in the value of output along the full oil and gas value chain would reduce New Mexico incomes, the number of supported jobs, contributions to state and local tax revenues. These impacts as estimated by comparing this report's Alternative Case to the Base Case is shown in Exhibit 6-1.

Exhibit 6-1: Summary of Economic Impact Measures

Economic Impact Measure	Cumulative Change 2019-2030	Units	Percent Change
Natural Gas Production	-6,614	bcf	-26.7%
Natural Gas Liquids Production	-437	million barrels	-28.9%
Crude Oil Production	-1,020	million barrels	-14.4%
Oil & Gas Related Capital Expenditures	($63)	2017$ billion	-36.3%
Value of Output (oil, gas, NGLs, CO2)	($123)	2017$ billion	-24.3%
Value of Output Full Oil & Gas Value	($134)	2017$ billion	-22.6%
New Mexico Income	($112)	2017$ billion	-23.0%
State and Local Tax Revenues	($12)	2017$ billion	-17.5%
Private Sector Traditional Jobs	-133,730	job-years	-12.1%
Private Sector Nontraditional Jobs	-20,795	job-years	-12.9%

The most important market and economic impacts of the infrastructure constraint modeled as the "Alternative Case" in comparison to the "Base Case" can be summarized as follows:

- Infrastructure investment from 2019 to 2030 in the Alternative Case would be $63 billion lower (-36%) than the Base Case. This reduction come from fewer pipeline and gathering systems project being built (as defined in the Alternative Case) and the knock-on effects that lead to less upstream and other investment.
- Less investment in pipeline and gathering systems would bottleneck production and lead to the adoption of higher-cost alternative transportation modes. This would cause the average 2019-2030 New Mexico Permian wellhead prices in the Alternative Case to be lower by $3.26/bbl. for crude oil, $3.03/bbl. lower for natural gas plant liquids and $0.50/Mcf lower for natural gas.
- Total Alternative Case crude oil production during the 2019-2030 period would be reduced by 1 billion barrels (-14%) compared to the Base Case.
- Total New Mexico natural gas liquids oil production during the 2019-2030 period would be reduced by 440 million barrels (-29%) compared to the Base Case.
- Total New Mexico dry natural gas production during the 2019-2030 period would be reduced by 6.6 trillion cubic feet (-27%) of the Base Case amount.
- The value of crude, NGL and natural gas production would decline by $123 billion or 24% during the 2019-2030 period compared to the Base Case.
- Overall value of output (including crude, NGL, and natural gas production) declines by $134 billion (-23%) during the 2019-2030 period compared to the Base Case.
- Oil and gas-related income earned in New Mexico in the form employee compensation, lease bonus and rent payments, production royalty payments, investment income, severance taxes, property taxes and state income taxes goes down by $112 billion (-23%) compared to the Base Case.
- The direct, indirect, and induced "traditional" private sector jobs supported by the oil and gas industry in New Mexico fall by 133,700 job-years (-12%) through 2030 due to infrastructure constraints.
- "Nontraditional" private sector jobs (independent contractors, temporary workers, etc.) supported by the oil and gas industry in New Mexico decline by 20,800 (-13%) through 2030.

- Because of the lower levels of value added and fewer jobs, the cumulative state and local tax revenue generated by oil and gas activity falls by $12 billion (-18%) over the 2019-2030 period in the Alternative Case as compared to the Base Case.

The high economic value of oil and gas infrastructure highlights the need to strike the right balances.

Policymakers may wish to consider the large potential economic benefit to New Mexico of future oil and gas infrastructure development when considering actions that could affect where, when and how such infrastructure can be developed in the state. The environmental, hedonic, political and other benefits of such actions should be weighed against the direct implementation/ compliance costs of the action and the larger potential economic losses to the state if oil and gas economic activity where to be reduced.

Appendix A: State and Local Government Revenues Attributable to the New Mexico Oil and Gas Industry

A.1 Introduction

This Appendix presents historical data on the amount of revenue going to state and local governments that can be attributed to the oil and gas industry of New Mexico and presents forecasts of those revenues under the two scenarios developed in this report. This Appendix discusses these revenues grouped into five general categories.

(1) "Direct" Upstream State Taxes & Fees

The first and largest category of revenues are those that are levied directly on working interest and royalty interests owners who are engaged in oil and gas production activities (that is, leasing land, drilling exploration wells, developing discoveries, and producing reserves). Exhibit A-1 shows such direct taxes and fees, which include the severance tax; the emergency school tax; conservation tax; ad valorem production taxes[16]; ad valorem equipment taxes; State Land Office rental and bonus income, State Land Office royalty payments; and federal land rental, bonus and royalty income transferred to the state.

Exhibit A-1: New Mexico (Direct) Taxes and Fees on Oil and Gas Production

Revenue Source	Oil	Gas	Revenue Distribution
Oil and Gas Severance Tax	3.75% of value	3.75% of value	Severance Tax Bonding Fund (then Severance Tax Permanent Fund)
Oil and Gas Emergency School Tax	3.15% of value	4.0% of value	General Fund
Oil and Gas Conservation Tax	0.19% of value	0.19% of value	General Fund and Oil and Gas Reclamation Fund
Oil and Gas Ad Valorem Production Tax	Based on property tax in the district of production	Based on property tax in the district of production	Local Governments
Oil and Gas Ad Valorem Equipment Tax	Based on property tax in the district of production	Based on property tax in the district of production	Local Governments
Natural Gas Processors Tax	Approximately 1 cent per MMBtu of wet gas processed		General Fund
State Land Office Rental and Bonus Income	Land leases and bids		Land Maintenance Fund (distributed monthly to 22 beneficiaries including the general fund)
State Land Office Royalty Payments	20% (adjusted based on the location of known production areas and the likelihood of discovering oil and gas)		Land Grant Permanent Fund
Federal Land Rental and Bonus Income	Land leases and bids		~50% to Federal Government
			~50% to New Mexico (General Fund)
			~50% to Federal Government

[16] The ad valorem production and equipment taxes are collected by the state and, so, are included in the table of state taxes and fees. However, all of the production tax and most of the equipment tax goes to local entities.

Federal Land Royalty	12.5% (U.S. federal on shore)	~50% to New Mexico (General Fund)

Source: New Mexico Legislative Finance Committee Brief, "New Mexico Cost Burden on the Oil and Gas Extraction Industry," June 4, 2018 and ICF.

(2) "Indirect" Upstream State Taxes & Fees

In addition to the taxes and fees that can be directly linked to oil and gas production activity, additional state taxes are paid by the oil and gas production industry and related parties. The major kinds of such "indirect" state taxes include:

- The Gross Receipts Tax paid on goods and service purchased in New Mexico,
- The Compensating Tax paid for goods and services purchased outside the state and then brought into the state,
- Personal State Income Tax paid by employees, stockholders and royalty interest holders, and
- Corporate State Income Tax paid by producers and the companies who supply them.

(3) Upstream Local Taxes & Fees

At the local level, in addition to ad valorem production taxes and ad valorem equipment taxes that can be directly linked to the oil and gas production, the oil and gas production industry pays property taxes and the portion of gross receipts taxes levied at the local level.

(4) Midstream and Downstream State & Local Taxes & Fees

For this study, the New Mexico oil and gas industry is defined to include not just oil and gas production, but also gas gathering, oil gathering and trucking, gas processing, petroleum refining, pipeline transportation, rail transportation, petroleum product wholesaling, and petroleum product retailing. These midstream and downstream segments also contribute state and local revenues in the form of Gross Receipts Tax, Compensating Tax, Personal State Income Tax, Corporate State Income Tax, local property taxes, and local gross receipts taxes.

(5) State & Local Taxes & Fees from Induced Economic Activity

The final category of taxes discussed in this report are the taxes associated with "induced economic activity" or as it is sometimes referred to "the multiplier effect." This is the economic impact that comes when the people who earn incomes in the upstream, midstream, and downstream segments of the oil and gas supply chain and in the industries that supply materials, goods and services to the oil and gas industry spend those incomes in New Mexico. This induced economic activity contributes revenues in the form of many kinds of taxes including Gross Receipts Tax, Compensating Tax, Personal State Income Tax, Corporate State Income Tax, local property taxes, and local gross receipt taxes.

A.2 Historical State Production Taxes, Royalties and Sovereign Wealth Funds

Exhibit A-2 shows the historical amounts of money that have been collected by the state annually through the direct oil and gas production taxes and fees. (Note that this table excludes transfers from the federal government, indirect upstream taxes, and royalties from state lands.

Historical data for these items are presented later.) The largest two sources of oil and gas production taxes and fees are the severance tax ($493 million in 2018) and the emergency school tax ($451 million in 2018).

Exhibit A-2: Historical Revenues from Oil and Gas Production Taxes in New Mexico (million nominal dollars)

Tax Source:	O&G Emergency School Tax	O&G Conservation: General Fund	O&G Severance	O&G Ad Valorem Production	Natural Gas Processors	O&G Ad Valorem Production Equipment	O&G Conservation: Reclamation Fund	Total
Disposition:	*General Fund*	*General Fund*	*Dedicated & Permanent Fund*	*Local*	*General Fund*	*Local*	*Dedicated*	
2007	$426.8	$19.0	$426.2	$124.3	$35.6	$26.1	$2.3	$1,060.3
2008	$557.3	$26.1	$567.4	$167.1	$30.6	$25.2	$3.0	$1,376.8
2009	$370.4	$16.9	$378.1	$114.6	$40.3	$28.2	$2.0	$950.6
2010	$324.5	$15.2	$327.6	$106.8	$40.4	$34.8	$2.0	$851.4
2011	$378.7	$18.5	$399.4	$131.1	$18.2	$28.6	$4.5	$978.8
2012	$399.4	$20.2	$428.7	$133.2	$23.3	$23.4	$4.9	$1,033.1
2013	$381.0	$19.8	$416.6	$126.4	$24.2	$26.9	$4.9	$999.8
2014	$507.9	$26.7	$557.2	$168.4	$16.2	$16.9	$6.4	$1,299.8
2015	$376.9	$19.3	$415.6	$128.2	$18.6	$30.1	$4.7	$993.4
2016	$220.8	$9.5	$245.3	$86.0	$20.4	$35.9	$2.6	$620.4
2017	$304.3	$14.5	$334.4	$118.7	$10.3	$22.2	$2.4	$806.9
2018	$450.8	$22.9	$492.6	$172.8	$10.8	$19.5	$2.6	$1,172.0

Source: http://www.tax.newmexico.gov/forms-publications.aspx

The accounting of tax revenue in New Mexico is complicated by the fact that some revenue streams are placed into permanent funds, which invest money in stocks and bonds and pay out income to the state general fund (moneys available for any purpose authorized by the legislature) and to various dedicated purposes. The New Mexico State Investment Council (SIC) manages the investments for New Mexico's permanent funds and investments for 20 New Mexican governmental entities. The state funds are:

- The Land Grant Permanent Fund,
- The Severance Tax Permanent Fund,
- The Tobacco Settlement Permanent Fund, and
- The Water Trust Fund.

Historical data for the Severance Tax Permanent Fund (STPF) is shown in Exhibit A-3.[17] The Severance Tax Permanent Fund was established by a constitutional amendment as a permanent endowment in 1976. It receives and invests a portion of the severance taxes collected on natural resources (oil, natural gas, other liquid hydrocarbons and hard rock minerals) extracted from New Mexico lands. Collected severance taxes are first transferred to

[17] There are often discrepancies among data sources for annual dollar amounts reported as tax receipts and flows into and out of the permanent funds. This may be due to differences in: the specific definitions employed by each data source, reporting years (fiscal versus calendar), whether data are corrected for month received versus month the tax was incurred, and whether and how later data revisions are incorporated.

the Severance Tax Bonding Fund and are deployed first to service debt requirements on senior and supplemental bonds issued under the Severance Tax Bonding Act for capital projects. Amounts in the Bonding Fund in excess of that needed for bond debt services are transferred twice a year to the Severance Tax Permanent Fund. As is shown in Exhibit A-3, there have been several recent years in which little or no new funds have been transferred into the Severance Tax Permanent Fund because the severance taxes where entirely used for debt service. Even so, the Severance Tax Permanent Fund balance has increased in many recent years because earnings on investments exceeded outflowing distributions. The formula for annual outflowing distributions from the Severance Tax Permanent Fund is set at 4.7% of the rolling five calendar year average market value of the fund. All of the Severance Tax Permanent Fund outflowing distributions go to the state general fund.

Exhibit A-3: Historical Severance Taxes and Flow In and Out of New Mexico's Severance Tax Permanent Fund (million nominal dollars)

Year	Severance Tax Collected *(1)*	Spent Immediately (e.g., Bond Payments)	Contributions to Severance Tax Permanent Fund *(2)*	Severance Tax Permanent Fund Balance *(2)*	STPR Income Dist. to Gen. Fund *(1,2)*	STPR Income Dist. to Gen. Fund Attrib. to O&G *(1)*
2007	$423	$399	$24	$4,700	$171	$147
2008	$514	$473	$41	$3,100	$177	$152
2009	$454	$424	$30	$3,500	$191	$164
2010	$332	$329	$3	$3,900	$187	$161
2011	$379	$371	$8	$3,700	$185	$159
2012	$437	$333	$104	$4,000	$183	$158
2013	$399	$394	$5	$4,167	$176	$152
2014	$525	$401	$125	$4,768	$171	$148
2015	$420	$419	$1	$4,730	$183	$158
2016	$299	$292	$8	$4,559	$194	$168
2017	$334	$334	$0	$4,931	$200	$174
2018	$493	$493	$0	$5,281	$210	$182

Sources: (1) New Mexico Tax Institute, "Fiscal Impacts of Oil and Natural Gas Production in New Mexico," January 2018 and other year. For latest edition see: https://cdn.ymaws.com/www.nmtri.org/resource/resmgr/FY18_NMTRI_OGAS_Fiscal_Impac.pdf (2) State of New Mexico Investment Council-Investment Office, "Report of Independent Auditors and Financial Statements with Supplementary Information," June 30, 2018 and earlier editions. Fiscal years are named for the year in which they end (on June 30th). See http://www.sic.state.nm.us/sic-annual-audit-reports.aspx. Also see: http://www.sic.state.nm.us/uploads/FileLinks/5344f5ea807f40d7a58c0498891a649a/NMSIC_60thAnniversaryReport_2018.pdf

The other New Mexico state fund of interest here is the Land Grant Permanent Fund, for which inflows, outflows and fund balance for are shown in Exhibit A-4. The Land Grant Permanent Fund is derived from 13 million acres of land granted by the United States to the Territory of New Mexico under the Ferguson Act of 1898[18] and the Enabling Act of 1910[19]. These state trust

[18] The Ferguson Act of 1898 gave sections 16 and 36 in every New Mexico township (typically consisting of 36 one-square-mile sections in total) to public schools.
[19] The Enabling Act of 1910 facilitated statehood (that occurred in 1912) and specified that sections 2 and 32 of each township would be held in trust for public schools.

lands include nine million surface ownership acres and 13 million mineral rights ownership acres, which are held in perpetual trust for 21 designated beneficiaries. Royalties from oil and gas production on New Mexico state trust lands provide 95% of the inflows to the Land Grant Permanent Fund.[20] Approximately 85 percent of Land Grant Permanent Fund outflowing distributions (counted as general funds) benefit public schools. The other 15 percent of outflowing distributions are dedicated funds going to specialty schools, state universities, public hospitals, water infrastructure, public buildings and prisons. The amount of outflowing distributions is set by a formula and is equal to 5.0% of rolling five calendar year average market value of the Land Grant Permanent Fund.

Exhibit A-4: Historical Oil and Gas Royalties from State Lands and Flows In and Out of New Mexico's Land Grant Permanent Fund (million nominal dollars)

Year	Oil & Gas Royalties (1)	Total Contributions to LGPF *(2)*	LGPF Balance (EOFY = June) *(2)*	*Distributions from LGPF (2)*	Distributions from LGPF to General Fund *(1)*	Distributions from LGPF to General Fund Attributed to Oil & Gas *(1)*
2007	$379	$387	$10,900	$430	$365	$353
2008	$460	$607	$9,400	$475	$391	$378
2009	$281	$287	$8,450	$520	$434	$419
2010	$317	$383	$9,550	$520	$437	$422
2011	$398	$476	$10,100	$530	$446	$431
2012	$499	$509	$10,600	$550	$462	$446
2013	$494	$619	$12,197	$527	$441	$426
2014	$726	$742	$14,345	$535	$449	$435
2015	$654	$669	$14,882	$596	$503	$487
2016	$406	$420	$14,777	$656	$555	$537
2017	$435	$468	$16,492	$638	$542	$524
2018	$679	$690	$17,903	$689	$587	$568

Sources: (1) New Mexico Tax Institute, "Fiscal Impacts of Oil and Natural Gas Production in New Mexico," January 2018 and other year. For latest edition see: https://cdn.ymaws.com/www.nmtri.org/resource/resmgr/FY18_NMTRI_OGAS_Fiscal_Impac.pdf (2) State of New Mexico Investment Council-Investment Office, "Report of Independent Auditors and Financial Statements with Supplementary Information," June 30, 2018 and earlier editions. Fiscal years are named for the year in which they end (on June 30th). See http://www.sic.state.nm.us/sic-annual-audit-reports.aspx. Also see: http://www.sic.state.nm.us/uploads/FileLinks/5344f5ea807f40d7a58c0498891a649a/NMSIC_60thAnniversaryReport_2018.pdf

A.3 State General Funds Attributed to Oil and Gas Production

Many of the taxes and fees levied on oil and gas production together with much of the income from the two oil and gas-related permanent funds enter into New Mexico state general funds. The general fund also includes "indirect" upstream state taxes (category #2), midstream and downstream taxes (the state portion of category #4), and state taxes related to induced effects (the state portion of category #5).

[20] 60 Years Anniversary Report 2018, The New Mexico State Investment Council, *See: http://www.sic.state.nm.us/uploads/FileLinks/5344f5ea807f40d7a58c0498891a649a/NMSIC_60thAnniversaryReport_2018.pdf*

The New Mexico Oil and Gas Association (NMOGA) has partially funded work by the New Mexico Tax Research Institute (NMTRI) to estimate the oil and gas exploration, drilling, and production industry's contributions to state revenues. Data for the direct and indirect impacts on General Revenues are available from NMTI for the years 2006 to 2018[21]. These studies include what we are calling here the category #1 and category #2 state taxes and fees. This report uses the NMTRI data for historical years and as a source of data to estimate future contributions. The relevant NMTRI revenue categories of General Funds to which the oil and gas industry contributes are shown in Exhibit A-5 with data for the 2018 fiscal year (July 1, 2017 to June 30, 2018).

[21] New Mexico Tax Institute, "Fiscal Impacts of Oil and Natural Gas Production in New Mexico," January 2018 and other year. For latest edition see: https://cdn.ymaws.com/www.nmtri.org/resource/resmgr/FY18_NMTRI_OGAS_Fiscal_Impac.pdf

Exhibit A-5: New Mexico General Fund Revenue Attributed to Oil and Gas Production in Fiscal Year 2018 ($million)

Revenue Category	Total from All Sources	Amount Attributed to Oil & Gas Production	Oil & Gas as % of Total
Gross Receipts Tax	$2,381.1	$188.0	7.9%
Compensating Tax	$56.1	$12.5	22.3%
Personal Income Tax	$1,519.0	$96.8	6.4%
Corporate Income Tax	$106.6	$22.8	21.4%
Oil & Gas School Tax	$450.8	$450.8	100.0%
Oil & Gas Conservation Tax	$22.9	$22.4	98.0%
Natural Gas Processors Tax	$10.8	$10.8	100.0%
Land Grant Permanent Fund	$586.6	$567.5	96.7%
Earnings on State Balances	$5.9	$1.9	31.5%
Severance Tax Permanent Fund Income	$210.4	$182.2	86.6%
Federal Mineral Leasing	$564.2	$541.7	96.0%
Land Office Income	$111.8	$79.4	71.0%
Miscellaneous Receipts	$46.9	$0.9	2.0%
Reversions	$79.8	$23.9	30.0%
Total Recurring Revenues	**$6,816.5**	**$2,201.7**	**32.3%**
Total Non-Recurring Revenues	$64.8	$0.0	0.0%
Grand Total Revenue	**$6,881.3**	**$2,201.7**	**32.0%**

Source: New Mexico Tax Institute, "State and Local Revenue Impacts of the Oil and Gas Industry Fiscal Year 2018 Update." These data account of the "upstream" portions of the oil and gas supply chain. With some exceptions, they exclude midstream and downstream segments of the supply chain and induced economic activity.

Gross Receipts Tax: The New Mexico Gross Receipts Tax (GRT) is collected on the gross receipts (total money taken in) of a business or service provider. It is usually passed along to the consumer of their goods and services. Many cities and counties in New Mexico also collect GRT to pay for municipal services, so the GRT rate will vary depending on where the purchase is made in the state. For its calculations, NMTRI assumes that the economic burden of the tax is fully borne by the buyer. Therefore, the purchases of goods and service by the four relevant NAICS code industries[22] times the relevant rates (these rates vary by jurisdiction but are roughly 5.125% for the state portion and 1.0% or more for the local portion) is counted as Gross Receipts Tax by oil and gas production.

Compensating Tax: A tax of 5.125% on goods that are bought outside of New Mexico for use in the state. It "compensates" for the fact that such purchases are not subject to the GRT. About

[22] The earlier GRT estimates included four North American Industrial Classification System industries: Oil and Gas Extraction 211110, Drilling Oil and Gas Wells 213111, Support Activities for Oil and Gas Operation 213112, and Support Activities for Oil and Gas Extraction 213118. Estimate for 2017 and 2018 added in NAICS code related to pipeline construction and operation.

73% of the compensating tax goes into the state general fund and 23% is distributed to local governments.

Personal Income Tax: Taxes paid on a New Mexico resident's personal income. This includes employees, stockholders and royalty interest holders in the oil and gas extraction industry and its related support industries. NMTRI estimates that the oil and gas production accounted for $96.8 million or 6.4% of all state personal income tax collected in 2018.

Corporate Income Tax: Taxes paid on company profits for operations in New Mexico in the oil and gas extraction industry and its related support industries. NMTRI estimates that such companies paid corporate income tax of $22.8 million in 2018, which was 21.4% of all corporate income tax paid to New Mexico in that year.

Oil & Gas School Tax: The emergency oil and gas school tax generated $450.8 million in revenue in 2018, all of which is considered oil and gas related. The tax is levied as a percent of value adjusted for allowable transportation and processing costs.

Oil Conservation: The Oil & Gas Conservation Tax totaled $22.9 million in 2018, almost all of which was attributable to oil and gas production and a small portion is attributed to coal. The tax rate is now 0.19% of net value. As can be seen in Exhibit A-2, a portion of the conservation tax is distributed to the dedicated oil conservation fund while the majority of proceeds go into the state general fund.

Natural Gas Processors: This tax is applied on a cents-per-MMBtu basis to wet gas processed through gas processing plants. It generated $10.8 million in 2018, all of which is considered oil and gas related.

Land Grant Permanent Fund Income: As was explained earlier, all the royalties paid on oil and gas and other mineral production from New Mexico state lands since 1924 have been deposited in the LGPF, which generates interest income that is booked as general fund revenue. In 2018, LGPF income was $586.6 million or which 96.7% or $567.5 million was attributed by NMTRI as originating from oil, gas, natural gas liquids and CO_2 royalties (including compound interest earned on those royalties).

Earnings on State Balances: NMTRI attributes the oil and gas production industry's share of the earnings on state balances based on the portion of the prior year's general fund that the oil and gas production industry contributed. These can be either negative or positive amounts.

Severance Tax Perm. Fund Income: In 2018, STPF income was $210.4 million or which 86.6% or $182.2 million was attributed by NMTRI as originating from oil, gas, natural gas liquids and CO_2 severance taxes.

Federal Mineral Leasing: The Bureau of Land Management (BLM) administers federal onshore lands and its sister agency the Office of Natural Resource Revenues (ONRR) receives revenues from those lands in the forms of lease bonuses, rents, production royalties, grazing fees, etc. Oil and gas royalties are approximately 1/8 of the oil and gas value, as adjusted for allowable transportation and processing costs. The ONRR transfers to New Mexico a little less than one-half of the revenues earned from federal lands in the state. In 2018, New Mexico received $564.2 million dollars from the federal government as its shares on mineral royalties, bonus payments and rents and other fees from federal lands. Of this amount, 96.0% or $541.7 million was attributed by NMTRI as originating from oil, gas, natural gas liquids and CO_2

exploration and production activity. (The remainder comes from mostly from coal and non-fuel minerals.)

Land Office Income: The State Land Office (SLO) manages land granted to the State at statehood in 1912. As was discussed above, since 1924, all the royalties paid on oil and gas and other mineral production from New Mexico state lands have been deposited in the LGPF, which generates interest income that is booked as general fund revenue. Separately, the SLO has a land maintenance fund that receives revenues from oil and gas bonus fees, grazing fees, and other sources. Land maintenance fund moneys in excess of the SLO operations budget are distributed to schools and other institutions and are counted as part of general fund revenue. In 2018, Land Office Income was $111.8 million of which 71% or $79.4 million was attributed by NMTRI as coming from oil and gas production activity.

Recurring Reversions: The oil and gas production industry's portion of recurring reversions is estimated using the average of the previous two years of its contribution percentage.

A.4 Local Revenue

Eleven counties in New Mexico impose "ad valorem production" and "ad valorem production equipment" taxes in lieu of property taxes on some mineral extraction properties.

The **Oil and Gas Ad Valorem Production Tax** is levied monthly on all interest owners (that is, working and royalty interests). Although it is conceptually a tax on reserves, it is computed using the value of oil or natural gas produced within a specific time period after deducting: (1) royalties paid to the U.S. government, the State of New Mexico, and/or Indian tribes; and (2) allowable transportation and processing expenses. The tax is collected by the State and distributed monthly to county treasurers and school districts. The tax rate varies among counties and among school districts and averages about 1.25% of wellhead value after deductions.

The **Ad Valorem Production Equipment Tax** is levied annually against the operator of the property. The taxable value of the equipment is computed as the annual value of products during the previous calendar year multiplied by 27 percent. For this calculation, there is no deduction for royalties paid to the State or Federal governments but deductions for allowable transportation and processing expenses can be made. The effective tax rate is about 0.30% of wellhead value after deductions. Revenues are distributed for various state, county, municipal, school district and higher education purposes.

In addition to these ad valorem production taxes and ad valorem equipment taxes, the oil and gas production industry pays local property taxes on aboveground property and the gross receipts taxes levied at the local level.

A.5 Projected Tax Revenues for the Base Case

Historical tax revenues from 2013 to 2018 and projected tax revenues to 2030 are shown in nominal dollars in Exhibit A-6 to Exhibit A-8. The first table shows revenues from the direct state oil and gas taxes and fees. The second table shows the accounting for the two oil and gas-related permanent funds including the distribution outflows to the state general fund. The third shows state general account revenues and estimate local tax revenues. These same data are shown again in Exhibit A-9, Exhibit A-10, and Exhibit A-12, but in real 2017 dollars. Much of the

historical general revenue data for these tables comes from the NMTRI data discussed earlier. However, note that these tables include ICF estimates for general fund amounts that are not included in the NMTRI estimates such as midstream and downstream taxes (what we have called category #4) and the state taxes related to induced effects (category #5). The tables also include local taxes & fees (category #3) that are only partially included in the NMTRI reports.

The ICF projections are based on applying the historically observed tax rates and ratios into the future. In other words, no changes to tax laws or regulations are assumed to occur. The tax calculations are mostly a function of three factors:

(1) Wellhead values of crude oil, dry natural gas, natural gas plant liquids and CO2 (applies to severance taxes, school taxes, royalties, ad valorem taxes, etc.),
(2) Levels of drilling activity or expenditures (applies to GRT, compensating taxes, etc.), or
(3) Value added occurring in the state (applies to all the taxes related to midstream, downstream and induced activity).

The accounting for future permanent fund balances and outflowing distributions is made assuming that returns on investment are 5.86% per annum for the STPF and 5.39% for the LGPF. These are the unweighted historical averages over the last eleven years. The accounting for the STPF assuming that the amount of severance tax that is applied first toward making bond payments grows at 3% per year and then the remaining amounts, if any, are added to STPF.

Exhibit A-6: Base Case Tax Revenues in Nominal Dollars (nominal$ million) (part 1 of 3)

Base Case in Nominal Million Dollars per Fiscal Year *<< historical forecast >>*

	Revenue Category	Disposition	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Oil & Gas Taxes	O&G Emergency School Tax	State General Funds	$381	$508	$377	$221	$304	$451	$544	$579	$679	$832	$999	$1,160	$1,327	$1,511	$1,697	$1,868	$2,029	$2,182
	O&G Conservation: General Fund	State General Funds	$20	$27	$19	$9	$15	$23	$26	$28	$33	$40	$48	$56	$64	$73	$82	$90	$98	$106
	O&G Severance Tax	Bond Payments & Contrib. to STPF	$417	$557	$416	$245	$334	$493	$598	$637	$747	$916	$1,100	$1,277	$1,461	$1,663	$1,868	$2,057	$2,233	$2,402
	O&G Ad Valorem Production	Local Revenues	$126	$168	$128	$86	$119	$173	$204	$217	$255	$312	$375	$436	$498	$567	$637	$702	$762	$820
	Natural Gas Processors Tax	State General Funds	$24	$16	$19	$20	$10	$11	$18	$19	$21	$23	$24	$25	$26	$27	$28	$29	$29	$30
	O&G Ad Valorem Production Equipment	Local Revenues	$27	$17	$30	$36	$22	$20	$32	$40	$43	$50	$61	$74	$85	$98	$111	$125	$138	$149
	O&G Conservation: Reclamation Fund	State Dedicated	$5	$6	$5	$3	$2	$3	$5	$5	$6	$8	$9	$11	$12	$14	$16	$17	$19	$20
	Sum of Production Taxes		**$1,000**	**$1,300**	**$993**	**$620**	**$807**	**$1,172**	**$1,427**	**$1,526**	**$1,783**	**$2,180**	**$2,618**	**$3,038**	**$3,475**	**$3,953**	**$4,440**	**$4,888**	**$5,308**	**$5,709**
St. Ld.	Royalties from State Lands	Contribution to LGPF	**$494**	**$726**	**$654**	**$406**	**$435**	**$679**	**$873**	**$931**	**$1,095**	**$1,348**	**$1,626**	**$1,894**	**$2,171**	**$2,471**	**$2,779**	**$3,065**	**$3,330**	**$3,582**

Base Case in Nominal Million Dollars per Fiscal Year

			Average				Total			
	Revenue Category	Disposition	2013-18	2019-25	2026-30	2019-30	2013-18	2019-25	2026-30	2019-30
Oil & Gas Taxes	O&G Emergency School Tax	State General Funds	$374	$874	$1,857	$1,284	$2,242	$6,119	$9,287	$15,406
	O&G Conservation: General Fund	State General Funds	$19	$42	$90	$62	$113	$296	$449	$745
	O&G Severance Tax	Bond Payments & Contrib. to STPF	$410	$962	$2,045	$1,413	$2,462	$6,736	$10,223	$16,959
	O&G Ad Valorem Production	Local Revenues	$133	$328	$698	$482	$800	$2,298	$3,488	$5,786
	Natural Gas Processors Tax	State General Funds	$17	$22	$29	$25	$100	$156	$143	$298
	O&G Ad Valorem Production Equipment	Local Revenues	$25	$55	$124	$84	$152	$385	$621	$1,006
	O&G Conservation: Reclamation Fund	State Dedicated	$4	$8	$17	$12	$24	$57	$87	$144
	Sum of Production Taxes		**$982**	**$2,292**	**$4,860**	**$3,362**	**$5,892**	**$16,047**	**$24,298**	**$40,345**
St. Ld. Roy.	Royalties from State Lands	Contribution to LGPF	**$566**	**$1,420**	**$3,046**	**$2,097**	**$3,395**	**$9,938**	**$15,228**	**$25,166**

Exhibit A-7: Base Case Tax Revenues in Nominal Dollars (nominal$ million) (part 2 of 3)

Base Case in Nominal Million Dollars per Fiscal Year *<< historical forecast >>*

	Severance Tax Permanent Fund: Flows and Balances	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Severance Tax Permanent Fund	Severance Tax Collected	$399	$525	$420	$299	$334	$493	$598	$637	$747	$916	$1,100	$1,277	$1,461	$1,663	$1,868	$2,057	$2,233	$2,402
	Spent Immediately (e.g., Bond Payments)	$394	$401	$419	$292	$334	$493	$507	$523	$538	$554	$571	$588	$606	$624	$643	$662	$682	$702
	Contributions to Severance Tax Permanent F	$5	$125	$1	$8	$0	$0	$91	$115	$209	$361	$529	$689	$855	$1,039	$1,225	$1,395	$1,551	$1,700
	Severance Tax Permanent Fund Balance	$4,167	$4,768	$4,730	$4,559	$4,931	$5,281	$5,453	$5,652	$5,949	$6,403	$7,037	$7,851	$8,857	$10,076	$11,513	$13,157	$14,995	$17,023
	STPR Income Dist. to Gen. Fund	$176	$171	$183	$194	$200	$210	$228	$235	$243	$256	$270	$287	$309	$339	$378	$426	$484	$551
	STPR Income Dist. to Gen. Fund Attrib. to O&	$152	$148	$158	$168	$174	$182	$198	$203	$211	$222	$234	$248	$268	$294	$327	$369	$419	$477
	Gain in Value of STPF's Investments	*$338*	*$647*	*$144*	*$15*	*$572*	*$560*	*$309*	*$320*	*$331*	*$349*	*$375*	*$412*	*$460*	*$519*	*$590*	*$675*	*$771*	*$879*
	Gain as % of BOFY Balance	*8.45%*	*15.53%*	*3.02%*	*0.31%*	*12.55%*	*11.36%*	*5.86%*	*5.86%*	*5.86%*	*5.86%*	*5.86%*	*5.86%*	*5.86%*	*5.86%*	*5.86%*	*5.86%*	*5.86%*	*5.86%*
	Dist. to Gen. Fund as % of BOFY Balance	*4.23%*	*3.58%*	*3.86%*	*4.24%*	*4.06%*	*3.98%*	*4.32%*	*4.30%*	*4.30%*	*4.31%*	*4.22%*	*4.07%*	*3.94%*	*3.83%*	*3.75%*	*3.70%*	*3.68%*	*3.67%*
	5YRA STPF Balance	*$3,640*	*$3,853*	*$4,107*	*$4,273*	*$4,445*	*$4,631*	*$4,854*	*$4,991*	*$5,175*	*$5,453*	*$5,748*	*$6,099*	*$6,578*	*$7,219*	*$8,045*	*$9,067*	*$10,291*	*$11,720*
	Dist. To Gen. Fund as % of 5YRA Bal.	*4.84%*	*4.42%*	*4.45%*	*4.53%*	*4.51%*	*4.54%*	*4.70%*	*4.70%*	*4.70%*	*4.70%*	*4.70%*	*4.70%*	*4.70%*	*4.70%*	*4.70%*	*4.70%*	*4.70%*	*4.70%*

	Land Grant Permanent Fund: Flows and Balances	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Land Grant Permanent Fund	Oil & Gas Royalties	$494	$726	$654	$406	$435	$679	$873	$931	$1,095	$1,348	$1,626	$1,894	$2,171	$2,471	$2,779	$3,065	$3,330	$3,582
	Total Contributions to LGPF (includes non-O&G royalties and rental and bonus income)	$619	$742	$669	$420	$468	$690	$901	$961	$1,130	$1,391	$1,678	$1,955	$2,240	$2,550	$2,868	$3,163	$3,437	$3,697
	LGPF Balance (EOFY = June)	$12,197	$14,345	$14,882	$14,777	$16,492	$17,903	$18,984	$20,138	$21,471	$23,069	$24,975	$27,189	$29,727	$32,615	$35,865	$39,458	$43,373	$47,598
	Distributions from LGPF	$527	$535	$596	$656	$638	$689	$784	$830	$883	$950	$1,016	$1,086	$1,168	$1,264	$1,376	$1,504	$1,649	$1,810
	Distr. from LGPF to General Fund	$441	$449	$503	$555	$542	$587	$666	$706	$750	$807	$863	$923	$993	$1,075	$1,169	$1,278	$1,401	$1,539
	Distr. from LGPF to Gen. Fund Attributed to O	$426	$435	$487	$537	$524	$568	$646	$684	$727	$782	$837	$895	$962	$1,041	$1,133	$1,239	$1,358	$1,491
	Gain in Value of LGPF's Investments	$1,505	$1,941	$463	$131	$1,885	$1,410	$965	$1,023	$1,085	$1,157	$1,243	$1,346	$1,466	$1,602	$1,758	$1,933	$2,127	$2,338
	Gain as % of BOFY LGPF Balance	*14.20%*	*15.92%*	*3.23%*	*0.88%*	*12.75%*	*8.55%*	*5.39%*	*5.39%*	*5.39%*	*5.39%*	*5.39%*	*5.39%*	*5.39%*	*5.39%*	*5.39%*	*5.39%*	*5.39%*	*5.39%*
	5-Year Average LGPF Balance	$9,620	$10,179	$11,359	$12,425	$13,360	$14,539	$15,680	$16,608	$17,659	$18,998	$20,313	$21,727	$23,368	$25,286	$27,515	$30,074	$32,971	$36,208
	Distribution to Gen. Fund as % of 5YRA Bal.	*5.48%*	*5.26%*	*5.25%*	*5.28%*	*4.78%*	*4.74%*	*5.00%*	*5.00%*	*5.00%*	*5.00%*	*5.00%*	*5.00%*	*5.00%*	*5.00%*	*5.00%*	*5.00%*	*5.00%*	*5.00%*

Base Case in Nominal Million Dollars per Fiscal Year		Average				Total			
	Severance Tax Permanent Fund: Flows and Balances	**2013-18**	**2019-25**	**2026-30**	**2019-30**	**2013-18**	**2019-25**	**2026-30**	**2019-30**
Severance Tax Permanent Fund	Severance Tax Collected	$412	$962	$2,045	$1,413	$2,471	$6,736	$10,223	$16,959
	Spent Immediately (e.g., Bond Payments)	$389	$555	$663	$600	$2,332	$3,888	$3,313	$7,201
	Contributions to Severance Tax Permanent Fund	$23	$407	$1,382	$813	$138	$2,848	$6,910	$9,758
	Severance Tax Permanent Fund Balance	$4,739	$6,743	$13,353	$9,497				
	STPR Income Dist. to Gen. Fund	$189	$261	$436	$334	$1,134	$1,828	$2,178	$4,006
	STPR Income Dist. to Gen. Fund Attrib. to O&G	$164	$226	$377	$289	$982	$1,583	$1,886	$3,469
	Gain in Value of STPF's Investments	*$379*	*$365*	*$687*	*$499*	*$2,276*	*$2,556*	*$3,434*	*$5,990*
	Gain as % of BOFY Balance	*8.54%*	*5.86%*	*5.86%*	*5.86%*				
	Dist. to Gen. Fund as % of BOFY Balance	*3.99%*	*4.21%*	*3.73%*	*4.01%*				
	5YRA STPF Balance	*$4,158*	*$5,557*	*$9,268*	*$7,103*				
	Dist. To Gen. Fund as % of 5YRA Bal.	*4.55%*	*4.70%*	*4.70%*	*4.70%*				
Land Grant Permanent Fund	**Land Grant Permanent Fund: Flows and Balances**	**2013-18**	**2019-25**	**2026-30**	**2019-30**	**2013-18**	**2019-25**	**2026-30**	**2019-30**
	Oil & Gas Royalties	$566	$1,420	$3,046	$2,097	$3,395	$9,938	$15,228	$25,166
	Total Contributions to LGPF (includes non-O&G royalties and rental and bonus income)	$601	$1,465	$3,143	$2,164	$3,609	$10,256	$15,716	$25,971
	LGPF Balance (EOFY = June)	$15,099	$23,650	$39,782	$30,372				
	Distributions from LGPF	$607	$960	$1,521	$1,193	$3,641	$6,718	$7,603	$14,320
	Distr. from LGPF to General Fund	$513	$816	$1,292	$1,014	$3,076	$5,710	$6,462	$12,172
	Distr. from LGPF to Gen. Fund Attributed to O&G	$496	$790	$1,252	$983	$2,976	$5,533	$6,262	$11,795
	Gain in Value of LGPF's Investments	*$1,222*	*$1,184*	*$1,952*	*$1,504*	*$7,335*	*$8,286*	*$9,758*	*$18,044*
	Gain as % of BOFY LGPF Balance	*9.25%*	*5.39%*	*5.39%*	*5.39%*				
	5-Year Average LGPF Balance	*$11,914*	*$19,193*	*$30,411*	*$23,867*				
	Distribution to Gen. Fund as % of 5YRA Bal.	*5.13%*	*5.00%*	*5.00%*	*5.00%*				

Exhibit A-8: Base Case Tax Revenues in Nominal Dollars (nominal$ million) (part 3 of 3)

Base Case in Nominal Million Dollars per Fiscal Year *<< historical forecast >>*

	General Fund Revenue Attributed to O&G Production	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
State General Fund Revenues from O&G Production	Gross Receipts	$129	$154	$177	$104	$104	$188	$195	$208	$244	$299	$359	$417	$477	$543	$610	$671	$729	$784
	Compensating	$16	$14	$17	$19	$11	$13	$31	$34	$34	$35	$35	$35	$35	$36	$36	$36	$36	$36
	Personal Income Tax	$124	$143	$129	$108	$94	$97	$160	$173	$175	$177	$179	$181	$182	$184	$186	$188	$190	$192
	Corporate Income Tax	$54	$42	$36	$17	$10	$23	$21	$21	$24	$27	$31	$35	$39	$43	$48	$52	$56	$59
	Oil & Gas School Tax	$380	$501	$375	$237	$304	$451	$544	$579	$679	$832	$999	$1,160	$1,327	$1,511	$1,697	$1,868	$2,029	$2,182
	Oil Conservation	$20	$26	$19	$11	$17	$22	$26	$28	$33	$40	$48	$56	$64	$73	$82	$90	$98	$106
	Natural Gas Processors	$24	$16	$18	$20	$10	$11	$18	$19	$21	$23	$24	$25	$26	$27	$28	$29	$29	$30
	Land Grant Perm. Fund Income	$426	$435	$487	$537	$524	$568	$646	$684	$727	$782	$837	$895	$962	$1,041	$1,133	$1,239	$1,358	$1,491
	Earnings on State Balances	$2	$3	$3	$3	-$1	$2	$1	$1	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2
	Severance Tax Perm. Fund Income	$152	$148	$158	$168	$174	$182	$198	$203	$211	$222	$234	$248	$268	$294	$327	$369	$419	$477
	Federal Mineral Leasing	$406	$541	$508	$363	$418	$542	$552	$578	$642	$739	$845	$947	$1,052	$1,168	$1,285	$1,394	$1,496	$1,594
	Land Office Income	$48	$33	$27	$26	$49	$79	$76	$81	$95	$117	$140	$163	$186	$212	$238	$262	$284	$306
	Recurring Reversions	$21	$32	$19	$18	$24	$25	$23	$23	$24	$24	$25	$25	$26	$26	$27	$28	$28	$29
	Total General Funds Attributed to Upstream	**$1,802**	**$2,087**	**$1,973**	**$1,635**	**$1,737**	**$2,202**	**$2,490**	**$2,632**	**$2,910**	**$3,318**	**$3,758**	**$4,188**	**$4,647**	**$5,160**	**$5,699**	**$6,228**	**$6,754**	**$7,288**
General Funds	**Gen. Funds Attrib. to Mid- & Downstream**	$105	$109	$115	$110	$118	$130	$135	$143	$155	$169	$181	$192	$203	$213	$223	$232	$241	$249
	General Funds Attributed to Induced Activities	$186	$207	$134	$122	$160	$243	$246	$262	$303	$366	$433	$497	$563	$636	$710	$777	$841	$901
	All General Funds Attrib. to O&G	**$2,092**	**$2,402**	**$2,222**	**$1,867**	**$2,014**	**$2,575**	**$2,870**	**$3,038**	**$3,368**	**$3,852**	**$4,372**	**$4,878**	**$5,414**	**$6,009**	**$6,632**	**$7,237**	**$7,835**	**$8,438**
Local Rev. from O&G Prod.	**Local Revenues Attributed to O&G Production**																		
	Ad Valorem Production	$126	$168	$128	$86	$119	$173	$204	$217	$255	$312	$375	$436	$498	$567	$637	$702	$762	$820
	Ad Valorem Production Equipment	$27	$17	$30	$36	$22	$20	$32	$40	$43	$50	$61	$74	$85	$98	$111	$125	$138	$149
	Local Gross Receipts Tax	$29	$35	$40	$23	$25	$41	$44	$47	$55	$68	$81	$94	$108	$123	$138	$152	$165	$177
	Total Local Revenues Attributed to O&G Prod.	**$182**	**$220**	**$198**	**$145**	**$166**	**$233**	**$280**	**$304**	**$353**	**$430**	**$518**	**$604**	**$692**	**$788**	**$887**	**$979**	**$1,064**	**$1,146**
Local Revenue	**Local Rev. Attrib. to Mid- & Downstream**	$88	$91	$97	$92	$99	$109	$113	$120	$130	$141	$152	$161	$170	$179	$187	$195	$202	$209
	Local Rev. Attributed to Induced Activities	$155	$173	$112	$102	$134	$204	$206	$220	$254	$306	$363	$416	$472	$533	$595	$651	$704	$755
	Local Rev. Attrib. to O&G	**$426**	**$485**	**$407**	**$340**	**$398**	**$546**	**$599**	**$644**	**$736**	**$877**	**$1,032**	**$1,181**	**$1,334**	**$1,499**	**$1,668**	**$1,825**	**$1,971**	**$2,110**
All State Gen. Fund + Local Revenue Attributed to O&G		**$2,518**	**$2,887**	**$2,629**	**$2,206**	**$2,413**	**$3,121**	**$3,470**	**$3,682**	**$4,104**	**$4,730**	**$5,404**	**$6,059**	**$6,747**	**$7,509**	**$8,300**	**$9,062**	**$9,806**	**$10,548**

Base Case in Nominal Million Dollars per Fiscal Year		Average				Total			
		2013-18	2019-25	2026-30	2019-30	2013-18	2019-25	2026-30	2019-30
State General Fund Revenues from O&G Production	**General Fund Revenue Attributed to O&G Production**								
	Gross Receipts	$143	$314	$667	$461	$855	$2,198	$3,336	$5,534
	Compensating	$15	$34	$36	$35	$89	$239	$180	$419
	Personal Income Tax	$116	$175	$188	$181	$695	$1,225	$942	$2,167
	Corporate Income Tax	$30	$28	$52	$38	$181	$199	$258	$457
	Oil & Gas School Tax	$375	$874	$1,857	$1,284	$2,248	$6,119	$9,287	$15,406
	Oil Conservation	$19	$42	$90	$62	$115	$296	$449	$745
	Natural Gas Processors	$17	$22	$29	$25	$100	$156	$143	$298
	Land Grant Perm. Fund Income	$496	$790	$1,252	$983	$2,976	$5,533	$6,262	$11,795
	Earnings on State Balances	$2	$2	$2	$2	$13	$11	$9	$20
	Severance Tax Perm. Fund Income	$164	$226	$377	$289	$982	$1,583	$1,886	$3,469
	Federal Mineral Leasing	$463	$765	$1,387	$1,024	$2,778	$5,355	$6,937	$12,292
	Land Office Income	$44	$123	$260	$180	$262	$858	$1,302	$2,160
	Recurring Reversions	$23	$24	$28	$26	$139	$170	$138	$308
	Total General Funds Attributed to Upstream	**$1,906**	**$3,420**	**$6,226**	**$4,589**	**$11,434**	**$23,943**	**$31,128**	**$55,071**
General Funds	**Gen. Funds Attrib. to Mid- & Downstream**	$115	$168	$232	$195	$687	$1,178	$1,159	$2,337
	General Funds Attributed to Induced Activities	$175	$382	$773	$545	$1,051	$2,671	$3,865	$6,535
	All General Funds Attrib. to O&G	**$2,195**	**$3,970**	**$7,230**	**$5,329**	**$13,172**	**$27,791**	**$36,152**	**$63,943**
Local Rev. from O&G Prod.	**Local Revenues Attributed to O&G Production**								
	Ad Valorem Production	$133	$328	$698	$482	$800	$2,298	$3,488	$5,786
	Ad Valorem Production Equipment	$25	$55	$124	$84	$152	$385	$621	$1,006
	Local Gross Receipts Tax	$32	$71	$151	$104	$193	$497	$755	$1,252
	Total Local Revenues Attributed to O&G Prod.	$191	$454	$973	$670	$1,145	$3,180	$4,864	$8,044
Local Revenue	**Local Rev. Attrib. to Mid- & Downstream**	$96	$141	$194	$163	$576	$987	$971	$1,958
	Local Rev. Attributed to Induced Activities	$147	$320	$648	$456	$880	$2,238	$3,238	$5,476
	Local Rev. Attrib. to O&G	**$434**	**$915**	**$1,815**	**$1,290**	**$2,602**	**$6,405**	**$9,073**	**$15,478**
All State Gen. Fund + Local Revenue Attributed to O&G		**$2,629**	**$4,885**	**$9,045**	**$6,618**	**$15,773**	**$34,196**	**$45,225**	**$79,421**

Exhibit A-9: Base Case Tax Revenues in Real Dollars (2017$ million) (part 1 of 3)

Base Case in Real Million 2017 Dollars per Fiscal Year *<< historical forecast >>*

	Revenue Category	Disposition	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Oil & Gas Taxes	O&G Emergency School Tax	State General Funds	$404	$529	$388	$225	$304	$442	$522	$544	$625	$750	$882	$1,003	$1,124	$1,253	$1,379	$1,487	$1,581	$1,666
	O&G Conservation: General Fund	State General Funds	$21	$28	$20	$10	$15	$22	$25	$26	$30	$36	$43	$49	$54	$61	$67	$72	$76	$81
	O&G Severance Tax	Bond Payments & Contrib. to STPF	$442	$580	$428	$250	$334	$482	$574	$599	$687	$825	$971	$1,104	$1,237	$1,379	$1,518	$1,636	$1,740	$1,833
	O&G Ad Valorem Production	Local Revenues	$134	$175	$132	$88	$119	$169	$196	$204	$235	$282	$331	$377	$422	$471	$518	$558	$594	$625
	Natural Gas Processors Tax	State General Funds	$26	$17	$19	$21	$10	$11	$17	$18	$19	$20	$21	$22	$22	$23	$23	$23	$23	$23
	O&G Ad Valorem Production Equipment	Local Revenues	$29	$18	$31	$37	$22	$19	$31	$38	$39	$45	$54	$64	$72	$81	$90	$99	$107	$114
	O&G Conservation: Reclamation Fund	State Dedicated	$5	$7	$5	$3	$2	$3	$5	$5	$6	$7	$8	$9	$11	$12	$13	$14	$15	$16
	Sum of Production Taxes		**$1,061**	**$1,353**	**$1,023**	**$632**	**$807**	**$1,148**	**$1,369**	**$1,433**	**$1,641**	**$1,965**	**$2,311**	**$2,627**	**$2,942**	**$3,279**	**$3,607**	**$3,889**	**$4,136**	**$4,357**
St. Ld. Roy.	Royalties from State Lands	Contribution to LGPF	**$524**	**$756**	**$673**	**$414**	**$435**	**$665**	**$837**	**$875**	**$1,007**	**$1,215**	**$1,435**	**$1,638**	**$1,838**	**$2,050**	**$2,258**	**$2,439**	**$2,595**	**$2,734**

Base Case in Real Million 2017 Dollars per Fiscal Year			Average Real Dollars				Total Real Dollars			
	Revenue Category	Disposition	2013-18	2019-25	2026-30	2019-30	2013-18	2019-25	2026-30	2019-30
Oil & Gas Taxes	O&G Emergency School Tax	State General Funds	$382	$778	$1,473	$1,068	$2,292	$5,448	$7,365	$12,813
	O&G Conservation: General Fund	State General Funds	$19	$38	$71	$52	$115	$264	$356	$620
	O&G Severance Tax	Bond Payments & Contrib. to STPF	$420	$857	$1,621	$1,175	$2,517	$5,998	$8,107	$14,105
	O&G Ad Valorem Production	Local Revenues	$136	$292	$553	$401	$817	$2,046	$2,766	$4,812
	Natural Gas Processors Tax	State General Funds	$17	$20	$23	$21	$103	$140	$113	$253
	O&G Ad Valorem Production Equipment	Local Revenues	$26	$49	$98	$70	$155	$343	$492	$835
	O&G Conservation: Reclamation Fund	State Dedicated	$4	$7	$14	$10	$24	$51	$69	$120
	Sum of Production Taxes		**$1,004**	**$2,041**	**$3,854**	**$2,796**	**$6,024**	**$14,289**	**$19,268**	**$33,557**
St. Ld. Roy.	Royalties from State Lands	Contribution to LGPF	**$578**	**$1,264**	**$2,415**	**$1,743**	**$3,468**	**$8,846**	**$12,076**	**$20,922**

Exhibit A-10: Base Case Tax Revenues in Real Dollars (2017$ million) (part 2 of 3)

Base Case in Real Million 2017 Dollars per Fiscal Year *<< historical forecast >>*

	Severance Tax Permanent Fund: Flows and Balances	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Severance Tax Permanent Fund	Severance Tax Collected	$424	$547	$433	$305	$334	$482	$574	$599	$687	$825	$971	$1,104	$1,237	$1,379	$1,518	$1,636	$1,740	$1,833
	Spent Immediately (e.g., Bond Payments)	$418	$417	$432	$297	$334	$482	$487	$491	$495	$500	$504	$509	$513	$518	$522	$527	$531	$536
	Contributions to Severance Tax Permanent F	$6	$130	$1	$8	$0	$0	$87	$108	$192	$325	$467	$596	$724	$862	$995	$1,110	$1,209	$1,297
	Severance Tax Permanent Fund Balance	$4,421	$4,965	$4,873	$4,646	$4,931	$5,172	$5,231	$5,311	$5,475	$5,771	$6,212	$6,788	$7,500	$8,357	$9,353	$10,468	$11,685	$12,993
	STPR Income Dist. to Gen. Fund	$187	$178	$188	$197	$200	$206	$219	$220	$224	$231	$238	$248	$262	$281	$307	$339	$377	$420
	STPR Income Dist. to Gen. Fund Attrib. to O&	$161	$154	$163	$172	$174	$178	$190	$191	$194	$200	$207	$215	$227	$244	$266	$294	$326	$364

	Land Grant Permanent Fund: Flows and Balances	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Land Grant Permanent Fund	Oil & Gas Royalties	$524	$756	$673	$414	$435	$665	$837	$875	$1,007	$1,215	$1,435	$1,638	$1,838	$2,050	$2,258	$2,439	$2,595	$2,734
	Total Contributions to LGPF (includes non-	$656	$772	$690	$428	$468	$676	$864	$903	$1,040	$1,254	$1,481	$1,690	$1,897	$2,115	$2,330	$2,517	$2,678	$2,822
	LGPF Balance (EOFY = June)	$12,940	$14,936	$15,331	$15,057	$16,492	$17,534	$18,212	$18,921	$19,758	$20,792	$22,047	$23,508	$25,173	$27,051	$29,135	$31,395	$33,800	$36,329
	Distributions from LGPF	$559	$557	$614	$668	$638	$675	$752	$780	$813	$856	$897	$939	$989	$1,049	$1,118	$1,196	$1,285	$1,382
	Distr. from LGPF to General Fund	$468	$468	$518	$566	$542	$575	$639	$663	$691	$728	$762	$798	$841	$891	$950	$1,017	$1,092	$1,175
	Distr. from LGPF to Gen. Fund Attributed to O	$452	$453	$501	$547	$524	$556	$619	$643	$669	$705	$738	$774	$815	$864	$920	$985	$1,058	$1,138

Base Case in Real Million 2017 Dollars per Fiscal Year

		Average Real Dollars				Total Real Dollars			
	Severance Tax Permanent Fund: Flows and Balances	2013-18	2019-25	2026-30	2019-30	2013-18	2019-25	2026-30	2019-30
Severance Tax Permanent Fund	Severance Tax Collected	$421	$857	$1,621	$1,175	$2,525	$5,998	$8,107	$14,105
	Spent Immediately (e.g., Bond Payments)	$397	$500	$527	$511	$2,381	$3,499	$2,634	$6,132
	Contributions to Severance Tax Permanent Fund	$24	$357	$1,095	$664	$144	$2,499	$5,473	$7,972
	Severance Tax Permanent Fund Balance	$4,834	$6,041	$10,571	$7,929				
	STPR Income Dist. to Gen. Fund	$193	$235	$345	$281	$1,156	$1,642	$1,725	$3,367
	STPR Income Dist. to Gen. Fund Attrib. to O&G	$167	$203	$299	$243	$1,001	$1,422	$1,494	$2,916

	Land Grant Permanent Fund: Flows and Balances	2013-18	2019-25	2026-30	2019-30	2013-18	2019-25	2026-30	2019-30
Land Grant Permanent Fund	Oil & Gas Royalties	$578	$1,264	$2,415	$1,743	$3,468	$8,846	$12,076	$20,922
	Total Contributions to LGPF (includes non-O&G royalties and	$615	$1,304	$2,492	$1,799	$3,691	$9,129	$12,462	$21,591
	LGPF Balance (EOFY = June)	$15,382	$21,202	$31,542	$25,510				
	Distributions from LGPF	$619	$861	$1,206	$1,005	$3,711	$6,026	$6,029	$12,055
	Distr. from LGPF to General Fund	$523	$732	$1,025	$854	$3,135	$5,122	$5,125	$10,247
	Distr. from LGPF to Gen. Fund Attributed to O&G	$505	$709	$993	$827	$3,033	$4,963	$4,966	$9,929

Exhibit A-11: Base Case Tax Revenues in Real Dollars (2017$ million) (part 3 of 3)

Base Case in Real Million 2017 Dollars per Fiscal Year *<< historical forecast >>*

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
State General Fund Revenues from O&G Production	**General Fund Revenue Attributed to O&G**																		
	Gross Receipts	$136	$160	$183	$106	$104	$184	$187	$195	$224	$269	$317	$360	$404	$450	$495	$534	$568	$598
	Compensating	$17	$14	$17	$19	$11	$12	$30	$32	$32	$31	$31	$30	$30	$29	$29	$29	$28	$28
	Personal Income Tax	$132	$149	$133	$110	$94	$95	$153	$162	$161	$159	$158	$156	$155	$153	$151	$150	$148	$147
	Corporate Income Tax	$57	$44	$37	$17	$10	$22	$20	$20	$22	$25	$28	$30	$33	$36	$39	$41	$43	$45
	Oil & Gas School Tax	$403	$521	$387	$241	$304	$442	$522	$544	$625	$750	$882	$1,003	$1,124	$1,253	$1,379	$1,487	$1,581	$1,666
	Oil Conservation	$21	$27	$20	$11	$17	$22	$25	$26	$30	$36	$43	$49	$54	$61	$67	$72	$76	$81
	Natural Gas Processors	$26	$17	$19	$21	$10	$11	$17	$18	$19	$20	$21	$22	$22	$23	$23	$23	$23	$23
	Land Grant Perm. Fund Income	$452	$453	$501	$547	$524	$556	$619	$643	$669	$705	$738	$774	$815	$864	$920	$985	$1,058	$1,138
	Earnings on State Balances	$2	$3	$3	$3	-$1	$2	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1
	Severance Tax Perm. Fund Income	$161	$154	$163	$172	$174	$178	$190	$191	$194	$200	$207	$215	$227	$244	$266	$294	$326	$364
	Federal Mineral Leasing	$431	$563	$523	$370	$418	$531	$529	$543	$591	$666	$746	$819	$891	$969	$1,044	$1,109	$1,166	$1,217
	Land Office Income	$51	$34	$27	$27	$49	$78	$73	$76	$88	$105	$124	$141	$158	$176	$193	$208	$222	$234
	Recurring Reversions	$22	$33	$20	$19	$24	$24	$22	$22	$22	$22	$22	$22	$22	$22	$22	$22	$22	$22
	Total General Funds Attributed to Upstream	**$1,911**	**$2,172**	**$2,032**	**$1,663**	**$1,737**	**$2,156**	**$2,388**	**$2,473**	**$2,677**	**$2,991**	**$3,317**	**$3,621**	**$3,935**	**$4,280**	**$4,630**	**$4,955**	**$5,263**	**$5,562**
General Funds	**Gen. Funds Attrib. to Mid- & Downstream**	$111	$113	$119	$112	$118	$128	$129	$135	$142	$152	$160	$166	$172	$177	$181	$185	$188	$190
	General Funds Attributed to Induced Activities	$197	$215	$138	$124	$160	$238	$236	$246	$279	$329	$382	$430	$477	$528	$576	$618	$655	$688
	All General Funds Attrib. to O&G	**$2,219**	**$2,501**	**$2,289**	**$1,899**	**$2,014**	**$2,522**	**$2,754**	**$2,854**	**$3,099**	**$3,472**	**$3,859**	**$4,217**	**$4,584**	**$4,984**	**$5,388**	**$5,758**	**$6,106**	**$6,440**
Local Rev. from O&G	**Local Revenues Attributed to O&G Production**																		
	Ad Valorem Production	$134	$175	$132	$88	$119	$169	$196	$204	$235	$282	$331	$377	$422	$471	$518	$558	$594	$625
	Ad Valorem Production Equipment	$29	$18	$31	$37	$22	$19	$31	$38	$39	$45	$54	$64	$72	$81	$90	$99	$107	$114
	Local Gross Receipts Tax	$31	$36	$41	$24	$25	$40	$42	$44	$51	$61	$72	$81	$91	$102	$112	$121	$128	$135
	Total Local Revenues Attributed to O&G Prod.	**$193**	**$229**	**$204**	**$148**	**$166**	**$228**	**$269**	**$286**	**$325**	**$388**	**$457**	**$522**	**$586**	**$653**	**$720**	**$779**	**$829**	**$875**
Local Revenu	**Local Rev. Attrib. to Mid- & Downstream**	$93	$95	$100	$94	$99	$107	$108	$113	$119	$127	$134	$139	$144	$148	$152	$155	$157	$159
	Local Rev. Attributed to Induced Activities	$165	$180	$116	$104	$134	$199	$198	$206	$234	$276	$320	$360	$400	$442	$483	$518	$549	$576
	Local Rev. Attrib. to O&G	**$451**	**$505**	**$420**	**$346**	**$398**	**$535**	**$575**	**$605**	**$678**	**$791**	**$911**	**$1,021**	**$1,130**	**$1,244**	**$1,355**	**$1,452**	**$1,536**	**$1,611**
All State Gen. Fund + Local Revenue Attributed to O&G		**$2,671**	**$3,006**	**$2,709**	**$2,245**	**$2,413**	**$3,057**	**$3,329**	**$3,459**	**$3,777**	**$4,263**	**$4,771**	**$5,239**	**$5,714**	**$6,228**	**$6,743**	**$7,210**	**$7,642**	**$8,051**

Base Case in Real Million 2017 Dollars per Fiscal Year		Average Real Dollars				Total Real Dollars			
	General Fund Revenue Attributed to O&G Production	**2013-18**	**2019-25**	**2026-30**	**2019-30**	**2013-18**	**2019-25**	**2026-30**	**2019-30**
State General Fund Revenues from O&G Production	Gross Receipts	$145	$280	$529	$384	$873	$1,957	$2,645	$4,602
	Compensating	$15	$31	$29	$30	$91	$215	$143	$358
	Personal Income Tax	$119	$158	$150	$154	$712	$1,103	$749	$1,853
	Corporate Income Tax	$31	$25	$41	$32	$187	$178	$205	$383
	Oil & Gas School Tax	$383	$778	$1,473	$1,068	$2,298	$5,448	$7,365	$12,813
	Oil Conservation	$20	$38	$71	$52	$117	$264	$356	$620
	Natural Gas Processors	$17	$20	$23	$21	$103	$140	$113	$253
	Land Grant Perm. Fund Income	$505	$709	$993	$827	$3,033	$4,963	$4,966	$9,929
	Earnings on State Balances	$2	$1	$1	$1	$13	$10	$7	$17
	Severance Tax Perm. Fund Income	$167	$203	$299	$243	$1,001	$1,422	$1,494	$2,916
	Federal Mineral Leasing	$473	$684	$1,101	$857	$2,836	$4,785	$5,504	$10,289
	Land Office Income	$44	$109	$207	$150	$266	$764	$1,033	$1,797
	Recurring Reversions	$24	$22	$22	$22	$142	$153	$110	$263
	Total General Funds Attributed to Upstream	**$1,945**	**$3,058**	**$4,938**	**$3,841**	**$11,671**	**$21,403**	**$24,690**	**$46,093**
General Funds	**Gen. Funds Attrib. to Mid- & Downstream**	$117	$151	$184	$165	$701	$1,056	$921	$1,978
	General Funds Attributed to Induced Activities	$179	$340	$613	$454	$1,072	$2,380	$3,065	$5,445
	All General Funds Attrib. to O&G	**$2,241**	**$3,549**	**$5,735**	**$4,460**	**$13,444**	**$24,840**	**$28,676**	**$53,516**
Local Rev. from O&G	**Local Revenues Attributed to O&G Production**								
	Ad Valorem Production	$136	$292	$553	$401	$817	$2,046	$2,766	$4,812
	Ad Valorem Production Equipment	$26	$49	$98	$70	$155	$343	$492	$835
	Local Gross Receipts Tax	$33	$63	$120	$87	$197	$443	$598	$1,041
	Total Local Revenues Attributed to O&G Prod.	**$195**	**$405**	**$771**	**$557**	**$1,170**	**$2,832**	**$3,857**	**$6,688**
Local Revenu	**Local Rev. Attrib. to Mid- & Downstream**	$98	$126	$154	$138	$587	$885	$772	$1,657
	Local Rev. Attributed to Induced Activities	$150	$285	$514	$380	$898	$1,994	$2,568	$4,563
	Local Rev. Attrib. to O&G	**$442**	**$816**	**$1,439**	**$1,076**	**$2,655**	**$5,711**	**$7,197**	**$12,908**
All State Gen. Fund + Local Revenue Attributed to O&G		**$2,683**	**$4,364**	**$7,175**	**$5,535**	**$16,099**	**$30,551**	**$35,873**	**$66,424**

A.6 Projected Tax Revenues for the Alternative Case

The Alternative Case presented in this report is based on an assumption of constrained infrastructure development for new pipelines and gathering systems. These constraints might come about due to new environmental laws and regulations; delays in permitting processes; land rights and land use disputes; and political conflicts and indecision. The major economic and tax impacts of the Alternative Case include:

- Less capital expenditures on pipeline and gathering system infrastructure. This directly affects personal income taxes through the fewer construction-related jobs; GRT and compensating taxes through lower expenditures on construction goods, materials and services; and property taxes through there being fewer taxable pipeline and other assets.
- The lack of pipeline and gathering infrastructure can create transportation bottlenecks that can lead to shut-in oil and gas production, where alternative transportation methods do not exist or are economically infeasible. This affects all of the direct production taxes (severance, school, conservation, ad valorem), royalties and other land-related income from state and federal lands through reduced production volumes. Revenue are also reduced for corporate (production and service companies) and personal income taxes (stockholders of production and service companies and royalty interest owners)
- To the extent alternative transportation modes can be used, they are typically more expensive and cause the netback wellhead price of production to fall. This reduces the wellhead value of production from both new and existing wells. This further reduces production taxes, land-related revenues and income taxes.
- The combined effects of transportation bottlenecks and reduced wellhead prices reduces the incentive for new drilling and so upstream expenditures and jobs are reduced leading to less long-term oil and gas production. With less upstream investment and less oil and gas production volumes, all the sources of state and local government revenues discussed in this Appendix are reduced.

The tax results for the Alternative Case are shown in Exhibit A-12 to Exhibit A-14 in nominal dollars and in Exhibit A-15 to Exhibit A-17 in real dollars. The historical tax revenues from 2013 to 2018 are the same for the Base Case and Alternative Cases. These tables are organize in the same manner as the corresponding nominal-dollar and real-dollar Base Case tables. The first table of each set show revenues from the direct state oil and gas taxes and fees. The second tables shows the accounting for the two oil and gas-related permanent funds and the third table shows state general account revenues and estimate local tax revenues.

Exhibit A-12: Alternative Case Tax Revenues in Nominal Dollars (nominal$ million) (part 1 of 3)

Alternative Case in Nominal Million Dollars per Fiscal Year *<< historical forecast >>*

	Revenue Category	Disposition	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Oil & Gas Taxes	O&G Emergency School Tax	State General Funds	$381	$508	$377	$221	$304	$451	$544	$568	$635	$744	$864	$962	$1,040	$1,120	$1,203	$1,280	$1,353	$1,424
	O&G Conservation: General Fund	State General Funds	$20	$27	$19	$9	$15	$23	$26	$27	$31	$36	$42	$47	$50	$54	$58	$62	$65	$69
	O&G Severance Tax	Bond Payments & Contrib. to STPF	$417	$557	$416	$245	$334	$493	$599	$625	$699	$819	$952	$1,059	$1,144	$1,233	$1,325	$1,410	$1,489	$1,568
	O&G Ad Valorem Production	Local Revenues	$126	$168	$128	$86	$119	$173	$204	$213	$239	$279	$325	$361	$390	$421	$452	$481	$508	$535
	Natural Gas Processors Tax	State General Funds	$24	$16	$19	$20	$10	$11	$18	$18	$18	$18	$18	$18	$18	$18	$18	$18	$18	$18
	O&G Ad Valorem Production Equipment	Local Revenues	$27	$17	$30	$36	$22	$20	$32	$40	$42	$47	$55	$64	$71	$77	$83	$89	$94	$100
	O&G Conservation: Reclamation Fund	State Dedicated	$5	$6	$5	$3	$2	$3	$5	$5	$6	$7	$8	$9	$10	$10	$11	$12	$13	$13
	Sum of Production Taxes		**$1,000**	**$1,300**	**$993**	**$620**	**$807**	**$1,172**	**$1,428**	**$1,497**	**$1,670**	**$1,951**	**$2,264**	**$2,521**	**$2,723**	**$2,932**	**$3,150**	**$3,352**	**$3,541**	**$3,727**
St. Ld. Roy.	Royalties from State Lands	Contribution to LGPF	**$494**	**$726**	**$654**	**$406**	**$435**	**$679**	**$874**	**$915**	**$1,034**	**$1,225**	**$1,433**	**$1,601**	**$1,730**	**$1,861**	**$2,000**	**$2,130**	**$2,250**	**$2,367**

Alternative Case in Nominal Million Dollars per Fiscal Year

			Average				Total			
	Revenue Category	Disposition	2013-18	2019-25	2026-30	2019-30	2013-18	2019-25	2026-30	2019-30
Oil & Gas Taxes	O&G Emergency School Tax	State General Funds	$374	$765	$1,276	$978	$2,242	$5,357	$6,381	$11,738
	O&G Conservation: General Fund	State General Funds	$19	$37	$62	$47	$113	$259	$309	$568
	O&G Severance Tax	Bond Payments & Contrib. to STPF	$410	$842	$1,405	$1,077	$2,462	$5,897	$7,024	$12,921
	O&G Ad Valorem Production	Local Revenues	$133	$287	$479	$367	$800	$2,012	$2,396	$4,408
	Natural Gas Processors Tax	State General Funds	$17	$18	$18	$18	$100	$127	$91	$219
	O&G Ad Valorem Production Equipment	Local Revenues	$25	$50	$88	$66	$152	$350	$442	$792
	O&G Conservation: Reclamation Fund	State Dedicated	$4	$7	$12	$9	$24	$50	$60	$110
	Sum of Production Taxes		**$982**	**$2,008**	**$3,340**	**$2,563**	**$5,892**	**$14,053**	**$16,702**	**$30,755**
St. Ld. Roy.	Royalties from State Lands	Contribution to LGPF	**$566**	**$1,259**	**$2,122**	**$1,618**	**$3,395**	**$8,813**	**$10,608**	**$19,421**

Exhibit A-13: Alternative Case Tax Revenues in Nominal Dollars (nominal$ million) (part 2 of 3)

Alternative Case in Nominal Million Dollars per Fiscal Year *<< historical forecast >>*

	Severance Tax Permanent Fund: Flows and Balances	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Severance Tax Permanent Fund	Severance Tax Collected	$399	$525	$420	$299	$334	$493	$599	$625	$699	$819	$952	$1,059	$1,144	$1,233	$1,325	$1,410	$1,489	$1,568
	Spent Immediately (e.g., Bond Payments)	$394	$401	$419	$292	$334	$493	$507	$523	$538	$554	$571	$588	$606	$624	$643	$662	$682	$702
	Contributions to Severance Tax Permanent Fund	$5	$125	$1	$8	$0	$0	$91	$102	$161	$265	$380	$471	$538	$609	$682	$747	$807	$865
	Severance Tax Permanent Fund Balance	$4,167	$4,768	$4,730	$4,559	$4,931	$5,281	$5,453	$5,640	$5,889	$6,243	$6,721	$7,305	$7,972	$8,727	$9,573	$10,503	$11,511	$12,597
	STPR Income Dist. to Gen. Fund	$176	$171	$183	$194	$200	$210	$228	$235	$243	$256	$268	$282	$299	$321	$348	$379	$414	$454
	STPR Income Dist. to Gen. Fund Attrib. to O&G	$152	$148	$158	$168	$174	$182	$198	$203	$211	$221	$232	$244	$259	$278	$301	$328	$359	$393
	Gain in Value of STPF's Investments	*$338*	*$647*	*$144*	*$15*	*$572*	*$560*	*$309*	*$320*	*$331*	*$345*	*$366*	*$394*	*$428*	*$467*	*$511*	*$561*	*$615*	*$675*
	Gain as % of BOFY Balance	*8.45%*	*15.53%*	*3.02%*	*0.31%*	*12.55%*	*11.36%*	*5.86%*	*5.86%*	*5.86%*	*5.86%*	*5.86%*	*5.86%*	*5.86%*	*5.86%*	*5.86%*	*5.86%*	*5.86%*	*5.86%*
	Dist. to Gen. Fund as % of BOFY Balance	*4.23%*	*3.58%*	*3.86%*	*4.24%*	*4.06%*	*3.98%*	*4.32%*	*4.30%*	*4.31%*	*4.34%*	*4.29%*	*4.19%*	*4.09%*	*4.02%*	*3.98%*	*3.96%*	*3.95%*	*3.94%*
	5YRA STPF Balance	*$3,640*	*$3,853*	*$4,107*	*$4,273*	*$4,445*	*$4,631*	*$4,854*	*$4,991*	*$5,173*	*$5,439*	*$5,701*	*$5,989*	*$6,360*	*$6,826*	*$7,394*	*$8,060*	*$8,816*	*$9,657*
	Dist. To Gen. Fund as % of 5YRA Bal.	*4.84%*	*4.42%*	*4.45%*	*4.53%*	*4.51%*	*4.54%*	*4.70%*	*4.70%*	*4.70%*	*4.70%*	*4.70%*	*4.70%*	*4.70%*	*4.70%*	*4.70%*	*4.70%*	*4.70%*	*4.70%*

	Land Grant Permanent Fund: Flows and Balances	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Land Grant Permanent Fund	Oil & Gas Royalties	$494	$726	$654	$406	$435	$679	$874	$915	$1,034	$1,225	$1,433	$1,601	$1,730	$1,861	$2,000	$2,130	$2,250	$2,367
	Total Contributions to LGPF (includes non-O&G royalties and rental and bonus income)	$619	$742	$669	$420	$468	$690	$902	$945	$1,067	$1,264	$1,479	$1,652	$1,786	$1,921	$2,064	$2,198	$2,322	$2,443
	LGPF Balance (EOFY = June)	$12,197	$14,345	$14,882	$14,777	$16,492	$17,903	$18,985	$20,123	$21,392	$22,860	$24,559	$26,456	$28,513	$30,733	$33,122	$35,672	$38,371	$41,219
	Distributions from LGPF	$527	$535	$596	$656	$638	$689	$784	$830	$883	$949	$1,013	$1,079	$1,154	$1,238	$1,331	$1,434	$1,545	$1,664
	Distr. from LGPF to General Fund	$441	$449	$503	$555	$542	$587	$666	$706	$750	$807	$861	$917	$981	$1,052	$1,132	$1,219	$1,313	$1,415
	Distr. from LGPF to Gen. Fund Attributed to O&G	$426	$435	$487	$537	$524	$568	$646	$684	$727	$782	$834	$889	$950	$1,020	$1,096	$1,181	$1,273	$1,371
	Gain in Value of LGPF's Investments	$1,505	$1,941	$463	$131	$1,885	$1,410	$965	$1,023	$1,085	$1,153	$1,232	$1,324	$1,426	$1,537	$1,657	$1,785	$1,923	$2,068
	Gain as % of BOFY LGPF Balance	*14.20%*	*15.92%*	*3.23%*	*0.88%*	*12.75%*	*8.55%*	*5.39%*	*5.39%*	*5.39%*	*5.39%*	*5.39%*	*5.39%*	*5.39%*	*5.39%*	*5.39%*	*5.39%*	*5.39%*	*5.39%*
	5-Year Average LGPF Balance	$9,620	$10,179	$11,359	$12,425	$13,360	$14,539	$15,680	$16,608	$17,656	$18,979	$20,252	$21,584	$23,078	$24,756	$26,624	$28,677	$30,899	$33,282
	Distribution to Gen. Fund as % of 5YRA Bal.	*5.48%*	*5.26%*	*5.25%*	*5.28%*	*4.78%*	*4.74%*	*5.00%*	*5.00%*	*5.00%*	*5.00%*	*5.00%*	*5.00%*	*5.00%*	*5.00%*	*5.00%*	*5.00%*	*5.00%*	*5.00%*

Alternative Case in Nominal Million Dollars per Fiscal Year		Average				Total			
Severance Tax Permanent Fund	**Severance Tax Permanent Fund: Flows and Balances**	**2013-18**	**2019-25**	**2026-30**	**2019-30**	**2013-18**	**2019-25**	**2026-30**	**2019-30**
	Severance Tax Collected	$412	$842	$1,405	$1,077	$2,471	$5,897	$7,024	$12,921
	Spent Immediately (e.g., Bond Payments)	$389	$555	$663	$600	$2,332	$3,888	$3,313	$7,201
	Contributions to Severance Tax Permanent Fund	$23	$287	$742	$477	$138	$2,009	$3,711	$5,720
	Severance Tax Permanent Fund Balance	$4,739	$6,461	$10,582	$8,178				
	STPR Income Dist. to Gen. Fund	$189	$259	$383	$310	$1,134	$1,810	$1,915	$3,725
	STPR Income Dist. to Gen. Fund Attrib. to O&G	$164	$224	$332	$269	$982	$1,567	$1,659	$3,226
	Gain in Value of STPF's Investments	*$379*	*$356*	*$566*	*$443*	*$2,276*	*$2,492*	*$2,830*	*$5,322*
	Gain as % of BOFY Balance	*8.54%*	*5.86%*	*5.86%*	*5.86%*				
	Dist. to Gen. Fund as % of BOFY Balance	*3.99%*	*4.26%*	*3.97%*	*4.14%*				
	5YRA STPF Balance	*$4,158*	*$5,501*	*$8,151*	*$6,605*				
	Dist. To Gen. Fund as % of 5YRA Bal.	*4.55%*	*4.70%*	*4.70%*	*4.70%*				
Land Grant Permanent Fund	**Land Grant Permanent Fund: Flows and Balances**	**2013-18**	**2019-25**	**2026-30**	**2019-30**	**2013-18**	**2019-25**	**2026-30**	**2019-30**
	Oil & Gas Royalties	$566	$1,259	$2,122	$1,618	$3,395	$8,813	$10,608	$19,421
	Total Contributions to LGPF (includes non-O&G royalties and rental and bonus income)	$601	$1,299	$2,189	$1,670	$3,609	$9,095	$10,947	$20,042
	LGPF Balance (EOFY = June)	$15,099	$23,270	$35,823	$28,500				
	Distributions from LGPF	$607	$956	$1,442	$1,159	$3,641	$6,692	$7,212	$13,904
	Distr. from LGPF to General Fund	$513	$813	$1,226	$985	$3,076	$5,688	$6,130	$11,818
	Distr. from LGPF to Gen. Fund Attributed to O&G	$496	$787	$1,188	$954	$2,976	$5,512	$5,940	$11,452
	Gain in Value of LGPF's Investments	*$1,222*	*$1,173*	*$1,794*	*$1,431*	*$7,335*	*$8,208*	*$8,970*	*$17,177*
	Gain as % of BOFY LGPF Balance	*9.25%*	*5.39%*	*5.39%*	*5.39%*				
	5-Year Average LGPF Balance	*$11,914*	*$19,119*	*$28,848*	*$23,173*				
	Distribution to Gen. Fund as % of 5YRA Bal.	*5.13%*	*5.00%*	*5.00%*	*5.00%*				

Exhibit A-14: Alternative Case Tax Revenues in Nominal Dollars (nominal$ million) (part 3 of 3)

Alternative Case in Nominal Million Dollars per Fiscal Year *<< historical forecast >>*

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
State General Fund Revenues from O&G Production	**General Fund Revenue Attributed to O&G Production**																		
	Gross Receipts	$129	$154	$177	$104	$104	$188	$195	$204	$228	$267	$310	$346	$373	$402	$432	$460	$486	$512
	Compensating	$16	$14	$17	$19	$11	$13	$31	$31	$27	$26	$26	$22	$19	$18	$18	$19	$19	$20
	Personal Income Tax	$124	$143	$129	$108	$94	$97	$161	$163	$149	$147	$146	$135	$125	$123	$124	$127	$130	$133
	Corporate Income Tax	$54	$42	$36	$17	$10	$23	$21	$21	$23	$26	$28	$31	$33	$35	$37	$39	$41	$42
	Oil & Gas School Tax	$380	$501	$375	$237	$304	$451	$544	$568	$635	$744	$864	$962	$1,040	$1,120	$1,203	$1,280	$1,353	$1,424
	Oil Conservation	$20	$26	$19	$11	$17	$22	$26	$27	$31	$36	$42	$47	$50	$54	$58	$62	$65	$69
	Natural Gas Processors	$24	$16	$18	$20	$10	$11	$18	$18	$18	$18	$18	$18	$18	$18	$18	$18	$18	$18
	Land Grant Perm. Fund Income	$426	$435	$487	$537	$524	$568	$646	$684	$727	$782	$834	$889	$950	$1,020	$1,096	$1,181	$1,273	$1,371
	Earnings on State Balances	$2	$3	$3	$3	-$1	$2	$1	$1	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2
	Severance Tax Perm. Fund Income	$152	$148	$158	$168	$174	$182	$198	$203	$211	$221	$232	$244	$259	$278	$301	$328	$359	$393
	Federal Mineral Leasing	$406	$541	$508	$363	$418	$542	$552	$571	$616	$687	$764	$828	$880	$933	$989	$1,041	$1,090	$1,139
	Land Office Income	$48	$33	$27	$26	$49	$79	$76	$80	$89	$104	$121	$135	$146	$157	$169	$180	$190	$200
	Recurring Reversions	$21	$32	$19	$18	$24	$25	$23	$23	$24	$24	$25	$25	$26	$26	$27	$28	$28	$29
	Total General Funds Attributed to Upstream	**$1,802**	**$2,087**	**$1,973**	**$1,635**	**$1,737**	**$2,202**	**$2,491**	**$2,595**	**$2,780**	**$3,084**	**$3,413**	**$3,683**	**$3,920**	**$4,186**	**$4,475**	**$4,763**	**$5,053**	**$5,350**
General Funds	**Gen. Funds Attrib. to Mid- & Downstream**	$105	$109	$115	$110	$118	$130	$135	$143	$151	$160	$169	$175	$179	$183	$187	$191	$195	$199
	General Funds Attributed to Induced Activities	$186	$207	$134	$122	$160	$243	$246	$258	$286	$330	$378	$417	$447	$479	$512	$542	$571	$599
	All General Funds Attrib. to O&G	**$2,092**	**$2,402**	**$2,222**	**$1,867**	**$2,014**	**$2,575**	**$2,872**	**$2,996**	**$3,216**	**$3,574**	**$3,960**	**$4,275**	**$4,546**	**$4,848**	**$5,173**	**$5,496**	**$5,818**	**$6,148**
Local Rev. from O&G Prod.	**Local Revenues Attributed to O&G Production**																		
	Ad Valorem Production	$126	$168	$128	$86	$119	$173	$204	$213	$239	$279	$325	$361	$390	$421	$452	$481	$508	$535
	Ad Valorem Production Equipment	$27	$17	$30	$36	$22	$20	$32	$40	$42	$47	$55	$64	$71	$77	$83	$89	$94	$100
	Local Gross Receipts Tax	$29	$35	$40	$23	$25	$41	$44	$46	$52	$60	$70	$78	$84	$91	$98	$104	$110	$116
	Total Local Revenues Attributed to O&G Prod.	**$182**	**$220**	**$198**	**$145**	**$166**	**$233**	**$280**	**$299**	**$332**	**$387**	**$450**	**$503**	**$546**	**$588**	**$632**	**$674**	**$712**	**$750**
Local Revenue	**Local Rev. Attrib. to Mid- & Downstream**	$88	$91	$97	$92	$99	$109	$113	$119	$127	$134	$142	$147	$150	$153	$156	$160	$163	$167
	Local Rev. Attributed to Induced Activities	$155	$173	$112	$102	$134	$204	$206	$216	$239	$276	$317	$349	$375	$401	$429	$454	$478	$502
	Local Rev. Attrib. to O&G	**$426**	**$485**	**$407**	**$340**	**$398**	**$546**	**$600**	**$635**	**$698**	**$797**	**$908**	**$999**	**$1,071**	**$1,143**	**$1,217**	**$1,288**	**$1,354**	**$1,419**
All State Gen. Fund + Local Revenue Attributed to O&G		**$2,518**	**$2,887**	**$2,629**	**$2,206**	**$2,413**	**$3,121**	**$3,472**	**$3,630**	**$3,914**	**$4,372**	**$4,868**	**$5,275**	**$5,617**	**$5,990**	**$6,391**	**$6,784**	**$7,172**	**$7,566**

Alternative Case in Nominal Million Dollars per Fiscal Year		Average				Total			
	General Fund Revenue Attributed to O&G Production	**2013-18**	**2019-25**	**2026-30**	**2019-30**	**2013-18**	**2019-25**	**2026-30**	**2019-30**
State General Fund Revenues from O&G Production	Gross Receipts	$143	$275	$458	$351	$855	$1,924	$2,292	$4,216
	Compensating	$15	$26	$19	$23	$89	$183	$93	$276
	Personal Income Tax	$116	$146	$127	$139	$695	$1,025	$637	$1,662
	Corporate Income Tax	$30	$26	$39	$31	$181	$182	$193	$375
	Oil & Gas School Tax	$375	$765	$1,276	$978	$2,248	$5,357	$6,381	$11,738
	Oil Conservation	$19	$37	$62	$47	$115	$259	$309	$568
	Natural Gas Processors	$17	$18	$18	$18	$100	$127	$91	$219
	Land Grant Perm. Fund Income	$496	$787	$1,188	$954	$2,976	$5,512	$5,940	$11,452
	Earnings on State Balances	$2	$2	$2	$2	$13	$11	$9	$20
	Severance Tax Perm. Fund Income	$164	$224	$332	$269	$982	$1,567	$1,659	$3,226
	Federal Mineral Leasing	$463	$700	$1,038	$841	$2,778	$4,897	$5,191	$10,088
	Land Office Income	$44	$107	$179	$137	$262	$751	$895	$1,646
	Recurring Reversions	$23	$24	$28	$26	$139	$170	$138	$308
	Total General Funds Attributed to Upstream	**$1,906**	**$3,138**	**$4,765**	**$3,816**	**$11,434**	**$21,967**	**$23,827**	**$45,793**
General Funds	**Gen. Funds Attrib. to Mid- & Downstream**	$115	$159	$191	$172	$687	$1,112	$954	$2,066
	General Funds Attributed to Induced Activities	$175	$337	$540	$422	$1,051	$2,362	$2,702	$5,064
	All General Funds Attrib. to O&G	**$2,195**	**$3,634**	**$5,497**	**$4,410**	**$13,172**	**$25,440**	**$27,483**	**$52,923**
Local Rev. from O&G Prod.	**Local Revenues Attributed to O&G Production**								
	Ad Valorem Production	$133	$287	$479	$367	$800	$2,012	$2,396	$4,408
	Ad Valorem Production Equipment	$25	$50	$88	$66	$152	$350	$442	$792
	Local Gross Receipts Tax	$32	$62	$104	$79	$193	$435	$518	$954
	Total Local Revenues Attributed to O&G Prod.	$191	$400	$671	$513	$1,145	$2,797	$3,357	$6,154
Local Revenue	**Local Rev. Attrib. to Mid- & Downstream**	$96	$133	$160	$144	$576	$931	$799	$1,731
	Local Rev. Attributed to Induced Activities	$147	$283	$453	$354	$880	$1,979	$2,264	$4,243
	Local Rev. Attrib. to O&G	**$434**	**$815**	**$1,284**	**$1,011**	**$2,602**	**$5,708**	**$6,420**	**$12,128**
All State Gen. Fund + Local Revenue Attributed to O&G		**$2,629**	**$4,450**	**$6,781**	**$5,421**	**$15,773**	**$31,148**	**$33,903**	**$65,051**

Exhibit A-15: Alternative Case Tax Revenues in Real Dollars (2017$ million) (part 1 of 3)

Alternative Case in Real Million 2017 Dollars per Fiscal Year *<< historical forecast >>*

	Revenue Category	Disposition	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Oil & Gas Taxes	O&G Emergency School Tax	State General Funds	$404	$529	$388	$225	$304	$442	$522	$533	$585	$671	$763	$832	$880	$929	$977	$1,019	$1,054	$1,087
	O&G Conservation: General Fund	State General Funds	$21	$28	$20	$10	$15	$22	$25	$26	$28	$32	$37	$40	$43	$45	$47	$49	$51	$53
	O&G Severance Tax	Bond Payments & Contrib. to STPF	$442	$580	$428	$250	$334	$482	$574	$587	$643	$738	$840	$916	$969	$1,022	$1,076	$1,121	$1,161	$1,197
	O&G Ad Valorem Production	Local Revenues	$134	$175	$132	$88	$119	$169	$196	$200	$220	$252	$287	$312	$331	$349	$367	$383	$396	$408
	Natural Gas Processors Tax	State General Funds	$26	$17	$19	$21	$10	$11	$17	$17	$17	$16	$16	$16	$15	$15	$15	$15	$14	$14
	O&G Ad Valorem Production Equipment	Local Revenues	$29	$18	$31	$37	$22	$19	$31	$38	$38	$42	$48	$55	$60	$64	$67	$71	$74	$76
	O&G Conservation: Reclamation Fund	State Dedicated	$5	$7	$5	$3	$2	$3	$5	$5	$5	$6	$7	$8	$8	$9	$9	$10	$10	$10
	Sum of Production Taxes		**$1,061**	**$1,353**	**$1,023**	**$632**	**$807**	**$1,148**	**$1,370**	**$1,406**	**$1,537**	**$1,758**	**$1,998**	**$2,179**	**$2,306**	**$2,432**	**$2,559**	**$2,667**	**$2,760**	**$2,845**
St. Ld. Roy.	Royalties from State Lands	Contribution to LGPF	**$524**	**$756**	**$673**	**$414**	**$435**	**$665**	**$838**	**$860**	**$951**	**$1,104**	**$1,265**	**$1,384**	**$1,465**	**$1,544**	**$1,625**	**$1,694**	**$1,753**	**$1,807**

Alternative Case in Real Million 2017 Dollars per Fiscal Year			Average Real Dollars				Total Real Dollars			
	Revenue Category	Disposition	2013-18	2019-25	2026-30	2019-30	2013-18	2019-25	2026-30	2019-30
Oil & Gas Taxes	O&G Emergency School Tax	State General Funds	$382	$684	$1,013	$821	$2,292	$4,786	$5,066	$9,852
	O&G Conservation: General Fund	State General Funds	$19	$33	$49	$40	$115	$232	$245	$477
	O&G Severance Tax	Bond Payments & Contrib. to STPF	$420	$753	$1,115	$904	$2,517	$5,268	$5,577	$10,845
	O&G Ad Valorem Production	Local Revenues	$136	$257	$381	$308	$817	$1,797	$1,903	$3,700
	Natural Gas Processors Tax	State General Funds	$17	$16	$15	$16	$103	$115	$73	$188
	O&G Ad Valorem Production Equipment	Local Revenues	$26	$45	$70	$55	$155	$313	$351	$663
	O&G Conservation: Reclamation Fund	State Dedicated	$4	$6	$9	$8	$24	$45	$47	$92
	Sum of Production Taxes		**$1,004**	**$1,794**	**$2,652**	**$2,151**	**$6,024**	**$12,555**	**$13,262**	**$25,816**
St. Ld. Roy.	Royalties from State Lands	Contribution to LGPF	**$578**	**$1,124**	**$1,685**	**$1,358**	**$3,468**	**$7,869**	**$8,423**	**$16,292**

Exhibit A-16: Alternative Case Tax Revenues in Real Dollars (2017$ million) (part 2 of 3)

Alternative Case in Real Million 2017 Dollars per Fiscal Year *<< historical forecast >>*

	Severance Tax Permanent Fund: Flows and Balances	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Severance Tax Permanent Fund	Severance Tax Collected	$424	$547	$433	$305	$334	$482	$574	$587	$643	$738	$840	$916	$969	$1,022	$1,076	$1,121	$1,161	$1,197
	Spent Immediately (e.g., Bond Payments)	$418	$417	$432	$297	$334	$482	$487	$491	$495	$500	$504	$509	$513	$518	$522	$527	$531	$536
	Contributions to Severance Tax Permanent F	$6	$130	$1	$8	$0	$0	$88	$96	$148	$239	$336	$407	$456	$505	$554	$595	$629	$660
	Severance Tax Permanent Fund Balance	$4,421	$4,965	$4,873	$4,646	$4,931	$5,172	$5,231	$5,300	$5,419	$5,627	$5,933	$6,316	$6,751	$7,239	$7,777	$8,356	$8,970	$9,615
	STPR Income Dist. to Gen. Fund	$187	$178	$188	$197	$200	$206	$219	$220	$224	$230	$237	$243	$253	$266	$282	$301	$323	$346
	STPR Income Dist. to Gen. Fund Attrib. to O&	$161	$154	$163	$172	$174	$178	$190	$191	$194	$200	$205	$211	$219	$230	$244	$261	$280	$300

	Land Grant Permanent Fund: Flows and Balances	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Land Grant Permanent Fund	Oil & Gas Royalties	$524	$756	$673	$414	$435	$665	$838	$860	$951	$1,104	$1,265	$1,384	$1,465	$1,544	$1,625	$1,694	$1,753	$1,807
	Total Contributions to LGPF (includes non-	$656	$772	$690	$428	$468	$676	$865	$888	$982	$1,139	$1,306	$1,429	$1,512	$1,593	$1,677	$1,749	$1,809	$1,865
	LGPF Balance (EOFY = June)	$12,940	$14,936	$15,331	$15,057	$16,492	$17,534	$18,212	$18,906	$19,685	$20,604	$21,680	$22,874	$24,146	$25,490	$26,907	$28,382	$29,902	$31,460
	Distributions from LGPF	$559	$557	$614	$668	$638	$675	$752	$780	$812	$855	$894	$933	$977	$1,027	$1,081	$1,141	$1,204	$1,270
	Distr. from LGPF to General Fund	$468	$468	$518	$566	$542	$575	$639	$663	$691	$727	$760	$793	$831	$873	$919	$970	$1,023	$1,080
	Distr. from LGPF to Gen. Fund Attributed to O	$452	$453	$501	$547	$524	$556	$619	$643	$669	$704	$736	$769	$805	$846	$891	$940	$992	$1,046

Alternative Case in Real Million 2017 Dollars per Fiscal Year

		Average Real Dollars				Total Real Dollars			
	Severance Tax Permanent Fund: Flows and Balances	2013-18	2019-25	2026-30	2019-30	2013-18	2019-25	2026-30	2019-30
Severance Tax Permanent Fund	Severance Tax Collected	$421	$753	$1,115	$904	$2,525	$5,268	$5,577	$10,845
	Spent Immediately (e.g., Bond Payments)	$397	$500	$527	$511	$2,381	$3,499	$2,634	$6,132
	Contributions to Severance Tax Permanent Fund	$24	$253	$589	$393	$144	$1,769	$2,943	$4,713
	Severance Tax Permanent Fund Balance	$4,834	$5,797	$8,391	$6,878				
	STPR Income Dist. to Gen. Fund	$193	$232	$304	$262	$1,156	$1,626	$1,519	$3,146
	STPR Income Dist. to Gen. Fund Attrib. to O&G	$167	$201	$263	$227	$1,001	$1,408	$1,316	$2,724

	Land Grant Permanent Fund: Flows and Balances	2013-18	2019-25	2026-30	2019-30	2013-18	2019-25	2026-30	2019-30
Land Grant Permanent Fund	Oil & Gas Royalties	$578	$1,124	$1,685	$1,358	$3,468	$7,869	$8,423	$16,292
	Total Contributions to LGPF (includes non-O&G royalties and	$615	$1,160	$1,738	$1,401	$3,691	$8,121	$8,692	$16,813
	LGPF Balance (EOFY = June)	$15,382	$20,872	$28,428	$24,021				
	Distributions from LGPF	$619	$858	$1,145	$977	$3,711	$6,004	$5,723	$11,727
	Distr. from LGPF to General Fund	$523	$729	$973	$831	$3,135	$5,103	$4,865	$9,968
	Distr. from LGPF to Gen. Fund Attributed to O&G	$505	$706	$943	$805	$3,033	$4,945	$4,714	$9,659

Exhibit A-17: Alternative Case Tax Revenues in Real Dollars (2017$ million) (part 3 of 3)

Alternative Case in Real Million 2017 Dollars per Fiscal Year *<< historical forecast >>*

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
State General Fund Revenues from O&G Production	**General Fund Revenue Attributed to O&G**																		
	Gross Receipts	$136	$160	$183	$106	$104	$184	$187	$192	$210	$241	$274	$299	$316	$334	$351	$366	$379	$390
	Compensating	$17	$14	$17	$19	$11	$12	$30	$30	$25	$24	$23	$19	$16	$15	$15	$15	$15	$15
	Personal Income Tax	$132	$149	$133	$110	$94	$95	$154	$153	$137	$132	$129	$117	$105	$102	$101	$101	$101	$101
	Corporate Income Tax	$57	$44	$37	$17	$10	$22	$20	$20	$21	$23	$25	$27	$28	$29	$30	$31	$32	$32
	Oil & Gas School Tax	$403	$521	$387	$241	$304	$442	$522	$533	$585	$671	$763	$832	$880	$929	$977	$1,019	$1,054	$1,087
	Oil Conservation	$21	$27	$20	$11	$17	$22	$25	$26	$28	$32	$37	$40	$43	$45	$47	$49	$51	$53
	Natural Gas Processors	$26	$17	$19	$21	$10	$11	$17	$17	$17	$16	$16	$16	$15	$15	$15	$15	$14	$14
	Land Grant Perm. Fund Income	$452	$453	$501	$547	$524	$556	$619	$643	$669	$704	$736	$769	$805	$846	$891	$940	$992	$1,046
	Earnings on State Balances	$2	$3	$3	$3	-$1	$2	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1
	Severance Tax Perm. Fund Income	$161	$154	$163	$172	$174	$178	$190	$191	$194	$200	$205	$211	$219	$230	$244	$261	$280	$300
	Federal Mineral Leasing	$431	$563	$523	$370	$418	$531	$529	$536	$567	$619	$674	$716	$745	$774	$803	$828	$849	$869
	Land Office Income	$51	$34	$27	$27	$49	$78	$73	$75	$82	$94	$107	$117	$123	$130	$137	$143	$148	$152
	Recurring Reversions	$22	$33	$20	$19	$24	$24	$22	$22	$22	$22	$22	$22	$22	$22	$22	$22	$22	$22
	Total General Funds Attributed to Upstream	**$1,911**	**$2,172**	**$2,032**	**$1,663**	**$1,737**	**$2,156**	**$2,390**	**$2,438**	**$2,558**	**$2,780**	**$3,013**	**$3,185**	**$3,319**	**$3,472**	**$3,635**	**$3,790**	**$3,938**	**$4,083**
General Funds	**Gen. Funds Attrib. to Mid- & Downstream**	$111	$113	$119	$112	$118	$128	$129	$134	$139	$145	$149	$151	$152	$152	$152	$152	$152	$152
	General Funds Attributed to Induced Activities	$197	$215	$138	$124	$160	$238	$236	$242	$263	$297	$334	$360	$379	$397	$416	$431	$445	$457
	All General Funds Attrib. to O&G	**$2,219**	**$2,501**	**$2,289**	**$1,899**	**$2,014**	**$2,522**	**$2,755**	**$2,814**	**$2,960**	**$3,221**	**$3,496**	**$3,696**	**$3,850**	**$4,021**	**$4,202**	**$4,373**	**$4,534**	**$4,692**
Local Rev. from O&G	**Local Revenues Attributed to O&G Production**																		
	Ad Valorem Production	$134	$175	$132	$88	$119	$169	$196	$200	$220	$252	$287	$312	$331	$349	$367	$383	$396	$408
	Ad Valorem Production Equipment	$29	$18	$31	$37	$22	$19	$31	$38	$38	$42	$48	$55	$60	$64	$67	$71	$74	$76
	Local Gross Receipts Tax	$31	$36	$41	$24	$25	$40	$42	$43	$47	$54	$62	$68	$72	$75	$79	$83	$86	$88
	Total Local Revenues Attributed to O&G Prod.	**$193**	**$229**	**$204**	**$148**	**$166**	**$228**	**$269**	**$281**	**$306**	**$349**	**$397**	**$435**	**$462**	**$488**	**$514**	**$536**	**$555**	**$573**
Local Revenu	**Local Rev. Attrib. to Mid- & Downstream**	$93	$95	$100	$94	$99	$107	$108	$112	$116	$121	$125	$127	$127	$127	$127	$127	$127	$127
	Local Rev. Attributed to Induced Activities	$165	$180	$116	$104	$134	$199	$198	$203	$220	$249	$280	$302	$317	$333	$348	$361	$373	$383
	Local Rev. Attrib. to O&G	**$451**	**$505**	**$420**	**$346**	**$398**	**$535**	**$575**	**$596**	**$642**	**$719**	**$802**	**$864**	**$907**	**$948**	**$989**	**$1,024**	**$1,055**	**$1,083**
All State Gen. Fund + Local Revenue Attributed to O&G		**$2,671**	**$3,006**	**$2,709**	**$2,245**	**$2,413**	**$3,057**	**$3,331**	**$3,411**	**$3,602**	**$3,940**	**$4,298**	**$4,560**	**$4,757**	**$4,968**	**$5,191**	**$5,397**	**$5,589**	**$5,775**

Alternative Case in Real Million 2017 Dollars per Fiscal Year		Average Real Dollars				Total Real Dollars			
	General Fund Revenue Attributed to O&G Production	**2013-18**	**2019-25**	**2026-30**	**2019-30**	**2013-18**	**2019-25**	**2026-30**	**2019-30**
State General Fund Revenues from O&G Production	Gross Receipts	$145	$246	$364	$295	$873	$1,719	$1,820	$3,539
	Compensating	$15	$24	$15	$20	$91	$166	$74	$240
	Personal Income Tax	$119	$133	$101	$120	$712	$928	$506	$1,434
	Corporate Income Tax	$31	$23	$31	$26	$187	$163	$153	$316
	Oil & Gas School Tax	$383	$684	$1,013	$821	$2,298	$4,786	$5,066	$9,852
	Oil Conservation	$20	$33	$49	$40	$117	$232	$245	$477
	Natural Gas Processors	$17	$16	$15	$16	$103	$115	$73	$188
	Land Grant Perm. Fund Income	$505	$706	$943	$805	$3,033	$4,945	$4,714	$9,659
	Earnings on State Balances	$2	$1	$1	$1	$13	$10	$7	$17
	Severance Tax Perm. Fund Income	$167	$201	$263	$227	$1,001	$1,408	$1,316	$2,724
	Federal Mineral Leasing	$473	$627	$825	$709	$2,836	$4,387	$4,124	$8,510
	Land Office Income	$44	$96	$142	$115	$266	$671	$710	$1,382
	Recurring Reversions	$24	$22	$22	$22	$142	$153	$110	$263
	Total General Funds Attributed to Upstream	**$1,945**	**$2,812**	**$3,784**	**$3,217**	**$11,671**	**$19,683**	**$18,918**	**$38,601**
General Funds	**Gen. Funds Attrib. to Mid- & Downstream**	$117	$143	$152	$146	$701	$999	$759	$1,757
	General Funds Attributed to Induced Activities	$179	$302	$429	$355	$1,072	$2,112	$2,146	$4,258
	All General Funds Attrib. to O&G	**$2,241**	**$3,256**	**$4,364**	**$3,718**	**$13,444**	**$22,794**	**$21,822**	**$44,616**
Local Rev. from O&G Prod.	**Local Revenues Attributed to O&G Production**								
	Ad Valorem Production	$136	$257	$381	$308	$817	$1,797	$1,903	$3,700
	Ad Valorem Production Equipment	$26	$45	$70	$55	$155	$313	$351	$663
	Local Gross Receipts Tax	$33	$56	$82	$67	$197	$389	$412	$801
	Total Local Revenues Attributed to O&G Prod.	**$195**	**$357**	**$533**	**$430**	**$1,170**	**$2,499**	**$2,665**	**$5,164**
Local Revenue	**Local Rev. Attrib. to Mid- & Downstream**	$98	$120	$127	$123	$587	$837	$636	$1,472
	Local Rev. Attributed to Induced Activities	$150	$253	$360	$297	$898	$1,770	$1,798	$3,568
	Local Rev. Attrib. to O&G	**$442**	**$729**	**$1,020**	**$850**	**$2,655**	**$5,105**	**$5,099**	**$10,204**
All State Gen. Fund + Local Revenue Attributed to O&G		**$2,683**	**$3,986**	**$5,384**	**$4,568**	**$16,099**	**$27,899**	**$26,921**	**$54,820**

The results of the two case are summarized in real dollars in Exhibit A-18. State general fund taxes and fees attributable to all segments of the oil and gas supply chain over the 2019-to-2030 forecast period decline by 16.6% in the Alternative Case as compared to the Base Case. For local revenues, the decline is 20.9%. The average decline for both state and local revenues is 17.5%.

In comparison to the Base Case, the Alternative Case reduces the value of crude oil, natural gas, natural gas liquid and CO_2 production by 24.3% over the 2019-to-2030 forecast period. The contribution to state GDP and income from production also goes down by the same 24.3% between the two cases. The midstream and downstream sectors are not affected as much by the Alternative Case assumptions because the volumes of refinery throughput, petroleum product wholesaling and retailing, and natural gas distribution are not changed. Overall, the state GDP and income from all segments of the oil and gas supply chain combined declines by 23.0%.

The decline in oil and gas industry contributions to state general fund and local revenues (-17.5%) is not as great as that in GDP (-23.0%). This is due to (1) the nature of some taxes and fees (which are not a direct function of the value of output or value added) and (2) the operation of the permanent funds which tend to absorb and smooth out changes to fund contributions from severance taxes and royalties from state lands. The second factor can be seen from the fact that severance taxes (-23.1%) and royalties from state land (-22.1%) decline at higher rates than that of the -17.5% combined rate for state general fund and local revenues.

Exhibit A-18: Summary of State and Local Revenue Impacts from the Two Case (2017$ million)

		Actual 2017	Base Case		Alternative Case		Alternative vs. Base Case: Impact as %
			Average 2019-30	Cumulative 2019-30	Average 2019-30	Cumulative 2019-30	
	Sum of Production Taxes Collected*	$807	$2,796	$33,557	$2,151	$25,816	-23.1%
	EOFY Balance of Severance Tax Permanent Fund*	$4,931	$7,929		$6,878		-13.3%
	Royalties from State Lands*	$435	$1,743	$20,922	$1,358	$16,292	-22.1%
	EOFY Balance of Land Grant Permanent Fund*	$16,492	$25,510		$24,021		-5.8%
State General Funds	Attributed to Upstream	$1,737	$3,841	$46,093	$3,217	$38,601	-16.3%
State General Funds	Attributed to Mid- &	$118	$165	$1,978	$146	$1,757	-11.1%
State General Funds	Attributed to Induced Activities	$160	$454	$5,445	$355	$4,258	-21.8%
State General Funds	Attributed to All O&G	**$2,014**	**$4,460**	**$53,516**	**$3,718**	**$44,616**	-16.6%
Local Revenues	Attributed to Upstream	$166	$557	$6,688	$430	$5,164	-22.8%
Local Revenues	Attributed to Mid- &	$99	$138	$1,657	$123	$1,472	-11.1%
Local Revenues	Attributed to Induced Activities	$134	$380	$4,563	$297	$3,568	-21.8%
Local Revenues	Attributed to All O&G	**$398**	**$1,076**	**$12,908**	**$850**	**$10,204**	-20.9%
All State General Funds + Local Revenues Attributed to O&G		**$2,413**	**$5,535**	**$66,424**	**$4,568**	**$54,820**	-17.5%

Note: Royalties from state lands and a portion of severence taxes go into permanent funds, from which annual distributions are made into state general funds and other dedicated uses.

Appendix B: Details of Model Results

Exhibit B-1: New Mexico New Infrastructure Builds – Base Case

	Base Case	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Natural Gas	Gas Gathering Line Miles	427	453	297	176	241	318	336	405	496	440	405	361	331	326	307	292	279	269
	Gas Gathering Line Avg. Size (Inches)	4	4	5	5	5	6	6	6	6	7	7	7	7	7	8	8	8	9
	Gas Gathering Line Compression (1000 HP)	19	24	15	15	33	69	51	38	66	66	49	41	38	36	30	25	21	18
	Gas Processing Capacity (MMcfd)	92	115	74	75	162	342	252	186	328	329	241	202	189	176	148	124	104	87
	Gas Processing Compression (1000 HP)	9	12	7	7	16	34	25	19	33	33	24	20	19	18	15	12	10	9
	Gas Processing Lateral Miles	12	15	10	10	22	46	34	25	44	44	32	27	25	24	20	16	14	12
	Gas Processing Lateral Size (Inches)	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
	Intrastate Gas Pipeline Miles	65	0	15	15	5	29	22	16	28	28	21	17	16	15	13	11	9	7
	Intrastate Gas Pipeline Avg. Size (Inches)	24	0	24	16	12	24	24	24	24	24	24	24	24	24	24	24	24	24
	Intrastate Gas Pipeline Compression (1000 HP)	14	0	3	3	16	6	5	3	6	6	4	4	3	3	3	2	2	2
	Interstate Gas Pipeline Miles	24	0	4	3	11	1	23	17	117	0	0	0	0	0	0	0	0	0
	Interstate Gas Pipeline Avg. Size (Inches)	30	0	30	30	30	20	24	30	31	0	0	0	0	0	0	0	0	0
	Interstate Gas Pipeline Compression (1000 HP)	14	0	2	2	6	3	27	26	34	0	0	0	0	0	0	0	0	0
Crude Oil	Oil Gathering Line Miles	199	221	161	97	144	218	247	337	435	406	374	345	325	320	307	295	283	272
	Oil Gathering Line Avg. Size (Inches)	4	4	4	4	4	6	6	6	6	6	6	8	8	8	8	8	8	8
	Crude Oil Lateral Miles	5	5	12	12	17	28	16	16	25	22	15	12	11	9	8	6	5	4
	Crude Oil Lateral Size (Inches)	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
	Crude Oil Storage Capacity (MBbl)	967	928	2,326	2,282	3,125	5,229	3,076	2,945	4,627	4,177	2,829	2,242	1,985	1,770	1,409	1,125	906	724
	Interstate Crude Oil Pipeline Miles	177	0	277	315	0	0	125	0	0	125	0	0	0	125	0	0	0	0
	Interstate Crude Oil Pipeline Avg. Size (Inches)	24	0	24	24	0	0	24	0	0	24	0	0	0	24	0	0	0	0
	Interstate Crude Oil Pumping (1000 HP)	14	0	23	26	0	0	8	0	0	11	0	0	0	11	0	0	0	0
NGL	NGL Lateral Miles	4	5	7	1	0	16	12	9	16	16	11	10	9	8	7	6	5	4
	NGL Lateral Size (Inches)	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
	Interstate NGL Pipeline Miles	65	103	93	59	32	0	0	73	0	75	0	0	0	75	0	0	0	0
	Interstate NGL Pipeline Avg. Size (Inches)	24	24	24	24	24	0	0	24	0	24	0	0	0	24	0	0	0	0
	Interstate NGL Pumping (1000 HP)	4	7	6	4	2	0	0	5	0	5	0	0	0	5	0	0	0	0
CO2	CO2 Pipeline Miles	117	0	0	16	10	0	0	0	0	0	0	0	211	0	0	0	0	0
	CO2 Pipeline Size (Inches)	20	0	0	20	20	0	0	0	0	0	0	0	16	0	0	0	0	0
	CO2 Pipeline Pumping (1000 HP)	15	0	0	2	1	0	0	0	0	0	0	0	26	0	0	0	0	0

Exhibit B-2: New Mexico New Infrastructure Builds - Alternative Case

	Alternative Case	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Natural Gas	Gas Gathering Line Miles	427	453	297	176	241	318	340	346	395	350	298	209	177	169	159	153	149	146
	Gas Gathering Line Avg. Size (Inches)	4	4	5	5	5	6	6	6	5	6	6	7	7	7	8	8	8	9
	Gas Gathering Line Compression (1000 HP)	19	24	15	15	33	69	51	18	5	6	5	4	5	4	4	4	4	3
	Gas Processing Capacity (MMcfd)	92	115	74	75	162	342	252	90	23	28	22	21	24	19	19	19	18	16
	Gas Processing Compression (1000 HP)	9	12	7	7	16	34	25	9	2	3	2	2	2	2	2	2	2	2
	Gas Processing Lateral Miles	12	15	10	10	22	46	34	12	3	4	3	3	3	3	3	2	2	2
	Gas Processing Lateral Size (Inches)	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
	Intrastate Gas Pipeline Miles	65	0	15	15	5	29	22	8	2	2	2	2	2	2	2	2	2	1
	Intrastate Gas Pipeline Avg. Size (Inches)	24	0	24	16	12	24	24	24	24	24	24	24	24	24	24	24	24	24
	Intrastate Gas Pipeline Compression (1000 HP)	14	0	3	3	16	6	5	2	0	1	0	0	0	0	0	0	0	0
	Interstate Gas Pipeline Miles	24	0	4	3	11	1	0	0	0	0	0	0	0	0	0	0	0	0
	Interstate Gas Pipeline Avg. Size (Inches)	30	0	30	30	30	20	0	0	0	0	0	0	0	0	0	0	0	0
	Interstate Gas Pipeline Compression (1000 HP)	14	0	2	2	6	3	0	0	0	0	0	0	0	0	0	0	0	0
Crude Oil	Oil Gathering Line Miles	199	221	161	97	144	218	250	288	347	323	275	200	174	165	158	155	151	148
	Oil Gathering Line Avg. Size (Inches)	4	4	4	4	4	6	6	6	6	8	8	8	8	8	8	8	8	8
	Crude Oil Lateral Miles	5	5	12	12	17	28	17	16	25	22	14	2	0	0	0	0	0	0
	Crude Oil Lateral Size (Inches)	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
	Crude Oil Storage Capacity (MBbl)	967	928	2,326	2,282	3,125	5,229	3,106	2,925	4,600	4,179	2,641	446	0	0	0	0	0	0
	Interstate Crude Oil Pipeline Miles	177	0	277	315	0	0	125	0	0	0	0	0	0	0	0	0	0	0
	Interstate Crude Oil Pipeline Avg. Size (Inches)	24	0	24	24	0	0	24	0	0	0	0	0	0	0	0	0	0	0
	Interstate Crude Oil Pumping (1000 HP)	14	0	23	26	0	0	8	0	0	0	0	0	0	0	0	0	0	0
NGL	NGL Lateral Miles	4	5	7	1	0	16	12	4	1	1	1	1	1	1	1	1	1	1
	NGL Lateral Size (Inches)	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
	Interstate NGL Pipeline Miles	65	103	93	59	32	0	0	73	0	0	0	0	0	0	0	0	0	0
	Interstate NGL Pipeline Avg. Size (Inches)	24	24	24	24	24	0	0	24	0	0	0	0	0	0	0	0	0	0
	Interstate NGL Pumping (1000 HP)	4	7	6	4	2	0	0	5	0	0	0	0	0	0	0	0	0	0
CO2	CO2 Pipeline Miles	117	0	0	16	10	0	0	0	0	0	0	0	0	0	0	0	0	0
	CO2 Pipeline Size (Inches)	20	0	0	20	20	0	0	0	0	0	0	0	0	0	0	0	0	0
	CO2 Pipeline Pumping (1000 HP)	15	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Exhibit B-3: New Mexico Oil and Gas Capital Expenditures (Million 2017$)

Base Case	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Drilling	$3,406	$5,622	$4,343	$2,749	$5,160	$9,982	$12,289	$12,408	$12,516	$12,615	$12,712	$12,790	$12,862	$12,947	$13,018	$13,090	$13,159	$13,236
Natural Gas	$844	$274	$276	$240	$366	$688	$561	$538	$483	$483	$483	$483	$483	$483	$483	$483	$483	$483
Crude Oil	$1,050	$51	$1,035	$1,356	$91	$169	$497	$135	$207	$207	$207	$207	$207	$207	$207	$207	$207	$207
NGL	$375	$315	$327	$238	$98	$27	$20	$234	$60	$60	$60	$60	$60	$60	$60	$60	$60	$60
CO2	$568	$0	$0	$57	$25	$0	$0	$0	$122	$122	$122	$122	$122	$122	$122	$122	$122	$122
Replacement/Refurbishment	$1,160	$725	$798	$922	$694	$682	$698	$716	$727	$750	$773	$785	$795	$809	$822	$829	$834	$839
Total	**$7,404**	**$6,988**	**$6,779**	**$5,562**	**$6,434**	**$11,547**	**$14,066**	**$14,032**	**$14,117**	**$14,239**	**$14,358**	**$14,449**	**$14,530**	**$14,629**	**$14,713**	**$14,792**	**$14,867**	**$14,948**

Alternative Case	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Drilling	$3,406	$5,622	$4,343	$2,749	$5,160	$9,982	$12,450	$10,307	$9,354	$9,659	$9,046	$7,071	$6,650	$6,537	$6,627	$6,813	$6,980	$7,177
Natural Gas	$844	$274	$276	$240	$366	$688	$519	$232	$107	$118	$105	$98	$92	$81	$86	$83	$94	$96
Crude Oil	$1,050	$51	$1,035	$1,356	$91	$169	$499	$125	$175	$194	$141	$66	$47	$44	$41	$39	$38	$36
NGL	$375	$315	$327	$238	$98	$27	$20	$227	$2	$2	$2	$2	$2	$2	$2	$2	$1	$1
CO2	$568	$0	$0	$57	$25	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Replacement/Refurbishment	$1,160	$725	$798	$922	$694	$682	$698	$715	$719	$721	$722	$722	$720	$717	$715	$714	$712	$711
Total	**$7,404**	**$6,988**	**$6,779**	**$5,562**	**$6,434**	**$11,547**	**$14,186**	**$11,605**	**$10,358**	**$10,694**	**$10,016**	**$7,959**	**$7,511**	**$7,380**	**$7,471**	**$7,650**	**$7,825**	**$8,021**

Exhibit B-4: New Mexico Oil and Gas Value of Output (Million 2017$)

Base Case	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Production	$16,081	$17,829	$10,083	$8,885	$12,225	$19,649	$19,598	$21,308	$25,646	$30,716	$35,620	$39,818	$44,707	$49,531	$54,168	$57,673	$61,266	$64,047
Gathering & Processing	$839	$885	$936	$936	$983	$1,203	$1,348	$1,475	$1,696	$1,913	$2,070	$2,201	$2,319	$2,430	$2,521	$2,595	$2,655	$2,704
Pipeline Transmission	$1,813	$1,884	$1,934	$1,928	$2,017	$2,204	$2,373	$2,516	$2,764	$3,008	$3,184	$3,330	$3,464	$3,588	$3,690	$3,773	$3,841	$3,897
Gas Distribution	$375	$351	$354	$351	$327	$377	$336	$336	$336	$336	$336	$336	$336	$336	$336	$336	$336	$336
Other	$1,575	$1,590	$1,695	$1,492	$1,592	$1,594	$1,593	$1,593	$1,592	$1,592	$1,591	$1,590	$1,590	$1,589	$1,589	$1,588	$1,587	$1,587
Total	**$20,682**	**$22,539**	**$15,003**	**$13,592**	**$17,144**	**$25,025**	**$25,249**	**$27,227**	**$32,034**	**$37,565**	**$42,802**	**$47,275**	**$52,416**	**$57,475**	**$62,303**	**$65,964**	**$69,685**	**$72,571**

Alternative Case	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Production	$16,081	$17,829	$10,083	$8,885	$12,225	$19,649	$19,622	$20,501	$23,457	$26,977	$30,413	$32,184	$34,045	$35,828	$37,715	$38,941	$40,388	$41,404
Gathering & Processing	$839	$885	$936	$936	$983	$1,203	$1,349	$1,444	$1,564	$1,683	$1,763	$1,777	$1,778	$1,778	$1,778	$1,778	$1,778	$1,778
Pipeline Transmission	$1,813	$1,884	$1,934	$1,928	$2,017	$2,204	$2,374	$2,487	$2,642	$2,795	$2,898	$2,917	$2,918	$2,919	$2,920	$2,921	$2,922	$2,923
Gas Distribution	$375	$351	$354	$351	$327	$377	$336	$336	$336	$336	$336	$336	$336	$336	$336	$336	$336	$336
Other	$1,575	$1,590	$1,695	$1,492	$1,592	$1,594	$1,593	$1,593	$1,592	$1,592	$1,591	$1,590	$1,590	$1,589	$1,589	$1,588	$1,587	$1,587
Total	**$20,682**	**$22,539**	**$15,003**	**$13,592**	**$17,144**	**$25,025**	**$25,274**	**$26,361**	**$29,591**	**$33,382**	**$37,000**	**$38,805**	**$40,666**	**$42,450**	**$44,337**	**$45,564**	**$47,011**	**$48,027**

Exhibit B-5: New Mexico Value Added from Oil and Gas Activity (Million 2017$)

Base Case	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total O/G NM Income (direct & indirect)	$12,814	$14,017	$8,996	$8,076	$10,390	$15,499	$15,575	$16,816	$19,880	$23,425	$26,808	$29,699	$33,039	$36,329	$39,476	$41,861	$44,291	$46,175
Total NM Induced Income (30% of D&I)	$3,844	$4,205	$2,699	$2,423	$3,117	$4,650	$4,672	$5,045	$5,964	$7,028	$8,042	$8,910	$9,912	$10,899	$11,843	$12,558	$13,287	$13,853
Total O/G NM D,I & Induced Income	**$16,659**	**$18,222**	**$11,695**	**$10,499**	**$13,507**	**$20,149**	**$20,247**	**$21,861**	**$25,844**	**$30,453**	**$34,850**	**$38,609**	**$42,950**	**$47,227**	**$51,319**	**$54,419**	**$57,579**	**$60,028**
State GDP (from BEA to 2018) (2017$)	$93,844	$96,569	$94,020	$92,668	$94,211	$96,474	$92,663	$94,676	$98,518	$102,850	$107,026	$110,720	$114,870	$118,978	$122,952	$126,171	$129,445	$132,181
State non-energy GDP (2017$)	$77,185	$78,348	$82,325	$82,169	$80,704	$76,325	$77,089	$77,859	$78,638	$79,424	$80,219	$81,021	$81,831	$82,649	$83,476	$84,311	$85,154	$86,005
ICF NM D,I,&I O/G Income as % of NM GDP	17.8%	18.9%	12.4%	11.3%	14.3%	20.9%	21.9%	23.1%	26.2%	29.6%	32.6%	34.9%	37.4%	39.7%	41.7%	43.1%	44.5%	45.4%

Alternative Case	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total O/G NM Income (direct & indirect)	$12,814	$14,017	$8,996	$8,076	$10,390	$15,499	$15,591	$16,258	$18,325	$20,766	$23,114	$24,300	$25,532	$26,712	$27,961	$28,773	$29,731	$30,403
Total NM Induced Income (30% of D&I)	$3,844	$4,205	$2,699	$2,423	$3,117	$4,650	$4,677	$4,877	$5,498	$6,230	$6,934	$7,290	$7,659	$8,014	$8,388	$8,632	$8,919	$9,121
Total O/G NM D,I & Induced Income	**$16,659**	**$18,222**	**$11,695**	**$10,499**	**$13,507**	**$20,149**	**$20,268**	**$21,135**	**$23,823**	**$26,995**	**$30,048**	**$31,590**	**$33,191**	**$34,726**	**$36,350**	**$37,405**	**$38,651**	**$39,524**
State GDP (from BEA to 2018) (2017$)	$93,844	$96,569	$94,020	$92,668	$94,211	$96,474	$92,679	$94,117	$96,963	$100,190	$103,332	$105,321	$107,363	$109,361	$111,437	$113,084	$114,885	$116,409
State non-energy GDP (2017$)	$77,185	$78,348	$82,325	$82,169	$80,704	$76,325	$77,089	$77,859	$78,638	$79,424	$80,219	$81,021	$81,831	$82,649	$83,476	$84,311	$85,154	$86,005
ICF NM D,I,&I O/G Income as % of NM GDP	17.8%	18.9%	12.4%	11.3%	14.3%	20.9%	21.9%	22.5%	24.6%	26.9%	29.1%	30.0%	30.9%	31.8%	32.6%	33.1%	33.6%	34.0%

Exhibit B-6: New Mexico Jobs from Oil and Gas Activity

Base Case	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
"Wages & Salary" Jobs																		
Oil and Gas Sector Jobs	34,176	36,761	34,693	29,153	31,306	34,941	36,878	36,912	37,225	37,584	37,267	37,359	38,219	37,930	37,611	37,661	37,720	37,775
Other Related Direct and Indirect Jobs	20,236	21,745	20,543	17,318	18,582	20,692	21,823	21,840	22,026	22,240	22,043	22,096	22,617	22,438	22,241	22,269	22,303	22,335
Total Direct and Indirect Jobs	54,412	58,506	55,236	46,471	49,888	55,634	58,701	58,752	59,252	59,824	59,310	59,455	60,836	60,368	59,851	59,930	60,023	60,111
Induced Jobs	29,505	31,690	29,953	25,288	27,125	30,173	31,810	31,833	32,105	32,418	32,123	32,200	32,968	32,701	32,408	32,448	32,497	32,544
Direct, Indirect, and Induced Jobs	**83,917**	**90,196**	**85,189**	**71,759**	**77,013**	**85,806**	**90,511**	**90,585**	**91,357**	**92,242**	**91,433**	**91,655**	**93,805**	**93,069**	**92,259**	**92,378**	**92,520**	**92,654**
Other Jobs																		
Independent Contractors, On-call Workers, Temporary Help, etc.	**10,207**	**9,746**	**10,292**	**10,822**	**11,617**	**11,767**	**12,380**	**12,530**	**12,824**	**13,120**	**13,279**	**13,444**	**13,670**	**13,776**	**13,851**	**13,944**	**14,021**	**14,087**

Alternative Case	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
"Wages & Salary" Jobs																		
Oil and Gas Sector Jobs	34,176	36,761	34,693	29,153	31,306	34,941	36,982	34,850	33,878	34,222	33,690	31,909	31,503	31,379	31,437	31,574	31,703	31,854
Other Related Direct and Indirect Jobs	20,236	21,745	20,543	17,318	18,582	20,692	21,882	20,640	20,071	20,271	19,962	18,928	18,692	18,620	18,653	18,733	18,808	18,895
Total Direct and Indirect Jobs	54,412	58,506	55,236	46,471	49,888	55,634	58,865	55,489	53,949	54,494	53,653	50,837	50,195	49,999	50,091	50,307	50,511	50,750
Induced Jobs	29,505	31,690	29,953	25,288	27,125	30,173	31,895	30,096	29,272	29,562	29,115	27,621	27,280	27,176	27,224	27,338	27,447	27,573
Direct, Indirect, and Induced Jobs	**83,917**	**90,196**	**85,189**	**71,759**	**77,013**	**85,806**	**90,759**	**85,586**	**83,222**	**84,056**	**82,768**	**78,458**	**77,474**	**77,175**	**77,315**	**77,645**	**77,957**	**78,323**
Other Jobs																		
Independent Contractors, On-call Workers, Temporary Help, etc.	**10,207**	**9,746**	**10,292**	**10,822**	**11,617**	**11,767**	**12,415**	**11,912**	**11,810**	**12,067**	**12,017**	**11,506**	**11,384**	**11,346**	**11,361**	**11,400**	**11,435**	**11,477**

Exhibit B-7: New Mexico Total Wages from Oil and Gas Activity for "Wages & Salary" Jobs (Million 2017$)

Base Case	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Oil and Gas Sector Total Wages	$2,199	$2,441	$2,240	$1,779	$1,943	$2,226	$2,359	$2,365	$2,391	$2,419	$2,407	$2,417	$2,469	$2,457	$2,443	$2,448	$2,454	$2,459
Other Related Direct and Indirect Total Wages	$1,023	$1,135	$1,044	$830	$907	$1,037	$1,099	$1,101	$1,113	$1,126	$1,120	$1,125	$1,150	$1,144	$1,137	$1,139	$1,142	$1,144
Total Direct and Indirect Total Wages	$3,222	$3,576	$3,284	$2,609	$2,850	$3,263	$3,457	$3,467	$3,504	$3,545	$3,527	$3,542	$3,619	$3,601	$3,580	$3,588	$3,596	$3,604
Induced Total Wages	$1,072	$1,189	$1,093	$870	$950	$1,087	$1,151	$1,154	$1,166	$1,180	$1,174	$1,179	$1,205	$1,199	$1,191	$1,194	$1,196	$1,199
Direct, Indirect, and Induced Total Wages	**$4,294**	**$4,765**	**$4,377**	**$3,480**	**$3,799**	**$4,350**	**$4,608**	**$4,620**	**$4,670**	**$4,725**	**$4,701**	**$4,720**	**$4,824**	**$4,800**	**$4,771**	**$4,781**	**$4,792**	**$4,802**

Alternative Case	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Oil and Gas Sector Total Wages	$2,199	$2,441	$2,240	$1,779	$1,943	$2,226	$2,367	$2,222	$2,159	$2,187	$2,153	$2,028	$2,000	$1,991	$1,995	$2,005	$2,014	$2,025
Other Related Direct and Indirect Total Wages	$1,023	$1,135	$1,044	$830	$907	$1,037	$1,102	$1,035	$1,006	$1,019	$1,003	$946	$933	$929	$931	$935	$939	$944
Total Direct and Indirect Total Wages	$3,222	$3,576	$3,284	$2,609	$2,850	$3,263	$3,469	$3,257	$3,166	$3,206	$3,156	$2,974	$2,933	$2,920	$2,926	$2,940	$2,953	$2,969
Induced Total Wages	$1,072	$1,189	$1,093	$870	$950	$1,087	$1,155	$1,085	$1,054	$1,068	$1,051	$991	$977	$973	$975	$980	$984	$989
Direct, Indirect, and Induced Total Wages	**$4,294**	**$4,765**	**$4,377**	**$3,480**	**$3,799**	**$4,350**	**$4,623**	**$4,341**	**$4,220**	**$4,274**	**$4,207**	**$3,965**	**$3,910**	**$3,894**	**$3,901**	**$3,920**	**$3,938**	**$3,958**

Appendix C: Additional Information on ICF Modeling Tools

C.1 Gas Market Model (GMM)

ICF's Gas Market Model (GMM) is an internationally recognized modeling and market analysis system for the North American gas market. The GMM was developed by Energy and Environmental Analysis, Inc., now a wholly owned business unit within ICF, in the mid-1990s to provide forecasts of the North American natural gas market under different assumptions. In its infancy, the model was used to simulate changes in the gas market that occur when major new sources of gas supply are delivered into the marketplace.

The GMM has been used to complete strategic planning studies for many private sector companies. The different studies include:

- Analyses of different pipeline expansions;
- Measuring the impact of gas-fired power generation growth;
- Assessing the impact of low and high gas supply; and
- Assessing the impact of different regulatory environments.

In addition to its use for strategic planning studies, the model has been widely used by a number of institutional clients and advisory councils, including the recent Interstate Natural Gas Association of America (INGAA) study. The model was also the primary tool used to complete the widely referenced study on the North American Gas market for the National Petroleum Council in 2003.

GMM is a full supply/demand equilibrium model of the North American gas market. The model solves for monthly natural gas prices throughout North America, given different supply/demand conditions, the assumptions for which are specified by the user.

There are nine different components of ICF's model, as shown in (Exhibit C-1). The inputs for the model are provided through a "drivers" spreadsheet. The user provides assumptions for weather, economic growth, oil prices, and gas supply deliverability, among other variables. ICF's market reconnaissance keeps the model up to date with generating capacity, storage and pipeline expansions, and the impact of regulatory changes in gas transmission. This is important to maintaining model credibility and confidence of results.

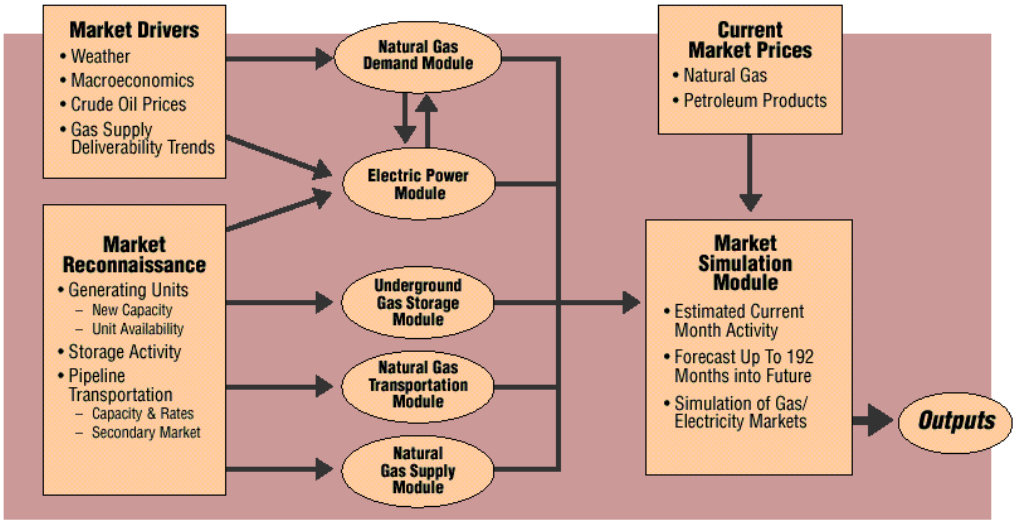
Overall, the model solves for monthly market clearing prices by considering the interaction between supply and demand curves at each of the model's nodes. The supply side of the equation includes prices determined by production and storage price curves that reflect prices as a function of production and storage utilization (Exhibit C-2). Total U.S. and Canadian gas supplies include production, LNG imports, and storage withdrawals (in the withdrawal season only).[23] Gas production is solved in 81 distinct regions throughout the United States and Canada and is represented by both short- and long-run supply curves. In the short run (i.e., the current month), gas production is bound by the amount of available productive capacity. In the long run,

[23] Storage withdrawals are solved within the model based on "storage supply curves" that reflect the level of withdrawals relative to gas prices. The curves have been fit to historical price and withdrawal data.

productive capacity changes as a function of the available gas resource, the cost of development, and the solved gas price. North American LNG imports and exports are exogenously specified by the selected scenario. For each modeling, ICF includes its own projection of North American LNG imports and export by terminal.

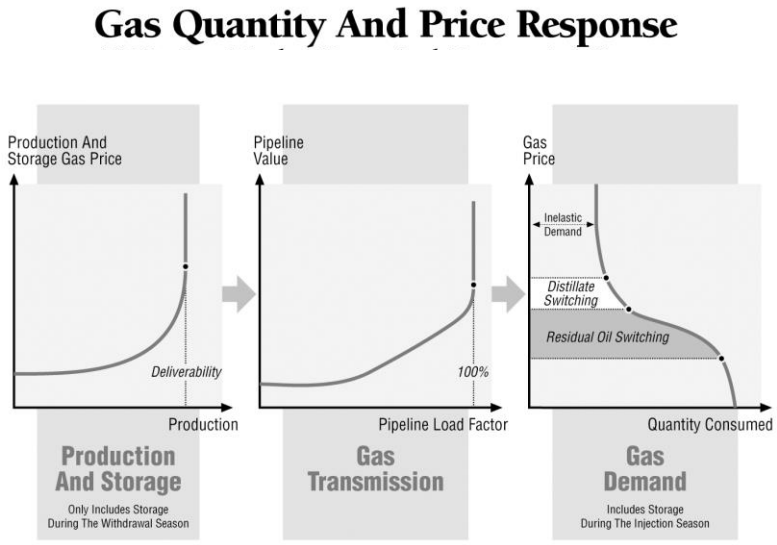
Prices are also influenced by "pipeline discount" curves, which reflect the change in basis or the marginal value of gas transmission as a function of the load factor of the pipeline corridor. The structure of the transmission network is shown in (Exhibit C-3). The discount curves have been empirically fit to historic basis values and pipeline load factors on each pipeline corridor. Pipeline capacity expansions are exogenously specified for each scenario.

Exhibit C-1: GMM Structure



Source: ICF GMM®

Exhibit C-2: Natural Gas Supply and Demand Curves in the GMM



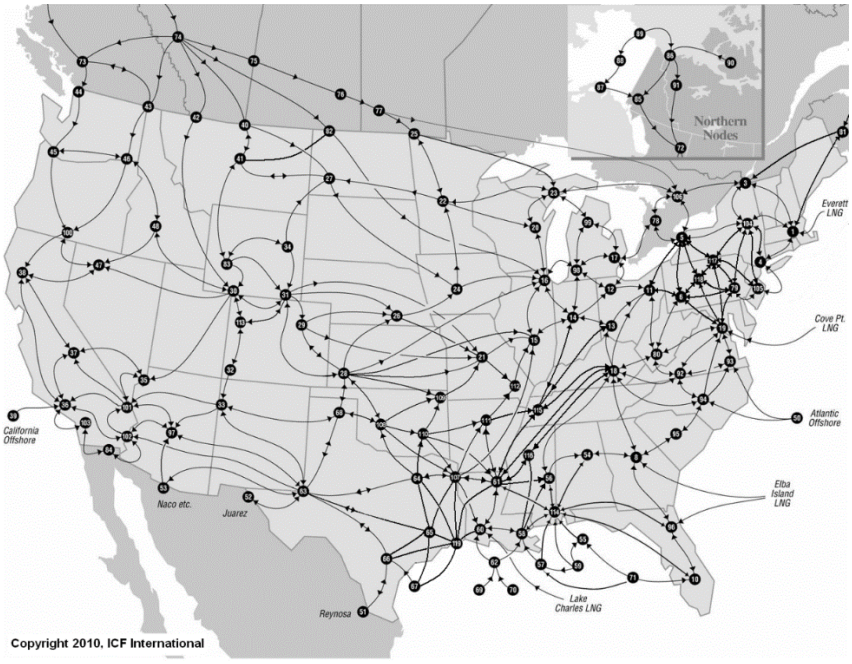
Source: ICF GMM®

On the demand-side of the equation, prices are represented by a curve that captures the fuel-switching behavior of end-users at different price levels. The gas demand routine solves for gas demand across different sectors, given economic growth, weather, and the level of price competition between gas and oil. The electric power module solves for the power generation dispatch on a regional basis to determine the amount of gas used in power generation, which is allocated along with end-use gas demand to model nodes. The GMM forecast for power generation is consistent with ICF's Integrated Planning Model (IPM®), and the GMM power module allows for elasticity around IPM results to allow for seasonal/monthly variations. The GMM provides IPM with gas supply curves and basis that is used to determine gas prices for power plants within the IPM framework. The demand forecast for gas in the power sector from the IPM is then used as a benchmark to iterate both models until the gas prices and gas demand from power plants are converged in both models. Furthermore, IPM provides coal and oil retirements, and generation forecast from nuclear, hydro, and non-hydro renewables that is used in the GMM electric power model.

The GMM balances supply and demand at all nodes in the model at the market clearing prices determined by the shape of the supply, demand, and transportation curves. The model nodes are tied together by a series of network links in the gas transportation module. The gas supply component of the model solves for node-level natural gas deliverability or supply capability, including LNG import levels. The model solves for gas storage injections and withdrawals at different gas prices. The components of supply (i.e., gas deliverability, storage withdrawals, supplemental gas, LNG imports, and imports to Mexico) are balanced against demand (i.e., end-use demand, power generation gas demand, LNG exports, and exports to Mexican) at each of the nodes and gas prices are solved for in the market simulation module.

Unlike other commercially available models for the gas industry, ICF does significant backcasting (calibration) of the model's curves and relationships on a monthly basis to make sure that the model reliably reflects historical gas market behavior, instilling confidence in the projected results.

Exhibit C-3: GMM Transmission Network



Source: ICF GMM®

C.2 Permian Dynamic Scenarios Framework (PDSF)

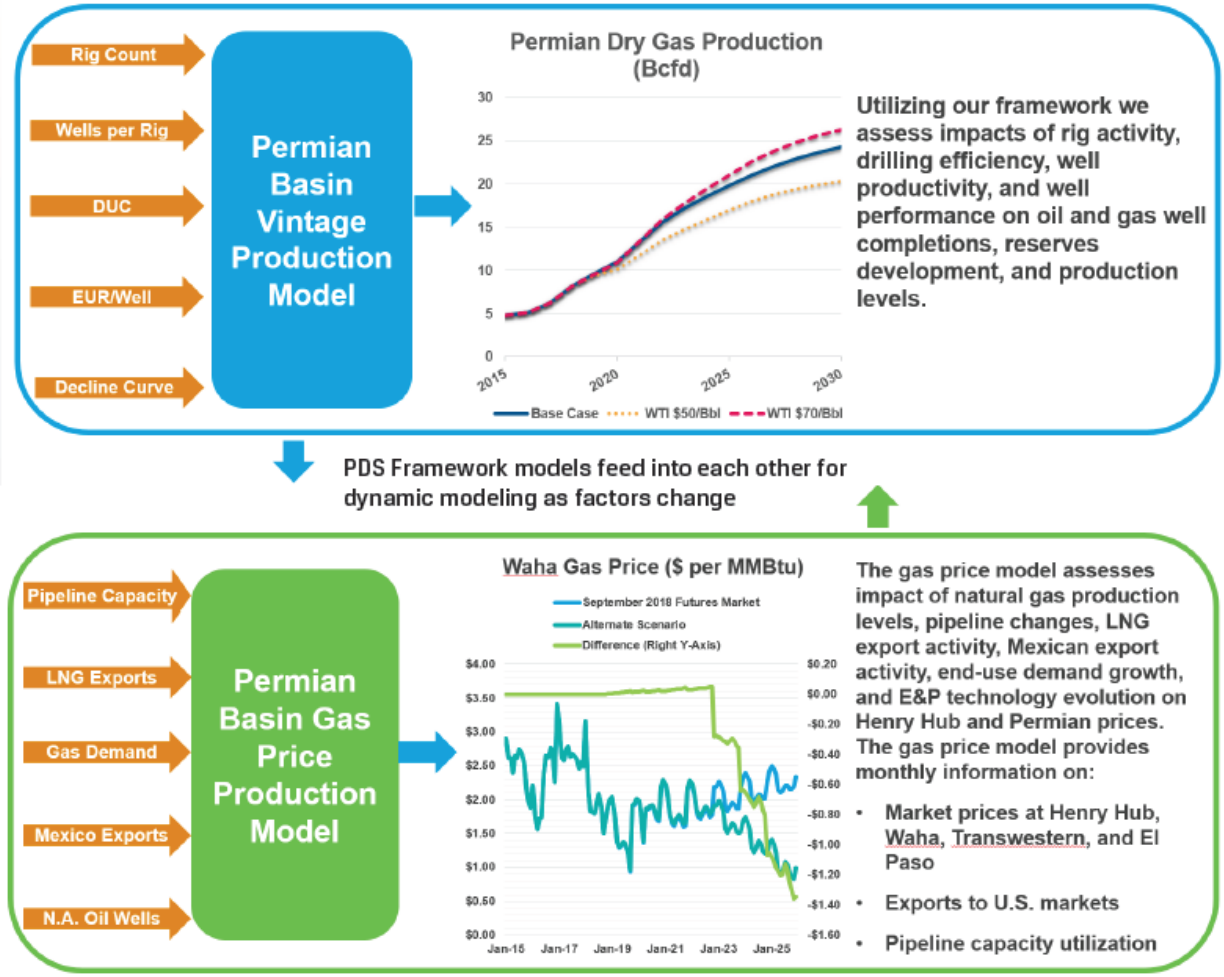
ICF's Permian Dynamic Scenario Framework (PDSF) relies on a Permian Basin Vintage Production Model. In turn, those production changes are considered along with user assumptions for pipeline capacity, export levels, and market growth to estimate price and basis changes in our unique Permian Basin Gas Price Model (Exhibit C-4). Example of questions that PDSF answers include:

- How will oil prices affect drilling activity and production?
- How will increases or decreases in drilling activity affect production?
- How will technology continue to impact oil and gas production?
- How will the basin's pipelines be used in the future?
- How much will prices change with limited pipeline expansion?
- How will the basin's production affect broader prices?
- What levels of oil and gas exports will the basin support?
- Will drilled but uncompleted wells (DUCs) continue to increase?

Permian Basin Vintage Production Model covers four Permian areas, New Mexico Delaware, Texas Delaware, Central (TX), and Midland (TX). It assesses impact of rig activity, drilling efficiency, drilled but uncompleted (DUC) wells inventory, well productivity (estimated ultimate recovery/EUR), and well performance (decline curve) on:

- Horizontal and vertical well drilling and well completions
- Natural gas (wet and dry), crude oil, and NGL vintage production and reserves

Exhibit C-4: Permian Dynamic Scenarios Framework



C.3 Detailed Production Report (DPR)

ICF's Detailed Production Report (DPR) is a gas and oil vintage well production model that provides a complete outlook for U.S. and Canada natural gas, natural gas liquids (NGLs), and crude oil (Exhibit C-5). The DPR presents annual production projections for more than 50 basins throughout the U.S. and Canada, and includes total production for both the U.S. and Canada. The report's gas production projections are linked to ICF's Natural Gas-Strategic Outlook, which provides additional insight into the future of the North American natural gas market.

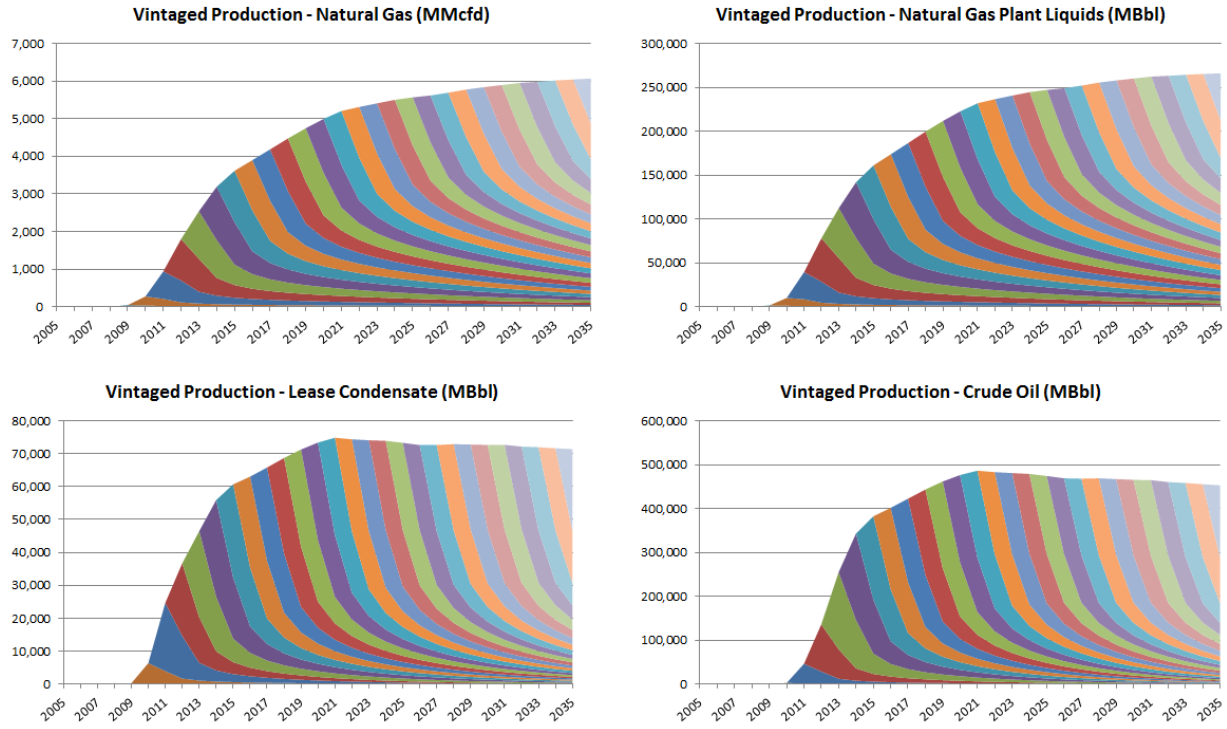
The DPR contains many findings that will be of interest to oil and gas producers, field services companies, and the investment community, including:

- Projected gas, oil, and NGL production by year and by region through 2035.
- Projected gas and oil well activity by year and region through 2035.
- Vintage production charts for each region, showing how production changes over time.
- Estimated ultimate recovery (EUR) statistics for oil, gas, and NGLs wells by region.

The DPR was developed by ICF in the 2011 and its forecasts have been widely used by a number of institutional clients and advisory councils. INGAA midstream infrastructure studies in 2011, 2014, and 2016 relied on the DPR for natural gas, NGL, and oil production trends based on projections of gas and oil drilling activity to assess midstream infrastructure needs in the U.S. and Canada through 2035.

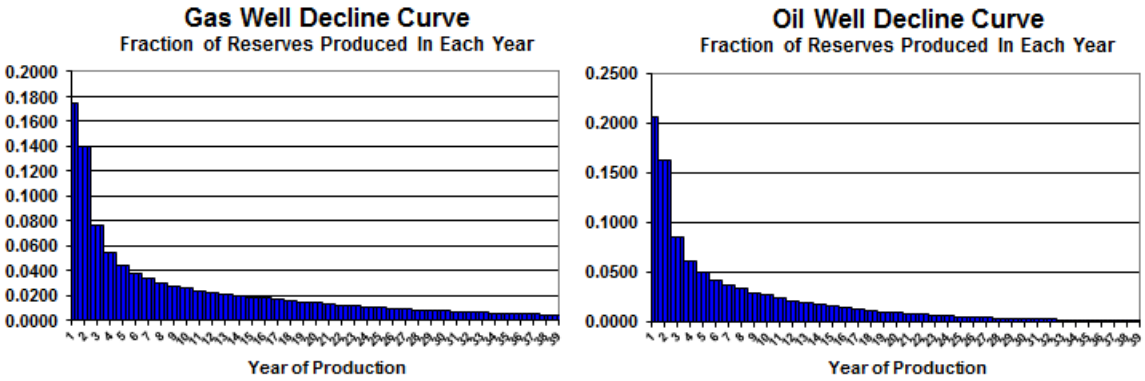
The DPR's historical gas/oil well completions, gas/NGLs/crude oil production, and gas-to-liquids ratio are calibrated to most recent statistics. The historical data is also used to estimate gas/NGLs/crude oil EURs. The main drivers for DPR forecasts are gas production forecasts from ICF's Gas Market Model (GMM) and expected gas and oil well production decline curves (Exhibit C-6). The GMM node-level annual gas production is mapped to each of the 56 DPR plays/production basins and broken out by gas resource type (Exhibit C-7). DPR projections are also affected by assumptions for expected gas versus oil directed drilling ratio over time, EUR improvements due to advancement in horizontal drilling and hydraulic fracturing technology, EUR reductions that occur as drilling activities move away from sweet spots, and changes to production decline profiles due to changes in production operation such as "well throttling" implemented to improve EURs.

Exhibit C-5: Example Vintage Production from DPR



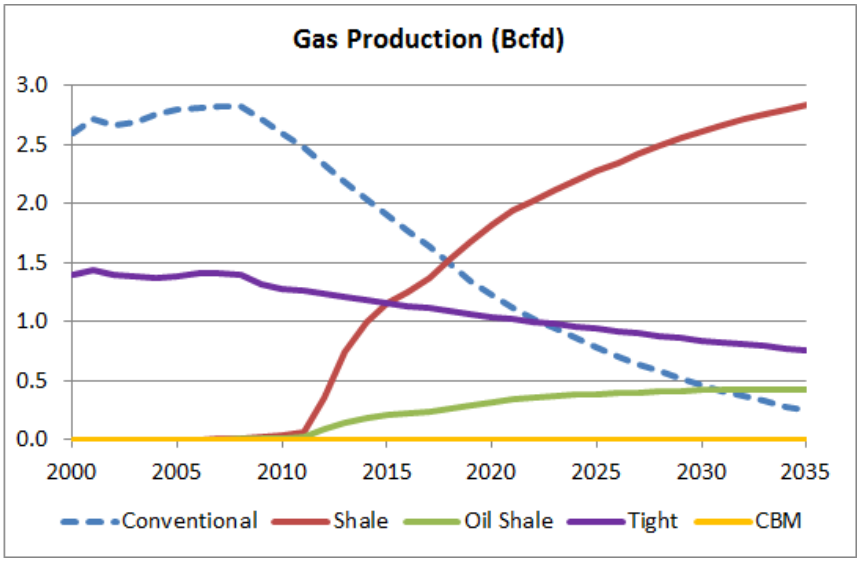
Source: ICF

Exhibit C-6: Example Oil and Gas Well Decline Curves



Source: ICF

Exhibit C-7: Example Breakout of Gas Production by Type



Source: ICF

C.4 NGL Transport Model (NGLTM)

ICF has developed a Natural Gas Liquids Transport Model (NGLTM) to represent the annual transport of NGLs in the U.S. and Canada. The model can move "raw mix" NGLs and "pure" NGLs products between supply areas and market areas along active corridors representing existing or future pipeline paths, as well as existing and future paths for rail movement of NGLs. Imports and exports of NGL products are also represented in the model framework.

NGL production is based on ICF's Detailed Production Report. Excess production is moved from growing supply areas to the dominant NGL demand centers along the Gulf coast. Imports and exports of pure NGL products bring the market areas into balance. NGLTM also includes estimates of ethane rejection due to growing production that outpaces demand and infrastructure growth.

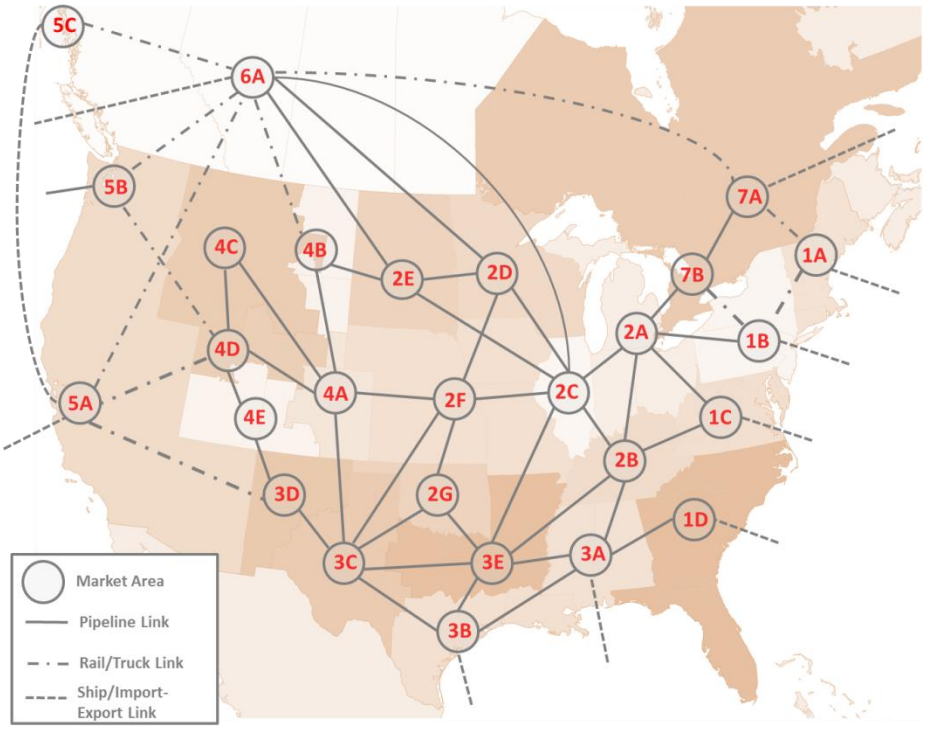
The NGLTM contains 27 supply/demand areas for the U.S. and Canada (Exhibit C-8). The areas are connected by roughly 200 corridors representing individual pipeline projects and other forms of available transport (truck, rail, and ship) to move both raw NGLs (y-mix) and pure NGLs products like Ethane and Propane from production areas to demand areas.

- The model minimizes the cost of transport between areas using mileage-based transport costs with pipelines assumed to have significantly lower unit costs of transport than rail and truck transport.
- The model solves for annual NGL flows between areas. Raw mix and purity movements are accounted for separately.
- Capacity on individual NGL pipelines and pipeline expansion projects are often represented separately. Pipeline capacity for petroleum products pipelines that move NGLs, rich gas natural gas pipelines, or crude lines that transport raw mix or diluent products may also be represented in the model as NGLs transport capacity.

- Annual supply, demand, and imports/exports of NGLs are set by assumption or from other publicly available analyses using ICF's models and forecasting tools.
- Since the model is solving for annual transport, short term or seasonal storage of NGLs in raw or purity form is not considered.
- Capacity for transporting NGLs within each supply/demand area is not specifically modeled, but intra-area projects may be included to estimate total pipeline infrastructure costs.
- Refined petroleum products like gasoline or diesel fuel are not included in the movements of this model, but refined bi-products which resemble the heavier NGLs and can be used as diluents to Canadian oil sands crude are represented.

The model contains a historical stack of capacity currently available and planned for the future. Actual or announced costs of pipeline projects are included where available, and costs for expansions and new pipelines are estimated by ICF. Additional unplanned capacity that is required to balance production with demand is added based on ICF's judgment and knowledge of NGL markets.

Exhibit C-8: NGL TM Paths



Source: ICF

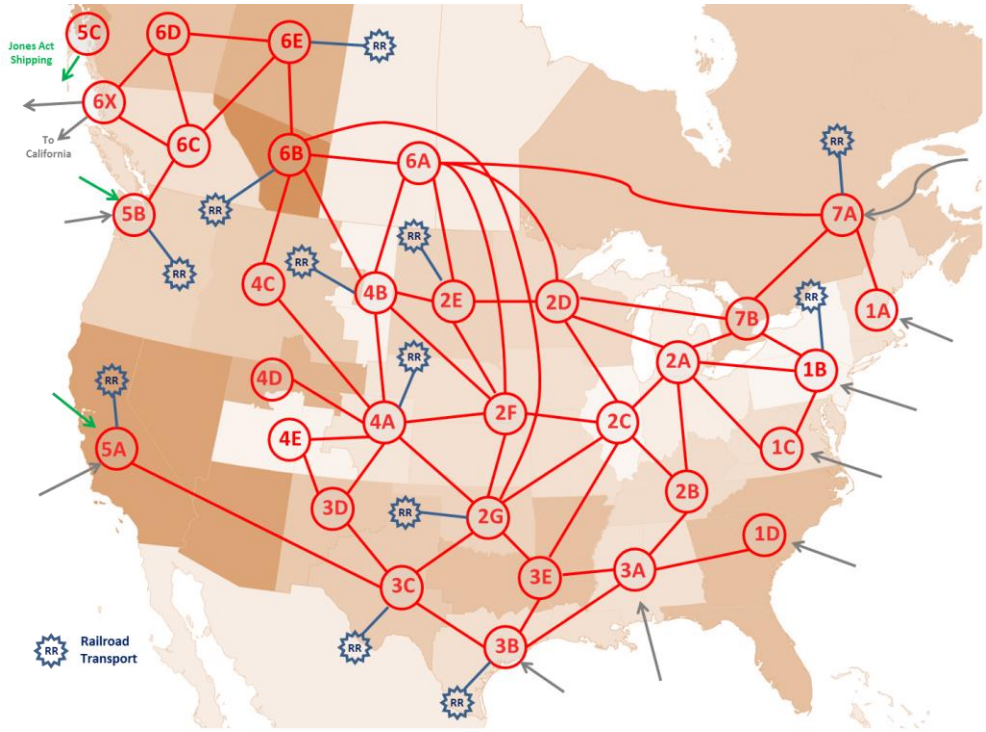
C.5 Crude Oil Transport Model (COTM)

ICF has developed a Crude Oil Transport Model (COTM) to represent annual transport of crude oil in the U.S. and Canada. The model can move crude oil between supply areas and market areas along active corridors representing existing or future pipeline paths, as well as existing

and future paths for rail movements of crude oil. Imports and exports of crude oil are also represented in the model framework.

The COTM contains 32 supply/demand areas for the U.S. and Canada (Exhibit C-9). Crude oil production is based on ICF's Detailed Production Report. Excess production is moved from growing supply areas to the dominant oil demand centers (i.e., refineries) along the Gulf Coast. Imports and exports of crude oil bring the market areas into balance.

Exhibit C-9: COTM Paths



Source: ICF

The supply and demand areas are connected by over 250 corridors representing individual pipeline projects and other forms of available transport (truck, rail, and ship) to move crude oil from production areas to demand areas.

- Refinery capacity is not assumed to grow. However, refineries may enhance their capacity to accommodate increased refinery input and changing crude slates over time.
- U.S. refinery input is based on EIA AEO projections. Canada refinery input is held constant at historical levels.
- Net imports into Canada can be negative, which means crude can be exported from the east and west coasts of Canada.
- The model considers exports of crude (negative imports) from the U.S. Gulf Coast.
- Pipeline and railroad capacity along each corridor is specified as an input. Existing capacity is augmented by a stack of announced projects in the U.S. and Canada. Additional unplanned projects are added to permit markets to balance or facilitate export of oil.

- Rates for transport rely on each corridor's mileage and based on ICF's proprietary cost information. ICF assumes that rail corridor rates include additional costs for loading and unloading.

The model contains a historical stack of capacity currently available and planned for the future. Actual or announced costs of pipeline projects are included where available and costs for expansions and new pipelines are estimated by ICF. Additional unplanned capacity required to balance the production with demand is added based on ICF's judgment and knowledge of individual crude markets.