U.S. OIL AND GAS

INFRASTRUCTURE INVESTMENT

THROUGH 2035

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AN ENGINE FOR ECONOMIC GROWTH

STUDY PREPARED FOR **AMERICAN PETROLEUM INSTITUTE**

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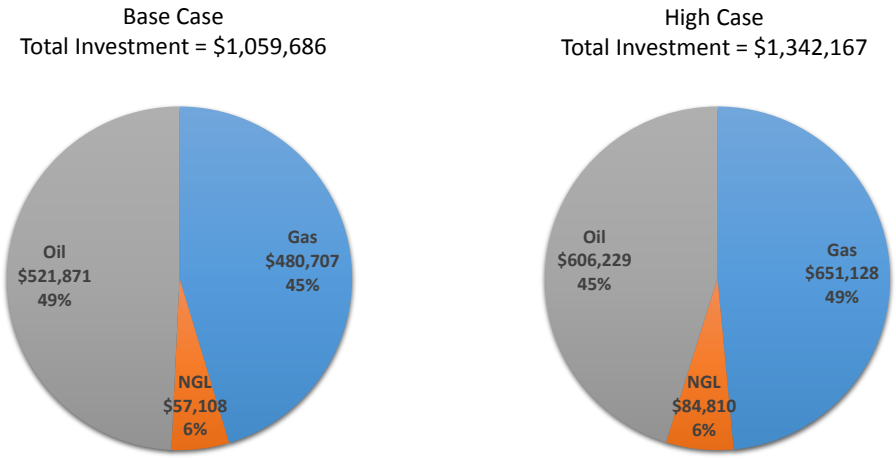
Executive Summary

During the past five years, U.S. oil and gas infrastructure development proceeded at a rapid pace, and many have wondered whether the trend can continue. In that light, API contracted ICF to undertake a study that investigates the amount of oil and gas infrastructure development possible in the U.S. through 2035. This report summarizes results of the study.

The report focuses on the amount of infrastructure needed for two different scenarios, a Base Case and a High Case, each of which are plausible depictions of future market conditions. While the Base Case represents a most likely scenario, the High Case is put forward to assess infrastructure development in a more robust environment that is fostered by a larger hydrocarbon resource base and more rapid advancements in E&P technology. The study assesses capital expenditures associated with and the resulting economic consequences of oil and gas infrastructure development. Key findings are as follows:

1) Rapid infrastructure development is likely to continue for a prolonged period of time. The primary drivers for robust development are still in place – shale and tight resource development is likely to continue in earnest, and markets will grow in response to the relatively low commodity prices that are being fostered by new oil and gas supplies.
2) Total capital expenditures (CAPEX) for oil and gas infrastructure development will range from $1.06 to $1.34 trillion from 2017 through 2035 (Exhibit ES-1). These levels of investment equate to an average annual CAPEX ranging from $56 to $71 billion throughout the projection (Exhibit ES-2). This includes investments in new as well as existing infrastructure for the following categories: a) Surface and Lease Equipment; b) Gathering and Processing Facilities; c) Oil, Gas, and NGL Pipelines; d) Oil and Gas Storage Facilities; e) Refineries and Oil Products Pipelines; and f) Export Terminals.

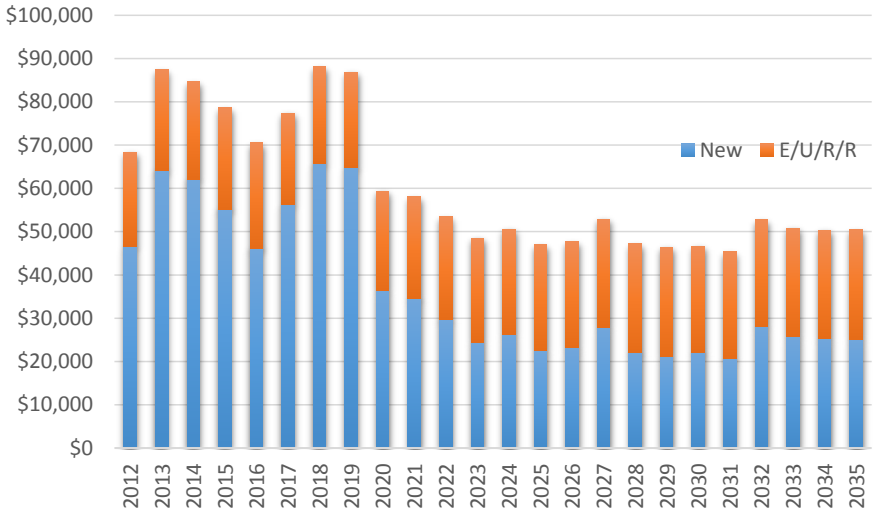
Exhibit ES-1: Projected Capital Investment in Oil and Gas Infrastructure from 2017-2035 (Million 2015$)



3) Investment in infrastructure contributes $1.50 to $1.89 trillion to U.S. Gross Domestic Product (GDP) over the projection period, or between $79 and $100 billion annually.
4) Infrastructure development will employ an average of 828,000 to 1,047,000 individuals annually in the U.S. Significant jobs are created not only within states where infrastructure development occurs, but across ALL states because of indirect and induced labor impacts. Oil and gas infrastructure development has far-reaching benefits across the entire U.S. economy.
5) The outcome of the scenarios is dependent on regulatory approvals of infrastructure projects.

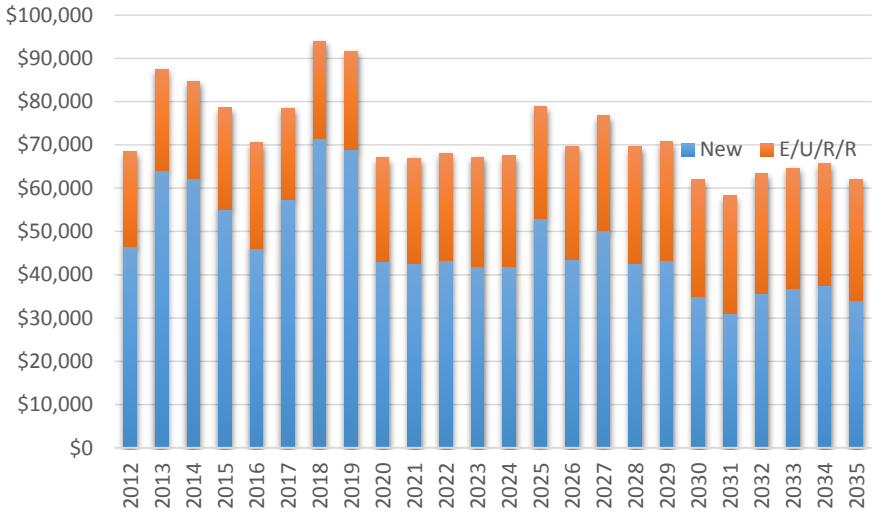
Exhibit ES-2: Oil and Gas Infrastructure CAPEX by Year (Million 2015$)

Base Case
Projected (2017-2035) Average Annual CAPEX = $55,773



E/U/R/R = Enhancement/Upgrade/Replacement/Refurbishment

High Case
Projected (2017-2035) Average Annual CAPEX = $70,640



E/U/R/R = Enhancement/Upgrade/Replacement/Refurbishment

Study Highlights

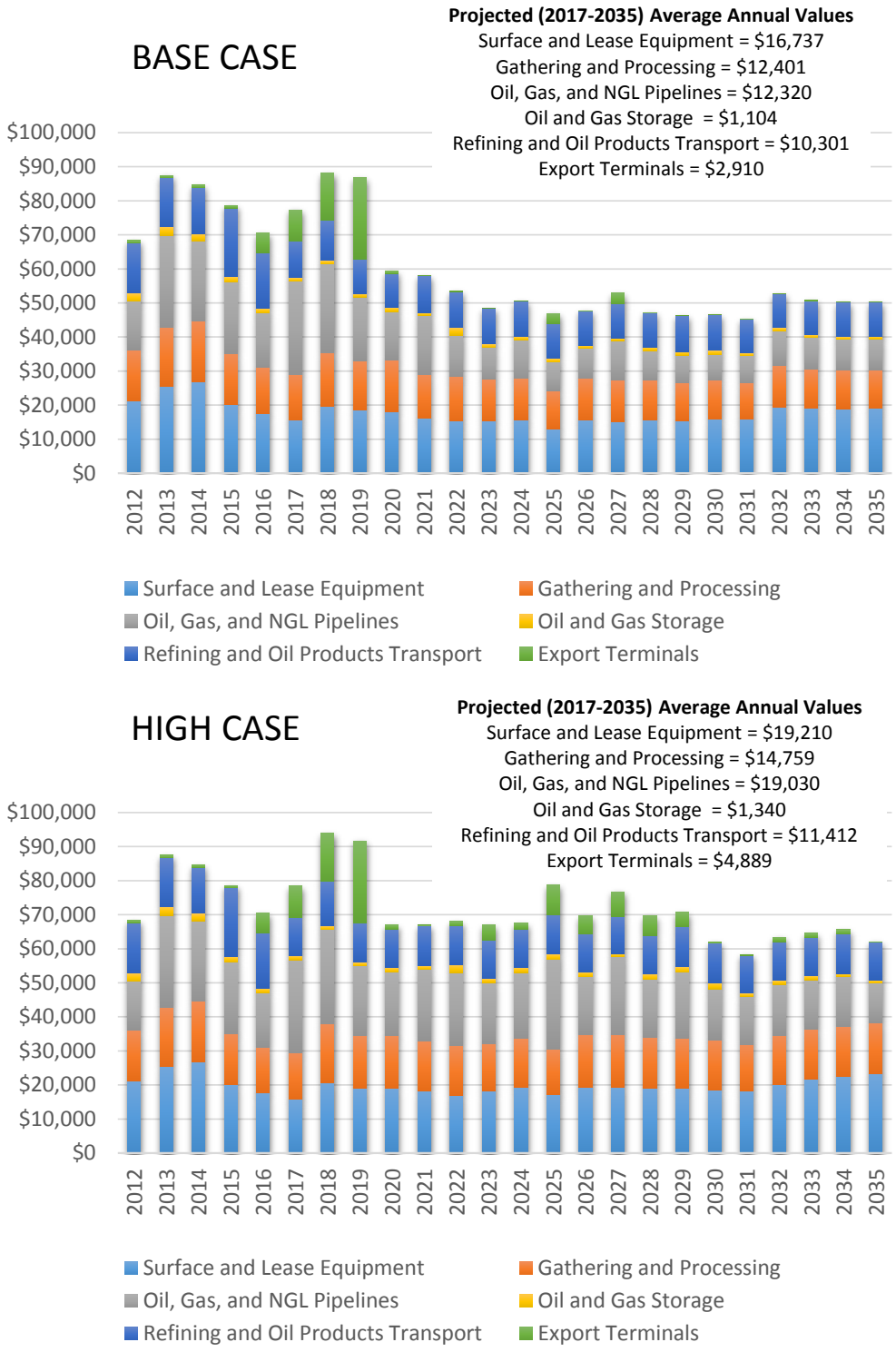
The scenarios in this study project significant growth in oil and gas production and markets that evolve to accommodate such growth. While the Base Case shows fairly constant U.S. oil production in aggregate, tight oil supplies will continue to grow to offset declines in conventional production. In the High Case, oil production growth is robust with U.S. production rising to upwards of 12 million barrels per day by 2035. Natural gas production growth is even more pronounced, increasing from roughly 72 billion cubic feet per day at present to between 110 and 131 billion cubic feet per day by 2035. Natural gas liquids (NGL) will track along with gas production over time.

Such robust production growth is supported by strong demand growth. Refinery output in the U.S. will increase from its present level of just over 16 million barrels per day to between 17 and 19 million barrels per day by 2035. Increased oil refining is driven by tight oil development within the U.S. and oil sands production from Western Canada. Gas markets grow dramatically, with significant growth of liquefied natural gas (LNG) exports, exports to Mexico, increases in petrochemical activity, and increases in gas-fired power generation. Petrochemical activity and exports also drive growth in NGL markets.

Robust development of unconventional oil and gas resources and the supporting market activity promote new transport capability for oil and gas. As a result transport capability for oil, gas, and NGLs increases by 3.0 to 5.0 million barrels per day, 49 to 68 billion cubic feet per day, and 1.8 to 2.6 million barrels per day, respectively. Incremental transport is also supported by a significant amount of new gathering and processing infrastructure.

Thus, investment in oil and gas infrastructure will sum to $1.06 to $1.34 trillion from 2017 through 2035, averaging $56 to $71 billion per year. Roughly 30 percent of the investment or $16.7 to $19.2 billion annually will be for surface and lease equipment (Exhibit ES-3), which is split between investment in equipment that supports production from onshore wells and development of offshore platforms located in the Gulf of Mexico. Oil, gas, and NGL pipeline development will also be robust with an annual average CAPEX of $12.3 to $19.0 billion from 2017 through 2035, equating to between 22 and 27 percent of the total infrastructure investment. Across the U.S., there will be 27,000 to 45,000 miles of pipelines with 10 to 12 million horsepower of compression added and replaced throughout the period. Gathering and processing investment ranks third among the investment categories, with an average annual CAPEX of $12.4 to $14.8 billion accounting for roughly 22 percent of the total infrastructure investment. This investment is aimed at gathering and processing oil, gas, and NGLs from 24,075 to 28,175 new well completions per year, and there will be 218,000 to 240,000 miles of gathering lines, 22 to 29 million horsepower and compression, 70 to 85 billion cubic feet per day of processing plant capacity, and 5 to 6 million barrels per day of fractionation capacity built and replaced throughout the projection. The remainder of the investment, or between $14.3 and $17.6 billion per year is required to support refining, storage, and export activities.

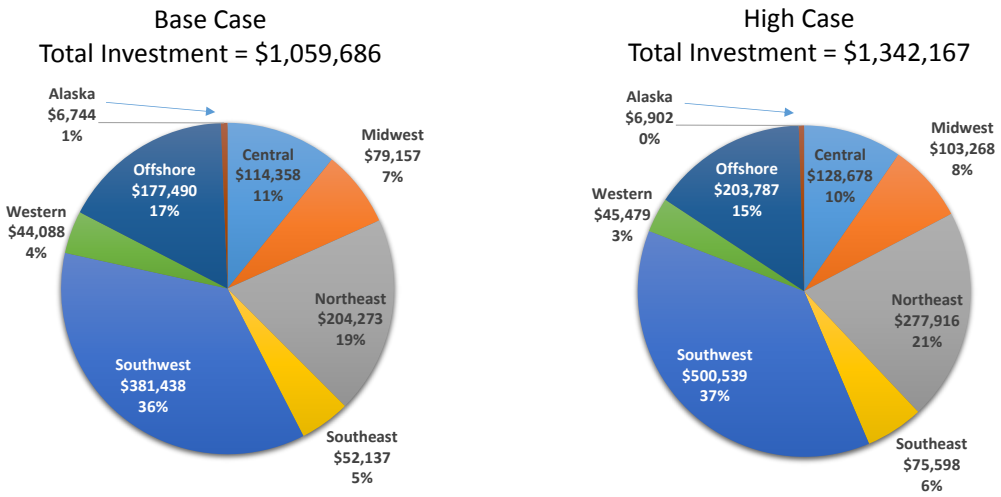
Exhibit ES-3: Annual Oil and Gas Infrastructure CAPEX by Category (Million 2015$)



Geographically, oil and gas infrastructure investment will be greatest in the Southwest, which includes Texas, with a total CAPEX of $381 to $501 billion, accounting for 36 to 37 percent of the total infrastructure investment across the U.S. (Exhibit ES-4). It should come as little surprise that this area leads the way on

infrastructure development because it is relatively friendly to oil and gas development and is already home to a significant amount of infrastructure. However, the Northeast/Midwest U.S. will also see a significant investment in oil and gas infrastructure, with total investment for the area ranging from $283 to $381 billion, accounting for roughly 27 to 28 percent of the total oil and gas infrastructure investment across the U.S. The focus for this area has been and will continue to be on developing and transporting the vast amount of natural gas resource contained in the Marcellus/Utica producing basin. Infrastructure development for this area will depend on approvals of pipeline projects and market evolution. Offshore Gulf of Mexico infrastructure development is also significant at $177 to $204 billion, accounting for roughly 16 percent of the total investment that occurs across each of the scenarios. Collectively, other geographic areas account for the remaining $296 to $360 billion or roughly 27 percent of the total investment across the projections.

Exhibit ES-4: Regional CAPEX for Oil and Gas Infrastructure from 2017-2035 (Million 2015$)



Infrastructure development will continue to have significant and widespread impacts on the U.S. economy. It will support an average of 828,000 to 1,047,000 jobs each year from 2017 through 2035. It will also add a total of $1.50 to $1.89 trillion or an annual average of $79 to $100 billion to U.S. Gross Domestic Product. Federal taxes related to oil and gas infrastructure development will total $304 to $386 billion, while state taxes will total $236 to $299 billion throughout the projection period. All states benefit from infrastructure development as there are indirect and induced employment benefits spread to states even where these is no infrastructure development.

Concluding Statement

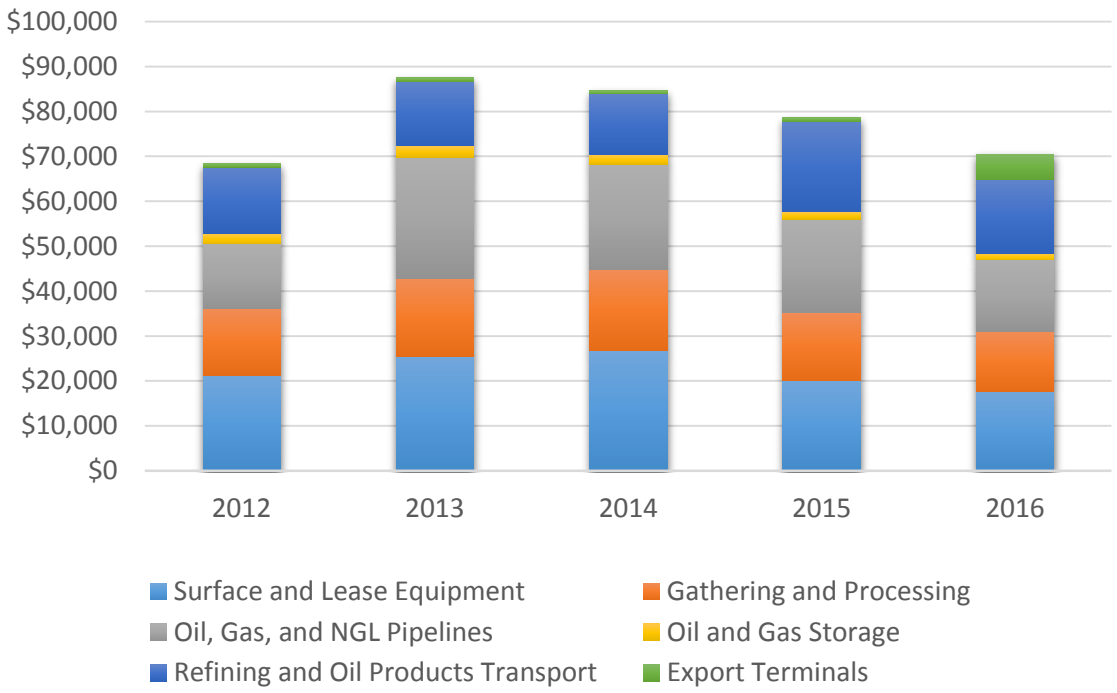
A robust environment for oil and gas infrastructure development has not yet run its course and is likely to continue for many years, with total investment in oil and gas infrastructure ranging from $1.06 to $1.34 trillion from 2017 through 2035. This investment will have positive impacts on the U.S. economy, employing many individuals and contributing significantly to Gross Domestic Product. It will also foster delivery of lower cost energy to households and businesses, and help the upstream and downstream portions of the oil and gas business develop more fully over time.

1 Introduction

1.1 Study Objectives

With the advent of oil and gas development from shale formations, North America's energy business has been transformed. The Shale Revolution has brought about a renewed focus on North America's oil and gas development, and U.S. oil production has risen from roughly from 5 to 9 million barrels per day while natural gas production has risen from about 55 to 72 billion cubic feet per day over the past decade. As a result, growth in the business that involve processing, refining, and transport of oil and gas has also been strong with $390 billion of spending for new infrastructure during the past five years (**Exhibit 1**).

Exhibit 1: Infrastructure CAPEX during the Past Five Years, Million 2015$



Generally, recent capital expenditures (i.e., the CAPEX from 2012 through 2016) for infrastructure have been averaging about $78 billion per year, with a peak expenditure of over $85 billion in 2013. Spending has been greatest for surface equipment with an average annual CAPEX of roughly $22billion in real terms. This category includes offshore oil platforms in the Gulf of Mexico, each of which is relatively expensive. New pipelines have accounted for roughly one-third of the capital expenditure, averaging just over $20 billion per year, while onshore gathering and processing expenditures have averaged about $16 billion per year in real terms. The remaining categories that include oil and gas storage, refining enhancements and upgrades, products and rail transport, and export facilities collectively add roughly $20 billion per year to the total. In short, significant infrastructure development has occurred across a number of categories.

Even while robust growth in U.S. oil and gas production and infrastructure development has occurred, much uncertainty remains about whether such growth will continue. The relatively low oil and gas price environment over the past few years has reduced E&P spending and activity, and infrastructure development has slowed from its peak in 2013. Thus, this study is being undertaken to examine whether the drivers of robust infrastructure development are still in place and to project potential needs and impacts of infrastructure going forward considering the uncertainty that exists.

The primary objective of the study is to inform industry, policymakers, and stakeholders about the dynamics of North America's energy markets based on a detailed supply/demand outlook for oil and gas development. Within this context, the study assesses oil and gas infrastructure needed to support the delivery of crude oil and oil products, natural gas, and natural gas liquids (NGLs). The associated economic benefits of infrastructure development, most notably GDP and jobs impacts are also projected.

The study considers recent trends and uncertainties, investigating impacts of those trends on future infrastructure requirements with two scenarios, a "Base Case" and a "High Growth Case". These cases are briefly described below.

- The study's Base Case represents a reasonable set of expectations about the future that are consistent with recent market activity. The case may also be characterized as a "status quo" case in that it reflects future market growth consistent with recent trends in the power sector and for export activity. In the case, oil and gas prices rebound so as to support E&P activity that is sufficient to satisfy market growth.

- The study's High Case depicts a higher growth environment for exploration and production (E&P) activity and oil and gas infrastructure development that is fostered by a larger hydrocarbon resource base and more rapid advancements in E&P technology. The case depicts an environment in which oil and gas development is 20% to 30% above the development forecast in the Base Case.

To develop the Base and High Case results, the study includes the following components:

- Natural gas supply/demand projections that rely on the most current market trends.

- Projections for North American E&P activity that are supported by a robust, cost effective, and growing resource base for oil and natural gas.

- An assessment of natural gas use in power plants, considering load requirements and an ever-changing mix of generation assets.

- An assessment of onshore lease equipment, offshore production facilities, and gathering, processing, and fractionation needs to permit the delivery of hydrocarbons to an already extensive pipeline grid that supports delivery to refineries, markets, end-users, and export terminals.

- Review of oil and gas storage requirements to temporarily store hydrocarbons until they are needed in markets and at refineries.

- Analysis of NGL and oil infrastructure requirements, including refinery upgrades that are required to process the lighter sweeter crudes that are being developed across North America and the incremental oil products transport that is needed to accomodate increased refinery output.

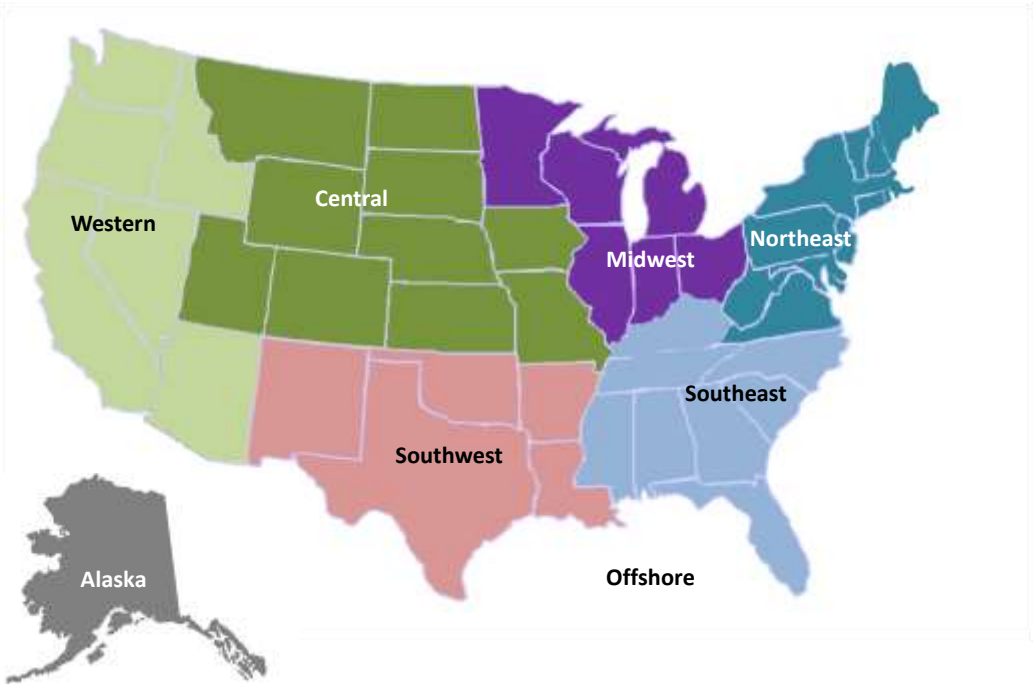
- An assessment of the increased oil, gas, and NGL exports that could occur with increasing North American supplies.

The economic impact analysis that is discussed near the end of the report is based on IMPLAN modeling, which provides direct, indirect, and induced job impacts of the oil and gas infrastructure development. Measures of state-level employment and value added impacts are included.

1.2 Study Regions

For reporting, this study applies U.S. DOE EIA pipeline regions for the Lower 48 states in the U.S. (**Exhibit 2**). It is worth noting that the Marcellus and Utica shale plays are split between the Northeast and Midwest. Significant gas and natural gas liquids (NGLs) production growth from this area is expected to drive a large amount of infrastructure development in the future. Another significant area of growth will be the Southwest, which is an area already with a large amount of oil and gas infrastructure and is also home to many producing basins.

Exhibit 2: Study Regions



1.3 Infrastructure Coverage

Exhibit 3 lists the infrastructure categories assessed in this study. The study applies a broad definition to infrastructure that includes all assets needed to process, refine, store, and transport oil, gas, NGLs, and oil products to end-users. End-users include industrial facilities that use oil, gas, and NGLs as either a fuel or feedstock, petrochemical facilities, power plants, export terminals, and distribution companies. Distribution infrastructure has been excluded from the analysis, and expenditures for upgrades and enhancements to distribution systems could add billions of dollars to the capital expenditures discussed throughout this report.

Exhibit 3: Oil and Gas Infrastructure Categories

Category	Sub-Category	Type of Hydrocarbon
Surface and Lease Equipment	Onshore Lease Equipment	Oil and Gas
	Offshore Production Platforms	Oil
Gathering and Processing	Gas Gathering Lines	Gas
	Oil Gathering Lines	Oil
	Compressors	Gas
	Processing Plants	Gas
	Fractionation Facilities	NGL
Oil, Gas, and NGL Pipelines	Oil Pipelines	Oil
	Pumps for Oil Pipelines	Oil
	Gas Pipelines	Gas
	Compressor Stations for Gas Pipelines	Gas
	NGL Pipelines	NGL
	Pumps for NGL Pipelines	NGL
Oil and Gas Storage	Above Ground Tank Farms	Oil
	Underground Storage	Gas and NGL
Refining and Oil Products Transport	Refining	Oil
	Oil Product Pipelines	Oil
	Pumps for Oil Product Pipelines	Oil
	Rail Transport	Oil and NGL
Export Terminals	LNG Export Facilities	Gas
	NGL Export Terminals	NGL

The main infrastructure categories include: surface and lease equipment; gathering and processing; oil, gas, and NGL pipelines; oil and gas storage; refining and oil products transport; and export terminals. Each category is also split into sub-categories to provide additional detail. In addition, each sub-sub category is allocated into gas, oil, or NGL development in order to link the different activities with broader reporting by type of hydrocarbon.

Transmission pipelines include mainline capacity from supply areas to market areas and laterals on isolated segments that connect individual facilities or a cluster of facilities to a pipeline's mainline. Gas gathering pipe is the pipe that connects wells to a mainline or to a gas processing plant where the liquids and non-hydrocarbon gases are extracted. Oil gathering pipe collects and delivers crude oil from oil wells and lease condensate from gas wells to nearby crude oil storage and treatment tanks or to crude oil transmission mainlines. Surface and Lease equipment for oil wells includes accessory equipment, the disposal system, electrification, flowlines, free water knockout units, heater treaters, LACT units, manifolds, producing separators, production pumping equipment, production pumps, production valves and mandrels, storage tanks, and test separators. Surface and Lease equipment for gas wells includes dehydrators, disposal pumps, electrification, flowlines and connections, the production package, production pumping equipment, production pumps, and storage tanks.

Reported infrastructure development and the corresponding CAPEX include projects for new capacity as well as projects to refurbish, replace, upgrade, and enhance existing capacity. Throughout the projection, refurbishments, replacements, upgrades, and enhancements are made to legacy capacity in place before the start of the projection and also to capacity added during the projection. Refurbishments, replacements, upgrades, and enhancements include changes made to refineries for the purpose of processing lighter sweeter crudes that are being developed across North America. They also include capital expenditures related to integrity management programs for pipelines and for NOx emissions reductions at compressor stations.

Capital expenditures reported throughout the report are in 2015$, unless otherwise stated. They do not include operations and maintenance (O&M) costs, because O&M costs are not typically capitalized. Costs associated with O&M could add billions of dollars to the total expenditures reported herein, and would account for a significant number of jobs beyond the employment levels that are reported in Section 6.

1.4 Report Structure

The remainder of this report contains the following information:

- Section 2 provides an overview of the modeling methodology.
- Section 3 summarizes the scenarios applied in this study, presenting the trends for oil and gas production and demand, and examining market dynamics for gas, NGL, and oil transport.
- Section 4 provides the results for oil and gas infrastructure development. The section starts off with an overview, followed by a detailed discussion that examines infrastructure development in

the two scenarios for each of the infrastructure categories. The section ends with a discussion about regional development.

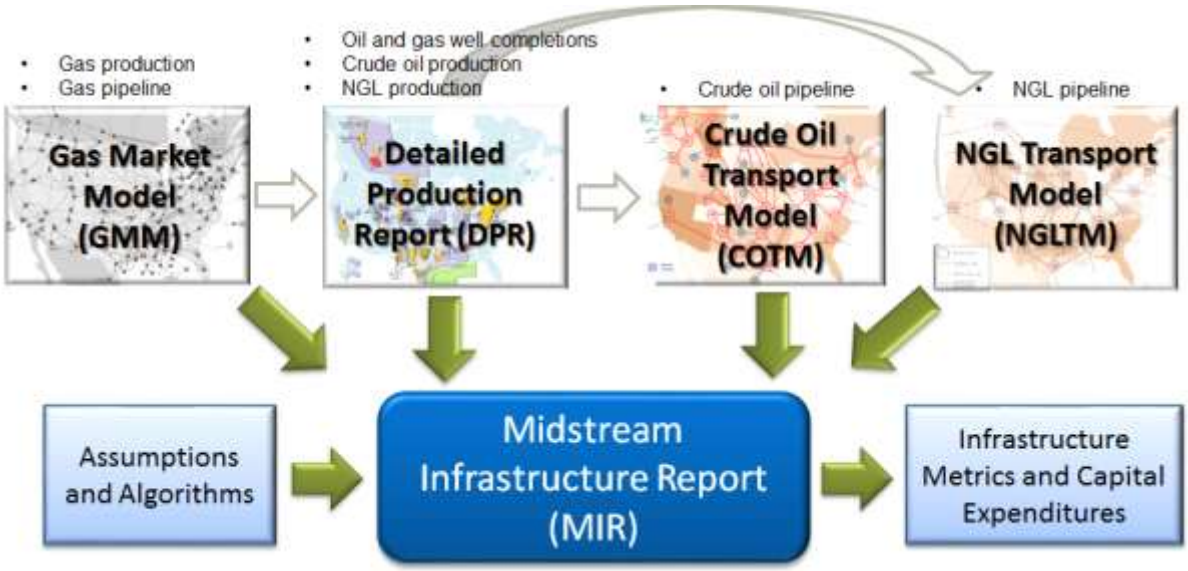
- Section 5 provides results of the economic impact analysis to assess the jobs and GDP impacts of infrastructure development.
- Section 6 lists key findings for the study.
- Appendix A discusses the ICF modeling tools applied to complete this analysis.
- Appendix B provides details for infrastructure development, including all of the key statistics that drive infrastructure investment
- Appendix C provides capital expenditures by region.
- Appendix D provides projected annual averages for Gross State Product and Taxes by state.

2 Methodology

2.1 Modeling Framework

In this study, oil and gas infrastructure development and capital expenditure requirements are determined based on ICF's Midstream Infrastructure Report (MIR) process, shown in **Exhibit 4**. ICF's MIR uses four proprietary modeling tools, namely ICF's Gas Market Model (GMM), the Detailed Production Report (DPR), a Natural Gas Liquids (NGL) Transport Model (NGLTM), and a Crude Oil Transport Model (COTM). Detailed descriptions of these modeling tools are provided in Appendix A.

Exhibit 4: Modeling Tools for ICF's Midstream Infrastructure Report



The GMM, a full supply-demand equilibrium model of the North American gas market, is a widely used model that is 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 that is likely to be developed based on gas market and supply dynamics.

ICF's DPR, a vintage production model, is used to estimate the number of oil and gas well completions and well recoveries based on levels of gas production that are calculated in the GMM and projections of oil and gas prices, gas-directed versus oil-directed drilling, and well productivity. Crude oil and NGLs production projections for over 50 regions are estimated in the DPR based on assumed liquids-to-gas ratios.

ICF's NGLTM and COTM are used to evaluate NGL and crude oil transport and 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. Within the Midstream Infrastructure Report itself, refinery enhancements and output are estimated along oil product transport and crude oil and oil products exports.

2.2 Infrastructure Methodology and Criteria

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

- Regional natural gas supply-demand growth based on scenario market trends;
- Well completions and production by region;
- Gas processing and NGL fractionation requirements;
- Changes in power plant gas use;
- Regional underground and above ground natural gas storage needs;
- Changes in transportation of natural gas, NGLs, and oil brought on by regional supply-demand balances, changing market forces, and world trade of raw and refined energy products; and
- Enhancement, upgrade, replacement, and refurbishment (E/U/R/R) requirements for existing oil and gas assets.

2.2.1 Estimating the Amount of Infrastructure Development

The criteria applied to estimate new infrastructure development and the capital expenditures associated with it are listed in **Exhibit 5**. 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.

Surface and lease equipment, offshore platforms, gathering, processing, and fractionation projects are included in the infrastructure assessment. Natural gas transport capability is added to the infrastructure stack based on projections from the GMM. The decision to add pipeline capacity is based on supply growth and market evolution within and across geographic areas. 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 are included. If unknown for a specific project, the project's pipeline mileage and compression are calculated using rule-of-thumb estimates, which are based on historical capacity expansion data along various pipeline corridors.

Exhibit 5: Criteria for New Infrastructure Development

Metric	Criteria
Gas gathering line miles per well (for gathering gas both from gas wells and oil wells)	Low productivity gas and oil wells use small-diameter gathering lines and are assumed to require an average of 0.35 miles/well and 0.25 miles/well, respectively. Higher productivity gas and oil wells require larger-diameter but shorter gathering pipelines. Factors are applied to adjust miles/well and diameter based on the number of wells per pad. Miles/well factors range from 1.0 for 4-well pads to 0.5 for 8-well pads. Diameter factors range from 1.0 for 4-well pads to 1.4 for 8-well pads.
Oil gathering line miles per oil well (only applies to high-productivity wells)	0.25 miles/well for 4-well pads and 0.125 miles/wells for 8-well pads.
Low-productivity non-associated gas estimated ultimate recovery (EUR) cutoff	EUR less than 0.5 billion cubic feet per day per well.
Low-productivity associated gas EUR cutoff	EUR less than 0.15 billion cubic feet per day per well
Low-productivity oil well EUR cutoff	EUR less than 30,000 barrels/well
Number of wells per pad	An average of 4 wells per pad is assumed for 2015; the number of wells per pad is assumed to increase linearly to 8 wells per pad by 2035. Given the assumed criteria above, an increased number of wells per pad reduces total gathering line mileage, but increases line diameters.
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	Average of 60 percent; varies by play and region.

Exhibit 5: Criteria for New Infrastructure Development (Continued)

Metric	Criteria
Gas processing plant size	Between 25 and 600 million cubic feet per day, yielding an average of 275 million cubic feet per day for all production; varies by play and region.
Gas laterals for processing plant	20 miles per plant.
Gas lateral diameters for processing plant	Between 10 to 30 inches estimated by considering the size of the plant.
Gas power plant capacity	If unknown, the average power plant size for combined cycle plants is assumed to be 500 Megawatts (MW). Combustion turbine capacity can range up to 500 MW.
Gas laterals for gas power plants	15 miles per power plant.
Gas lateral diameter for gas power plant	24 inches for combined cycles. Diameter for small power plants is calculated using Panhandle Equation assuming a heat rate of 8,000 Btu/kWh (to estimate gas throughput).
Gas storage capacity	5 billion cubic feet of incremental working gas capacity for every 1 billion cubic feet per day of LNG export capacity added after 2020. 1 billion cubic feet of incremental working gas capacity for every 1 Gigawatt of incremental gas-fired generating capacity added after 2020.
Compression requirements for gas storage fields	1,880 horsepower per billion cubic feet of working gas capacity for salt cavern storage. 610 horsepower per billion cubic feet of working gas capacity for depleted reservoir storage. 1,200 horsepower per billion cubic feet of working gas capacity for aquifer reservoir storage.

Exhibit 5: Criteria for New Infrastructure Development (Continued)

Metric	Criteria
Portion of NGL production growth that requires new fractionation capacity	Average of 85 percent, varies by play and region.
NGL Fractionation Plant Size	Between 25,000 and 500,000 barrel per day, yielding an average of 75,000 barrel per day for all production; varies by play and region.
NGL Laterals for Fractionation and Petrochemical Facilities	Between 60 and 400 miles per 100,000 barrels per day of NGLs, varies by play and region.
NGL lateral diameter	Between 10 to 16 inches, varies by play and region.
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.
Oil product pipeline miles	Average of 1.3 miles per 1,000 barrels per day of incremental refinery output.
Oil product pipeline diameter	Average of 15 inches, varies by PADD.
Pumping requirements for crude oil and oil product pipelines	Average of 177 horsepower per mile of pipeline.

Oil and gas lease equipment and offshore platform requirements are calculated based on incremental well completions and the expected oil, gas, and NGL production from the wells. This analysis does not provide detailed measures or metrics for lease equipment such as miles of flowlines and connections, number of dehydrators, storage tanks, disposal systems, separators, etc. Expenditures for incremental lease equipment, as discussed in Section 4, are directly proportional to the number of well completions. Incremental capacity for offshore platforms is estimated for incremental oil, gas, and NGL production as a barrel of oil equivalent (BOE) rate based on new offshore well completions.

The mileage for gas gathering lines is computed by considering incremental gas production, the number of well completions, estimated ultimate recovery (EUR) per well, well spacing, and number of wells in multi-well pad configurations. The core calculations assume a certain amount of gathering line mileage per well. Compression requirements for gas gathering lines are estimated based on production levels and by assuming a pre-defined horsepower-to-production ratio, estimated from historical data.

Gas processing plant capacity is computed by assuming that a portion of the production growth requires new processing capacity. The number of processing plants that are needed is estimated based on the total incremental processing capacity that is required and assuming an average plant size for each geographic area. Pipeline lateral requirements for connecting processing plants with pipeline mainlines are calculated based on the number of new plants that are required, with an assumed mileage for each lateral. The diameter of the laterals is estimated based on the size of the gas processing plants in a geographic area.

The number of unplanned gas-fired power plants is derived by considering the growth of gas-fired power generation. The total incremental gas power plant capacity is applied to estimate the number of new gas power plants that will be built in each geographic area, based on assumed plant sizes. The required lateral pipeline mileage is then calculated using an assumed mileage per plant. The diameter for the laterals is estimated based on the required throughput for each plant, calculated based on each plant's heat rate.

Gas storage is added in response to LNG and power plant additions. Lateral mileage, sizing, and compression needs to connect gas storage are based on the amount of storage capacity added.

NGL pipeline capacity is based on supply development, North American market growth, and export activity. Announced NGL pipeline projects that are under construction or deemed far enough along in the development process to be completed are included in infrastructure tallies. 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) to be used as a diluent for oil transport are included.

New NGL pipeline projects are included to support future supply development and market growth. NGLs produced in relatively constrained areas require new pipelines to foster transport of the liquids to market areas or export facilities. If unknown, pipeline mileage for new capacity is estimated based on the distance between geographic areas, and the size of the pipeline and pumping requirements are estimated based on expected throughput.

NGL lateral mileage from gas processing and fractionation facilities to a NGL transmission line is calculated based on the amount of NGLs that are processed (i.e., removed from the gas stream). Lateral mileage and

the diameter for each lateral are estimated based on an assumed number of miles per volume of NGLs processed and is based on an average processing-fractionation plant size.

Incremental NGL fractionation capacity is estimated based on NGL supply development and market growth. NGL export capacity is scenario-dependent, based on supply development and market activity.

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

The need for crude oil transmission capacity is based on supply development and import/export activity. The study considers rail and trucking of oil as transport options. Announced pipeline projects have been included in the pipeline stack. If unknown for a project, pipeline mileage is estimated based on the distance between the relevant geographic areas for each project. The sizing of a pipeline and pumping requirements are estimated based on throughput.

Crude oil storage is added based on oil production growth within geographic areas. The number of crude oil tanks is computed based on the required storage capacity for fields, assuming an average tank size. The required number of tank farms is computed based on an average number of storage tanks per tank farm. The lateral mileage for oil storage capacity is estimated by assuming that so many miles of lateral are needed per tank farm.

As mentioned above, this study accounts for crude oil transport by rails. Thus, planned rail cars and loading and unloading terminal capacity additions are included in the infrastructure stack. However, the study does not include unplanned rail car and terminal loading/unloading capacity, as incremental pipeline capacity is considered to be a more cost-effective option for unplanned capacity, especially when the capacity requirement is significant.

Planned crude oil refinery capacity additions and enhancements are included and reported in the Enhancements, Upgrades, Replacements, and Refurbishments category discussed below. We include changes to refineries only in this category because it is difficult to distinguish between "new" capacity and enhancements and upgrades to existing capacity. In addition, the analysis considers refurbishments and replacements to capacity along with the upgrades and enhancements.

The need for crude product pipeline is based on growth in refinery output. Refinery output has been estimated considering supply changes and market growth. New crude product pipeline miles are calculated based on the miles needed per unit volume growth of refinery output as calculated from historical data. The diameter of the pipeline is assumed based on the average diameter for existing pipelines. Pumping requirements are estimated based on historical horsepower per mile of pipeline statistics.

Enhancements, upgrades, replacements, and refurbishments (E/U/R/R) 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 E/U/R/R percent for gathering line compressor is 5.00 (i.e., 1 divided by 20 years). That means that each year, 5.00 percent of the installed gathering line compressors will require E/U/R/R. All of the E/U/R/R criteria for existing infrastructure are summarized in **Exhibit 6**.

Exhibit 6: Enhancements, Upgrades, Replacements, and Refurbishments (E/U/R/R) Criteria

Infrastructure Type	Annual E/U/R/R (%)	Installed Units as of 2015
Gathering Line Pipe (Miles)	1.76%	432,000
Gathering Line Compressor (1000 Horsepower)	5.00%	11,400
Lease Equipment (Book Value of Installed Equipment, million$)	2.86%	$101,400
Oil, Gas, and NGL Pipeline (Miles)	0.07%	501,354 /1
Gas Pipeline Compressor (1000 Horsepower)	1.25%	20,600
Oil and NGL Pump (1000 Horsepower)	1.25%	5,200
Gas Processing Plant Capacity (billion cubic feet per day)	2.86%	95
NGL Fractionation Capacity (thousand barrel oil equivalent per day)	2.86%	2,800
Underground Gas Storage (billion cubic feet of working gas capacity)	1.02%	3,900
Crude Oil Storage (thousand barrel)	2.86%	560,000
Crude Oil Refining Capacity (thousand barrel per day)	4.22%	18,058

1. Does not include CO_2 pipelines.

2.2.2 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. Unless otherwise specified, the same unit cost measures are also applied to estimate total E/U/R/R expenditures.

Pipeline cost assumptions have been derived by considering data from Oil and Gas Journal (OGJ) surveys of pipeline projects. Using the OGJ data, we have completed a regression analysis of data across years to determine an average U.S. pipeline cost of $178,000 per inch-mile for 2016 (in nominal dollars) for large gas transmission pipelines. The data for future years is extrapolated from that level based on the regression. Regional cost multipliers have also been derived from OGJ data, and are shown in **Exhibit 7**. Cost multipliers are very different across regions; for example, costs are relatively high in the Northeast where projects have been very difficult and time consuming to construct, but much lower in the Southwest which has generally been a much more friendly area for infrastructure development.

Exhibit 7: Regional Cost Multipliers for Pipeline Development

Region	Regional Cost Multipliers
Central	0.65
Midwest	1.20
Northeast	1.68
Offshore	1.00
Southeast	0.80
Southwest	0.74
Western	0.94

Smaller-diameter pipes used in gathering systems have lower unit costs that vary by diameter. As shown in **Exhibit 8**, gathering line costs (which have also been derived from OGJ survey results) for pipes between one and sixteen inches in diameter range from $56,000 to $149,000 per inch-mile in 2016, well below the average inch-mile cost of the larger-diameter transmission pipelines discussed above. The same regional cost factors discussed above apply as well to gathering projects.

Exhibit 8: Gathering Line Costs in 2016

Line Diameter (Inches)	Gathering Line Costs (Nominal$/inch-mile)
1	$56,278
2	$42,208
4	$35,173
6	$29,418
8	$30,697
10	$47,964
12	$83,137
14	$134,299
16	$148,688

Similar regression analysis has been completed for compression and pumping costs using OGJ survey data. Compression and pumping costs in 2016 are estimated to be about $3,000 per horsepower. Compression and pumping costs also vary by region, with costs being highest in the Midwest and lowest in the West (**Exhibit 9**).

Exhibit 9: Regional Cost Multipliers for Compression and Pumping Costs

Region	Regional Cost Factors
Central	1.27
Midwest	1.26
Northeast	1.06
Offshore	1.00
Southeast	0.92
Southwest	0.90
Western	0.79

Lease equipment costs have been estimated from EIA Oil and Gas Lease Equipment and Operating Cost data, and the cost is adjusted to current levels based on Producer Price Index Industry Data from the Bureau of Labor Statistics. The costs average $87,000 per gas well and $210,000 per oil well. Oil and gas offshore platform costs are based on historical expenditure information provided by various sources. Average platform costs of $21,000 per barrel of oil equivalent are applied for offshore development.

Gas storage field costs are shown in **Exhibit 10**. Costs vary depending on the type of underground storage field (i.e., salt cavern, depleted reservoir, or aquifer storage) with an average of $32 million per billion cubic feet of working gas capacity applied for new projects and $27 million per billion cubic feet of working gas capacity applied for expansion projects. E/U/R/R requirements for gas storage are assumed to have a cost of 18 million per billion cubic feet of installed working gas capacity.

Exhibit 10: Natural Gas Storage Costs in 2016 (Million$ per Billion Cubic Feet of Working Gas Capacity)

Field Type	Expansion	New
Salt Cavern	$27.8	$33.0
Depleted Reservoir	$16.4	$18.8
Aquifer	$31.8	$38.9

Other unit costs for remaining types of assets as estimated from various sources are as follows:

- Gas processing costs (not including compression) in 2016 are about $638,000 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 are added to the cost of capacity directly above.
- Costs for NGL fractionation facilities average about $6,500 per barrel of oil equivalent (BOE) per day of processed NGLs.
- Costs for NGL export facilities are purity dependent, averaging about $6,150 per barrel of oil equivalent (BOE) per day of ethane, about $5,000 per BOE per day for propane and butane.
- Costs of LNG export facilities, as identified in U.S. Department of Energy export applications and other publicly available sources, average $4 billion to $5 billion per billion cubic feet per day of export capacity.
- The unit cost for crude oil storage tanks is assumed to be about $15 per barrel of oil.
- The unit cost for crude oil refining capacity expansion is about $12,000 per barrel of oil equivalent (BOE) per day.

3 Scenario Overview

3.1 Defining the Study's Scenarios

Oil and gas markets are facing a great deal of uncertainty with relatively low commodity prices currently hampering supply development. In late 2015, crude oil prices declined precipitously, mainly due to a supply glut brought about by reduced growth in global markets. According to the U.S. DOE EIA, crude oil production in the U.S. increased significantly into 2015, with production peaking at over 9 million barrels per day earlier in the year. The increase came almost entirely from development of tight oil and shale plays. The growth reduced crude oil imports to the U.S. and contributed to a significant supply overhang in global markets, adding to record inventory levels for crude oil.

At the same time, natural gas and NGL prices declined in response to robust gas supply growth occurring from shale resources. The mild winter of 2015-16 created a natural gas storage overhang in the U.S. that further reduced prices, and natural gas at Henry Hub fell to under $2 per MMBtu by March 2016.

The low commodity price environment has slowed E&P activity and arrested the robust supply increases that had been occurring before 2016. The slowing supply growth has brought about reduced infrastructure development, creating a cloud of uncertainty for future growth of oil and gas infrastructure. But, while the scale of uncertainty that currently exists is significant, the environment remains positive for oil and gas development in the longer term.

There are a number of factors still at work to increase supply and motivate infrastructure development. Notably, the shale and tight oil and gas resource base across North America is large and there is still a vast amount of relatively low cost oil and gas remaining to be developed. The application of technology is continuing to reduce drilling costs and enhance well productivity. Thus, the unit cost of oil and gas production is continuing to decline.

In addition to the productivity gains and cost reductions that have been occurring, markets appear to be poised for growth. Indeed, refinery input and output has been increasing during the past few years as North American oil production is creating a renewed interest in investments in refineries to increase product output. Natural gas exports are on the cusp of growing significantly, both to Mexico and to markets around the globe where $3 per MMBtu Henry Hub gas is attractive. Further, low gas prices have fostered growth for gas-fired power generation as coal plants continue to retire across the U.S. This trend seems irreversible in light of regulations that encourage clean power. However, it is worth noting that while the scenarios include currently enacted environmental regulations and regional efforts to control carbon emissions, they do not include any federal programs aimed at carbon emissions, such as the Clean Power Plan. Nevertheless, the relatively low gas price environment generally discourages additional investment to upgrade and/or further limit emissions from coal plants, especially considering that a threat for federal carbon control still looms on the horizon. Petrochemical facilities appear to be poised for a resurgence with the relatively low natural gas and NGL prices that have been brought about by the robust

supply development. Thus, a number of markets appear to be poised for growth, which would foster a renewed interest in supply development.

Considering these factors, this study includes two cases, a Base Case and a High Case that project different amounts of growth for supply and markets. The Base Case, which represents a "Status Quo" scenario, shows increasing oil and gas supply due to continued productivity improvements for supply and to satisfy market growth that comes from the power sector, export activity, and petrochemical facilities. The supply growth that occurs in the case, in turn, fosters a renewed interest in development of oil and gas infrastructure. The case includes a robust natural gas resource base and growth across a number of markets (**Exhibit 11**). The E&P technology assumptions in the case are consistent with recent advancements in technology and drilling costs remain constant in real terms. In addition, there is growth in the amount of resource that is recoverable over time, with the concept of resource appreciation included in the case. Thus, the unit costs of production are generally declining in the future, consistent with recent trends.

As alluded to above, the Base Case includes growth across a number of different markets. Most notably, refinery input continues to increase, albeit relatively modestly, and continued development of tight oil supplies here in the U.S. and incremental imports from Canada modestly reduce near-term imports of crude from overseas, consistent with recent trends. Natural gas markets grow fairly robustly as there is additional gas use in petrochemical facilities and in the power sector where coal plants continue to retire and some nuclear plants are retired at the end of their 60-year life. LNG and Mexican exports of natural gas also rise fairly significantly over time, consistent with recent trends. For NGL, both domestic ethylene and polypropylene production increase along with exports. The market growth projected in the scenario is sustained by supply development that occurs at reasonable prices. In the case, oil prices approach $75 by 2025 while Henry Hub price averages a little over $4 per MMBtu over through 2035.

The High Case is provided to depict an increased growth environment for oil and gas supply and markets to assess the full potential for oil and gas infrastructure development. The case is developed by assuming a larger recoverable resource base for oil and gas and more robust improvements in technology that drive productivity gains above those in the Base Case. The scenario has been developed by using the Base Case as a starting point and assuming that changes brought about between the U.S. DOE EIA Annual Energy Outlook (AEO) reference case and high resource and technology case occur.

The case generally assumes a resource base that is 40 to 55 percent larger and well productivity that improves at a much faster pace. Admittedly, technology improvements and the amount of recoverable resource are among the most difficult factors to predict, so it is reasonable to assume that these drivers of growth could be more robust in light of improvements in productivity and recoverable resource that have recently occurred.

In the High Case, lower gas and NGL prices that are brought about because of the increased productivity of wells. Thus, the case projects substantially greater market growth across a number of markets. Most notably, refinery input in the case increases relatively significantly as robust increases in domestic production back out crude imports. Thus, oil product movement also increases as a result of the growth

in refinery output. Natural gas markets are noticeably larger, with increases across the board for petrochemical and power plant gas use and LNG and Mexican exports. LNG and Mexican exports rise significantly to an average of 21 billion cubic feet per day after 2020. NGL markets also continue to grow at a robust pace, with ethylene and polypropylene production rising along with NGL exports.

Exhibit 11: Scenario Assumptions and Trends

Category	Base Case	High Case
Macroeconomics	U.S. Gross Domestic Product (GDP) grows at 2.1 percent per year	Same
	U.S. Industrial Production grows at 1.8 percent per year	U.S. industrial output up to 2.0 percent per year
	Global economic activity rebounds to pre-2015 growth rates	Same
Oil and Gas Supply	U.S. Recoverable oil resource at 250 billion barrels and recoverable gas resource at 3,600 trillion cubic feet	Oil resource base increased by 55 percent and gas resource base increased by 40 percent
	Recoverable resource appreciates by 0.9 percent per year	Recoverable resource appreciation up by 20 percent over Base Case
	Oil and gas drilling costs constant in real terms	Drilling costs are reduced by roughly 35 percent
	Average well productivity improves by roughly 20 percent every 7 years	Time for improvement reduced by roughly 30 percent
U.S. Oil Market Dynamics	WTI rises from current level to $75 per barrel (2015$) by 2025	Same
	Canadian imports rise to 4.1 million barrel per day (MMBpd) after Keystone Pipeline is completed	Canadian imports increase more robustly to 4.4 MMBpd
	Other crude imports decline to 3.5 MMBpd after 2020 and then rise back to 4.7 MMBpd by 2035	Other crude imports decline to 1.8 MMBpd by 2035
	Refinery input grows from 16.4 MMBpd in 2015 to 17 MMBpd by 2035	Refinery input grows by another 1.8 MMBpd over the Base Case
	Oil products transport up with refinery output	Same

Exhibit 11: Scenario Assumptions and Trends (Continued)

Category	Base Case	High Case
U.S. Natural Gas Market Dynamics	Henry Hub prices average about $4.30 per MMBtu (2015$)	Henry Hub prices down by roughly 15 percent versus the Base Case
	Modest growth in households and commercial establishments using gas, mostly due to oil-to-gas conversions	Same
	Petrochemical gas use up by 1.9 billion cubic feet per day (Bcfd) over current level by 2035	Petrochemical gas use up roughly 30 percent over Base Case levels
	Electric load growth averages 0.95 percent per year	Electric load growth averages 1.01 percent per year
	108 Gigawatts (GW) of coal plants retire by 2035	132 GW of coal plants retire by 2035
	28 GW of nuclear plants retire by 2035	30 GW of nuclear plants retire by 2035
	85 GW of renewables capacity added by 2035	Only 70 GW of capacity added, due to reduced gas prices
	Modest penetration of gas vehicles amounts to 0.2 billion cubic feet per year of consumption post-2020	Same
	LNG exports and exports to Mexico average 15.8 Bcfd after 2020	LNG exports and exports to Mexico average 21.0 Bcfd after 2020
U.S. NGL Market Dynamics	NGL prices track oil and gas prices	Same, but price levels are lower due to reduced gas prices
	0.4 MMBpd of ethylene production (i.e, ethane crackers) added through 2035	Up over base case level by 0.3 MMBpd
	0.2 MMBpd of polypropylene production added through 2035	Up over base case level by 0.1 MBpd
	Butane & Pentane+ consumption grows by 0.6 MMBpd through 2035	Up over base case level by 0.2 MMBpd
	NGL exports average 1.8 MMBpd after 2020	NGL exports average 2.5 MMBpd after 2020

3.2 Comparison of Supply, Demand, and Pipeline Capacity in the Scenarios

As mentioned above, this study's cases show very different results for supply, demand, and transport of hydrocarbons. This section further examines those trends, comparing and contrasting results for each case.

3.2.1 Projected Oil, Gas, and NGL Production

Each of the study's cases show noticeable increases in production from shale and tight resources. However, the amount of growth is very different between the two cases due to the assumptions that have been made regarding resource base and technology improvements.

For oil, the Base Case shows a modest decline in total crude oil production for the U.S. over the course of the projection (**Exhibit 12**). In the case, increases in shale and tight oil production are more than offset by declines in conventional onshore production. So, the total production falls from its current value of roughly 9 million barrels per day to nearly 8 million barrels per day by 2035. The implication of these production trends is that new pipeline transport and oil handling capability will be selectively needed in areas where transport needs are growing. Further, most of the pipeline capacity needed to serve those areas is already under construction and scheduled to be completed during the next year.

Perhaps the more striking result is the difference between the cases. By 2035, the High Case shows a production increase of roughly 4 million barrels per day versus the Base Case, with its crude oil production rising to over 12 million barrels per day by 2035. This difference is driven by the more robust resource base assumed in the High Case. Essentially, the amount of oil resource applied in the Base Case is insufficient to offset the impact of resource depletion over time, whereas the resource in the High Case is large enough to offset resource depletion, fostering incremental growth in total oil production. The High Case effectively provides a more robust environment for development of new oil transport and oil handling capabilities.

For natural gas, the picture is somewhat different, with each of the cases showing significant growth in total gas production over time (**Exhibit 13**). That's because market growth drives production increases in each of the scenarios. However, market growth is very different for each case because the cost of supply and prices are different. In the High Case, the increased resource base and accelerated technological advancement yields lower gas prices, and thus, greater market growth. So, the High Case shows production growing to 131 billion cubic feet per day while the Base Case shows production growing to only 110 billion cubic feet per day by 2035. It is also interesting to note that the production growth in the High Case is more consistent with recent history. That is to say that the production follows a more linear path in the future, consistent with the historical trend. In the Base Case, market growth slows over time, yielding reduced growth in consumption and a slowing trend for production in the longer term.

For each case, natural gas production growth is concentrated in shale and tight formations. As is the case for oil, the productivity gains in shale resources will continue to increase production from shale plays, while conventional onshore and other production that includes coalbed methane and offshore Gulf of Mexico gas supplies declines. Because shale plays are geographically widespread, production growth and the need for new infrastructure will be geographically widespread – a natural gas capacity chart shown later in this section will illuminate this point. However, as discussed later, because the cost of production is relatively low in the Marcellus/Utica compared to production costs elsewhere, a significant portion of the growth in production and new infrastructure will be concentrated in the Northeast U.S.

For natural gas liquids (NGLs), production growth is also very significant for each of the scenarios (**Exhibit 14**). This is because NGLs track natural gas production over time; that occurs because NGLs are a by-product of the gas production stream. Thus, Base Case NGL production grows by a little over 2 million barrels per day while High Case NGL production grows by roughly 3.5 million barrels per day through 2035. As is the case for natural gas, NGL production growth is concentrated in unconventional (i.e., shale) resources.

It is worth noting that it will be important for natural gas liquids markets to grow to "absorb" the levels of production that are projected in the scenarios. Absent market growth, liquids could be stranded, potentially becoming a deterrent to natural gas market development. Further elaboration on this point is required since it is not necessarily an intuitive finding.

A significant portion of the NGL production increase will be comprised of ethane, with 60 to 70 percent of the NGL stream containing that hydrocarbon. Ethane, of course, could be retained in the gas stream and not separately extracted from the stream or produced. When ethane is retained in the stream and not separately produced, it is referred to as "ethane rejection". While ethane can be rejected into the gas stream and placed into a natural gas pipeline, there are limits as to the amount of ethane that could be transported on most natural gas pipelines in the U.S. The limits relate to the heat content of the gas stream. As greater amounts of ethane are rejected into the gas stream, which is largely comprised of methane, the heat content for the entire stream rises and may potentially exceed pipeline limits. At that point, the stream is not suitable for gas pipeline transport, and would need to find another option to be transported to markets. In short, it is important for NGL markets to evolve so that ethane rejection doesn't become the proverbial "tail wagging the dog" as far as gas production is concerned.

Further, it is also uncommon for gas pipelines to transport propane or butane as the heat content of those hydrocarbons is too high to be absorbed into the stream. So, at a minimum, much if not all of the propane and butane would need to be separated from the gas stream. With the levels of NGL production exhibited in the scenarios, lack of markets for the liquids could very well place strain on gas transport. To avoid such a problem, development of ethane crackers, polypropylene facilities, and NGL export terminals is a necessity. Such market development would likely be concentrated along the Gulf Coast, making development of incremental transport of liquids-laden streams via pipeline and/or rail a necessity – this point will be discussed in greater detail below.

Exhibit 12: Crude Oil Production in the Scenarios (Million Barrel per Day)

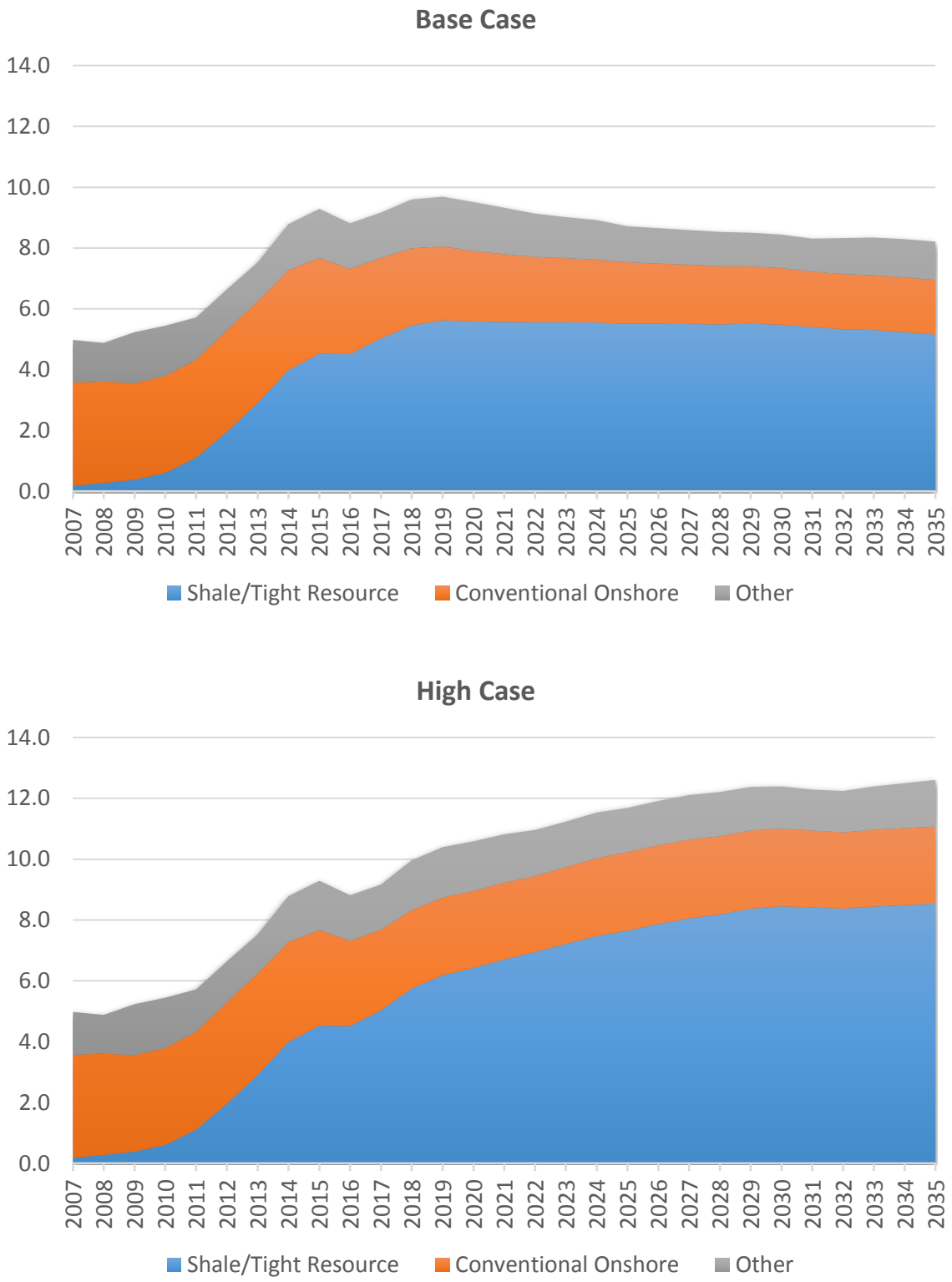


Exhibit 13: Natural Gas Production in the Scenarios (Billion Cubic Feet per Day)

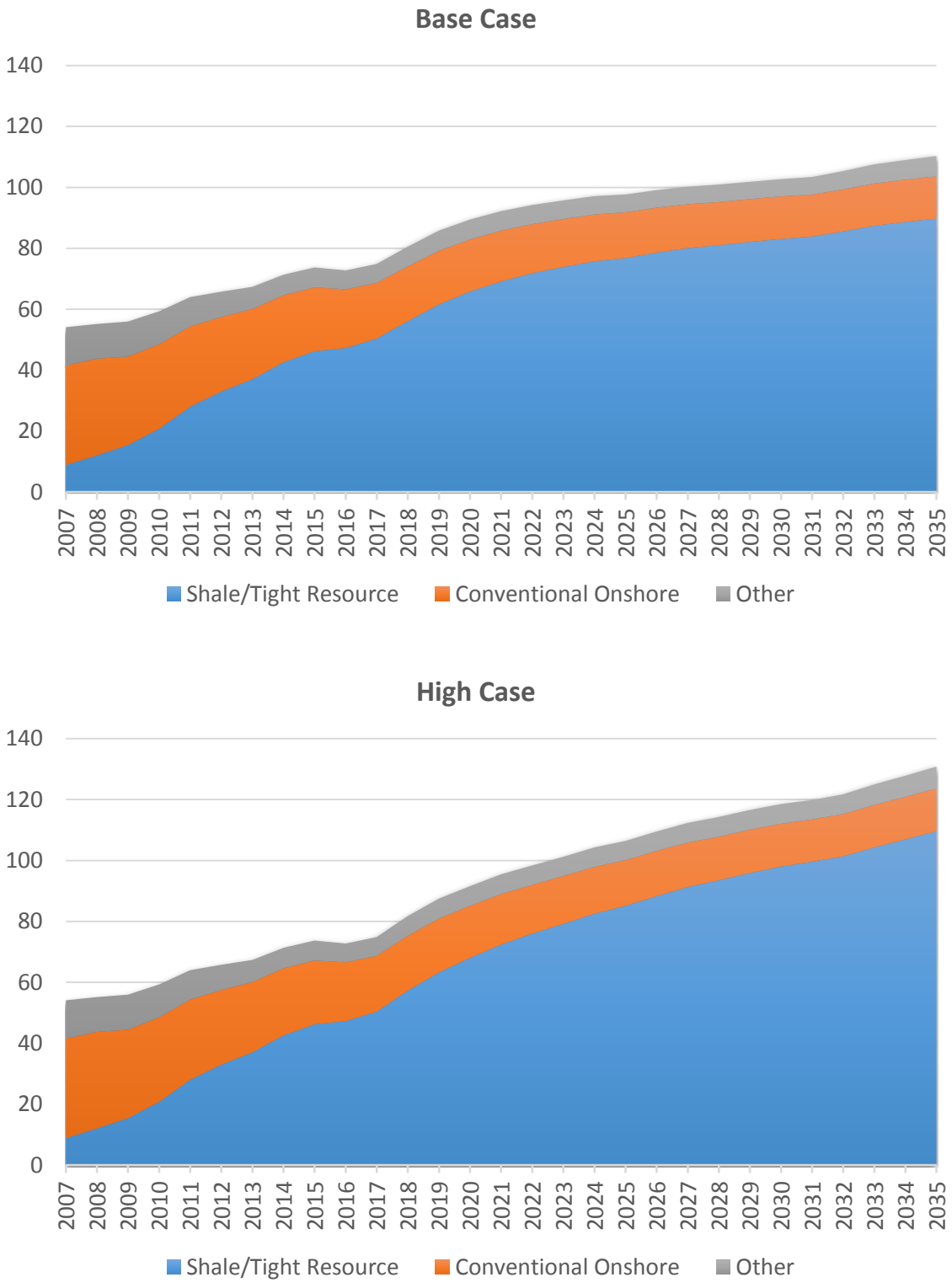
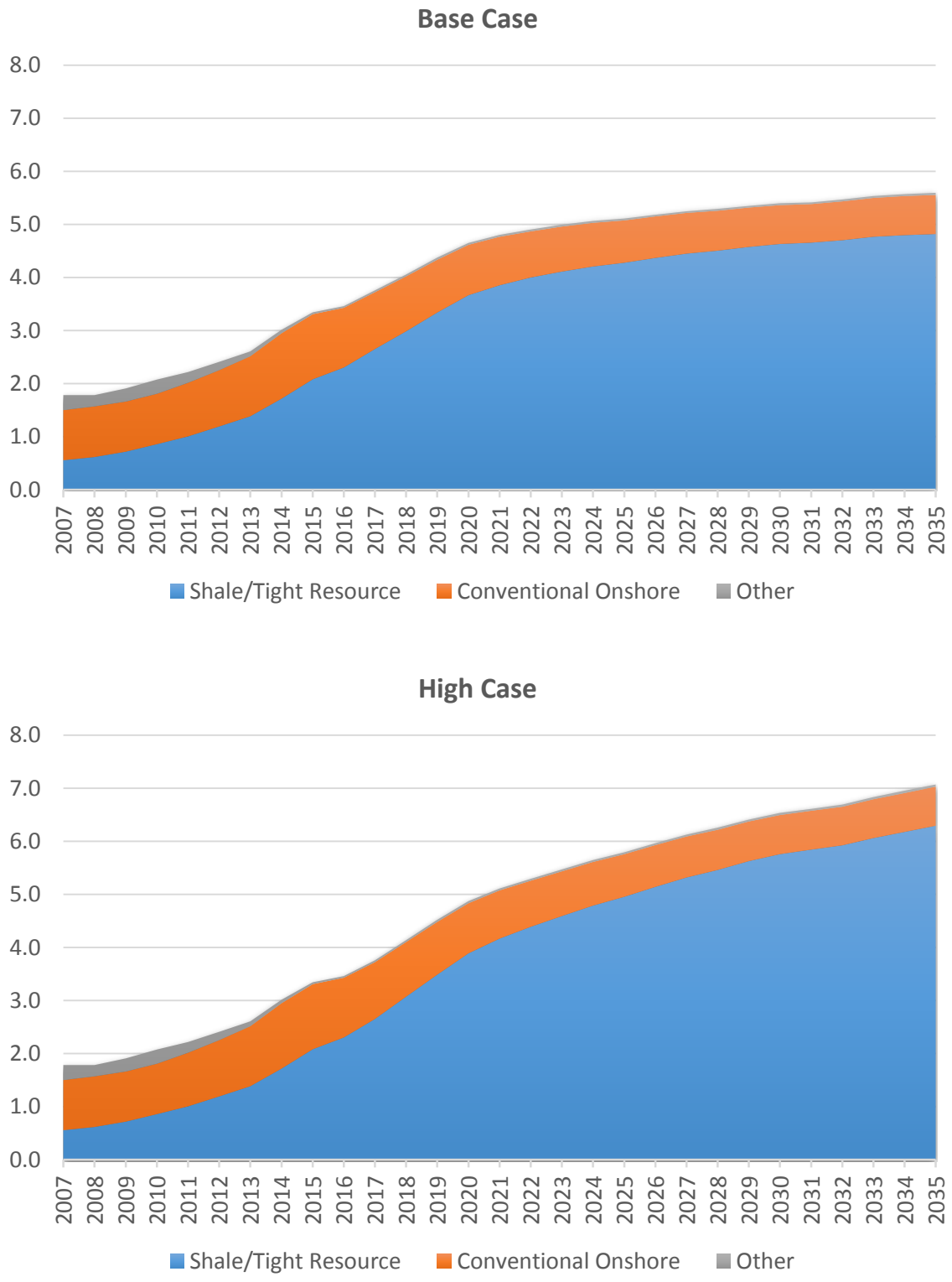


Exhibit 14: NGL Production in the Scenarios (Million Barrel per Day)



3.2.2 Projected Markets for Oil, Gas, and NGLs

Each of the study's cases show significant market growth driven by a variety of factors. This sub-section discusses projected market growth and its primary drivers.

To begin with oil, we project that U.S. refinery output will increase as production from tight oil supplies increases and as imports of heavy crude from Western Canada grow. **Exhibit 15** shows refinery crude oil input increase from their current level of just over 16 million barrels per day to between 17 and 19 million barrels per day for the Base Case and High Case, respectively. This increased refinery input and output would be made possible by upgrades and refurbishments.

The two cases project a very different composition for oil supplies to refineries. In the Base Case, much of the incremental supply to support an increasing utilization of U.S. refineries comes from Western Canada. While it is true that Canadian imports could increase by roughly 1 million barrels per day with projects like Keystone XL, the exhibit doesn't necessarily tell the full story. That is, the oil stream from the U.S. is becoming more highly comprised of light sweet crudes over time. So, in the future, increasing supplies of Canadian heavy oil are being blended with an increasing amount of lighter crudes from the U.S. in the U.S. refineries

Not only do the increased supplies of Canadian oil and the lighter sweeter crudes increase refinery input over time, but they also displace crude oil imports from other countries. While this is a trend that has already been underway, it has the potential to accelerate as shown in the High Case. In that case, the increase of domestic crude oil production along with the incremental imports of heavy crude oil from Western Canada potentially cuts crude oil imports from other countries in half over time. Increasing refinery input would increase oil product output, products that can be exported elsewhere, yielding an even greater boost to the U.S. economy.

For natural gas, each of the scenarios project very significant market growth, with Base Case gas use approaching 105 billion cubic feet per day while the High Case closes on 125 billion cubic feet per day by 2035 (**Exhibit 16**). These are dramatic increases over the current level of consumption in the U.S. that averages about 72 billion cubic feet per day over the course of a year.

The growth in natural gas use comes from a couple different areas. Perhaps the most noticeable growth comes from LNG exports, which grow to between 10 and 19 billion cubic feet per day in the Base Case and High Case, respectively. These levels of LNG export are supported by 15 to 30 trains of liquefaction capacity, almost entirely located along the U.S. Gulf Coast. A significant amount of liquefaction capacity is already under construction and scheduled to come online over the next few years. Whether or not the continued growth of LNG toward levels observed in the High Case will actually come about will be mostly a function of U.S. gas prices and global market growth for LNG, particularly from Asian buyers. The larger resource base and more robust advancement of E&P technologies in the High Case yields lower gas prices which fosters the increased LNG exports in the scenario.

The second-most noticeable area of growth for gas use comes from the power sector, where incremental gas use grows by between 12 and 25 billion cubic feet per day in the Base and High Case, respectively. While this seems like pretty dramatic growth, there are a few different factors driving the result. First, and following recent trends, there is likely to be a significant amount of coal power plant capacity retired in the future. There are a number of environmental regulations that make coal power capacity more expensive to operate than gas capacity. Further, the efficiency of the existing coal fleet is generally much less than the efficiency of the gas fleet, with the average heat rate of the units being much greater. In addition, the threat of carbon regulation, while reduced with the Trump administration, still looms on the horizon. All of these factors, combined with relatively low gas prices do not necessarily bode well for coal generation. Thus, in addition to the coal capacity already retired to date, the Base Case and High case retire an additional 108 to 132 Gigawatts of coal capacity, respectively. Much of this retired capacity will move over to gas and renewables generation.

In addition to coal plant retirements, two other factors behind the increase in gas generation are electric load growth and nuclear plant retirements. The scenarios each assume significant electric load growth consistent with ISO projections. They also include a number of plant retirements after a number of older nuclear plants reach an age of 60 years. Each of these increase the amount of generation that gas and renewables must provide as the coal plants continue to retire.

The final two growth components for natural gas consumption are exports to Mexico and petrochemical gas use. In the Base Case and High Case, exports to Mexico rise by roughly 3 billion cubic feet per day, a result driven by replacement of Mexico's oil generating facilities with gas generating facilities. Petrochemical gas use grows by between 1 and 2 billion cubic feet per day to round out total growth in gas use during the projection period. Most of the increase occurs at refineries, ammonia (fertilizer) plants, and for methanol production.

Finally, the natural gas liquids (NGL) market is set for robust growth in the future. As mentioned above, NGLs are a by-product of natural gas production. So, with the robust growth of gas production depicted in each of the scenarios, it will become important for NGL markets to evolve to "absorb" the liquids that will come from the gas stream. Thus, the Base Case and High case project between 2.2 and 3.5 million barrel per day of market growth, respectively (**Exhibit 17**).

The biggest growth component for NGLs is exports, which grow to between 2.0 and 2.8 million barrel per day in the scenarios. While not shown, the largest increases for exports occur for propane, a large portion of which is exported to Asia to support polypropylene production. The second largest growth component is for ethane, which is used in ethane crackers domestically to produce ethylene. More modest growth occurs for butane and pentanes+ which are used mostly in refineries.

Exhibit 15: U.S. Refinery Input (Million Barrel per Day)

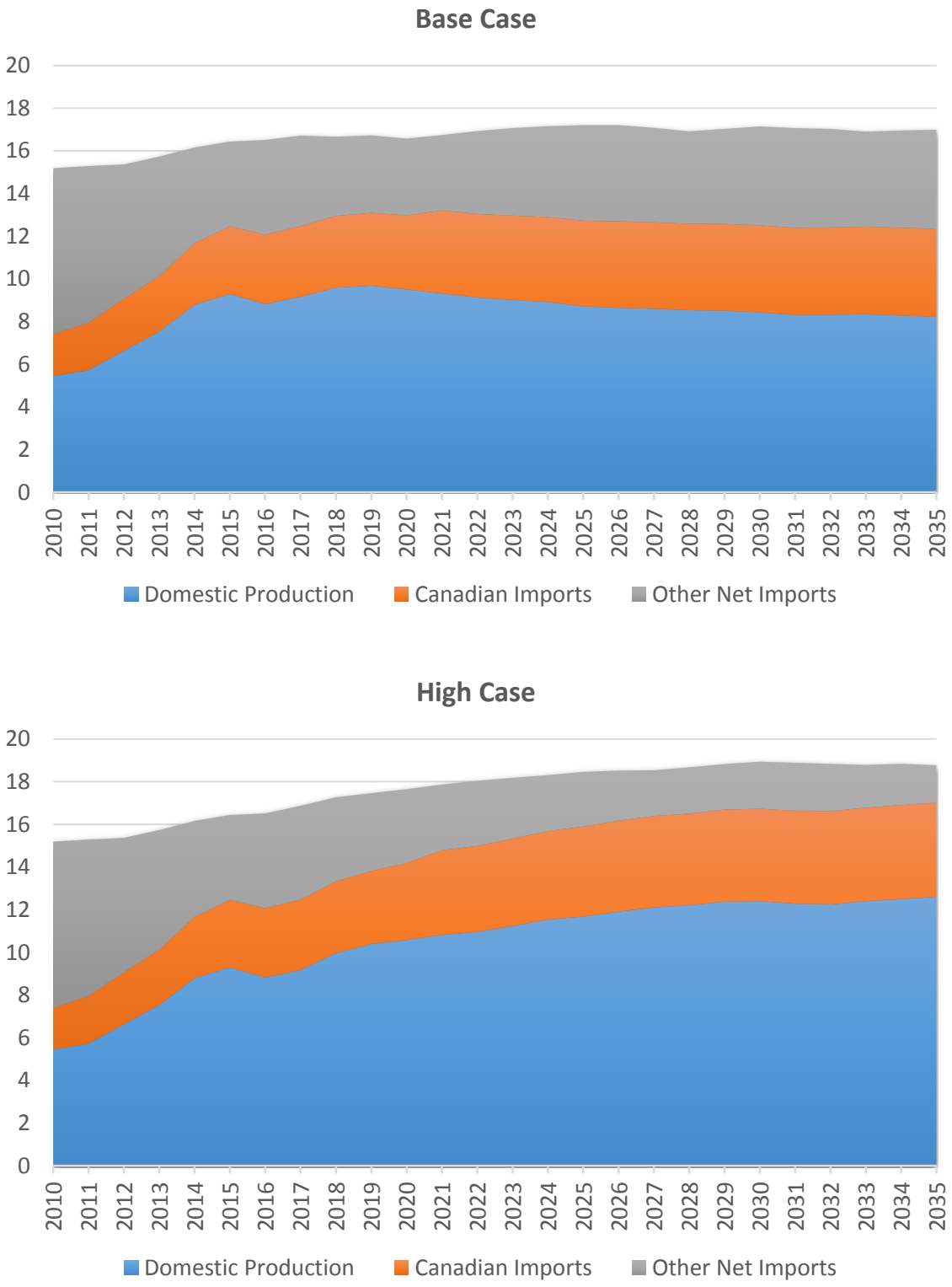


Exhibit 16: Natural Gas Market Growth (Billion Cubic Feet per Day)

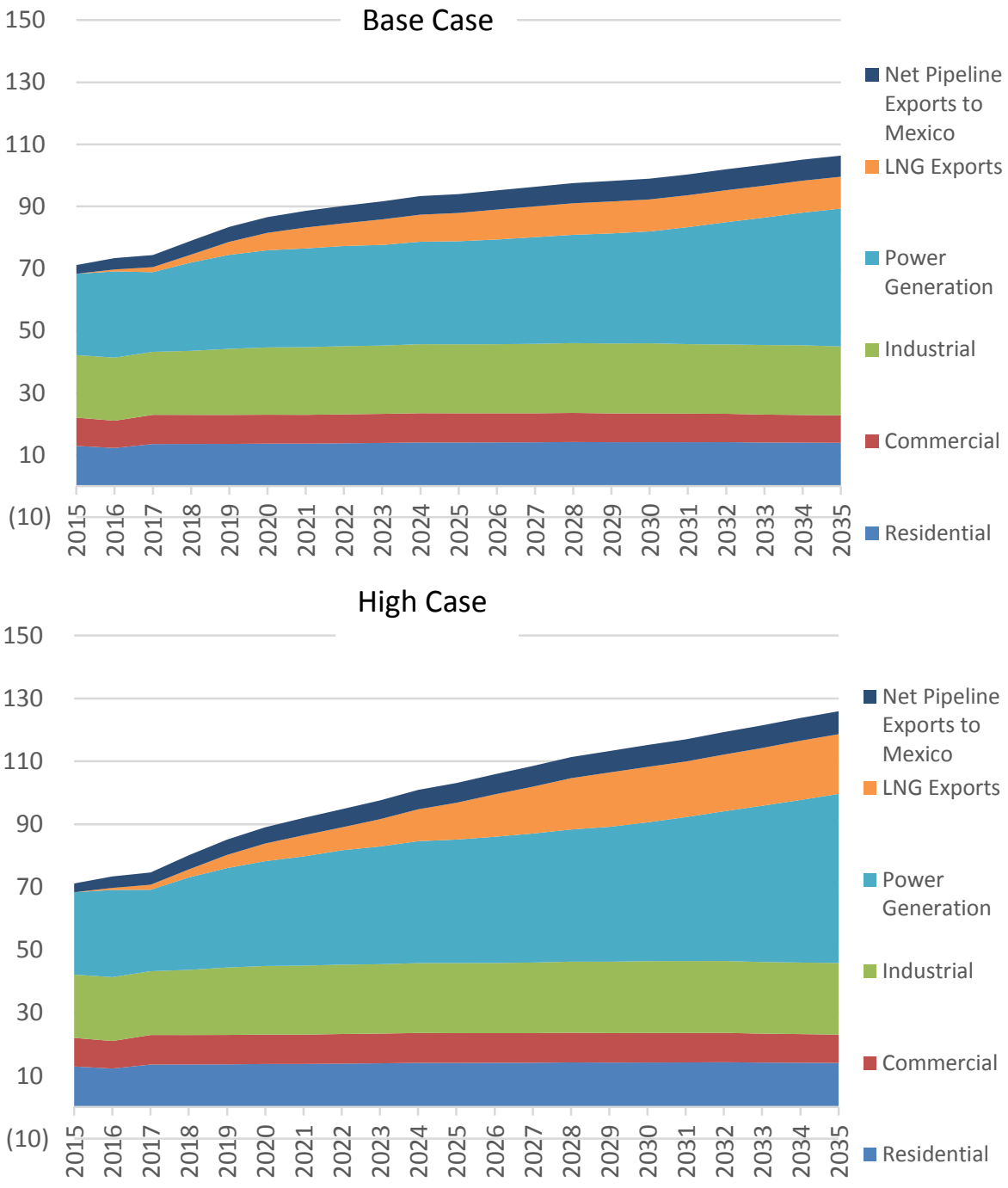
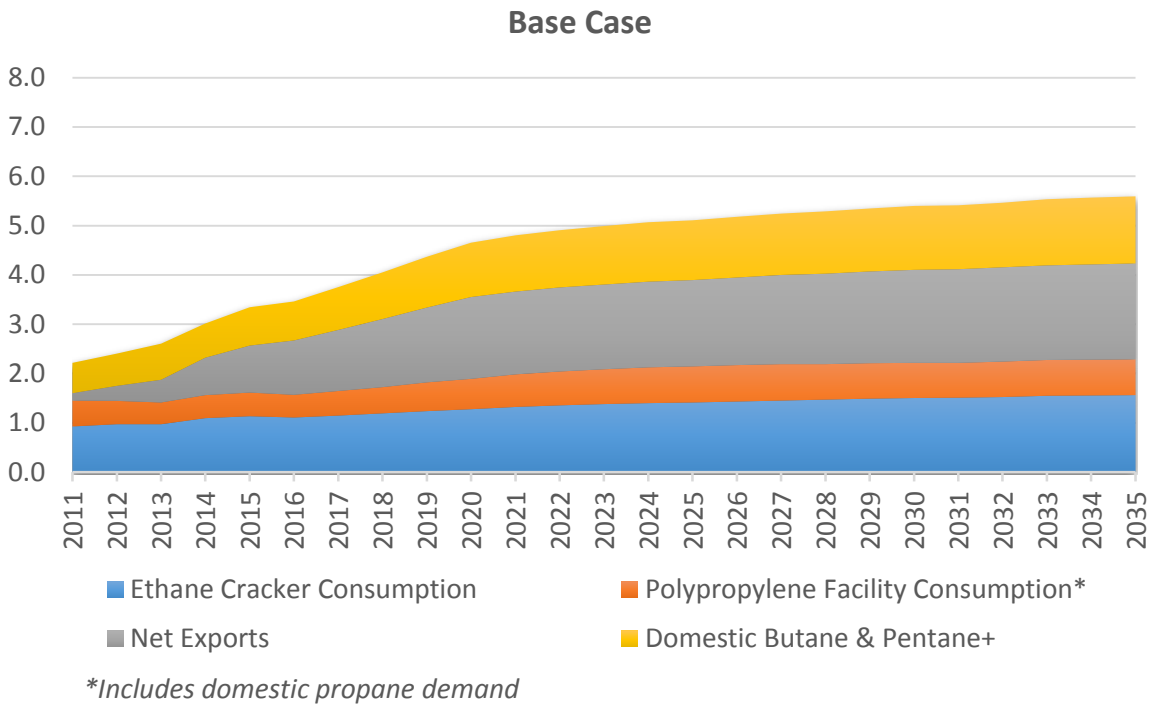
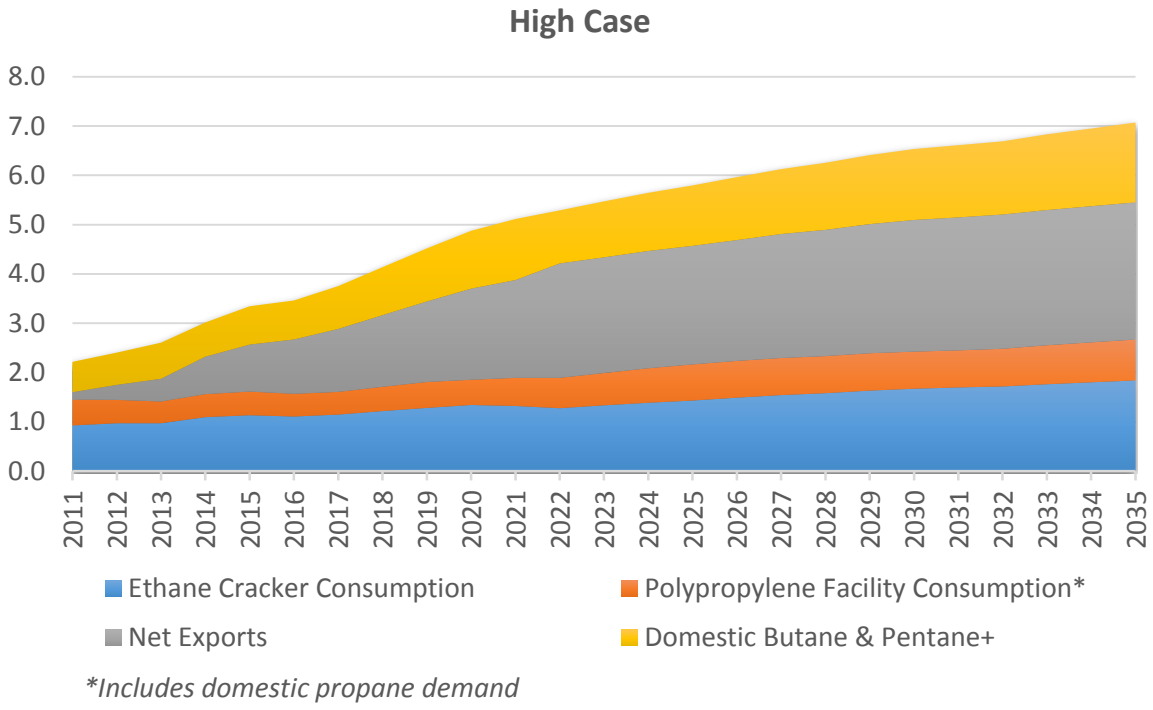


Exhibit 17: Natural Gas Liquids Market Growth (Billion Cubic Feet per Day)





3.2.3 Projected Transport of Oil, Gas, and NGLs

Considering the production and market dynamics discussed above, we have used the modeling framework discussed in Section 2 to assess the amount of pipeline capacity needed to support transport of oil, gas, and NGL. This sub-section discusses results of that analysis.

To begin with oil, we find that 3.0 million barrels per day of new capacity will be added in the Base Case, while 5.0 million barrels per day will be needed in the High Case (**Exhibit 18**). Much of the new transport capability for each of the cases, or 2.2 million barrels per day, is already under construction and scheduled to be completed within the next 12 months.

Exhibit 18: Crude Oil Pipeline Capacity Added in the Scenarios (Million Barrel per Day)

Base Case

Originating Region	2015	2016	2017-2020	2021-2025	2026-2030	2031-2035	2017-2035	Average Annual 2017-2035
U.S.	**3.6**	**1.4**	**2.2**	**0.8**	**-**	**-**	**3.0**	**0.2**
Central	0.4	0.5	0.8	0.8	-	-	1.6	0.1
Midwest	1.3	0.1	0.6	-	-	-	0.6	0.0
Northeast	0.3	-	-	-	-	-	-	-
Offshore	-	-	-	-	-	-	-	-
Southeast	-	-	-	-	-	-	-	-
Southwest	1.6	0.9	0.8	-	-	-	0.8	0.0
Western	-	-	-	-	-	-	-	-
Alaska	-	-	-	-	-	-	-	-

High Case

Originating Region	2015	2016	2017-2020	2021-2025	2026-2030	2031-2035	2017-2035	Average Annual 2017-2035
U.S.	**3.6**	**1.4**	**2.9**	**1.3**	**0.8**	**-**	**5.0**	**0.3**
Central	0.4	0.5	0.8	0.8	0.3	-	1.9	0.1
Midwest	1.3	0.1	0.8	-	-	-	0.8	0.0
Northeast	0.3	-	-	-	-	-	-	-
Offshore	-	-	-	-	-	-	-	-
Southeast	-	-	-	-	-	-	-	-
Southwest	1.6	0.9	1.3	0.5	0.5	-	2.3	0.1
Western	-	-	-	-	-	-	-	-
Alaska	-	-	-	-	-	-	-	-

Geographically, that capacity is concentrated in the Central, Midwest, and Southwest. Incremental transport in the Central and Midwest is already being added to support imports of heavy crude oil from Alberta's oil sands. These are legacy projects that were already underway before the collapse in oil prices and near-term slowdown in oil sands development. Another portion of the capacity is aimed at transporting incremental supplies from the Bakken toward the East Coast and Gulf Coast. Yet another

portion of the capacity is aimed at transporting growing supplies of crude oil from West Texas to refineries concentrated mostly along the Texas Gulf Coast.

In each of the cases after 2020, between 800,000 and 1.1 million barrels per day of incremental transport will be needed to support imports of heavy crude from Alberta's oil sands – recall from the discussion above that oil sands production will resume its growth as oil prices rebound to $75 per barrel (2015$) in the projections. Beyond that, the High Case adds another 1.7 million barrels per day of crude oil transport capability as incremental production growth that is fostered by the increased resource base and technological advancements. Most of the incremental capacity, or 1.5 million barrels per day is added in the Southwest to support additional transport of crude oil from the Permian Basin toward the Midcontinent and Gulf Coast refinery complex. The Permian Basin is the most prolific and cost effective oil province in the U.S. with a vast amount of resource in a number of different plays, so it stands to reason that any resource base improvements and/or technological advances would have a more pronounced impact on production from that area. The remainder of the incremental transport in the High Case originates from the Bakken into the Midwest.

It is also worth noting that the vast majority of the new oil pipeline transport that is projected for the U.S. is likely to be completed during the next 5 to 10 years. This stands to reason since a robust buildout of transport capability has occurred during the past five years and is currently ongoing. Thus, as production growth slows over the projection period, the need of incremental capacity also slows as already built capacity is relied on to transport incremental supplies.

For transport of natural gas, between 49 and 68 billion cubic feet per day of new pipeline capacity will be needed to support the levels of production and market growth that are projected through 2035 (**Exhibit 19**). The incremental transport of 2.6 to 3.6 billion cubic feet per day per year would be added to an already extensive gas transportation network that currently provides roughly 150 billion cubic feet per day of transport capability. Thus, the size of the U.S. gas transportation network will increase at a rate of roughly 2 percent per year in the future.

Unlike oil transport, which is more geographically limited, the buildout of the gas transportation network is likely to occur in many different areas. Of course, because it is the most cost effective gas producing area in North America, much of the new gas pipeline capacity will originate from the Marcellus and Utica production basin. Effectively, 32 to 47 billion cubic feet per day of new capacity will be placed to transport supplies from the Marcellus and Utica to consumers and export facilities that are geographically widespread across the eastern part of the continent. Thus, although the capacity that originates from the area shows up in the table in the Northeast and Midwest (based on the points of origination for projects), the capacity will have far reaching effects on other market areas where gas is delivered.

Because there are many different pipeline projects aimed at providing the incremental transport for Marcellus/Utica gas, many different companies will benefit from development of the area's gas supplies, Further, impacts of the development of the area's gas will have far reaching benefits for the nation's gas consumers and the overall economy, as will be discussed later in Section 5.

Exhibit 19: Natural Gas Pipeline Capacity Added in the Scenarios (Billion Cubic Feet per Day)

Base Case

Originating Region	2015	2016	2017-2020	2021-2025	2026-2030	2031-2035	2017-2035	Average Annual 2017-2035
U.S.	**6.8**	**5.7**	**39.2**	**7.8**	**2.0**	**0.5**	**49.5**	**2.6**
Central	-	-	-	-	0.5	-	0.5	0.0
Midwest	1.9	2.7	4.4	1.0	-	0.5	5.9	0.3
Northeast	2.5	2.1	18.2	6.6	1.5	-	26.3	1.4
Offshore	-	-	-	-	-	-	-	-
Southeast	0.8	0.2	3.2	0.2	-	-	3.4	0.2
Southwest	1.7	0.6	12.6	-	-	-	12.6	0.7
Western	-	-	0.8	-	-	-	0.8	0.0
Alaska	-	-	-	-	-	-	-	-

High Case

Originating Region	2015	2016	2017-2020	2021-2025	2026-2030	2031-2035	2017-2035	Average Annual 2017-2035
U.S.	**6.8**	**5.7**	**39.4**	**12.9**	**10.9**	**4.2**	**67.4**	**3.5**
Central	-	-	0.2	-	0.5	-	0.7	0.0
Midwest	1.9	2.7	4.4	2.0	1.0	1.0	8.4	0.4
Northeast	2.5	2.1	18.2	10.8	6.3	3.0	38.2	2.0
Offshore	-	-	-	-	-	-	-	-
Southeast	0.8	0.2	3.2	0.2	1.0	-	4.4	0.2
Southwest	1.7	0.6	12.6	-	2.1	0.2	14.9	0.8
Western	-	-	0.8	-	-	-	0.8	0.0
Alaska	-	-	-	-	-	-	-	-

Of course, development of Marcellus/Utica supplies as well as development of supplies from other basins (e.g., the Haynesville in Northwest Louisiana and East Texas), will impact development elsewhere because of the market growth that the supplies support. Thus, the scenarios project a significant amount of new capacity is needed in the Southwest and Southeast, where between 16 and 19 billion cubic feet per day of new transport capability will be required. This new capacity will be needed to facilitate LNG exports as well as exports to Mexico and foster the growth of gas-fired power generation.

Interestingly, not much new pipeline capacity appears to be needed in the Central and Western U.S. These areas are already "over-piped" and have modest expectations for market growth. Indeed gas consumption in these areas may struggle to keep pace with growth elsewhere. In fact, gas consumption may even decline in the westernmost parts of the continent, especially in California where there is an increased focus on renewable energy policies.

Unlike oil, where development of new capacity noticeably slows over the projection period, development of gas pipeline capacity is projected to be more uniform throughout the projection period. While the cases project a slowdown from the very robust expansion that is likely to take place over the next few years, the scenarios also project 10 to 28 billion cubic feet per day of new capability after 2020. This result depends on the size of the resource base and continued technological advancements. These changes are important because they would keep gas prices from rising in response to the robust market growth occurring in the High Case. Thus, because the relatively large resource base and technological advancements keep gas prices relatively low, they continue to foster the market growth and incremental infrastructure development required in the High Case.

For transport of natural gas liquids (NGLs), between 1.8 and 2.6 million barrel per day of new pipeline capacity will be needed to support the levels of production and market growth that are projected through 2035 (**Exhibit 20**). Almost all of this new capacity will be placed in service over the next decade.

Exhibit 20: NGL Pipeline Capacity Added in the Scenarios (Million Barrel per Day)

Base Case

Originating Region	2015	2016	2017-2020	2021-2025	2026-2030	2031-2035	2017-2035	Average Annual 2017-2035
U.S.	**1.2**	**0.3**	**1.5**	**0.3**	**-**	**-**	**1.8**	**0.1**
Central	0.1	0.0	0.0	-	-	-	0.0	0.0
Midwest	0.1	0.2	0.5	-	-	-	0.5	0.0
Northeast	0.1	-	0.5	0.2	-	-	0.7	0.0
Offshore	-	-	-	-	-	-	-	-
Southeast	-	-	-	-	-	-	-	-
Southwest	0.8	0.1	0.4	0.1	-	-	0.5	0.0
Western	-	-	-	-	-	-	-	-
Alaska	-	-	-	-	-	-	-	-

High Case

Originating Region	2015	2016	2017-2020	2021-2025	2026-2030	2031-2035	2017-2035	Average Annual 2017-2035
U.S.	**1.2**	**0.3**	**1.6**	**0.9**	**-**	**0.1**	**2.6**	**0.1**
Central	0.1	0.0	0.0	-	-	-	0.0	0.0
Midwest	0.1	0.2	0.5	0.2	-	-	0.7	0.0
Northeast	0.1	-	0.5	0.4	-	-	0.9	0.0
Offshore	-	-	-	-	-	-	-	-
Southeast	-	-	-	-	-	-	-	-
Southwest	0.8	0.1	0.5	0.4	-	0.1	1.0	0.1
Western	-	-	-	-	-	-	-	-
Alaska	-	-	-	-	-	-	-	-

The areas for development of new capacity include the: 1) Northeast – home to the Marcellus and Utica where gas production is likely to continue to grow very rapidly; 2) the Midwest where the Aux Sable liquids extraction facility resides; and 3) the Southwest where there are potentially a large number of "wet" gas plays that contain significant amounts of liquids resource. The last of these areas, the Southwest, is also home to the Mont Belvieu, a widely recognized location for NGL transactions, that is in relatively close proximity to a number of sites where additional petrochemical facilities (i.e., ethane crackers and polypropylene plants) and NGL export terminals could be built and/or expanded.

4 Oil and Gas Infrastructure Requirements

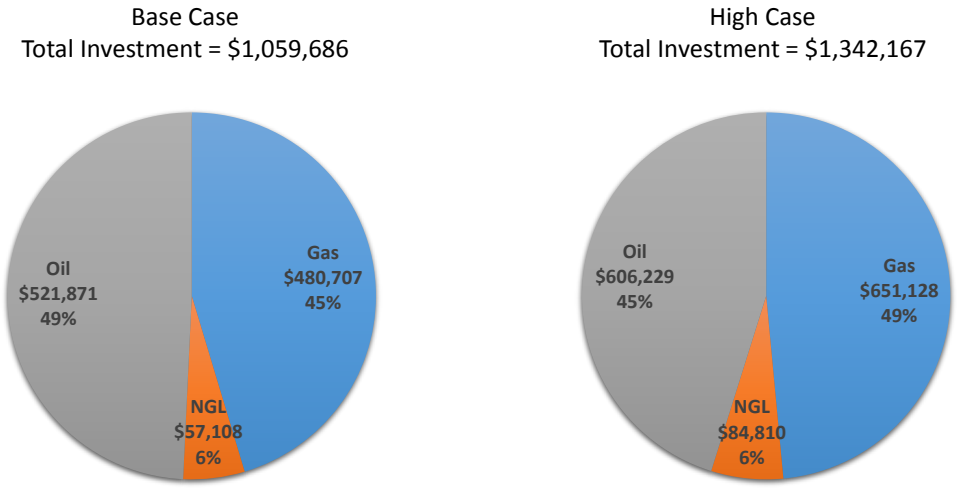
The supply, demand, and transport dynamics discussed in the previous section lay the foundation for determining the need for oil and gas infrastructure. New infrastructure will be required to process and transport hydrocarbons from regions where production is projected to grow to locations where the hydrocarbons are used. Thus, the types and amounts of oil and gas infrastructure and the associated capital investment is dependent on how the produced volumes of crude oil, natural gas, and NGLs are processed, refined, and transported across the U.S.

This section examines the oil and gas infrastructure needed for each of the scenarios. It begins with a high level overview of infrastructure requirements, and then investigates the specific requirements for each infrastructure category. After that, it examines regional trends for infrastructure development and expenditures. Results from the section, in particular capital expenditures for infrastructure, are applied in the following section to investigate the potential economic impacts of oil and gas infrastructure development, most notably employment and GDP impacts.

4.1 Overview of Oil and Gas Infrastructure Development

Applying the modeling tools and methodology discussed in Section 2, total oil and gas infrastructure investment is projected to range between $1.06 and $1.34 trillion from 2017 through 2035 for the Base Case and High Case, respectively (**Exhibit 21**), averaging between $56 and $71 billion per year. These estimates align well with the aforementioned oil and gas infrastructure investment of $390 billion that has occurred during the past five years, suggesting that the robust environment for oil and gas infrastructure development has not yet run its course and is likely to continue for many years.

Exhibit 21: Projected Capital Investment in Oil and Gas Infrastructure from 2017-2035 (Million 2015$)



Investment is strongest for natural gas gathering, processing and transport, with capital outlays totaling between $481 and $651 billion over the projection period, accounting for between 45 and 49 percent of the total investment. Natural gas infrastructure development has significant upside and risk because of uncertainties around gas market development. Oil capital expenditures range from $522 to $606 billion, with total expenditures much more consistent across the scenarios. This is because two of the biggest components for oil-related investment, offshore oil platforms and refinery upgrades and refurbishments are relatively steady in the different environments depicted in the scenarios. NGL investment is much less at between $57 and $85 billion (i.e., 6 percent of the total), as expenditures are more narrowly focused on fractionation facilities and a few large pipeline projects.

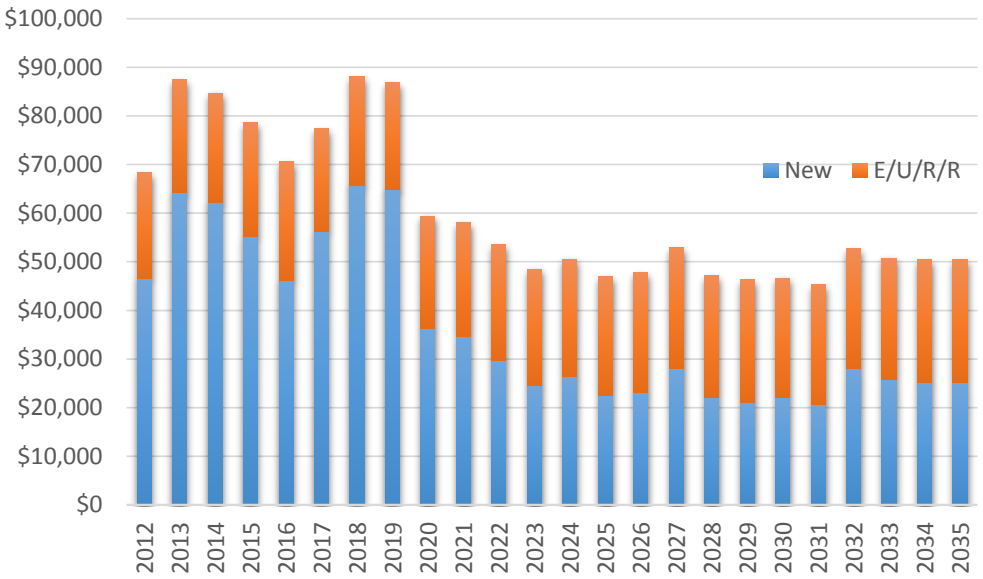
Much of the infrastructure projected here faces regulatory hurdles, but because this study is aimed at quantifying potential infrastructure development and its associated CAPEX, it assumes that regulatory hurdles will be overcome and infrastructure will be built in response to market needs. However, it is worth noting that project delays in regulatory approvals processes pose significant downside risk for projected investment and the associated economic benefits discussed later in Section 5.

For the most part and as mentioned above, infrastructure development and its associated CAPEX is relatively steady throughout the projection period, averaging between $56 and $71 billion per year (**Exhibit 22**). While robust buildout of infrastructure is likely to continue over the next few years, buildout and investment in infrastructure is significant even in the longer term, with investment in new infrastructure (NOT including enhancements, upgrades, replacements, and refurbishments of existing infrastructure) averaging between $25 and $41 billion after 2020. Investment is, however, much more steady in the High Case where the aforementioned upside potential for gas infrastructure development is realized.

It is also worth noting that infrastructure development is buoyed after 2020 by expenditures aimed at enhancing, upgrading, replacing and refurbishing older assets and equipment. Over time, equipment and parts wear out, and assets must be adapted to respond to changes in the market and to comply with regulations. This will be the case for refineries, which would need to adapt to a changing oil stream as volumes of lighter sweet crude oil from the U.S. increase over time. Integrity management regulations also necessitate replacement of assets. Further, some equipment with moving parts that is more frequently used, for example, skid mounted compressor units relied on in gathering systems will wear out and need to be replaced. Each of these factors as well as others will contribute to the $25 to $27 billion per year CAPEX required to enhance, upgrade, replace, and refurbish existing facilities. Also, it should be noted that none of these capital expenditures include operations and maintenance expenses, which would potentially add billions of dollars to the values.

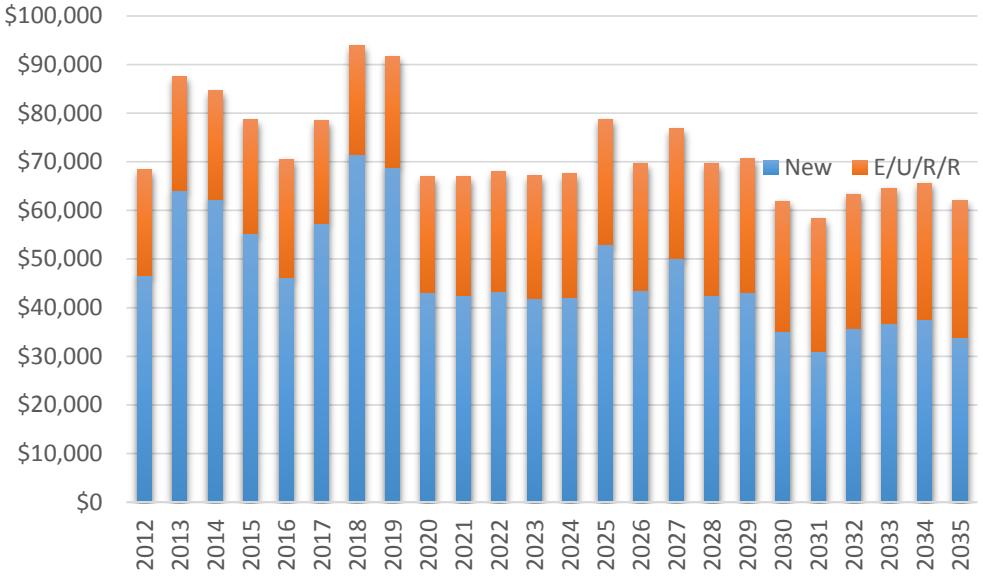
Exhibit 22: Oil and Gas Infrastructure CAPEX by Year (Million 2015$)

Base Case
Projected (2017-2035) Average Annual CAPEX = $55,773



E/U/R/R = Enhancement/Upgrade/Replacement/Refurbishment

High Case
Projected (2017-2035) Average Annual CAPEX = $70,640



E/U/R/R = Enhancement/Upgrade/Replacement/Refurbishment

4.2 Oil and Gas Infrastructure Development by Category

This portion of the report discusses investment by category. Expenditures across categories are first discussed in broad terms directly below, and then each category is separately examined.

Among the categories, investment is greatest for surface and lease equipment with capital expenditures totaling between $318 and $365 billion from 2017 to 2035, accounting for about 30 percent of the total oil and gas infrastructure investment (**Exhibit 23**). The average annual CAPEX is fairly steady from year to year, ranging from $16.7 to $19.2 billion per year (**Exhibit 24**). Roughly 80 percent of the expenditures are for equipment that is put in place to support new producing wells and the remaining 20 percent is attributed to replacement and refurbishment of existing infrastructure.

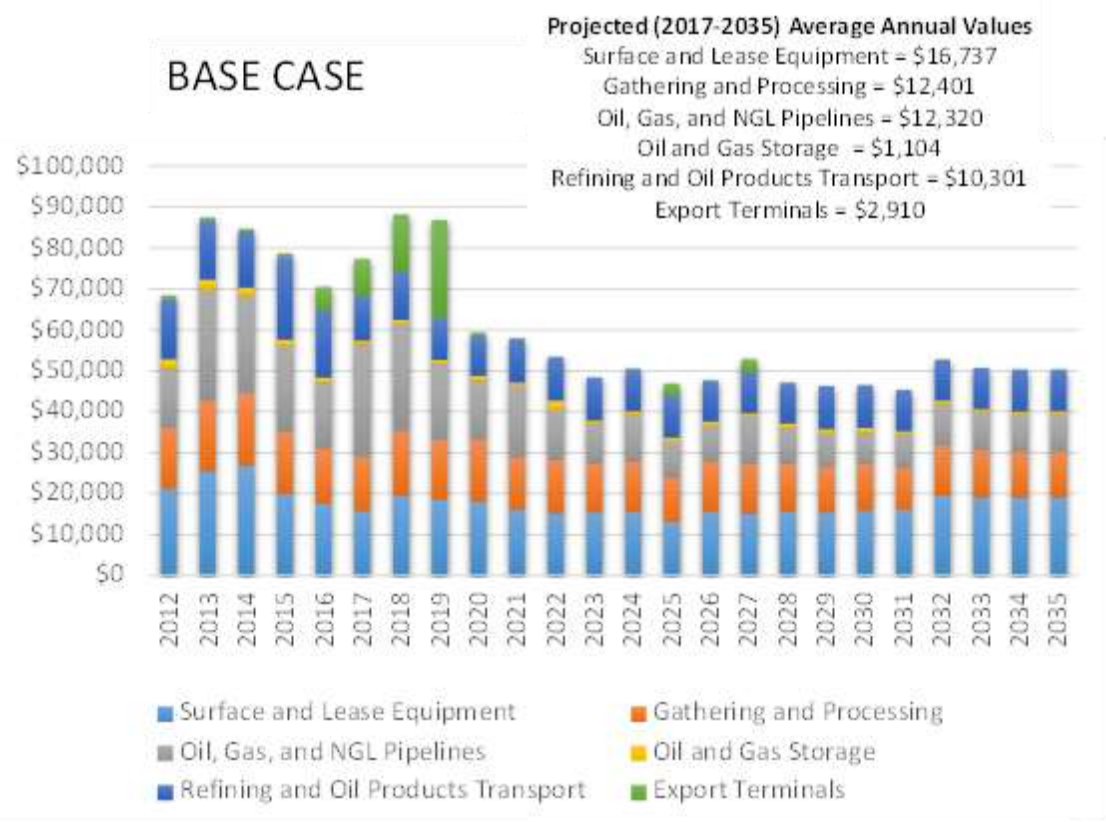
Pipeline development ranks second with a total CAPEX of $234 and $362 billion over the projection, accounting for 22 to 27 percent of the total oil and gas infrastructure investment. These amounts equate to an average annual CAPEX of between $12.3 and $19.0 billion. Much of the expenditure, or about 75 percent of it is for new infrastructure, with only 25 percent attributed to replacement and refurbishment of existing infrastructure. This category has significant upside potential and risk depending on the evolution of gas and NGL markets.

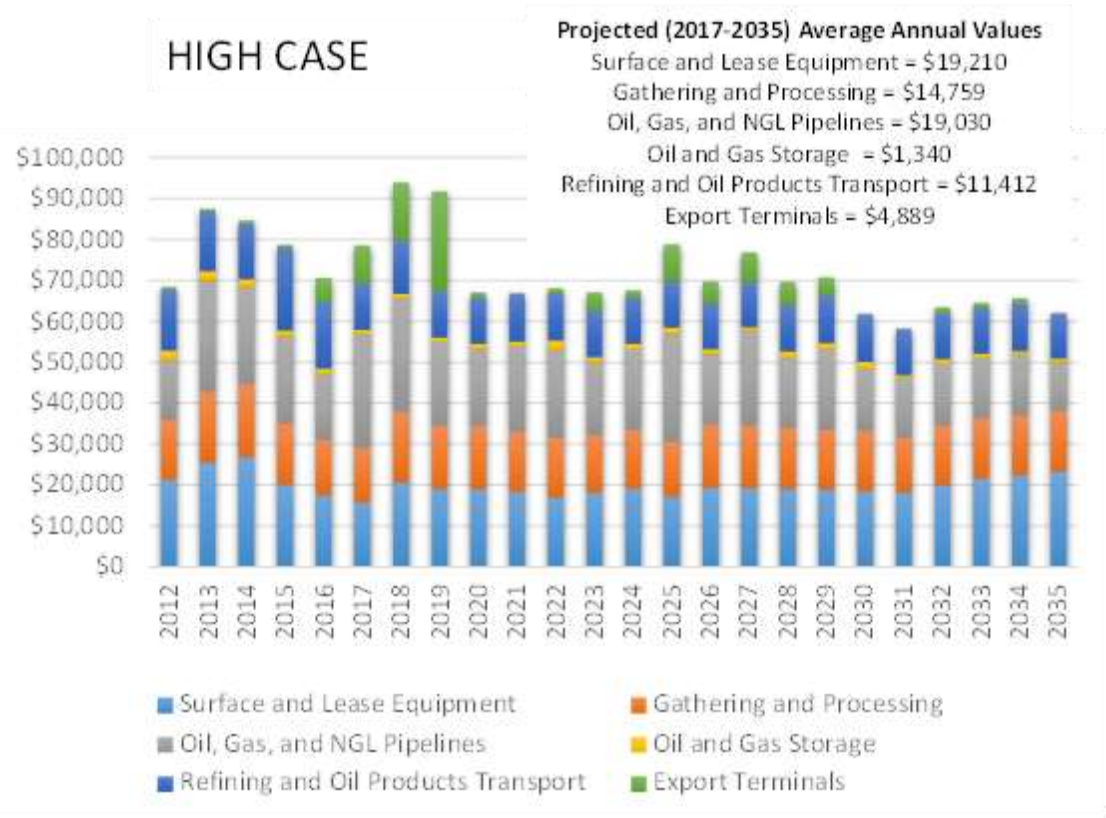
Gathering and processing investment runs a close third with a total CAPEX of $236 and $280 billion over the projection, accounting for 22 percent of the total oil and gas infrastructure investment. The average annual expenditure is $12.4 to $14.8 billion. A significant portion, or 47 percent of the CAPEX is for replacement and refurbishment of existing infrastructure, mostly replacement of "small package" compressors and components in processing plants that wear out over time. The three remaining categories collectively add a total CAPEX of $272 to $335 billion over the projection, or $14.3 to $17.6 billion annually.

Exhibit 23: Oil and Gas Infrastructure CAPEX from 2017-2035 by Category (Million 2015$)

	2012-16		Base Case, 2017-35		High Case, 2017-35	
	CAPEX	% of Total	CAPEX	% of Total	CAPEX	% of Total
Surface and Lease Equipment	$111,375	28.6%	$318,010	30.0%	$364,997	27.2%
Gathering and Processing	$78,524	20.2%	$235,621	22.2%	$280,418	20.9%
Oil, Gas, and NGL Pipelines	$101,670	26.1%	$234,072	22.1%	$361,579	26.9%
Oil and Gas Storage	$10,242	2.6%	$20,977	2.0%	$25,456	1.9%
Refining and Oil Products Transport	$79,081	20.3%	$195,722	18.5%	$216,829	16.2%
Export Terminals	$8,742	2.2%	$55,284	5.2%	$92,887	6.9%
Total Expenditures	$389,633	100.0%	$1,059,686	100.0%	$1,342,167	100.0%

Exhibit 24: Annual Oil and Gas Infrastructure CAPEX by Category (Million 2015$)





4.2.1 Capital Expenditures for Surface and Lease Equipment

As discussed above, surface and lease equipment capital expenditures are very significant, totaling $318 to $365 billion over the projection. These values equate to annual expenditures of $16.7 to $19.2 billion for the Base Case and High Case, respectively (**Exhibit 25**). The values align well with average annual expenditures over the past five years.

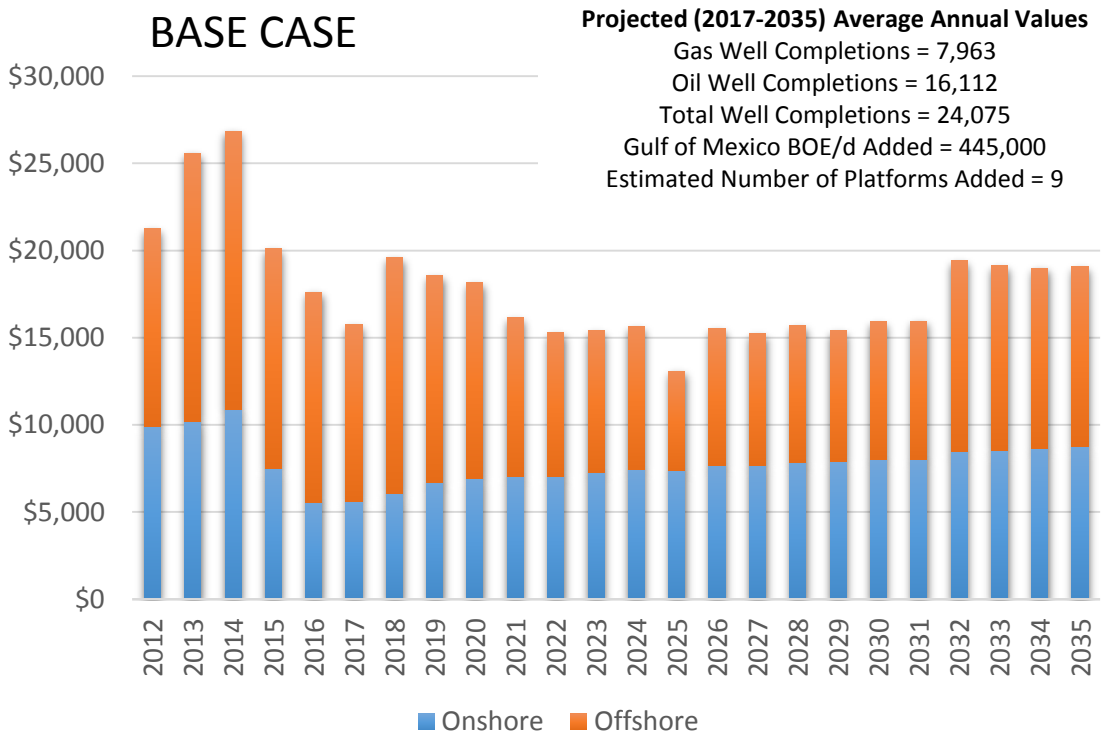
Over half of the investment in surface and lease equipment is devoted to offshore oil platforms in the Gulf of Mexico, with a projected annual CAPEX averaging between $9.2 and $10.6 billion. Offshore development is bolstered by the rebound of oil prices to $75 per barrel in real terms in each of the scenarios. Further, because oil prices are the same in each scenario, the level of offshore drilling activity is about the same. The Base Case projects that 445,000 barrels of oil equivalent per day are added each year, while the High Case projects a slightly greater level of 512,000 barrels of oil equivalent per day each year. Note that these statistics, as well as others are listed in the exhibit and are also shown in tables showing regional detail in Appendix B. The difference in oil added results because of the incremental resource and accelerated technology advancement assumed in the High Case. The production levels require 9 to 10 new platforms every year, each of which are relatively large deep water platforms costing about $1 billion.

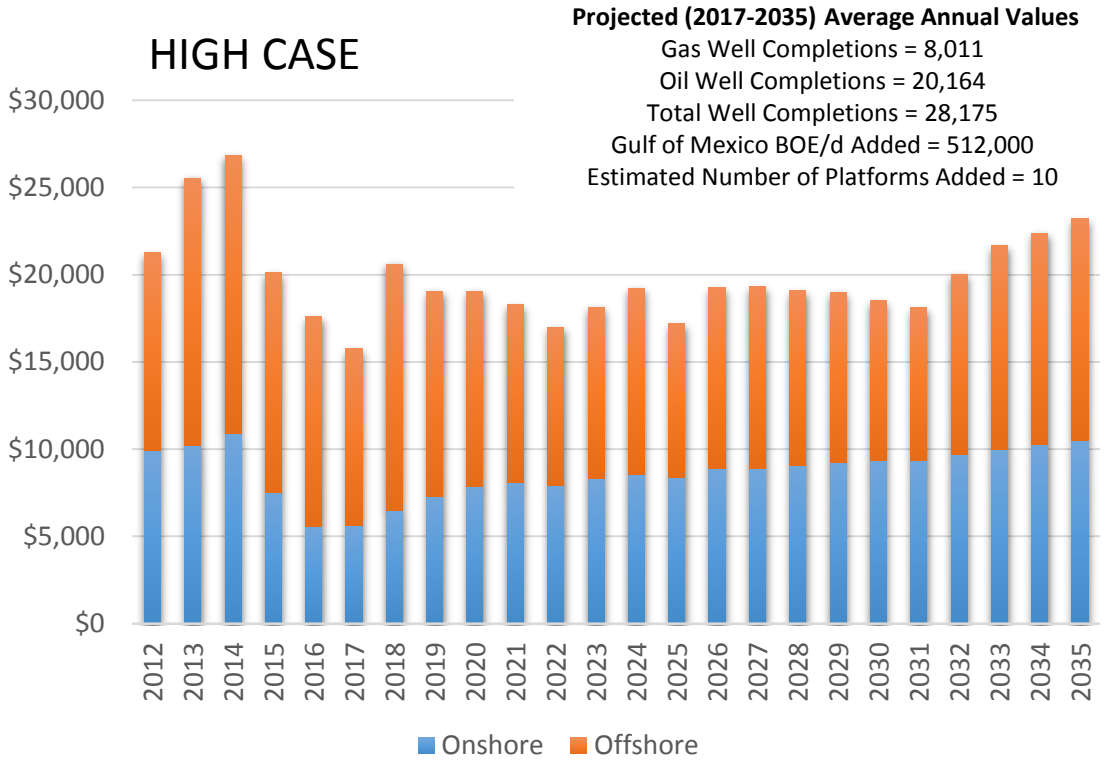
Projected annual CAPEX for onshore surface and lease equipment averages $7.5 to $8.7 billion for the Base Case and High Case, respectively. While these values are significant, they are somewhat below levels from ten years ago as the number of annual well completions in the U.S. has declined significantly since that time. With the move away from conventional resource to shale and tight resource development, individual wells have become much more productive. Thus, far fewer wells are required to increase production when compared with ten years ago. Because there are fewer wells needed, the amount of surface and lease equipment projected year by year is also much less than it once was, driving down surface and lease equipment expenditures relative to historical expenditures. However, today's equipment is also built to handle larger volumes of production, offsetting some of the cost reduction. In addition, the cost reduction is also offset by replacement and refurbishment costs that make up roughly 40 percent of the total expenditures for onshore surface and lease equipment.

The difference in CAPEX for onshore surface and lease equipment between cases is driven by the slightly greater activity in the High Case versus the Base Case. The High Case projects an average of 28,175 oil and gas well completions each year while the Base Case projects only 24,075 oil and gas well completions per year. With well completions up by about 17 percent in the High Case versus the Base Case, it should come as no surprise that investment in surface and lease equipment is up by nearly that same percent in the High Case.

Increased drilling activity between the cases occurs almost exclusively in oil well completions where the resource base has been increased very significantly in the High Case relative to the Base Case. Gas well completions are up only slightly in the High Case versus the Base Case. In the High Case, well productivity improvements, and not well completions, drive the dramatic increases in gas production over time, as was discussed earlier in Section 3.

Exhibit 25: Surface and Lease Equipment CAPEX (Million 2015$)





4.2.2 Capital Expenditures for Gathering and Processing

As discussed above, gathering and processing capital expenditures rank third among the categories with investment totaling $236 to $280 billion over the projection. These values equate to annual expenditures of $12.4 to $14.8 billion for the Base Case and High Case, respectively (**Exhibit 26**), aligning well with average annual expenditures during the past five years.

Roughly one-third or the largest portion of the total investment for this category is devoted to gathering lines, with a projected annual CAPEX averaging between $4.6 and $4.9 billion for the Base and High Case, respectively. The difference between the two cases is attributed to the change in the number of well completions and the related changes in oil and gas production. In the U.S., 11,485 to 12,612 miles of gathering lines will be built or replaced each year, equating to a total of between 218,000 and 240,000 miles throughout the projection. Roughly 75 percent of the new and replaced lines are for gas gathering with the remainder added for oil gathering. Oil lines account for a smaller portion of gathering because there are significant amounts of crude oil stored in tanks near the wellhead and taken away by truck instead of pipe. The average diameter of the added gathering lines is roughly 6 inches for each case, but there is a great deal of regional variance in the diameter, as shown in tables in Appendix B.

To support the gas gathering process, between 1.2 and 1.5 million horsepower of compression will be needed each year, yielding an annual investment of $3.0 to $3.7 billion. Annual additions/enhancements to compression equate to 22 to 29 million horsepower throughout the projection. Much of the compression for gathering lines will be modularized skid-mounted units that can be easily added or removed over time.

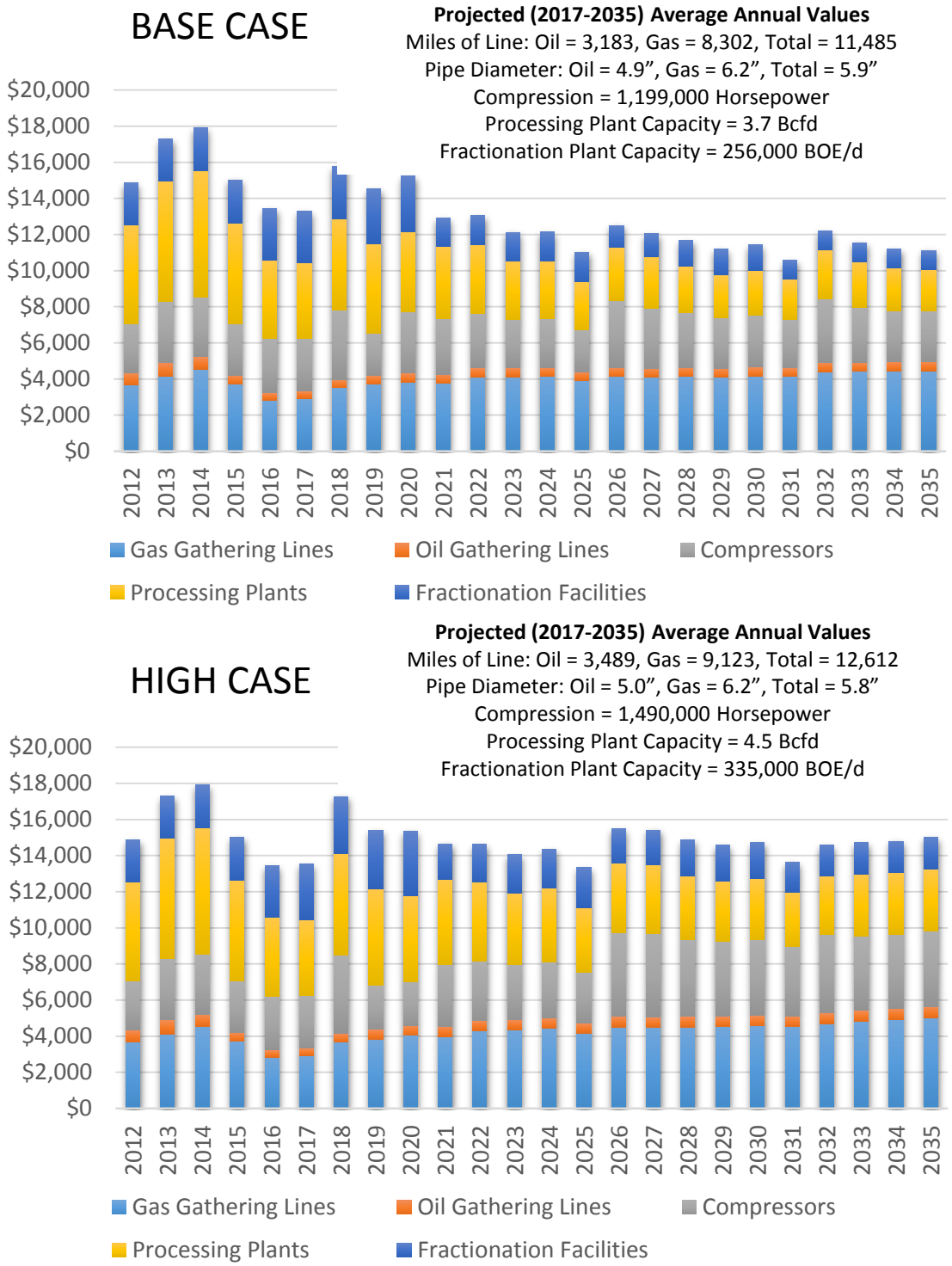
Investment in gas processing plants averages $3.2 to $4.0 billion per year for the Base and High Case, respectively. This sub-category includes separators, treaters, dehydrators, meters, control equipment, valves, and compressors located within the confines of the processing plant. Expenditures support 3.7 to 4.5 billion cubic feet per day per year of new and replaced processing capacity, which equates to 70 to 85 billion cubic feet per day of processing capacity throughout the projection. Across the U.S., this amount of capacity equates to between 13 and 17 processing plants each year, given that, on average, a single plant can process up to 275 million cubic feet of gas per day.

This analysis also shows that new and replaced NGL fractionation capacity of 256,000 to 335,000 barrels per day will be required each year, yielding an average annual CAPEX of $1.7 to $2.2 billion for the Base and High Case, respectively. The annual capacity additions equate to roughly 5 to 6 million barrels per day of new/replacement capacity throughout the projection. Further, these totals equal 3 to 5 fractionation plants each year, assuming that, on average, a single plant can process up to 75,000 barrels of NGLs per day.

Capital expenditures associated with enhancing, upgrading, replacing, and refurbishing infrastructure in this category are very significant, averaging $5.9 to $6.3 billion per year. This level of expenditures accounts for roughly 45 percent of the total investment in gathering and processing assets, which seems like a relatively large percent to invest in replacement and refurbishment of existing assets. However, the

level of investment is required because equipment and assets in this category wear out much more frequently than some of the longer lived assets included in other infrastructure categories.

Exhibit 26: Gathering and Processing CAPEX (Million 2015$)



4.2.3 Capital Expenditures for Oil, Gas, and NGL Pipelines

As discussed above, capital expenditures for oil, gas, and NGL pipelines rank second behind surface and lease equipment with investment totaling $234 to $362 billion over the projection. These values equate to annual expenditures of $12.3 to $19.0 billion for the Base Case and High Case, respectively (**Exhibit 27**). While these values are somewhat below average annual expenditures that have recently averaged just over $20 billion, they are still very significant and suggest that there are a number of years remaining for the robust oil and gas pipeline buildout that has been occurring.

The vast majority, or roughly 80 percent of the total investment in this category is for natural gas pipelines, with an average annual CAPEX of $10.1 to $15.3 billion. These values equate to a total of $190 to $290 billion throughout the projection.

Roughly 1,400 to 2,400 miles of natural gas pipeline are built each year, with a total of between 27,000 to 46,000 miles put in place throughout the projection. There is significant upside and risk for natural gas pipeline development, depending on market evolution and project approvals. In addition to the mileage of lines, there is between 524,000 and 596,000 horsepower of compression added each year, equating to a total of 10 to 12 million horsepower of compression over the course of the projection.

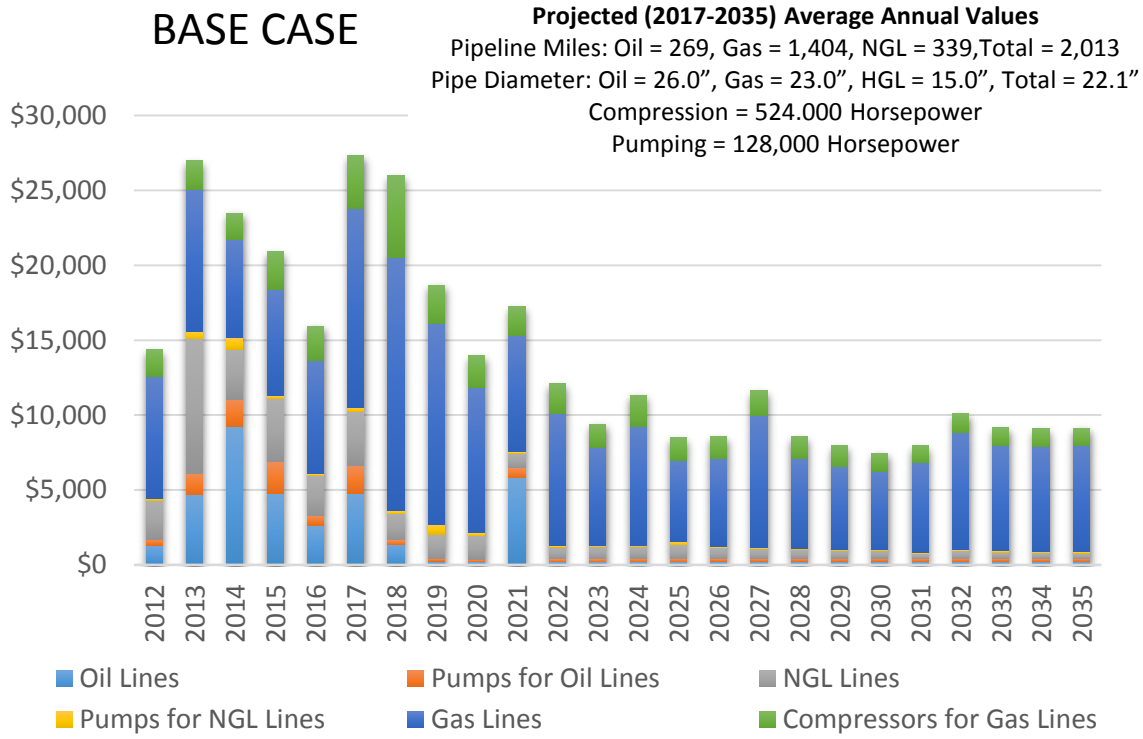
The vast majority of investment in natural gas pipelines is for new capacity, with only 20 percent of the total investment aimed at replacing and refurbishing older pipelines. Most, if not all of the replacement and refurbishment CAPEX for natural gas pipelines will be associated with integrity management programs and for upgrades necessary to comply with NOxemissions standards.

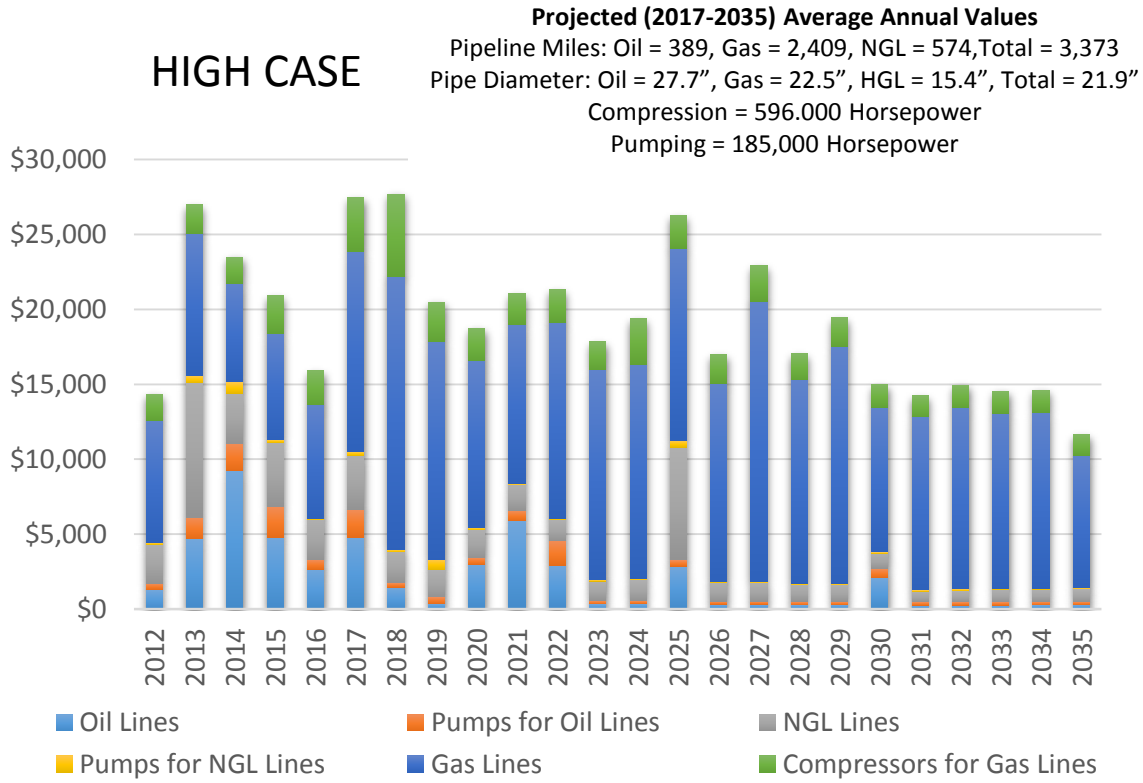
Oil and NGL pipeline investments average $2.2 to $3.7 billion per year, or between $42 and $70 billion over the entire projection. There are far fewer miles of oil and NGL pipeline required in the scenarios, in comparison to gas pipelines. Thus, only 600 to 950 miles of pipeline are added each year for a total of 11,000 to 18,000 miles over the entire projection. Pumping requirements for oil and NGL pipelines will total 128,000 to 185,000 horsepower each year, or 2.4 to 3.5 million horsepower over the entire projection.

Much of the new oil pipeline that is required is already under construction, or could be added with a few large projects. The same can also be said for NGL transport, where a few large projects could yield much of the needed capacity. Thus, oil and NGL pipeline investments are uneven over time, particularly when they are compared with investments in natural gas pipelines that are much steadier throughout the projection.

Most of the pipeline capacity that is added in each of the scenarios is fairly large pipe, averaging just over 22” in diameter. Some of the projects, particularly the oil projects aimed at transporting heavy crude oil from Western Canada into the U.S. and toward the Gulf Coast require very large pipes, each of which is upwards of 32” in diameter.

Exhibit 27: Oil, Gas, and Natural Gas Liquids (NGLs) Pipeline CAPEX (Million 2015$)





4.2.4 Capital Expenditures for Oil and Gas Storage

Capital expenditures for oil and gas storage are the least significant of the investments discussed in this report. This result occurs because there is already a vast amount of oil and gas storage capacity in place across the U.S., and the need of new storage infrastructure is not very significant. Thus, total capital expenditures range from $21.0 and $25.5 billion over the projection period, equating to an average annual CAPEX of $1.1 to $1.3 billion (**Exhibit 28**).

Even though there is already a large amount of storage in place, the two scenarios add incremental storage in response to market and supply growth. For crude oil, storage is added to provide a temporary "holding location" for supplies until they are able to be transported to centralized tank farms and/or refineries. The Base Case adds 1.1 million barrels of storage per year in response to the modest oil production growth that occurs over time, while the High Case adds 5.0 million barrels of storage per year in response to the enhanced production growth that occurs. Total storage additions in the High Case approach 100 million barrels by 2035, in line with the Case's crude oil production growth of nearly 4 million barrels per day.

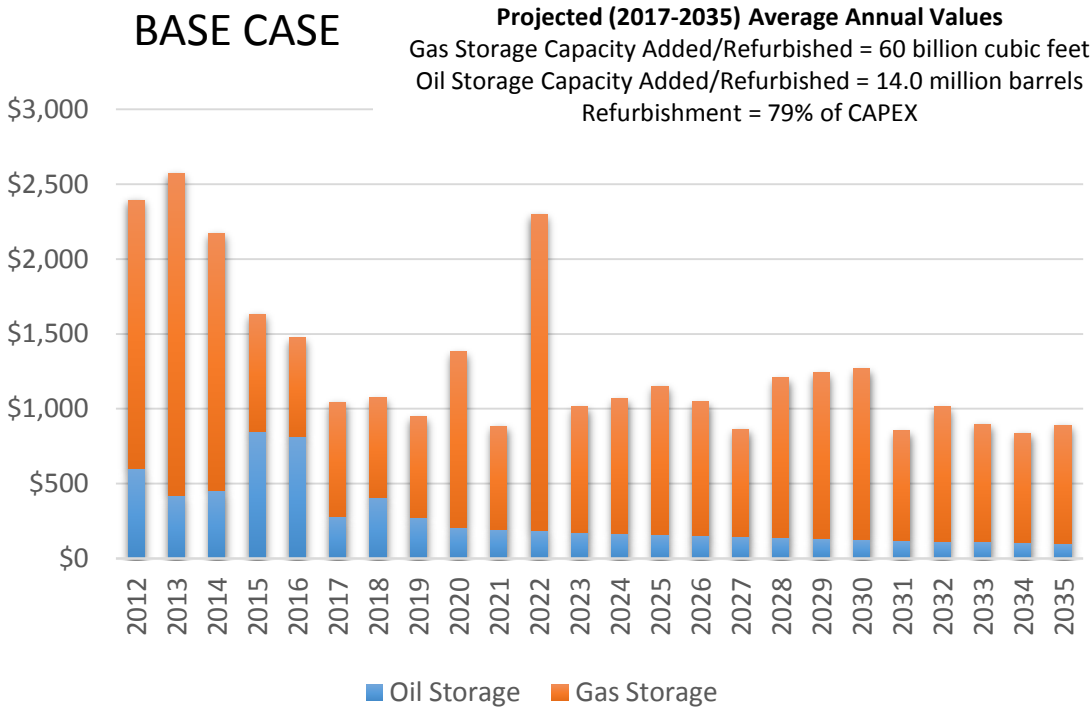
However, the far greater portion of the oil storage investment in the case occurs for replacement and refurbishment of already existing oil tanks. Essentially, there are 13 to 14 million barrels per year of oil tanks replaced and/or refurbished in the cases, yielding roughly $3 billion per year expenditure for oil tank upkeep.

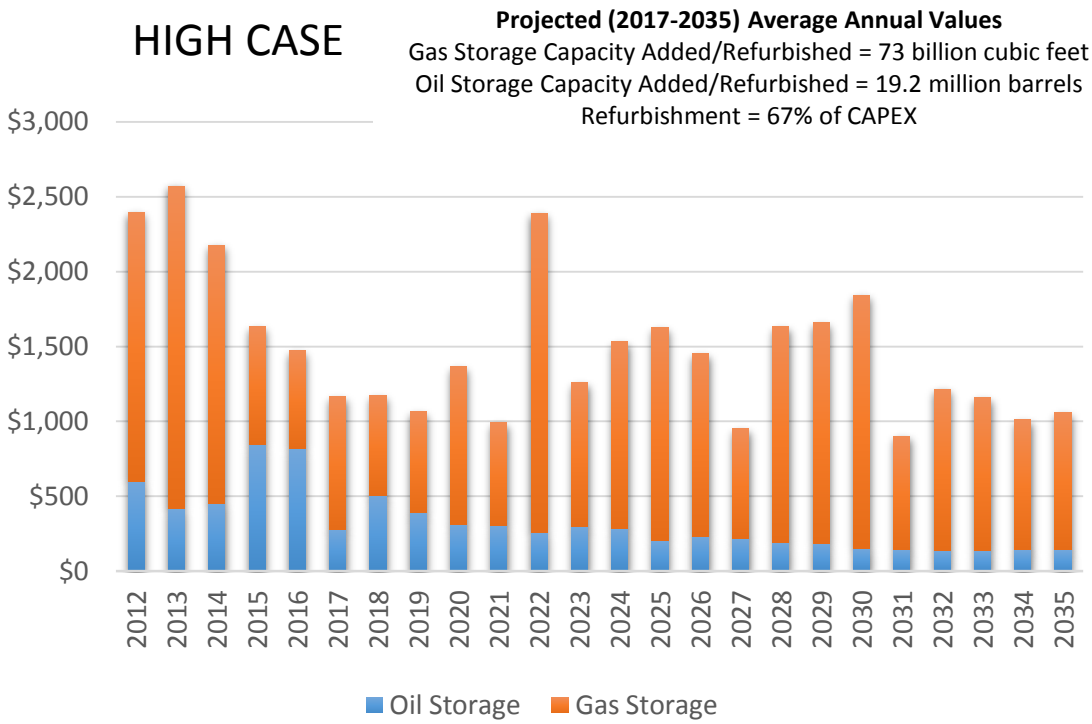
With regards to natural gas, the Base Case adds 19 billion cubic feet per year of working gas capability while the High Case adds 31 billion cubic feet per year of working gas capability. This added storage is mostly high deliverability salt cavern storage located in relatively close proximity to where gas markets grow most significantly, that is, near power plants, large petrochemical facilities, and LNG export facilities. The gas storage is added mostly to manage loads and balance consumption with supplies. The larger market growth in the High Case accounts for the incremental 12 billion cubic feet per year that is added above Base Case levels.

Even with these storage additions, the largest portion of the projected storage expenditures in the Base and High Case are for replacement, refurbishment, and upgrades of existing storage capability, notably in gas storage fields. The cases project that $13 to $14 billion of the total storage expenditures are needed from 2017 through 2035 to replace and refurbish old wells in gas storage fields.

Thus, gas storage injection and withdrawal wells supporting roughly 40 billion cubic feet of working gas capacity are reworked or replaced each year in order to improve well completion integrity. Over the entire projection, the total amount of working gas capacity that is touched by such well integrity management programs will total almost 800 billion cubic feet, which is approximately 20 percent of the effective working gas capacity currently in place in the U.S. There is little doubt that well integrity management programs for storage fields are becoming a significant area of focus for the foreseeable future.

Exhibit 28: Oil and Gas Storage CAPEX (Million 2015$)





4.2.5 Capital Expenditures for Refining and Oil Products Transport

The scenarios project capital expenditures for refining and oil products transport of $196 to $217 billion from 2017 to 2035. These values equate to $10.3 to $11.4 billion per year (**Exhibit 29**). While these values are significant, they are somewhat below recent annual expenditures that have averaged close to $16 billion. The recent historical expenditures have a significant annual expenditure of almost $3 billion for rail transport of crude oil that is not present in the future – more to be said on this point below.

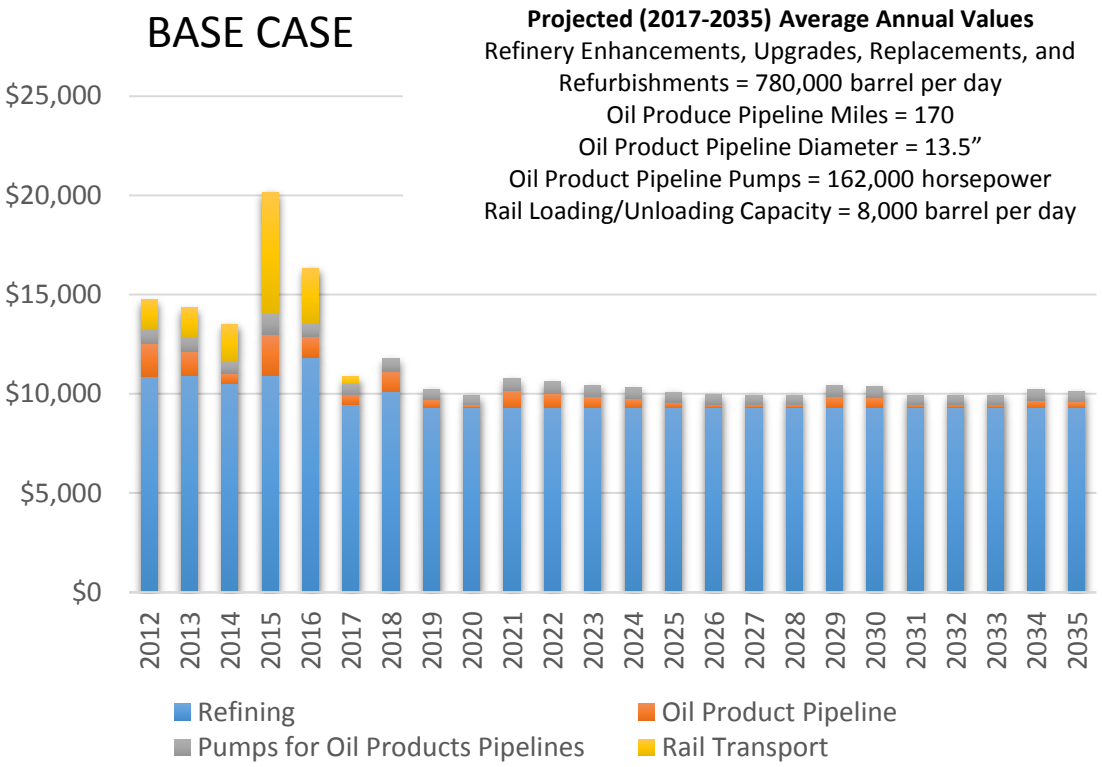
By far, the most significant expenditure in this category is associated with enhancing, upgrading, replacing, and refurbishing refining capacity. A resurgence in refining has occurred with the dawn of tight oil supply development in the U.S. The tight oil supplies from a number of different basins are generally made up of lighter, sweeter crudes that are somewhat different from the oil that has historically been delivered to U.S. refineries, which has been heavier and sour. Thus, there have been significant investments to enhance and upgrade refineries during the past few years to handle the different qualities of the slate of crudes that are being produced and delivered to refineries. Thus, recent investment in retooling U.S. refineries has averaged about $6.5 billion per year.

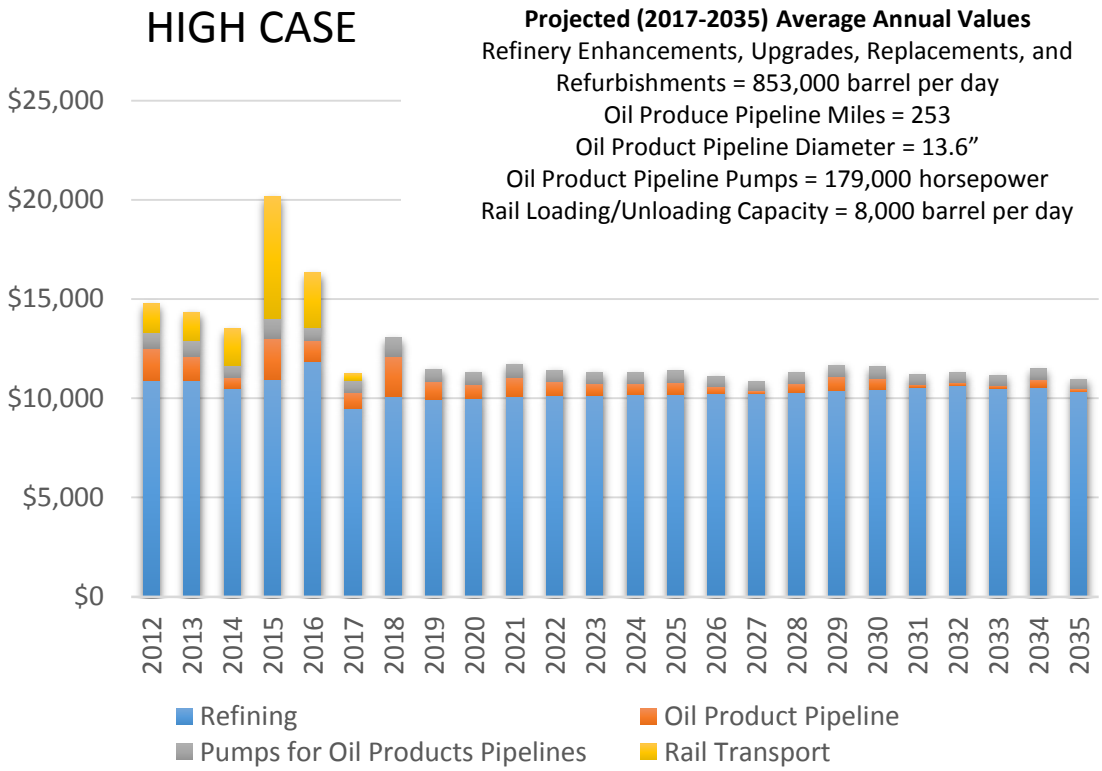
The scenarios project that the recent trend for refining upgrades and enhancements will continue, with an additional CAPEX of $178 to $194 billion devoted to refineries during the projection. These values equate to annual investment of $9.4 and $10.2 billion for the Base and High Case, respectively. The investments will be aimed at increasing refining runs with the lighter, sweeter crudes that are being developed in the scenarios. The difference between the Base Case and High Case is associated with increased refinery input and output in the High Case.

To support the takeaway of the increased amount of products from the refineries, between 170 and 253 miles per year of oil products pipelines will need to be built of replaced each forecast year. With an average diameter of about 13.5”, the annual CAPEX for the oil products pipelines will range from $250 to $500 million. In addition to the miles of pipe, between 162,000 and 179,000 horsepower of pumps will be put in place to support the transport of oil transport along the pipelines.

Perhaps the most surprising result for this category of oil infrastructure investment is the lack of investment in new rail transport, as alluded to above. This result occurs because of two reasons. First, a significant part of recent historical expenditures for rail transport of crude oil has been focused on replacing aging rail cars to comply with recent regulations. To date, a substantial portion of the fleet has been replaced, so that investment has mostly run its course. The second reason, which is the more significant driver of the result is that the study has more generally assumed incremental crude oil and oil products transport will be almost entirely satisfied with new pipeline capacity, substantiating levels of investment in crude oil pipeline transport discussed earlier. Admittedly, there could be additional penetration of rail transport, especially because rail transport has “optionality” that pipelines do not necessarily offer. However, if additional rail transport were to supplant pipeline transport, some portion of the CAPEX would merely move from pipeline to rail transport and the total projected capital expenditure across all categories may not necessarily change by much. That result would depend on the amount of pipeline capacity that is supplanted by rail transport, because rail transport is typically more expensive than pipeline transport.

Exhibit 29: Refining and Oil Products Transport CAPEX (Million 2015$)





4.2.6 Capital Expenditures for Export Terminals

The scenarios project capital expenditures for liquefied natural gas (LNG) and natural gas liquid (NGL) export facilities ranging from $55 to $93 billion from 2017 to 2035. These values equate to $3.0 to $4.9 billion per year (**Exhibit 30**), well above recent historical averages. Thus, the U.S. is right at the cusp of significant growth for LNG and NGL exports.

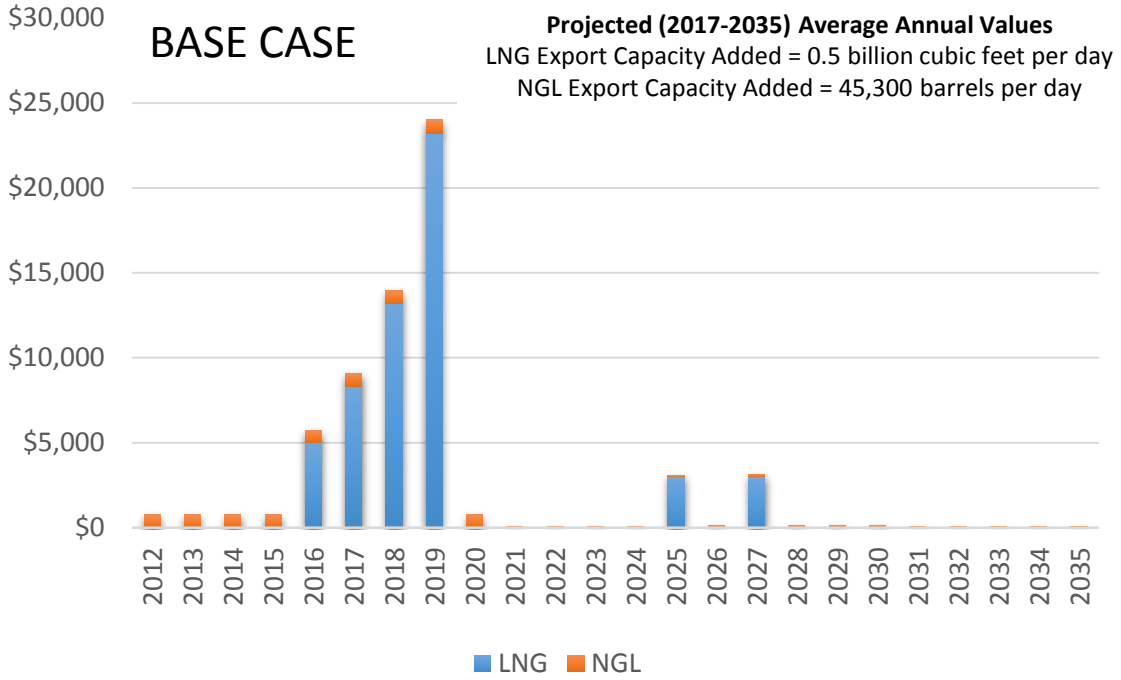
With the Base Case assuming 15 trains of liquefaction (i.e., 0.5 billion cubic feet per day per year of new capacity) placed into service to support roughly 10 billion cubic feet per day of exports after 2025, total expenditures for LNG export facilities rise to over $50 billion from 2017 through 2035. While this level of investment equates to an average annual CAPEX of $2.7 billion over the entire projection period, almost all of the new capacity is added during the next five years. Thus, investment through 2022 averages almost $9.0 billion per year. The majority of the new facilities are placed into service along the Gulf Coast at various locations including Sabine Pass, Corpus Christi, Freeport, and Lake Charles.

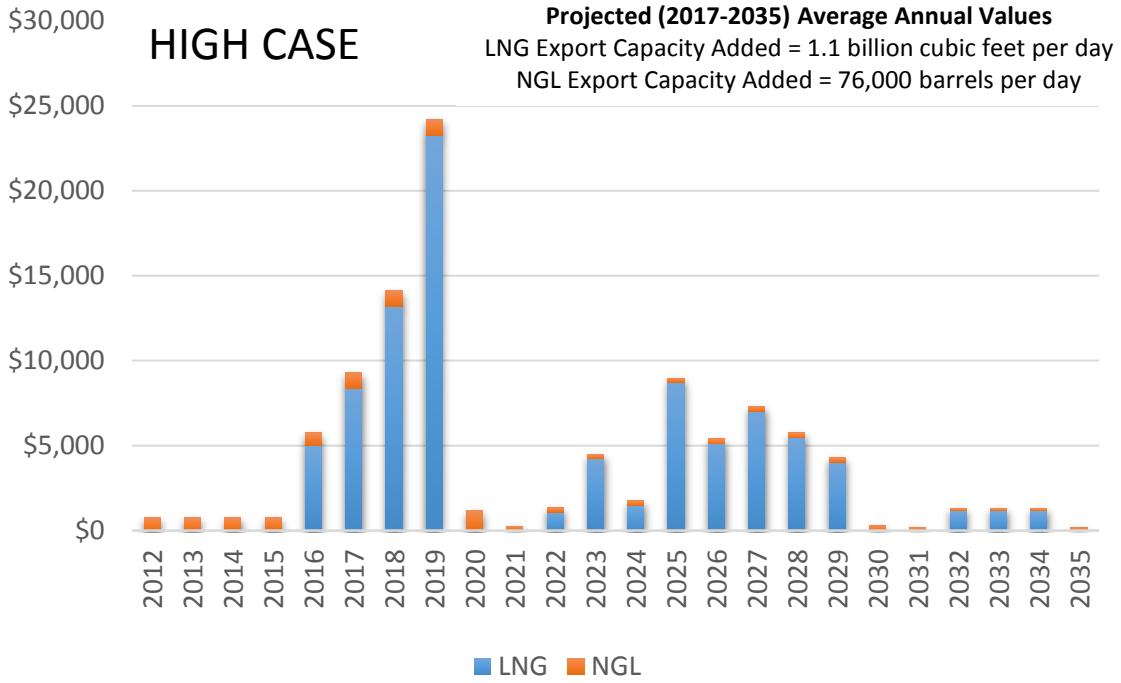
The High Case adds 10 to 12 additional trains of LNG to support exports that rise to roughly 19 billion cubic feet per day after 2025. The new capacity in the case sums to 1.1 billion cubic feet per day each year. These additions yield a total investment of over $85 billion throughout the projection, averaging nearly $4.5 billion per year. Unlike the Base Case, the investment is more prolonged with significant levels of investment occurring after the next five years. Much of the incremental capacity in the scenario is provided by additional liquefaction at locations already developed in the Base Case, plus some other locations that are not included in the Base Case.

Natural gas liquids export facilities added in the cases contribute between $4.5 and $7.5 billion to the total CAPEX. While the dollar value of NGL export facilities is much lower than the expenditures for LNG export facilities, the expenditure supports a significant amount of new export capacity – the scenarios add between 45,300 and 76,000 barrels per day of NGL export capacity each year. Thus, the total NGL export capacity added sums to 0.9 to 1.5 million barrels per day throughout the projection.

Much of the new NGL capacity will be built to accommodate propane exports. However, there will also be incremental capacity required to support exports of ethane and butane. Even though there is a significant amount of export capability added, the CAPEX is not nearly as large as it is for LNG because liquefaction facilities required to produce the LNG are relatively expensive facilities, compared with the liquids handling, loading, and unloading facilities needed to facilitate liquids import and export activity.

Exhibit 30: Liquefied Natural Gas (LNG) and Natural Gas Liquids (NGL) Export Terminal CAPEX (Million 2015$)





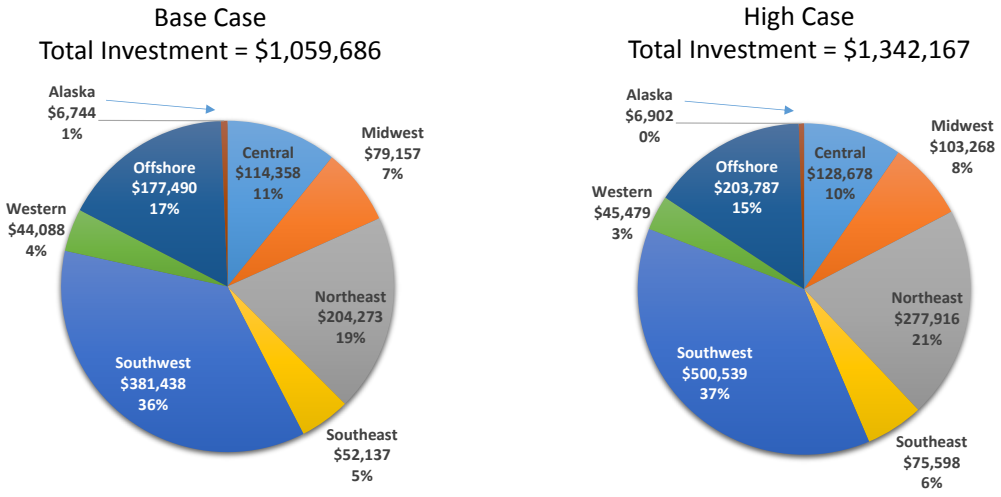
4.3 Summary of Regional Investment in Oil and Gas Infrastructure

Regionally, oil and gas infrastructure development is projected to be greatest in the Southwest, which accounts for between $381 and $501 billion, or 36 to 37 percent of the total oil and gas infrastructure investment in infrastructure throughout the projection (**Exhibit 31**). It should come as little surprise that this area leads the way on infrastructure development because it is relatively friendly to oil and gas development that is already home to a significant amount of infrastructure. Thus, a fair portion of the investment in this area will be focused not only on development of new facilities, but also on enhancing, upgrading, replacing, and refurbishing existing infrastructure.

However, the Northeast U.S. will also witness a significant investment in oil and gas infrastructure moving forward, with total investment for the area ranging between $204 and $278 billion. These values equate to roughly 20 percent of the total oil and gas infrastructure investment across the U.S. The focus for this area has been and will continue to be on developing and transporting the vast amount of natural gas resource contained in the Marcellus/Utica producing basin. Infrastructure development for this area will greatly depend on approvals of pipeline projects and market evolution.

Offshore Gulf of Mexico infrastructure development is also significant at $177 to $204 billion, accounting for roughly 16 percent of the total investment that occurs across each of the scenarios. The relatively stable and consistent investment in this area is linked to offshore oil platforms. Collectively, other geographic areas account for the remaining $296 to $360 billion, or roughly 27 percent of the total investment across the projections. Reasons for development of these other areas are varied, as summarized in the discussion below.

Exhibit 31: Cumulative Regional CAPEX for Oil and Gas Infrastructure, 2017-2035 (Million 2015$)



Central

Total investment in this region will range from $114 to $129 billion over the course of the projection, equating to annual investment of $6.0 and $6.8 billion for the Base and High Case, respectively (**Exhibit 32** and **Exhibit 34**). These values amount to roughly 10 to 11 percent (**Exhibit 33** and **Exhibit 35**) of the total investment in oil and gas infrastructure across the U.S. Investment in this area will be focused on development and replacement of surface and lease equipment and gathering and processing facilities, as the area is home to many producing wells and roughly 20 percent of the future E&P activity will be concentrated within the area. The area is home to a number of large producing basins, including the Bakken and Williston, Greater Green River, Uinta/Piceance, DJ, and Powder River, as well as the more recently developed Niobrara region. Each of these producing areas has a vast amount of resource remaining to be developed, providing significant opportunity for continued oil and gas infrastructure development across the area.

Midwest

Total investment in this region will range from $79 to $104 billion (i.e., roughly 8 percent of the U.S. total) throughout the projection, equating to $4.2 to $5.4 billion annually. Roughly half of the projected investment for the area is focused on new pipeline projects, a number of which are aimed at delivering incremental natural gas supplies from burgeoning production in the Marcellus and Utica into the area. However, there is also significant investment projected for the area's refineries, which are located closer to the Bakken Shale and Western Canada than many refineries elsewhere across the U.S; the area's refineries are very likely to enhance and upgrade their capabilities to handle increasing volumes of oil from those areas.

Northeast

As mentioned above, total oil and gas infrastructure investment for this region is very significant at $204 to $278 billion, representing roughly 20 percent of total investment across the U.S. throughout the projection. Roughly 40 to 45 percent of the area's annual investment of $10.8 to $14.6 billion is focused on building new gas and NGL pipelines from the Marcellus and Utica producing areas. Also, there is a significant difference between the Base and High Case because the area is highly dependent on market evolution; that is to say market development for the area's gas is vital for infrastructure development. Greater growth in natural gas markets would spur significant infrastructure development, and vice versa.

Gathering and processing development also accounts for a significant portion of the area's investment, as there will be 18,500 to 20,000 miles of gathering line, 31.0 to 41.0 billion cubic feet per day of gas processing plant capacity, and 1.2 to 1.7 million barrels per day of NGL fractionation capacity developed or replaced from 2017 through 2035. In aggregate, the gathering and processing facilities added within this area will account for roughly 40 percent of the total gathering and processing capabilities added across the U.S.

Southeast

Total investment in this region will range from $52 to $76 billion (i.e., roughly 5 percent of the U.S. total) throughout the projection, equating to $2.7 to $4.0 billion annually. Roughly 70 percent of the projected investment for the area is focused on new pipeline projects, almost all of which are designed to deliver natural gas to power plants. This area will potentially experience very robust growth in gas-fired power generation as the nation's coal power plants continue to retire. There is also some investment in the area for refinery upgrades and enhancements.

Southwest

As mentioned above, investment in oil and gas infrastructure for this region is the most significant across the U.S. at $381 to $501 billion, accounting for 36 to 37 percent of total investment throughout the projection. These levels of investment equate to $20.1 and $26.3 billion annually. Future investment for infrastructure in this region is more broadly and evenly spread across infrastructure categories, or at least much more so than in other regions. This is an intuitive finding considering that, historically, the area's infrastructure has been very robust and diverse.

The sub-category with the most significant spending in this area is refining, with average annual expenditures of $5.2 to $5.8 billion. This area has a vast refinery complex that will be in need of upgrades and enhancements as production from tight oil resources grows over time.

Gathering and processing runs a close second to refining with average annual expenditures ranging from $4.9 to $5.8 billion. The area's production is fairly well spread between oil, gas, and NGLs, so future infrastructure should be broadly focused on developing each hydrocarbon.

Investment in the area's surface and lease equipment is also projected to be fairly sizeable, running from $4.7 to $5.6 billion per year. With many oil and gas producing wells already in the area, and with the Base and High Case projecting that the area will account for 55 to 60 percent of new producing wells from 2017 through 2035, it is not surprising that over half of the study's total investment for onshore surface and lease equipment for the U.S. is driven by well completions in this area.

After surface and lease equipment, investments for pipelines and the area's export facilities will range from $2.4 to $4.5 billion for each sub-category. There are many new pipeline facilities needed to foster hydrocarbon transport into, within, and out of the area. Oil pipelines are needed to transport incremental supplies from West Texas to refineries near the Texas Gulf Coast; gas pipelines are needed to feed LNG export and petrochemical facilities and to move gas to locations that export gas from the U.S. to Mexico; and NGL pipelines are needed to transport natural gas liquids to export terminals, new ethane crackers, and new poly-propylene production facilities. Finally, new LNG export terminals and incremental NGL export capacity will be heavily concentrated in this area in the future.

Of all regions across the U.S., this area is also most significant for oil and gas storage development, with annual CAPEX ranging from $390 to $488 million. There are many oil tank farms spread along the Gulf Coast, and the study projects that new oil storage capacity will continue to be developed there. In

addition, much of the high deliverability salt cavern storage that will be developed in the future will be concentrated in the area because of the favorable geology for such storage. In short, this region will remain the most robust region for oil and gas infrastructure development moving forward.

West

Oil and gas infrastructure investment in this area is relatively modest at $44 to $45 billion, accounting for roughly 4 percent of the total investment throughout the projection. These levels of investment equate to an annual average of $2.3 to $2.4 billion. The majority of the area's investment will be concentrated in refinery refurbishments and upgrades, but it remains to be seen whether the area's refineries, mostly located in California, will undertake significant investments considering potential market and regulatory changes. Thus, these investments, which are a relatively small portion of the projected total investment across the U.S., are somewhat at risk.

Offshore Gulf of Mexico

As mentioned above, investment in this area will total $177 to $204 billion from 2017 through 2035, or $9.3 to $10.7 billion per year. The area's investment accounts for roughly 16 percent of the total investment across the U.S. Investment is almost entirely concentrated in offshore platform development, with 9 to 10 new oil platforms projected to be placed into service each year.

Alaska

Oil and gas infrastructure development in this State is relatively small at roughly $7 billion from 2017 through 2035. Future investment is mostly focused on infrastructure needed to support oil production from the North Slope, which has been declining and is likely to continue to decline in the future. While the State has a vast amount of gas resource that could be developed, the scenarios included herein do not consider development of that resource. Such development could dramatically change the infrastructure investment results for the State.

Exhibit 32: Projected Annual CAPEX by Region and Category, Base Case (Million 2015$)

	Central	Midwest	Northeast	Southeast	Southwest	West	Offshore	Alaska	U.S.
Surface and Lease Equipment	$1,733	$51	$693	$42	$4,694	$294	$9,213	$18	$16,737
Gathering and Processing	$2,023	$294	$4,595	$119	$4,915	$142	$86	$226	$12,401
Oil, Gas, and NGL Pipelines	$1,321	$2,090	$4,335	$1,783	$2,358	$372	$42	$19	$12,320
Oil and Gas Storage	$123	$227	$183	$109	$390	$69	$0	$3	$1,104
Refining and Products Transport	$818	$1,505	$692	$593	$5,160	$1,443	$0	$90	$10,301
Export Terminals	$0	$0	$252	$98	$2,560	$0	$0	$0	$2,910
Total Midstream Investment	$6,019	$4,166	$10,751	$2,744	$20,076	$2,320	$9,342	$355	$55,773

Exhibit 33: Percent of Projected Annual CAPEX by Region and Category, Base Case

	Central	Midwest	Northeast	Southeast	Southwest	West	Offshore	Alaska	U.S.
Surface and Lease Equipment	3.1%	0.1%	1.2%	0.1%	8.4%	0.5%	16.5%	0.0%	30.0%
Gathering and Processing	3.6%	0.5%	8.2%	0.2%	8.8%	0.3%	0.2%	0.4%	22.2%
Oil, Gas, and NGL Pipelines	2.4%	3.7%	7.8%	3.2%	4.2%	0.7%	0.1%	0.0%	22.1%
Oil and Gas Storage	0.2%	0.4%	0.3%	0.2%	0.7%	0.1%	0.0%	0.0%	2.0%
Refining and Products Transport	1.5%	2.7%	1.2%	1.1%	9.3%	2.6%	0.0%	0.2%	18.5%
Export Terminals	0.0%	0.0%	0.5%	0.2%	4.6%	0.0%	0.0%	0.0%	5.2%
Total Midstream Investment	10.8%	7.5%	19.3%	4.9%	36.0%	4.2%	16.7%	0.6%	100.0%

Exhibit 34: Projected Annual CAPEX by Region and Category, High Case (Million 2015$)

	Central	Midwest	Northeast	Southeast	Southwest	West	Offshore	Alaska	U.S.
Surface and Lease Equipment	$1,808	$54	$775	$52	$5,612	$293	$10,600	$15	$19,210
Gathering and Processing	$2,203	$402	$5,833	$103	$5,768	$142	$83	$224	$14,759
Oil, Gas, and NGL Pipelines	$1,677	$3,100	$6,799	$2,893	$4,100	$401	$42	$19	$19,030
Oil and Gas Storage	$155	$263	$218	$140	$488	$72	$0	$3	$1,340
Refining and Products Transport	$929	$1,616	$749	$693	$5,836	$1,485	$0	$103	$11,412
Export Terminals	$0	$0	$252	$98	$4,539	$0	$0	$0	$4,889
Total Midstream Investment	$6,773	$5,435	$14,627	$3,979	$26,344	$2,394	$10,726	$363	$70,640

Exhibit 35: Percent of Projected Annual CAPEX by Region and Category, High Case (Million 2015$)

	Central	Midwest	Northeast	Southeast	Southwest	West	Offshore	Alaska	U.S.
Surface and Lease Equipment	2.6%	0.1%	1.1%	0.1%	7.9%	0.4%	15.0%	0.0%	27.2%
Gathering and Processing	3.1%	0.6%	8.3%	0.1%	8.2%	0.2%	0.1%	0.3%	20.9%
Oil, Gas, and NGL Pipelines	2.4%	4.4%	9.6%	4.1%	5.8%	0.6%	0.1%	0.0%	26.9%
Oil and Gas Storage	0.2%	0.4%	0.3%	0.2%	0.7%	0.1%	0.0%	0.0%	1.9%
Refining and Products Transport	1.3%	2.3%	1.1%	1.0%	8.3%	2.1%	0.0%	0.1%	16.2%
Export Terminals	0.0%	0.0%	0.4%	0.1%	6.4%	0.0%	0.0%	0.0%	6.9%
Total Midstream Investment	9.6%	7.7%	20.7%	5.6%	37.3%	3.4%	15.2%	0.5%	100.0%

5 Results of the Economic Impact Analysis

Investment in oil and gas infrastructure will have significant benefits for the U.S. economy. Specifically, it will increase both employment and Gross State Products. To assess economic benefits that result from the capital expenditures discussed above, we have applied IMPLAN, which is a widely used economic impact analysis system. 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 purchases 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).

Considering the total oil and gas infrastructure investment of $1.06 to $1.34 trillion, or $55 to $71 billion annually, the IMPLAN analysis projects that total direct, indirect, and induced employment, or the total number of jobs per year across the U.S. will average between 828,,000 and 1,047,,000 for the Base Case and High Case, respectively (**Exhibit 36** and **Exhibit 37**). These numbers are only for employment associated with oil and gas infrastructure development. They do not include jobs more broadly across the upstream and downstream segments of the industry, nor do they include jobs related to operating and maintaining oil and gas infrastructure, each of which would add millions to the U.S. labor pool. Nevertheless, the results suggest that oil and gas infrastructure development will be a significant engine for economic growth in the future.

The projections also show that infrastructure development will directly employ between 277,000 and 350,000 employees. These include employees at companies directly involved with the planning, designing, and construction of the infrastructure. However, the impacts outside of the companies directly involved in infrastructure development are also significant, with the projected results showing between 215,000 and 272,000 indirect jobs and between 337,000 and 425,000 induced jobs. In other words, benefits will be far reaching across the entire U.S. economy.

Infrastructure development drives employment across the country, even as far away as Hawaii where there are induced employment impacts. The top five states for employment associated with infrastructure development are Louisiana, Texas, Pennsylvania, California, and Ohio, in that order. However, Louisiana's and Texas' employment numbers are very close to each other, so it's difficult to distinguish which state will benefit more from investment in infrastructure development. Also note that California will have relatively modest direct investment in new infrastructure, so most of its employment

benefits will be based on indirect and induced employment impacts that occur from development occurring elsewhere.

This economic impact analysis also projects that U.S. Gross Domestic Product (GDP) associated with oil and gas infrastructure development will total $1.50 to $1.89 trillion for the 2017 to 2035 projection period (**Exhibit 38** and **Exhibit 39**). These values equate to annual average contributions of between $79 and $100 billion to U.S. GDP; note that annual average tables for Gross State Product (GSP) and taxes are shown in Appendix D.

Based on Gross State Product information provided in the exhibits, the top five beneficiaries of investment include Texas, Louisiana, Pennsylvania, California, and Ohio, in that order. These are the same states that benefited most from an employment standpoint. However, there are also billions of dollars of benefits to all other states across the U.S.

Federal and State tax coffers are also larger as a result of oil and gas infrastructure investment. Federal taxes associated with oil and gas infrastructure development will total $304 to $386 billion from 2017 to 2035, and annually, oil and gas infrastructure investment will contribute $16 to $20 billion to federal taxes. State and local taxes associated with oil and gas infrastructure development will sum to $236 to $299 billion from 2017 through 2035, and annually, oil and gas infrastructure investment will contribute $12 to $16 billion to state tax coffers. State and local governments will gain tens of billions of dollars from investments in oil and gas infrastructure.

All of the values from this economic impact analysis flow throughout the U.S. economy, having wide-ranging benefits for millions of Americans. As aforementioned, this analysis excludes values associated with operating and maintaining the infrastructure, and it also excludes values associated with the upstream and downstream segments of the business. However, the oil and gas infrastructure discussed herein will be critical to those sectors as well. Without development of such oil and gas infrastructure, the upstream and downstream will be developed less fully over time, and the foregone economic benefits would be very significant.

Oil and gas infrastructure development also fosters delivery of lower cost energy to households and businesses, which is another positive economic impact that has not been considered in this analysis. A more complete and thorough economic impact analysis would consider such benefits, as well as the foregone benefits for the upstream and downstream segments of the energy business, in addition to the economic impacts that are discussed herein. Collectively, such economic benefits would be multiples of impacts shown here.

Exhibit 36: Projected Employment (Jobs per Year) for the Base Case (Million 2015$)

	Average 2013-2016				Average 2017-2035			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
U.S.	**398,620**	**309,272**	**485,043**	**1,192,934**	**276,786**	**214,707**	**336,864**	**828,357**
Alabama	3,472	4,066	6,077	**13,615**	2,052	2,654	4,106	**8,812**
Alaska	3,144	1,500	1,689	**6,334**	1,594	765	1,005	**3,364**
Arizona	621	2,281	6,505	**9,407**	581	1,647	4,558	**6,786**
Arkansas	4,656	3,176	4,090	**11,922**	1,934	1,587	2,486	**6,007**
California	12,331	13,707	47,833	**73,871**	7,223	8,915	32,821	**48,959**
Colorado	10,858	6,569	9,025	**26,452**	5,739	3,695	5,779	**15,214**
Connecticut	157	2,136	6,111	**8,404**	204	1,529	4,268	**6,001**
Delaware	1,349	840	1,365	**3,554**	1,409	830	1,065	**3,304**
District of Columbia	367	180	1,009	**1,556**	296	145	712	**1,152**
Florida	1,200	2,821	18,567	**22,588**	1,711	2,389	13,124	**17,224**
Georgia	571	2,059	9,058	**11,688**	1,228	1,799	6,533	**9,560**
Hawaii	0	39	1,323	**1,363**	0	27	919	**946**
Idaho	565	772	1,681	**3,019**	660	663	1,240	**2,563**
Illinois	10,612	10,868	19,246	**40,726**	4,103	6,027	12,446	**22,576**
Indiana	4,550	8,091	10,473	**23,113**	2,425	5,270	7,069	**14,764**
Iowa	700	1,568	3,747	**6,015**	737	1,214	2,666	**4,617**
Kansas	9,493	5,706	6,032	**21,231**	6,208	3,796	4,062	**14,066**
Kentucky	2,192	2,942	5,118	**10,252**	1,622	2,117	3,564	**7,303**
Louisiana	96,309	44,294	33,454	**174,058**	72,774	32,948	25,217	**130,940**
Maine	154	1,023	1,744	**2,921**	172	742	1,228	**2,142**
Maryland	661	1,745	7,467	**9,873**	1,586	1,700	5,523	**8,808**
Massachusetts	162	3,391	10,135	**13,688**	227	2,410	7,067	**9,705**
Michigan	3,563	8,004	13,109	**24,676**	2,173	5,420	9,020	**16,613**
Minnesota	3,096	4,068	7,932	**15,096**	2,257	2,902	5,514	**10,673**
Mississippi	4,664	2,606	3,629	**10,899**	3,088	1,778	2,456	**7,321**
Missouri	590	2,185	6,339	**9,114**	714	1,664	4,482	**6,860**
Montana	2,876	1,466	1,694	**6,036**	1,557	817	1,049	**3,423**
Nebraska	761	990	2,430	**4,181**	919	880	1,789	**3,588**
Nevada	135	278	2,440	**2,852**	160	222	1,713	**2,095**
New Hampshire	127	619	1,799	**2,545**	144	457	1,264	**1,865**
New Jersey	5,310	4,915	13,214	**23,439**	3,216	3,205	9,037	**15,458**
New Mexico	10,683	5,426	4,619	**20,727**	6,034	3,120	2,836	**11,991**
New York	5,980	10,650	28,738	**45,369**	4,053	7,354	19,926	**31,333**
North Carolina	1,099	4,378	10,523	**16,000**	770	3,040	7,310	**11,121**
North Dakota	10,646	5,504	4,108	**20,258**	4,672	2,591	2,064	**9,327**
Ohio	15,099	16,102	19,636	**50,836**	11,383	11,676	13,834	**36,893**
Oklahoma	16,475	10,554	9,709	**36,738**	8,851	6,106	6,038	**20,995**
Oregon	526	1,918	4,506	**6,951**	271	1,289	3,102	**4,661**
Pennsylvania	27,964	22,267	25,408	**75,639**	29,214	20,299	20,244	**69,758**
Rhode Island	130	622	1,397	**2,149**	144	458	984	**1,586**
South Carolina	1,560	5,728	7,174	**14,462**	1,303	4,082	5,039	**10,424**
South Dakota	1,160	869	1,289	**3,318**	472	439	806	**1,717**
Tennessee	2,105	3,706	7,574	**13,385**	1,720	2,715	5,317	**9,752**
Texas	97,100	55,804	58,077	**210,981**	61,357	35,755	38,791	**135,902**
Utah	4,586	2,920	3,946	**11,452**	2,595	1,763	2,567	**6,925**
Vermont	127	386	827	**1,341**	147	297	590	**1,033**
Virginia	1,412	3,002	10,121	**14,536**	2,293	2,725	7,376	**12,394**
Washington	3,768	3,485	9,343	**16,596**	1,598	1,980	6,182	**9,760**
West Virginia	5,828	3,992	3,615	**13,435**	6,264	3,857	3,107	**13,229**
Wisconsin	1,781	4,166	7,722	**13,670**	1,085	2,826	5,311	**9,223**
Wyoming	5,342	2,887	2,376	**10,605**	3,847	2,118	1,658	**7,623**

Exhibit 37: Projected Employment (Jobs per Year) for the High Case (Million 2015$)

	Average 2013-2016				Average 2017-2035			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
U.S.	**398,620**	**309,272**	**485,043**	**1,192,934**	**349,895**	**272,132**	**425,195**	**1,047,222**
Alabama	3,470	4,065	6,076	**13,611**	2,703	3,414	5,216	**11,333**
Alaska	3,144	1,500	1,689	**6,334**	1,645	786	1,167	**3,598**
Arizona	621	2,281	6,505	**9,407**	617	2,031	5,724	**8,373**
Arkansas	4,656	3,176	4,090	**11,922**	3,487	2,522	3,410	**9,419**
California	12,331	13,707	47,833	**73,871**	7,163	10,398	40,873	**58,435**
Colorado	10,858	6,569	9,025	**26,452**	6,570	4,336	7,112	**18,018**
Connecticut	157	2,136	6,111	**8,404**	317	1,967	5,406	**7,690**
Delaware	1,349	840	1,365	**3,554**	1,859	1,091	1,363	**4,314**
District of Columbia	367	180	1,009	**1,556**	423	207	911	**1,541**
Florida	1,200	2,821	18,567	**22,588**	2,523	3,202	16,664	**22,389**
Georgia	571	2,059	9,058	**11,688**	1,425	2,228	8,209	**11,861**
Hawaii	0	39	1,323	**1,363**	0	35	1,160	**1,195**
Idaho	565	772	1,681	**3,019**	707	780	1,531	**3,018**
Illinois	10,612	10,868	19,246	**40,726**	5,461	7,800	15,773	**29,034**
Indiana	4,550	8,091	10,473	**23,113**	3,280	6,801	8,981	**19,062**
Iowa	700	1,568	3,747	**6,015**	837	1,494	3,342	**5,672**
Kansas	9,493	5,706	6,032	**21,231**	6,708	4,241	4,823	**15,772**
Kentucky	2,195	2,943	5,119	**10,257**	3,225	3,255	4,809	**11,289**
Louisiana	96,309	44,294	33,454	**174,058**	90,918	41,277	31,487	**163,682**
Maine	154	1,023	1,744	**2,921**	272	967	1,566	**2,804**
Maryland	661	1,745	7,467	**9,873**	1,754	2,048	6,897	**10,699**
Massachusetts	162	3,391	10,135	**13,688**	347	3,084	8,942	**12,374**
Michigan	3,563	8,004	13,109	**24,676**	2,673	6,833	11,374	**20,880**
Minnesota	3,096	4,068	7,932	**15,096**	2,699	3,606	6,922	**13,226**
Mississippi	4,662	2,605	3,628	**10,895**	3,965	2,279	3,119	**9,363**
Missouri	590	2,185	6,339	**9,114**	754	2,039	5,621	**8,414**
Montana	2,876	1,466	1,694	**6,036**	1,761	931	1,270	**3,962**
Nebraska	761	990	2,430	**4,181**	1,045	1,060	2,227	**4,332**
Nevada	135	278	2,440	**2,852**	166	265	2,153	**2,583**
New Hampshire	127	619	1,799	**2,545**	243	609	1,612	**2,465**
New Jersey	5,310	4,915	13,214	**23,439**	3,832	3,955	11,343	**19,130**
New Mexico	10,683	5,426	4,619	**20,727**	7,341	3,807	3,500	**14,648**
New York	5,980	10,650	28,738	**45,369**	5,719	9,614	25,319	**40,653**
North Carolina	1,099	4,378	10,523	**16,000**	874	3,805	9,208	**13,887**
North Dakota	10,646	5,504	4,108	**20,258**	4,944	2,801	2,348	**10,093**
Ohio	15,099	16,102	19,636	**50,836**	15,199	15,189	17,688	**48,076**
Oklahoma	16,475	10,554	9,709	**36,738**	11,975	8,124	7,836	**27,936**
Oregon	526	1,918	4,506	**6,951**	301	1,615	3,906	**5,822**
Pennsylvania	27,964	22,267	25,408	**75,639**	38,080	26,250	25,881	**90,211**
Rhode Island	130	622	1,397	**2,149**	242	610	1,259	**2,111**
South Carolina	1,560	5,728	7,174	**14,462**	1,675	5,186	6,378	**13,239**
South Dakota	1,160	869	1,289	**3,318**	563	540	1,009	**2,112**
Tennessee	2,107	3,707	7,575	**13,390**	3,339	4,010	7,020	**14,370**
Texas	97,100	55,804	58,077	**210,981**	76,583	44,749	48,723	**170,055**
Utah	4,586	2,920	3,946	**11,452**	3,090	2,137	3,191	**8,418**
Vermont	127	386	827	**1,341**	247	406	761	**1,414**
Virginia	1,411	3,002	10,121	**14,535**	2,634	3,323	9,244	**15,201**
Washington	3,768	3,485	9,343	**16,596**	1,604	2,329	7,682	**11,615**
West Virginia	5,827	3,992	3,615	**13,434**	9,839	5,818	4,427	**20,084**
Wisconsin	1,781	4,166	7,722	**13,670**	1,642	3,717	6,779	**12,137**
Wyoming	5,342	2,887	2,376	**10,605**	4,623	2,562	2,031	**9,217**

Exhibit 38: Projected Gross State Product and Taxes for the Base Case (Million 2015$)

	Total 2013-2016				Total 2017-2035			
	GDP	State/Local Tax	Federal Tax	Total Tax	GDP	State/Local Tax	Federal Tax	Total Tax
U.S.	**$453,712**	**$69,468**	**$79,239**	**$148,707**	**$1,496,910**	**$236,392**	**$303,990**	**$540,383**
Alabama	$5,905	$889	$1,030	**$1,918**	$18,501	$2,881	$3,762	**$6,643**
Alaska	$1,938	$562	$339	**$901**	$4,929	$1,481	$1,002	**$2,483**
Arizona	$4,478	$610	$781	**$1,391**	$15,081	$2,125	$3,061	**$5,186**
Arkansas	$4,264	$636	$743	**$1,379**	$10,981	$1,691	$2,230	**$3,920**
California	$29,884	$4,749	$5,214	**$9,964**	$95,286	$15,669	$19,367	**$35,036**
Colorado	$8,988	$1,282	$1,572	**$2,854**	$25,350	$3,742	$5,161	**$8,903**
Connecticut	$4,213	$575	$736	**$1,311**	$14,110	$1,991	$2,865	**$4,856**
Delaware	$1,246	$216	$218	**$434**	$5,246	$940	$1,065	**$2,005**
District of Columbia	$508	$94	$90	**$183**	$1,777	$338	$360	**$698**
Florida	$9,270	$1,243	$1,619	**$2,861**	$32,636	$4,519	$6,617	**$11,136**
Georgia	$5,187	$700	$907	**$1,607**	$19,069	$2,660	$3,856	**$6,516**
Hawaii	$512	$93	$89	**$182**	$1,690	$316	$343	**$660**
Idaho	$1,308	$181	$228	**$410**	$4,938	$707	$1,007	**$1,714**
Illinois	$16,846	$2,575	$2,947	**$5,522**	$47,766	$7,542	$9,697	**$17,239**
Indiana	$11,271	$1,679	$1,969	**$3,649**	$35,426	$5,459	$7,203	**$12,662**
Iowa	$2,816	$472	$492	**$964**	$9,881	$1,709	$2,001	**$3,710**
Kansas	$7,268	$1,134	$1,268	**$2,403**	$22,919	$3,707	$4,669	**$8,375**
Kentucky	$4,563	$673	$798	**$1,471**	$15,287	$2,330	$3,104	**$5,434**
Louisiana	$51,737	$7,912	$9,052	**$16,964**	$184,497	$29,246	$37,470	**$66,715**
Maine	$1,589	$256	$278	**$534**	$5,390	$896	$1,094	**$1,991**
Maryland	$4,301	$616	$752	**$1,368**	$16,850	$2,490	$3,385	**$5,875**
Massachusetts	$6,848	$967	$1,196	**$2,163**	$22,844	$3,333	$4,639	**$7,972**
Michigan	$12,162	$1,860	$2,124	**$3,984**	$39,428	$6,228	$8,005	**$14,233**
Minnesota	$6,622	$1,104	$1,158	**$2,262**	$22,021	$3,793	$4,483	**$8,276**
Mississippi	$3,611	$629	$632	**$1,261**	$11,572	$2,080	$2,355	**$4,435**
Missouri	$4,336	$581	$758	**$1,339**	$15,013	$2,079	$3,043	**$5,122**
Montana	$1,885	$274	$329	**$603**	$5,151	$771	$1,044	**$1,815**
Nebraska	$1,787	$275	$312	**$586**	$6,809	$1,078	$1,378	**$2,456**
Nevada	$1,134	$161	$198	**$359**	$3,896	$573	$791	**$1,364**
New Hampshire	$1,226	$148	$214	**$362**	$4,170	$519	$847	**$1,366**
New Jersey	$9,167	$1,404	$1,596	**$3,000**	$29,121	$4,605	$5,914	**$10,519**
New Mexico	$6,346	$1,210	$1,107	**$2,317**	$17,814	$3,517	$3,633	**$7,149**
New York	$20,147	$4,072	$3,520	**$7,592**	$66,221	$13,818	$13,433	**$27,251**
North Carolina	$7,873	$1,192	$1,375	**$2,567**	$25,983	$4,065	$5,270	**$9,335**
North Dakota	$6,312	$1,424	$1,100	**$2,524**	$14,293	$3,333	$2,909	**$6,241**
Ohio	$21,708	$3,387	$3,803	**$7,191**	$73,686	$11,875	$14,946	**$26,821**
Oklahoma	$12,764	$1,686	$2,230	**$3,916**	$36,085	$4,922	$7,346	**$12,268**
Oregon	$3,418	$570	$597	**$1,167**	$11,048	$1,903	$2,244	**$4,147**
Pennsylvania	$29,058	$4,226	$5,069	**$9,295**	$119,526	$17,939	$24,253	**$42,192**
Rhode Island	$1,084	$171	$190	**$361**	$3,698	$604	$751	**$1,355**
South Carolina	$7,913	$1,351	$1,378	**$2,729**	$26,602	$4,693	$5,405	**$10,097**
South Dakota	$1,237	$157	$216	**$372**	$3,266	$426	$660	**$1,087**
Tennessee	$6,163	$756	$1,078	**$1,833**	$20,937	$2,653	$4,252	**$6,905**
Texas	$70,239	$9,564	$12,248	**$21,812**	$217,924	$30,753	$44,304	**$75,057**
Utah	$4,028	$647	$702	**$1,349**	$11,875	$1,970	$2,417	**$4,387**
Vermont	$656	$109	$115	**$224**	$2,298	$393	$466	**$859**
Virginia	$6,419	$873	$1,122	**$1,995**	$24,274	$3,407	$4,908	**$8,315**
Washington	$6,586	$962	$1,150	**$2,113**	$19,312	$2,919	$3,921	**$6,840**
West Virginia	$4,832	$851	$844	**$1,695**	$21,320	$3,871	$4,316	**$8,186**
Wisconsin	$6,660	$1,029	$1,165	**$2,193**	$21,545	$3,441	$4,382	**$7,824**
Wyoming	$3,398	$680	$592	**$1,272**	$11,569	$2,393	$2,360	**$4,752**

Exhibit 39: Projected Gross State Product and Taxes for the High Case (Million 2015$)

	Total 2013-2016				Total 2017-2035			
	GDP	State/Local Tax	Federal Tax	Total Tax	GDP	State/Local Tax	Federal Tax	Total Tax
U.S.	**$453,712**	**$69,468**	**$79,239**	**$148,707**	**$1,893,138**	**$299,313**	**$385,676**	**$684,988**
Alabama	$5,904	$889	$1,030	**$1,918**	$23,666	$3,692	$4,824	**$8,515**
Alaska	$1,938	$562	$339	**$901**	$5,302	$1,597	$1,079	**$2,676**
Arizona	$4,478	$610	$781	**$1,391**	$18,819	$2,657	$3,831	**$6,488**
Arkansas	$4,264	$636	$743	**$1,379**	$16,322	$2,520	$3,335	**$5,856**
California	$29,884	$4,749	$5,214	**$9,964**	$115,832	$19,082	$23,600	**$42,681**
Colorado	$8,988	$1,282	$1,572	**$2,854**	$30,321	$4,489	$6,187	**$10,675**
Connecticut	$4,213	$575	$736	**$1,311**	$18,012	$2,547	$3,670	**$6,217**
Delaware	$1,246	$216	$218	**$434**	$6,811	$1,223	$1,388	**$2,611**
District of Columbia	$508	$94	$90	**$183**	$2,359	$450	$480	**$930**
Florida	$9,270	$1,243	$1,619	**$2,861**	$42,131	$5,847	$8,575	**$14,422**
Georgia	$5,187	$700	$907	**$1,607**	$23,832	$3,332	$4,839	**$8,171**
Hawaii	$512	$93	$89	**$182**	$2,136	$401	$435	**$836**
Idaho	$1,308	$181	$228	**$410**	$5,953	$854	$1,215	**$2,068**
Illinois	$16,846	$2,575	$2,947	**$5,522**	$61,123	$9,667	$12,447	**$22,115**
Indiana	$11,271	$1,679	$1,969	**$3,649**	$45,423	$7,010	$9,259	**$16,269**
Iowa	$2,816	$472	$492	**$964**	$12,290	$2,130	$2,497	**$4,627**
Kansas	$7,268	$1,134	$1,268	**$2,403**	$26,152	$4,240	$5,335	**$9,574**
Kentucky	$4,565	$673	$798	**$1,471**	$22,087	$3,376	$4,510	**$7,886**
Louisiana	$51,737	$7,912	$9,052	**$16,964**	$230,619	$36,620	$47,002	**$83,622**
Maine	$1,589	$256	$278	**$534**	$6,959	$1,160	$1,418	**$2,578**
Maryland	$4,301	$616	$752	**$1,368**	$20,731	$3,071	$4,185	**$7,256**
Massachusetts	$6,848	$967	$1,196	**$2,163**	$29,080	$4,252	$5,925	**$10,177**
Michigan	$12,162	$1,860	$2,124	**$3,984**	$49,761	$7,877	$10,133	**$18,010**
Minnesota	$6,622	$1,104	$1,158	**$2,262**	$27,528	$4,748	$5,609	**$10,357**
Mississippi	$3,610	$629	$632	**$1,261**	$14,787	$2,662	$3,016	**$5,678**
Missouri	$4,336	$581	$758	**$1,339**	$18,664	$2,590	$3,795	**$6,385**
Montana	$1,885	$274	$329	**$603**	$6,014	$902	$1,221	**$2,124**
Nebraska	$1,787	$275	$312	**$586**	$8,342	$1,323	$1,691	**$3,014**
Nevada	$1,134	$161	$198	**$359**	$4,841	$713	$986	**$1,699**
New Hampshire	$1,226	$148	$214	**$362**	$5,425	$677	$1,106	**$1,783**
New Jersey	$9,167	$1,404	$1,596	**$3,000**	$36,292	$5,752	$7,392	**$13,144**
New Mexico	$6,346	$1,210	$1,107	**$2,317**	$21,760	$4,304	$4,443	**$8,747**
New York	$20,147	$4,072	$3,520	**$7,592**	$85,263	$17,834	$17,360	**$35,193**
North Carolina	$7,873	$1,192	$1,375	**$2,567**	$32,683	$5,125	$6,651	**$11,776**
North Dakota	$6,312	$1,424	$1,100	**$2,524**	$15,674	$3,663	$3,193	**$6,856**
Ohio	$21,708	$3,387	$3,803	**$7,191**	$95,216	$15,383	$19,381	**$34,764**
Oklahoma	$12,764	$1,686	$2,230	**$3,916**	$47,627	$6,516	$9,720	**$16,235**
Oregon	$3,418	$570	$597	**$1,167**	$13,902	$2,400	$2,832	**$5,231**
Pennsylvania	$29,058	$4,226	$5,069	**$9,295**	$153,956	$23,173	$31,370	**$54,543**
Rhode Island	$1,084	$171	$190	**$361**	$4,826	$790	$984	**$1,774**
South Carolina	$7,913	$1,351	$1,378	**$2,729**	$33,793	$5,975	$6,886	**$12,861**
South Dakota	$1,237	$157	$216	**$372**	$4,051	$529	$822	**$1,351**
Tennessee	$6,165	$756	$1,078	**$1,834**	$29,223	$3,713	$5,964	**$9,676**
Texas	$70,239	$9,564	$12,248	**$21,812**	$272,969	$38,609	$55,638	**$94,247**
Utah	$4,028	$647	$702	**$1,349**	$14,543	$2,418	$2,967	**$5,384**
Vermont	$656	$109	$115	**$224**	$3,054	$524	$623	**$1,146**
Virginia	$6,419	$873	$1,122	**$1,995**	$30,100	$4,234	$6,109	**$10,343**
Washington	$6,586	$962	$1,150	**$2,113**	$23,463	$3,552	$4,776	**$8,328**
West Virginia	$4,832	$851	$844	**$1,695**	$31,432	$5,728	$6,406	**$12,134**
Wisconsin	$6,660	$1,029	$1,165	**$2,193**	$27,932	$4,469	$5,695	**$10,164**
Wyoming	$3,398	$680	$592	**$1,272**	$14,056	$2,914	$2,872	**$5,787**

6 Conclusions

There has been $390 billion invested in oil and gas infrastructure over the past five years, equating to an average annual investment of roughly $78 billion. Indeed, it has been a very robust period for infrastructure development, and many have wondered whether such levels of investment and development can continue.

Recent declines in oil and natural gas prices, driven by supply-demand dynamics, among other factors, have created an environment of great uncertainty for future energy investments, including investments in the midstream space. This study investigates investment in oil and gas infrastructure, and concludes that robust infrastructure development is likely to continue for a prolonged period of time. It also concludes that the robust investment in oil and gas infrastructure will have significant positive impacts for the U.S. economy.

To assess infrastructure development, the study considers both a "Base Case" and "High Case". Each of these scenarios are plausible representations of how the market may evolve over time. They provide an assessment of how much infrastructure will be needed across time, by type of infrastructure, and by region.

In each scenario, growth in shale gas and tight oil production continues, and production growth from cost-effective plays like the Marcellus and Utica in the Northeast U.S. and the Permian Basin in West Texas will be the main driver of oil and gas infrastructure development. Robust supply growth will continue to foster increased output from U.S. refineries, development of natural gas liquid (NGL) and liquefied natural gas (LNG) exports, incremental exports of natural gas to Mexico, new petrochemical facilities spread across the Northeast and near the Gulf Coast, and increases in gas-fired power generation. These factors, in turn, support oil and gas infrastructure development.

Summary of Scenario Trends

The supply and demand trends that underpin the study's scenarios and infrastructure development are summarized below:

- The Base Case and High Case both project significant supply and market growth, but the amount of growth differs between the cases.
- In aggregate, U.S. oil production is relatively constant in the Base Case, but increases by roughly 4 million barrels per day or by roughly 50 percent in the High Case. Tight oil supplies are a focus for development in each case.
- Natural gas production grows from roughly 70 billion cubic feet per day at present to over 110 billion cubic feet per day by 2035 in the Base Case, and to over 130 billion cubic feet per day in the High Case.

- NGL production is projected to grow to 6 to 7 million barrels per day by 2035 from the current level of roughly 3 million barrels per day.
- Refinery output will increase from a little over 16 million barrels per day at present to between 17 and 19 million barrels per day by 2035, driven by development of U.S. tight oil supplies.
- Natural gas market growth is strong in each scenario. The total market growth is underpinned by growth in LNG exports and exports to Mexico, growth in gas use as a fuel and feedstock in petrochemical facilities, and growth in gas-fired power generation.
- NGL market growth is also substantial in each scenario with new ethane crackers and poly-propylene facilities being added to the mix, and incremental export capability being developed over time.
- Between 3.0 and 5.0 million barrels per day of new oil transport capacity is placed into service in each of the scenarios.
- Between 49 and 68 billion cubic feet per day of new natural gas transport capacity will be needed to support the levels of gas production and associated market growth projected through 2035.
- Between 1.8 and 2.6 million barrels per day of new NGL transport capacity will be needed to support the levels of NGL production and associated market growth projected through 2035.

Summary of Projected Infrastructure Development

Total capital expenditures for oil and gas infrastructure from 2017 to 2035 are projected to be $1.06 and $1.34 trillion, equating to annual averages of $56 to $71 billion. In the Base Case, roughly 45 percent of the investment is attributed to natural gas infrastructure development, roughly 49 percent is attributed to oil infrastructure development, and the remaining investment is attributed to NGL infrastructure development. In the High Case, natural gas infrastructure development rises to 49 percent of the total investment, while oil infrastructure development falls to 45 percent of the total, and NGL infrastructure development remains at about the same percent as in the Base Case.

A summary of infrastructure investment by category follows:

- Surface and Lease Equipment will account for the largest portion of infrastructure development with a CAPEX of $318 to $365 over the investment horizon. The CAPEX is fairly equally split between onshore and offshore development, with investment in lease equipment for an average of 24,075 to 28,175 new wells and 9 to 10 new oil platforms each year.
- Oil, gas, and NGL pipelines come in second with a total CAPEX of $234 to $362 billion throughout the projection. Within this infrastructure category, investment is greatest for natural gas pipelines with a CAPEX totaling $190 to $290 billion throughout the projection. Roughly 1,400 to 2,400 miles of natural gas pipeline are built each year, with a total of between 27,000 to 46,000 miles put in place throughout the projection.

- Gathering and processing is third with a total CAPEX of $236 to $280 billion over the projection. The scenarios project 11,485 to 12,612 miles of gathering line, 1.2 to 1.5 million horsepower of compression, 3.7 to 4.5 billion cubic feet per day of processing plant capacity, and 256,000 to 335,000 million barrels per day of fractionation plant capacity will be added or replaced each year throughout the forecast period.

- Refining and oil products transport ranks fourth with a total CAPEX of $196 to $217 billion during the projection. The vast majority of the investment in this category is for refinery enhancements, upgrades, replacements, and refurbishments, with annual expenditures averaging $9.42 to $10.2 billion.

- LNG and NGL exports rank fifth among the categories with a total CAPEX of $55 to $93 billion. The scenarios increase LNG exports to between 10 and 19 billion cubic feet per day after 2025. The scenarios also add 45,300 and 76,000 barrels per day of NGL export capacity each year.

- Oil and gas storage ranks last among the investment categories with a total CAPEX of $21.1 to $25.5 billion. Much of the investment in this category is for replacement of natural gas storage injection and withdrawal wells related to well integrity management programs.

Regionally, the largest portion of infrastructure development occurs in the Southwest, with investment for the area totaling $381 to $501 billion over the projection. Investment for this area is widespread across a number of infrastructure categories. The Northeast ranks second with total investment of $204 to $278 billion. The largest portion of the expenditures for this area are for gas pipelines to transport Marcellus/Utica production to markets. However, gathering and processing investments are also quite significant in this area. Offshore investment ranks third among the regions, with a total CAPEX of $177 to $204 billion. Collectively, all other areas project total investment in oil and gas infrastructure of $296 to $360 billion.

Summary of the Economic Impact Analysis

The study also assesses economic benefits of the projected infrastructure development. Economic benefits of oil and gas infrastructure development are very significant, as highlighted below:

- The total investment of $1.06 to $1.34 trillion adds $1.50 to $1.89 trillion to U.S. Gross Domestic Product (GDP) from 2017 through 2035.

- Gross State Products increase across the U.S., and the five states that benefit most from the infrastructure development include Texas, Louisiana, Pennsylvania, California, and Ohio, in that order.

- Federal and State tax coffers are also larger as a result of oil and gas infrastructure investment. Federal taxes associated with infrastructure development will total $304 to $386 billion, and state and local taxes associated with development will sum to $236 to $299 billion from 2017 through 2035.

- The level of employment (i.e., the number of jobs) supported by infrastructure development averages 828,000 to 1,047,000 each year throughout the projection. There are an average of 277,000 to 350,000 employees directly supported by the development. But, employment impacts are widespread across the U.S. as there are also indirect and induced labor impacts included in the job totals.
- These employment and GSP benefits do not consider employment in the upstream and downstream portions of the oil and gas business, nor do they consider the operation and maintenance of the infrastructure. Those unconsidered segments would account for millions of jobs and significant contribution to GSP, which would add to the totals discussed here.
- Infrastructure development will have wide-ranging benefits for millions of Americans. The midstream business is critical to the growth of the upstream and downstream portions of the oil and gas business. Without adequate infrastructure to support processing and transport of oil and gas, the upstream and downstream will develop less fully over time, and the foregone economic benefits would be very significant. In addition, oil and gas infrastructure development fosters delivery of lower cost energy to households and businesses, which is another positive economic impact that has not been considered in this analysis.

Appendix A: ICF Modeling Tools

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 40**). 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.

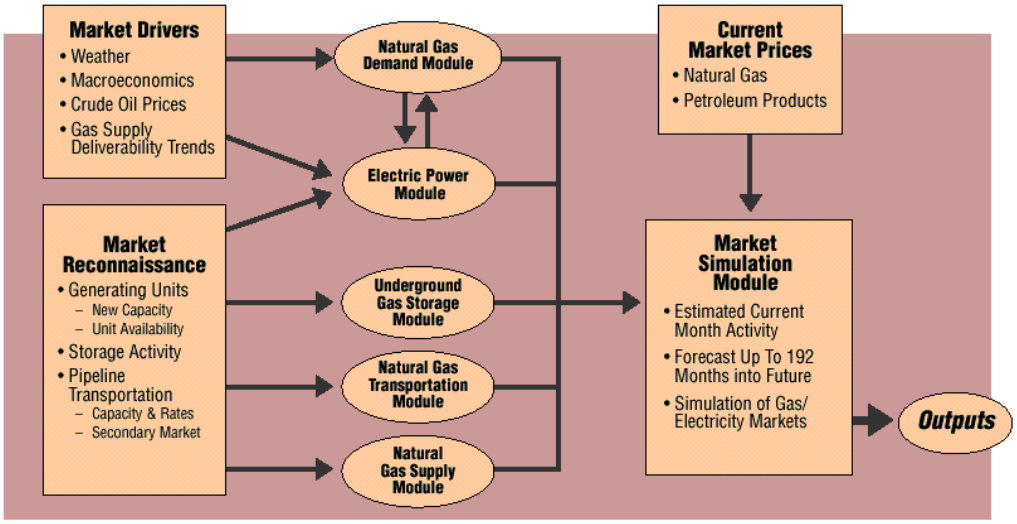
Overall, the model solves for monthly market clearing prices by considering the interaction between supply and demand curves at each of the model's nodes. On the supply side of the equation, prices are determined by production and storage price curves that reflect prices as a function of production and storage utilization (**Exhibit 41**). Total U.S. and Canadian gas supplies include production, LNG imports, and storage withdrawals (in the withdrawal season only).[1] 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, 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

[1] 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.

specified by the selected scenario. For each modeling, ICF includes its own projection of North American LNG imports and export by terminal.

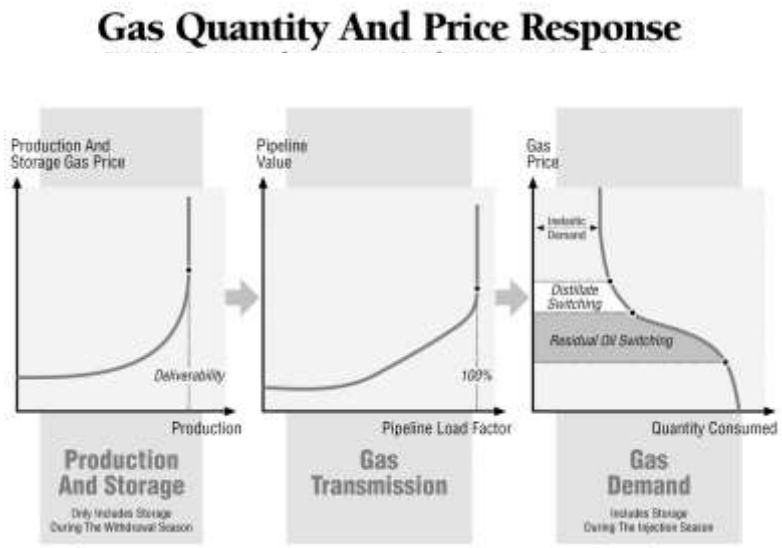
Prices are also influenced by "pipeline discount" curves, which reflect the change in basis or the marginal value of gas transmission as a function of the load factor of the pipeline corridor. The structure of the transmission network is shown in (**Exhibit 42**). The discount curves have been empirically fit to historic basis values and pipeline load factors on each pipeline corridor. Pipeline capacity expansions are exogenously specified for each scenario.

Exhibit 40: GMM Structure



Source: ICF GMM®

Exhibit 41: Natural Gas Supply and Demand Curves in the GMM



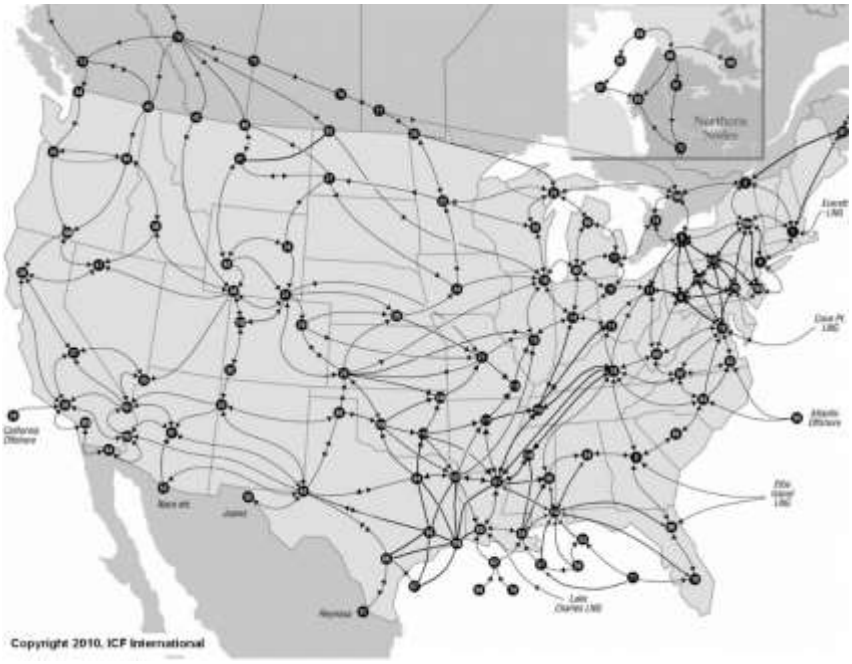
Source: ICF GMM®

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 42: GMM Transmission Network



Source: ICF GMM®

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 43**). 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.

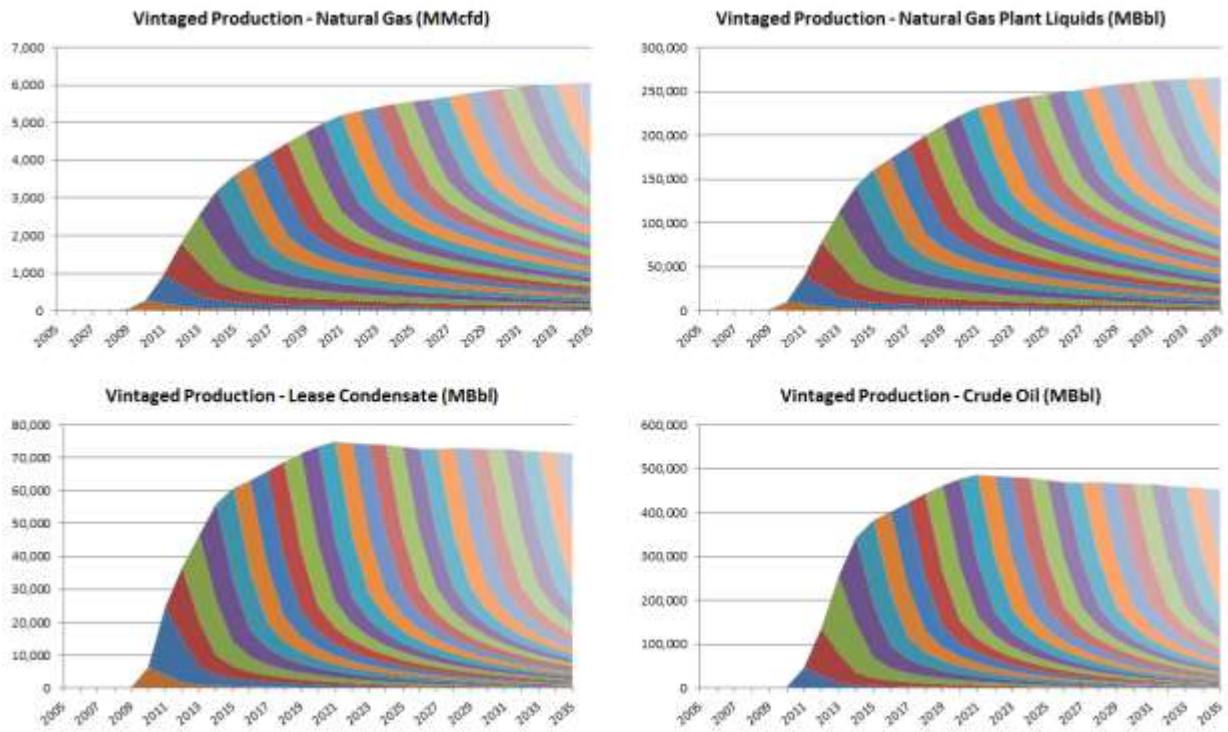
The DPR contains many findings that will be of interest to oil and gas producers, field services companies, and the investment community, including:

- 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.

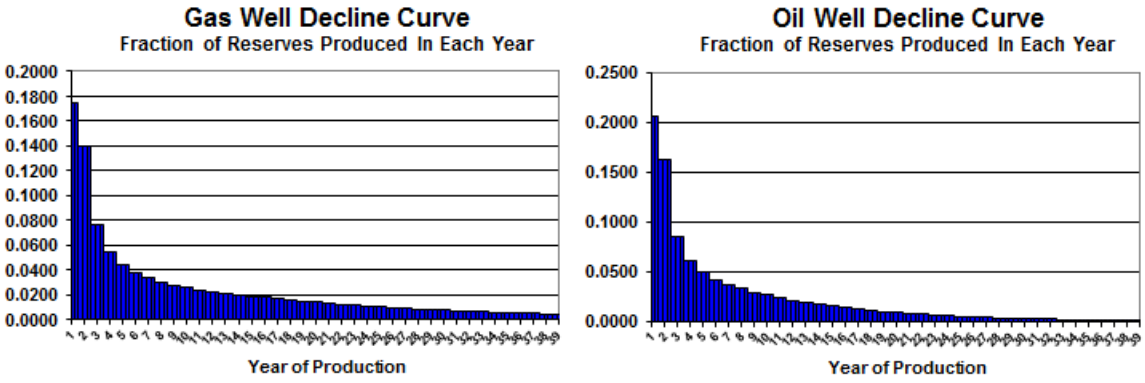
The DPR's historical gas/oil well completions, gas/NGLs/crude oil production, and gas-to-liquids ratio are calibrated to most recent statistics. The historical data is also used to estimate gas/NGLs/crude oil EURs. The main drivers for DPR forecasts are gas production forecasts from ICF's Gas Market Model (GMM) and expected gas and oil well production decline curves (**Exhibit 44**). 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 45**). 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 43: Example Vintage Production from DPR



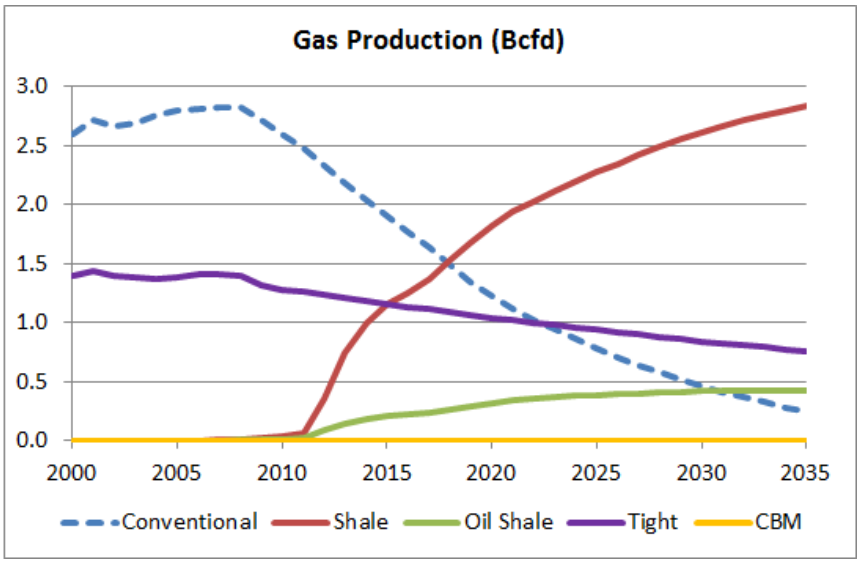
Source: ICF

Exhibit 44: Example Oil and Gas Well Decline Curves



Source: ICF

Exhibit 45: Example Breakout of Gas Production by Type



Source: ICF

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.

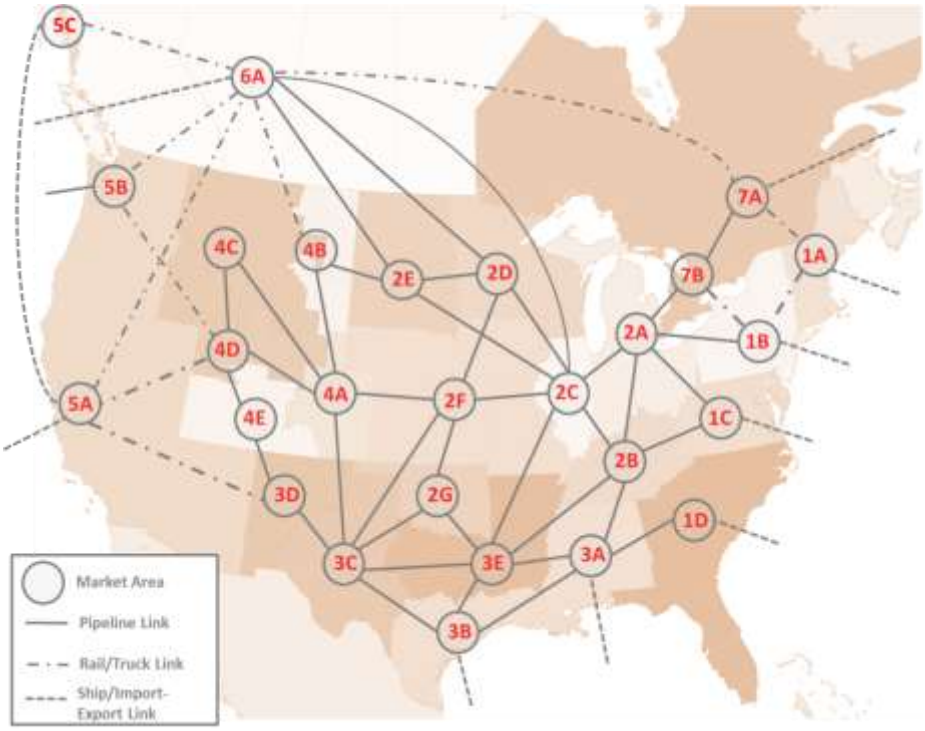
The NGLTM contains 27 supply/demand areas for the U.S. and Canada (**Exhibit 46**). The areas are connected by roughly 200 corridors representing individual pipeline projects and other forms of available transport (truck, rail, and ship) to move both raw NGLs (y-mix) and pure NGLs products like Ethane 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 publically 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 46: NGLTM Paths



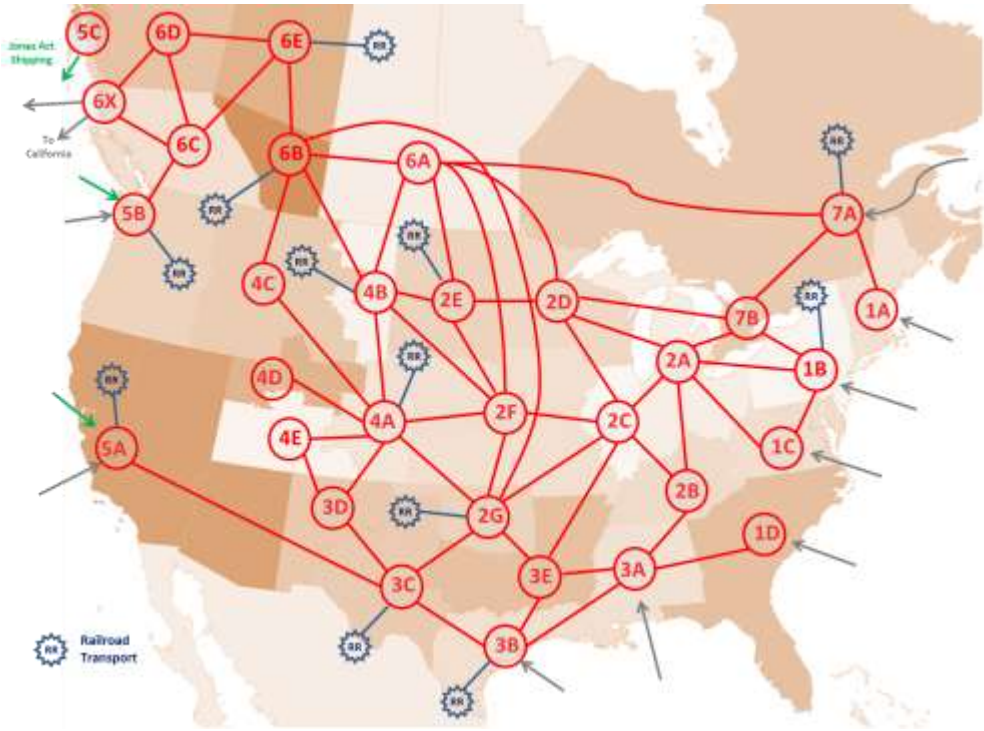
Source: ICF

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 47**). 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 47: 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.
- Net imports to the U.S. Gulf Coast can fall to 0 MBPD.
- 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 are based 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.

Appendix B: Details for Infrastructure Development

New Infrastructure and E/U/R/R

Exhibit 48: U.S. (Base Case) - New Infrastructure & E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	38,609	151,302	7,722	7,963
Oil Well Completions	128,666	306,132	25,733	16,112
Total Well Completions	167,275	457,433	33,455	24,075
Gas Production (Bcfd)	70.3	97.3	70.3	97.3
Crude Oil Production (MMBbl/d)	8.22	8.81	8.22	8.81
NGL Production (MMBbl/d)	2.97	5.04	2.97	5.04
Offshore Platform Capacity (MBOE/d)	3,091	8,454	618	445
Gathering and Processing				
Gas Gathering Line Miles	62,056	157,743	12,411	8,302
Gas Gathering Line Diameter (Inch)	5.4	6.2	5.4	6.2
Gas Gathering Line Compressor (1000 HP)	5,123	17,942	1,025	944
Oil Gathering Line Miles	23,617	60,475	4,723	3,183
Oil Gathering Line Diameter (Inch)	4.1	4.9	4.1	4.9
Oil & Gas Gathering Line Miles	85,673	218,218	17,135	11,485
Oil & Gas Gathering Line Diameter (Inch)	5.0	5.9	5.0	5.9
Gas Processing Plant Capacity (Bcfd)	33.1	69.6	6.6	3.7
Gas Processing Plant Compressor (1000 HP)	2,603	4,849	521	255
NGL Fractionation Capacity (MBOE/d)	1,885	4,866	377	256
Oil, Gas, and NGL Pipelines				
Oil Line Miles	10,950	5,108	2,190	269
Oil Line Diameter (Inch)	19.5	26.0	19.5	26.0
Pump for Oil Lines (1000 HP)	1,852	1,738	370	91
NGL Line Miles	13,883	6,449	2,777	339
NGL Line Diameter (Inch)	15.8	15.0	15.8	15.0
Pump for NGL Lines (1000 HP)	491	710	98	37
Gas Line Miles	8,135	26,682	1,627	1,404
Gas Line Diameter (Inch)	23.3	23.0	23.3	23.0
Compressor for Gas Lines (1000 HP)	722	524	722	524
Oil, Gas, and NGL Line Miles	32,968	38,240	6,594	2,013
Oil, Gas, and NGL Line Diameter (Inch)	18.9	22.1	18.9	22.1
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	207,525	265,409	41,505	13,969
Gas Storage Capacity (Bcf)	552	1,147	110	60
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	4,590	14,815	918	780
Oil Product Pipeline Miles	3,361	3,225	672	170
Oil Product Pipeline Diameter (Inch)	12.7	13.5	12.7	13.5
Oil Product Pipeline Pump (1000 HP)	1,239	3,079	248	162
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	1,365	146	273	8
Export Terminals				
LNG Export Capacity (Bcfd)	1.4	10.3	0.3	0.5
NGL Export Capacity (MBOE/d)	766.7	860.0	153.3	45.3

Exhibit 49: U.S. (High Case) - New Infrastructure & E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	38,609	152,205	7,722	8,011
Oil Well Completions	128,666	383,112	25,733	20,164
Total Well Completions	167,275	535,317	33,455	28,175
Gas Production (Bcfd)	70.3	107.3	70.3	107.3
Crude Oil Production (MMBbl/d)	8.22	11.55	8.22	11.55
NGL Production (MMBbl/d)	2.97	5.80	2.97	5.80
Offshore Platform Capacity (MBOE/d)	3,091	9,728	618	512
Gathering and Processing				
Gas Gathering Line Miles	62,056	173,336	12,411	9,123
Gas Gathering Line Diameter (Inch)	5.4	6.2	5.4	6.2
Gas Gathering Line Compressor (1000 HP)	5,123	22,092	1,025	1,163
Oil Gathering Line Miles	23,617	66,300	4,723	3,489
Oil Gathering Line Diameter (Inch)	4.1	5.0	4.1	5.0
Oil & Gas Gathering Line Miles	85,673	239,637	17,135	12,612
Oil & Gas Gathering Line Diameter (Inch)	5.0	5.8	5.0	5.8
Gas Processing Plant Capacity (Bcfd)	33.1	84.9	6.6	4.5
Gas Processing Plant Compressor (1000 HP)	2,603	6,217	521	327
NGL Fractionation Capacity (MBOE/d)	1,885	6,370	377	335
Oil, Gas, and NGL Pipelines				
Oil Line Miles	10,950	7,416	2,190	390
Oil Line Diameter (Inch)	19.5	27.6	19.5	27.6
Pump for Oil Lines (1000 HP)	1,852	2,694	370	142
NGL Line Miles	13,883	10,911	2,777	574
NGL Line Diameter (Inch)	15.8	15.4	15.8	15.4
Pump for NGL Lines (1000 HP)	491	817	98	43
Gas Line Miles	8,135	45,776	1,627	2,409
Gas Line Diameter (Inch)	23.3	22.5	23.3	22.5
Compressor for Gas Lines (1000 HP)	722	596	722	596
Oil, Gas, and NGL Line Miles	32,968	64,103	6,594	3,374
Oil, Gas, and NGL Line Diameter (Inch)	18.9	21.9	18.9	21.9
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	207,525	364,984	41,505	19,210
Gas Storage Capacity (Bcf)	552	1,392	110	73
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	4,590	16,198	918	853
Oil Product Pipeline Miles	3,361	4,808	672	253
Oil Product Pipeline Diameter (Inch)	12.7	13.6	12.7	13.6
Oil Product Pipeline Pump (1000 HP)	1,239	3,409	248	179
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	1,365	146	273	8
Export Terminals				
LNG Export Capacity (Bcfd)	1.4	20.2	0.3	1.1
NGL Export Capacity (MBOE/d)	766.7	1,443.6	153.3	76.0

Exhibit 50: Alaska (Base Case) - New Infrastructure & E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	25	53	5	3
Oil Well Completions	490	741	98	39
Total Well Completions	515	793	103	42
Gas Production (Bcfd)	0.9	0.8	0.9	0.8
Crude Oil Production (MMBbl/d)	0.48	0.34	0.48	0.34
NGL Production (MMBbl/d)	0.02	0.02	0.02	0.02
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	121	219	24	12
Gas Gathering Line Diameter (Inch)	9.3	10.8	9.3	10.8
Gas Gathering Line Compressor (1000 HP)	308	597	62	31
Oil Gathering Line Miles	161	370	32	19
Oil Gathering Line Diameter (Inch)	7.9	7.9	7.9	7.9
Oil & Gas Gathering Line Miles	282	588	56	31
Oil & Gas Gathering Line Diameter (Inch)	8.5	9.0	8.5	9.0
Gas Processing Plant Capacity (Bcfd)	1.4	2.7	0.3	0.1
Gas Processing Plant Compressor (1000 HP)	60	112	12	6
NGL Fractionation Capacity (MBOE/d)	3	0	1	0
Oil, Gas, and NGL Pipelines				
Oil Line Miles	13	41	3	2
Oil Line Diameter (Inch)	15.8	18.0	15.8	18.0
Pump for Oil Lines (1000 HP)	9	32	2	2
NGL Line Miles	0	0	0	0
NGL Line Diameter (Inch)	12.0	0.0	12.0	0.0
Pump for NGL Lines (1000 HP)	0	0	0	0
Gas Line Miles	5	17	1	1
Gas Line Diameter (Inch)	15.0	12.1	15.0	12.1
Compressor for Gas Lines (1000 HP)	0	0	0	0
Oil, Gas, and NGL Line Miles	18	58	4	3
Oil, Gas, and NGL Line Diameter (Inch)	16.0	16.3	16.0	16.3
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	2,158	4,349	432	229
Gas Storage Capacity (Bcf)	0	0	0	0
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	48	140	10	7
Oil Product Pipeline Miles	10	9	2	0
Oil Product Pipeline Diameter (Inch)	9.0	10.3	9.0	10.3
Oil Product Pipeline Pump (1000 HP)	3	7	1	0
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	0	0	0	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 51: Alaska (High Case) - New Infrastructure & E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	25	23	5	1
Oil Well Completions	490	571	98	30
Total Well Completions	515	594	103	31
Gas Production (Bcfd)	0.9	0.8	0.9	0.8
Crude Oil Production (MMBbl/d)	0.48	0.59	0.48	0.59
NGL Production (MMBbl/d)	0.02	0.02	0.02	0.02
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	121	193	24	10
Gas Gathering Line Diameter (Inch)	9.3	10.9	9.3	10.9
Gas Gathering Line Compressor (1000 HP)	308	597	62	31
Oil Gathering Line Miles	161	319	32	17
Oil Gathering Line Diameter (Inch)	7.9	7.9	7.9	7.9
Oil & Gas Gathering Line Miles	282	512	56	27
Oil & Gas Gathering Line Diameter (Inch)	8.5	9.0	8.5	9.0
Gas Processing Plant Capacity (Bcfd)	1.4	2.7	0.3	0.1
Gas Processing Plant Compressor (1000 HP)	60	112	12	6
NGL Fractionation Capacity (MBOE/d)	3	0	1	0
Oil, Gas, and NGL Pipelines				
Oil Line Miles	13	41	3	2
Oil Line Diameter (Inch)	15.8	18.0	15.8	18.0
Pump for Oil Lines (1000 HP)	9	32	2	2
NGL Line Miles	0	0	0	0
NGL Line Diameter (Inch)	12.0	0.0	12.0	0.0
Pump for NGL Lines (1000 HP)	0	0	0	0
Gas Line Miles	5	17	1	1
Gas Line Diameter (Inch)	15.0	12.1	15.0	12.1
Compressor for Gas Lines (1000 HP)	0	0	0	0
Oil, Gas, and NGL Line Miles	18	58	4	3
Oil, Gas, and NGL Line Diameter (Inch)	16.0	16.3	16.0	16.3
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	2,158	4,349	432	229
Gas Storage Capacity (Bcf)	0	0	0	0
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	48	159	10	8
Oil Product Pipeline Miles	10	15	2	1
Oil Product Pipeline Diameter (Inch)	9.0	10.0	9.0	10.0
Oil Product Pipeline Pump (1000 HP)	3	8	1	0
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	0	0	0	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 52: Central (Base Case) - New Infrastructure & E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	6,973	20,588	1,395	1,084
Oil Well Completions	38,290	69,050	7,658	3,634
Total Well Completions	45,262	89,638	9,052	4,718
Gas Production (Bcfd)	15.4	15.7	15.4	15.7
Crude Oil Production (MMBbl/d)	1.82	1.72	1.82	1.72
NGL Production (MMBbl/d)	0.57	0.74	0.57	0.74
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	16,245	37,541	3,249	1,976
Gas Gathering Line Diameter (Inch)	5.7	6.6	5.7	6.6
Gas Gathering Line Compressor (1000 HP)	842	1,854	168	98
Oil Gathering Line Miles	5,883	19,773	1,177	1,041
Oil Gathering Line Diameter (Inch)	4.4	4.7	4.4	4.7
Oil & Gas Gathering Line Miles	22,128	57,313	4,426	3,016
Oil & Gas Gathering Line Diameter (Inch)	5.4	5.9	5.4	5.9
Gas Processing Plant Capacity (Bcfd)	5.4	10.1	1.1	0.5
Gas Processing Plant Compressor (1000 HP)	352	492	70	26
NGL Fractionation Capacity (MBOE/d)	215	379	43	20
Oil, Gas, and NGL Pipelines				
Oil Line Miles	3,125	2,242	625	118
Oil Line Diameter (Inch)	17.7	29.7	17.7	29.7
Pump for Oil Lines (1000 HP)	363	559	73	29
NGL Line Miles	1,722	266	344	14
NGL Line Diameter (Inch)	12.7	14.5	12.7	14.5
Pump for NGL Lines (1000 HP)	113	103	23	5
Gas Line Miles	1,318	2,404	264	127
Gas Line Diameter (Inch)	16.0	19.4	16.0	19.4
Compressor for Gas Lines (1000 HP)	64	73	64	73
Oil, Gas, and NGL Line Miles	6,165	4,912	1,233	259
Oil, Gas, and NGL Line Diameter (Inch)	16.0	23.8	16.0	23.8
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	65,946	68,586	13,189	3,610
Gas Storage Capacity (Bcf)	108	144	22	8
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	318	1,016	64	53
Oil Product Pipeline Miles	1,052	530	210	28
Oil Product Pipeline Diameter (Inch)	10.1	11.3	10.1	11.3
Oil Product Pipeline Pump (1000 HP)	329	652	66	34
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	160	0	32	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 53: Central (High Case) - New Infrastructure & E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	6,973	20,913	1,395	1,101
Oil Well Completions	38,290	74,350	7,658	3,913
Total Well Completions	45,262	95,263	9,052	5,014
Gas Production (Bcfd)	15.4	16.9	15.4	16.9
Crude Oil Production (MMBbl/d)	1.82	2.15	1.82	2.15
NGL Production (MMBbl/d)	0.57	0.81	0.57	0.81
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	16,245	38,691	3,249	2,036
Gas Gathering Line Diameter (Inch)	5.7	6.6	5.7	6.6
Gas Gathering Line Compressor (1000 HP)	842	2,039	168	107
Oil Gathering Line Miles	5,883	20,649	1,177	1,087
Oil Gathering Line Diameter (Inch)	4.4	4.8	4.4	4.8
Oil & Gas Gathering Line Miles	22,128	59,339	4,426	3,123
Oil & Gas Gathering Line Diameter (Inch)	5.4	6.0	5.4	6.0
Gas Processing Plant Capacity (Bcfd)	5.4	11.4	1.1	0.6
Gas Processing Plant Compressor (1000 HP)	352	610	70	32
NGL Fractionation Capacity (MBOE/d)	215	388	43	20
Oil, Gas, and NGL Pipelines				
Oil Line Miles	3,125	2,882	625	152
Oil Line Diameter (Inch)	17.7	28.2	17.7	28.2
Pump for Oil Lines (1000 HP)	363	610	73	32
NGL Line Miles	1,722	300	344	16
NGL Line Diameter (Inch)	12.7	14.3	12.7	14.3
Pump for NGL Lines (1000 HP)	113	103	23	5
Gas Line Miles	1,318	3,455	264	182
Gas Line Diameter (Inch)	16.0	20.4	16.0	20.4
Compressor for Gas Lines (1000 HP)	64	78	64	78
Oil, Gas, and NGL Line Miles	6,165	6,637	1,233	349
Oil, Gas, and NGL Line Diameter (Inch)	16.0	23.5	16.0	23.5
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	65,946	96,517	13,189	5,080
Gas Storage Capacity (Bcf)	108	171	22	9
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	318	1,153	64	61
Oil Product Pipeline Miles	1,052	757	210	40
Oil Product Pipeline Diameter (Inch)	10.1	10.9	10.1	10.9
Oil Product Pipeline Pump (1000 HP)	329	699	66	37
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	160	0	32	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 54: Midwest (Base Case) - New Infrastructure & E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	109	637	22	34
Oil Well Completions	2,402	763	480	40
Total Well Completions	2,510	1,400	502	74
Gas Production (Bcfd)	0.3	0.3	0.3	0.3
Crude Oil Production (MMBbl/d)	0.04	0.01	0.04	0.01
NGL Production (MMBbl/d)	0.05	0.04	0.05	0.04
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	863	1,234	173	65
Gas Gathering Line Diameter (Inch)	4.3	5.3	4.3	5.3
Gas Gathering Line Compressor (1000 HP)	16	74	3	4
Oil Gathering Line Miles	0	0	0	0
Oil Gathering Line Diameter (Inch)	0.0	0.0	0.0	0.0
Oil & Gas Gathering Line Miles	863	1,234	173	65
Oil & Gas Gathering Line Diameter (Inch)	4.3	5.3	4.3	5.3
Gas Processing Plant Capacity (Bcfd)	0.7	1.7	0.1	0.1
Gas Processing Plant Compressor (1000 HP)	27	63	5	3
NGL Fractionation Capacity (MBOE/d)	155	543	31	29
Oil, Gas, and NGL Pipelines				
Oil Line Miles	1,032	980	206	52
Oil Line Diameter (Inch)	29.8	21.6	29.8	21.6
Pump for Oil Lines (1000 HP)	674	412	135	22
NGL Line Miles	1,754	292	351	15
NGL Line Diameter (Inch)	13.5	16.5	13.5	16.5
Pump for NGL Lines (1000 HP)	86	167	17	9
Gas Line Miles	808	4,518	162	238
Gas Line Diameter (Inch)	23.5	23.4	23.5	23.4
Compressor for Gas Lines (1000 HP)	35	55	35	55
Oil, Gas, and NGL Line Miles	3,593	5,791	719	305
Oil, Gas, and NGL Line Diameter (Inch)	20.5	22.7	20.5	22.7
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	2,838	2,960	568	156
Gas Storage Capacity (Bcf)	52	261	10	14
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	600	2,074	120	109
Oil Product Pipeline Miles	751	453	150	24
Oil Product Pipeline Diameter (Inch)	11.5	12.0	11.5	12.0
Oil Product Pipeline Pump (1000 HP)	269	608	54	32
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	350	0	70	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 55: Midwest (High Case) - New Infrastructure & E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	109	650	22	34
Oil Well Completions	2,402	989	480	52
Total Well Completions	2,510	1,639	502	86
Gas Production (Bcfd)	0.3	0.3	0.3	0.3
Crude Oil Production (MMBbl/d)	0.04	0.01	0.04	0.01
NGL Production (MMBbl/d)	0.05	0.04	0.05	0.04
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	863	1,287	173	68
Gas Gathering Line Diameter (Inch)	4.3	5.3	4.3	5.3
Gas Gathering Line Compressor (1000 HP)	16	90	3	5
Oil Gathering Line Miles	0	0	0	0
Oil Gathering Line Diameter (Inch)	0.0	0.0	0.0	0.0
Oil & Gas Gathering Line Miles	863	1,287	173	68
Oil & Gas Gathering Line Diameter (Inch)	4.3	5.3	4.3	5.3
Gas Processing Plant Capacity (Bcfd)	0.7	1.7	0.1	0.1
Gas Processing Plant Compressor (1000 HP)	27	65	5	3
NGL Fractionation Capacity (MBOE/d)	155	836	31	44
Oil, Gas, and NGL Pipelines				
Oil Line Miles	1,032	1,159	206	61
Oil Line Diameter (Inch)	29.8	23.8	29.8	23.8
Pump for Oil Lines (1000 HP)	674	523	135	28
NGL Line Miles	1,754	1,140	351	60
NGL Line Diameter (Inch)	13.5	16.8	13.5	16.8
Pump for NGL Lines (1000 HP)	86	190	17	10
Gas Line Miles	808	6,925	162	364
Gas Line Diameter (Inch)	23.5	23.1	23.5	23.1
Compressor for Gas Lines (1000 HP)	35	80	35	80
Oil, Gas, and NGL Line Miles	3,593	9,224	719	485
Oil, Gas, and NGL Line Diameter (Inch)	20.5	22.4	20.5	22.4
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	2,838	3,269	568	172
Gas Storage Capacity (Bcf)	54	307	11	16
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	600	2,202	120	116
Oil Product Pipeline Miles	751	628	150	33
Oil Product Pipeline Diameter (Inch)	11.5	11.7	11.5	11.7
Oil Product Pipeline Pump (1000 HP)	269	645	54	34
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	350	0	70	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 56: Northeast (Base Case) - New Infrastructure & E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	10,391	61,641	2,078	3,244
Oil Well Completions	3,788	7,110	758	374
Total Well Completions	14,179	68,751	2,836	3,618
Gas Production (Bcfd)	15.6	42.0	15.6	42.0
Crude Oil Production (MMBbl/d)	0.06	0.10	0.06	0.10
NGL Production (MMBbl/d)	0.28	1.47	0.28	1.47
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	6,565	17,527	1,313	922
Gas Gathering Line Diameter (Inch)	6.9	9.5	6.9	9.5
Gas Gathering Line Compressor (1000 HP)	1,731	9,423	346	496
Oil Gathering Line Miles	233	1,011	47	53
Oil Gathering Line Diameter (Inch)	4.0	4.0	4.0	4.0
Oil & Gas Gathering Line Miles	6,798	18,538	1,360	976
Oil & Gas Gathering Line Diameter (Inch)	6.8	9.2	6.8	9.2
Gas Processing Plant Capacity (Bcfd)	11.7	31.4	2.3	1.7
Gas Processing Plant Compressor (1000 HP)	1,176	2,762	235	145
NGL Fractionation Capacity (MBOE/d)	390	1,241	78	65
Oil, Gas, and NGL Pipelines				
Oil Line Miles	319	12	64	1
Oil Line Diameter (Inch)	31.8	25.9	31.8	25.9
Pump for Oil Lines (1000 HP)	100	22	20	1
NGL Line Miles	617	1,522	123	80
NGL Line Diameter (Inch)	19.1	14.8	19.1	14.8
Pump for NGL Lines (1000 HP)	8	46	2	2
Gas Line Miles	1,963	7,789	393	410
Gas Line Diameter (Inch)	26.2	24.8	26.2	24.8
Compressor for Gas Lines (1000 HP)	232	113	232	113
Oil, Gas, and NGL Line Miles	2,899	9,322	580	491
Oil, Gas, and NGL Line Diameter (Inch)	25.3	23.1	25.3	23.1
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	5,953	7,259	1,191	382
Gas Storage Capacity (Bcf)	43	123	9	6
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	288	973	58	51
Oil Product Pipeline Miles	253	147	51	8
Oil Product Pipeline Diameter (Inch)	16.0	14.0	16.0	14.0
Oil Product Pipeline Pump (1000 HP)	99	234	20	12
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	25	0	5	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.8	0.0	0.0
NGL Export Capacity (MBOE/d)	99.8	178.0	20.0	9.4

Exhibit 57: Northeast (High Case) - New Infrastructure & E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	10,391	63,172	2,078	3,325
Oil Well Completions	3,788	12,489	758	657
Total Well Completions	14,179	75,661	2,836	3,982
Gas Production (Bcfd)	15.6	47.3	15.6	47.3
Crude Oil Production (MMBbl/d)	0.06	0.17	0.06	0.17
NGL Production (MMBbl/d)	0.28	1.78	0.28	1.78
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	6,565	18,300	1,313	963
Gas Gathering Line Diameter (Inch)	6.9	9.5	6.9	9.5
Gas Gathering Line Compressor (1000 HP)	1,731	12,490	346	657
Oil Gathering Line Miles	233	1,758	47	93
Oil Gathering Line Diameter (Inch)	4.0	4.3	4.0	4.3
Oil & Gas Gathering Line Miles	6,798	20,058	1,360	1,056
Oil & Gas Gathering Line Diameter (Inch)	6.8	9.1	6.8	9.1
Gas Processing Plant Capacity (Bcfd)	11.7	41.1	2.3	2.2
Gas Processing Plant Compressor (1000 HP)	1,176	3,629	235	191
NGL Fractionation Capacity (MBOE/d)	390	1,694	78	89
Oil, Gas, and NGL Pipelines				
Oil Line Miles	319	428	64	23
Oil Line Diameter (Inch)	31.8	40.4	31.8	40.4
Pump for Oil Lines (1000 HP)	100	572	20	30
NGL Line Miles	617	2,260	123	119
NGL Line Diameter (Inch)	19.1	15.2	19.1	15.2
Pump for NGL Lines (1000 HP)	8	52	2	3
Gas Line Miles	1,963	12,407	393	653
Gas Line Diameter (Inch)	26.2	23.9	26.2	23.9
Compressor for Gas Lines (1000 HP)	232	130	232	130
Oil, Gas, and NGL Line Miles	2,899	15,095	580	794
Oil, Gas, and NGL Line Diameter (Inch)	25.3	23.1	25.3	23.1
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	5,953	12,298	1,191	647
Gas Storage Capacity (Bcf)	43	143	9	8
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	288	1,042	58	55
Oil Product Pipeline Miles	253	190	51	10
Oil Product Pipeline Diameter (Inch)	16.0	14.5	16.0	14.5
Oil Product Pipeline Pump (1000 HP)	99	243	20	13
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	25	0	5	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.8	0.0	0.0
NGL Export Capacity (MBOE/d)	99.8	178.0	20.0	9.4

Exhibit 58: Offshore (Base Case) - New Infrastructure & E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	153	320	31	17
Oil Well Completions	617	1,443	123	76
Total Well Completions	770	1,764	154	93
Gas Production (Bcfd)	3.8	3.6	3.8	3.6
Crude Oil Production (MMBbl/d)	0.00	0.00	0.00	0.00
NGL Production (MMBbl/d)	0.08	0.03	0.08	0.03
Offshore Platform Capacity (MBOE/d)	3,091	8,454	618	445
Gathering and Processing				
Gas Gathering Line Miles	283	519	57	27
Gas Gathering Line Diameter (Inch)	7.8	10.4	7.8	10.4
Gas Gathering Line Compressor (1000 HP)	150	243	30	13
Oil Gathering Line Miles	146	582	29	31
Oil Gathering Line Diameter (Inch)	5.0	6.8	5.0	6.8
Oil & Gas Gathering Line Miles	428	1,101	86	58
Oil & Gas Gathering Line Diameter (Inch)	6.8	8.5	6.8	8.5
Gas Processing Plant Capacity (Bcfd)	0.2	0.1	0.0	0.0
Gas Processing Plant Compressor (1000 HP)	18	16	4	1
NGL Fractionation Capacity (MBOE/d)	0	0	0	0
Oil, Gas, and NGL Pipelines				
Oil Line Miles	11	44	2	2
Oil Line Diameter (Inch)	24.0	24.0	24.0	24.0
Pump for Oil Lines (1000 HP)	12	46	2	2
NGL Line Miles	0	0	0	0
NGL Line Diameter (Inch)	0.0	0.0	0.0	0.0
Pump for NGL Lines (1000 HP)	0	0	0	0
Gas Line Miles	34	37	7	2
Gas Line Diameter (Inch)	28.6	25.0	28.6	25.0
Compressor for Gas Lines (1000 HP)	2	2	2	2
Oil, Gas, and NGL Line Miles	46	81	9	4
Oil, Gas, and NGL Line Diameter (Inch)	10.8	23.7	10.8	23.7
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	0	0	0	0
Gas Storage Capacity (Bcf)	0	0	0	0
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	0	0	0	0
Oil Product Pipeline Diameter (Inch)	0.0	0.0	0.0	0.0
Oil Product Pipeline Pump (1000 HP)	0	0	0	0
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	0	0	0	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 59: Offshore (High Case) - New Infrastructure & E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	153	277	31	15
Oil Well Completions	617	1,326	123	70
Total Well Completions	770	1,603	154	84
Gas Production (Bcfd)	3.8	3.8	3.8	3.8
Crude Oil Production (MMBbl/d)	0.00	0.00	0.00	0.00
NGL Production (MMBbl/d)	0.08	0.04	0.08	0.04
Offshore Platform Capacity (MBOE/d)	3,091	9,728	618	512
Gathering and Processing				
Gas Gathering Line Miles	283	498	57	26
Gas Gathering Line Diameter (Inch)	7.8	10.2	7.8	10.2
Gas Gathering Line Compressor (1000 HP)	150	242	30	13
Oil Gathering Line Miles	146	549	29	29
Oil Gathering Line Diameter (Inch)	5.0	6.7	5.0	6.7
Oil & Gas Gathering Line Miles	428	1,047	86	55
Oil & Gas Gathering Line Diameter (Inch)	6.8	8.4	6.8	8.4
Gas Processing Plant Capacity (Bcfd)	0.2	0.1	0.0	0.0
Gas Processing Plant Compressor (1000 HP)	18	16	4	1
NGL Fractionation Capacity (MBOE/d)	0	0	0	0
Oil, Gas, and NGL Pipelines				
Oil Line Miles	11	44	2	2
Oil Line Diameter (Inch)	24.0	24.0	24.0	24.0
Pump for Oil Lines (1000 HP)	12	46	2	2
NGL Line Miles	0	0	0	0
NGL Line Diameter (Inch)	0.0	0.0	0.0	0.0
Pump for NGL Lines (1000 HP)	0	0	0	0
Gas Line Miles	34	37	7	2
Gas Line Diameter (Inch)	28.6	25.0	28.6	25.0
Compressor for Gas Lines (1000 HP)	2	2	2	2
Oil, Gas, and NGL Line Miles	46	81	9	4
Oil, Gas, and NGL Line Diameter (Inch)	10.8	23.7	10.8	23.7
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	0	0	0	0
Gas Storage Capacity (Bcf)	0	0	0	0
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	0	0	0	0
Oil Product Pipeline Diameter (Inch)	0.0	0.0	0.0	0.0
Oil Product Pipeline Pump (1000 HP)	0	0	0	0
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	0	0	0	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 60: Southeast (Base Case) - New Infrastructure & E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	494	1,398	99	74
Oil Well Completions	754	1,355	151	71
Total Well Completions	1,248	2,753	250	145
Gas Production (Bcfd)	0.6	0.5	0.6	0.5
Crude Oil Production (MMBbl/d)	0.10	0.06	0.10	0.06
NGL Production (MMBbl/d)	0.00	0.00	0.00	0.00
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	706	1,575	141	83
Gas Gathering Line Diameter (Inch)	4.5	5.2	4.5	5.2
Gas Gathering Line Compressor (1000 HP)	27	51	5	3
Oil Gathering Line Miles	244	629	49	33
Oil Gathering Line Diameter (Inch)	4.3	4.0	4.3	4.0
Oil & Gas Gathering Line Miles	950	2,204	190	116
Oil & Gas Gathering Line Diameter (Inch)	4.5	4.8	4.5	4.8
Gas Processing Plant Capacity (Bcfd)	0.5	1.0	0.1	0.1
Gas Processing Plant Compressor (1000 HP)	20	37	4	2
NGL Fractionation Capacity (MBOE/d)	5	122	1	6
Oil, Gas, and NGL Pipelines				
Oil Line Miles	24	51	5	3
Oil Line Diameter (Inch)	18.0	18.0	18.0	18.0
Pump for Oil Lines (1000 HP)	10	38	2	2
NGL Line Miles	27	27	5	1
NGL Line Diameter (Inch)	8.0	8.0	8.0	8.0
Pump for NGL Lines (1000 HP)	3	28	1	1
Gas Line Miles	1,924	6,192	385	326
Gas Line Diameter (Inch)	24.1	23.8	24.1	23.8
Compressor for Gas Lines (1000 HP)	213	89	213	89
Oil, Gas, and NGL Line Miles	1,975	6,270	395	330
Oil, Gas, and NGL Line Diameter (Inch)	23.8	23.7	23.8	23.7
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	3,070	3,796	614	200
Gas Storage Capacity (Bcf)	99	130	20	7
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	263	768	53	40
Oil Product Pipeline Miles	330	328	66	17
Oil Product Pipeline Diameter (Inch)	22.4	19.1	22.4	19.1
Oil Product Pipeline Pump (1000 HP)	136	358	27	19
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	70	0	14	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.4	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 61: Southeast (High Case) - New Infrastructure & E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	494	1,368	99	72
Oil Well Completions	754	2,172	151	114
Total Well Completions	1,248	3,540	250	186
Gas Production (Bcfd)	0.6	0.5	0.6	0.5
Crude Oil Production (MMBbl/d)	0.10	0.08	0.10	0.08
NGL Production (MMBbl/d)	0.00	0.00	0.00	0.00
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	706	1,767	141	93
Gas Gathering Line Diameter (Inch)	4.5	5.0	4.5	5.0
Gas Gathering Line Compressor (1000 HP)	27	51	5	3
Oil Gathering Line Miles	244	882	49	46
Oil Gathering Line Diameter (Inch)	4.3	4.0	4.3	4.0
Oil & Gas Gathering Line Miles	950	2,649	190	139
Oil & Gas Gathering Line Diameter (Inch)	4.5	4.7	4.5	4.7
Gas Processing Plant Capacity (Bcfd)	0.5	1.0	0.1	0.1
Gas Processing Plant Compressor (1000 HP)	20	37	4	2
NGL Fractionation Capacity (MBOE/d)	6	65	1	3
Oil, Gas, and NGL Pipelines				
Oil Line Miles	24	55	5	3
Oil Line Diameter (Inch)	18.0	18.0	18.0	18.0
Pump for Oil Lines (1000 HP)	10	38	2	2
NGL Line Miles	27	27	5	1
NGL Line Diameter (Inch)	8.0	8.0	8.0	8.0
Pump for NGL Lines (1000 HP)	3	28	1	1
Gas Line Miles	1,924	11,555	385	608
Gas Line Diameter (Inch)	24.1	22.7	24.1	22.7
Compressor for Gas Lines (1000 HP)	213	111	213	111
Oil, Gas, and NGL Line Miles	1,975	11,637	395	612
Oil, Gas, and NGL Line Diameter (Inch)	23.8	22.7	23.8	22.7
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	3,070	4,646	614	245
Gas Storage Capacity (Bcf)	99	177	20	9
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	263	873	53	46
Oil Product Pipeline Miles	330	485	66	26
Oil Product Pipeline Diameter (Inch)	22.4	20.4	22.4	20.4
Oil Product Pipeline Pump (1000 HP)	136	391	27	21
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	70	0	14	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.4	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 62: Southwest (Base Case) - New Infrastructure & E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	20,380	66,386	4,076	3,494
Oil Well Completions	75,030	216,916	15,006	11,417
Total Well Completions	95,410	283,302	19,082	14,911
Gas Production (Bcfd)	33.0	34.0	33.0	34.0
Crude Oil Production (MMBbl/d)	5.18	6.19	5.18	6.19
NGL Production (MMBbl/d)	1.93	2.70	1.93	2.70
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	34,057	93,539	6,811	4,923
Gas Gathering Line Diameter (Inch)	5.2	5.6	5.2	5.6
Gas Gathering Line Compressor (1000 HP)	2,019	5,630	404	296
Oil Gathering Line Miles	13,818	32,133	2,764	1,691
Oil Gathering Line Diameter (Inch)	4.0	5.2	4.0	5.2
Oil & Gas Gathering Line Miles	47,875	125,672	9,575	6,614
Oil & Gas Gathering Line Diameter (Inch)	4.8	5.5	4.8	5.5
Gas Processing Plant Capacity (Bcfd)	13.1	22.2	2.6	1.2
Gas Processing Plant Compressor (1000 HP)	939	1,340	188	71
NGL Fractionation Capacity (MBOE/d)	1,107	2,567	221	135
Oil, Gas, and NGL Pipelines				
Oil Line Miles	6,413	1,690	1,283	89
Oil Line Diameter (Inch)	18.1	24.4	18.1	24.4
Pump for Oil Lines (1000 HP)	675	592	135	31
NGL Line Miles	9,760	4,336	1,952	228
NGL Line Diameter (Inch)	16.6	15.1	16.6	15.1
Pump for NGL Lines (1000 HP)	280	365	56	19
Gas Line Miles	1,656	4,938	331	260
Gas Line Diameter (Inch)	24.8	20.9	24.8	20.9
Compressor for Gas Lines (1000 HP)	187	139	187	139
Oil, Gas, and NGL Line Miles	17,828	10,963	3,566	577
Oil, Gas, and NGL Line Diameter (Inch)	17.9	19.1	17.9	19.1
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	125,123	173,520	25,025	9,133
Gas Storage Capacity (Bcf)	159	392	32	21
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	2,557	7,747	511	408
Oil Product Pipeline Miles	577	1,283	115	68
Oil Product Pipeline Diameter (Inch)	13.6	13.9	13.6	13.9
Oil Product Pipeline Pump (1000 HP)	273	890	55	47
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	212	0	42	0
Export Terminals				
LNG Export Capacity (Bcfd)	1.4	9.1	0.3	0.5
NGL Export Capacity (MBOE/d)	664.3	680.9	132.9	35.8

Exhibit 63: Southwest (High Case) - New Infrastructure & E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	20,380	65,567	4,076	3,451
Oil Well Completions	75,030	282,729	15,006	14,880
Total Well Completions	95,410	348,297	19,082	18,331
Gas Production (Bcfd)	33.0	37.2	33.0	37.2
Crude Oil Production (MMBbl/d)	5.18	8.11	5.18	8.11
NGL Production (MMBbl/d)	1.93	3.06	1.93	3.06
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	34,057	107,032	6,811	5,633
Gas Gathering Line Diameter (Inch)	5.2	5.5	5.2	5.5
Gas Gathering Line Compressor (1000 HP)	2,019	6,511	404	343
Oil Gathering Line Miles	13,818	36,181	2,764	1,904
Oil Gathering Line Diameter (Inch)	4.0	5.2	4.0	5.2
Oil & Gas Gathering Line Miles	47,875	143,213	9,575	7,538
Oil & Gas Gathering Line Diameter (Inch)	4.8	5.5	4.8	5.5
Gas Processing Plant Capacity (Bcfd)	13.1	26.4	2.6	1.4
Gas Processing Plant Compressor (1000 HP)	939	1,720	188	91
NGL Fractionation Capacity (MBOE/d)	1,107	3,373	221	178
Oil, Gas, and NGL Pipelines				
Oil Line Miles	6,413	2,759	1,283	145
Oil Line Diameter (Inch)	18.1	27.2	18.1	27.2
Pump for Oil Lines (1000 HP)	675	836	135	44
NGL Line Miles	9,760	7,177	1,952	378
NGL Line Diameter (Inch)	16.6	15.3	16.6	15.3
Pump for NGL Lines (1000 HP)	280	443	56	23
Gas Line Miles	1,656	10,484	331	552
Gas Line Diameter (Inch)	24.8	21.0	24.8	21.0
Compressor for Gas Lines (1000 HP)	187	152	187	152
Oil, Gas, and NGL Line Miles	17,828	20,420	3,566	1,075
Oil, Gas, and NGL Line Diameter (Inch)	17.9	19.9	17.9	19.9
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	125,123	238,965	25,025	12,577
Gas Storage Capacity (Bcf)	158	495	32	26
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	2,557	8,672	511	456
Oil Product Pipeline Miles	577	1,963	115	103
Oil Product Pipeline Diameter (Inch)	13.6	14.0	13.6	14.0
Oil Product Pipeline Pump (1000 HP)	273	1,032	55	54
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	212	0	42	0
Export Terminals				
LNG Export Capacity (Bcfd)	1.4	19.1	0.3	1.0
NGL Export Capacity (MBOE/d)	664.3	1,264.5	132.9	66.6

Exhibit 64: Western (Base Case) - New Infrastructure & E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	85	278	17	15
Oil Well Completions	7,296	8,754	1,459	461
Total Well Completions	7,381	9,032	1,476	475
Gas Production (Bcfd)	0.6	0.5	0.6	0.5
Crude Oil Production (MMBbl/d)	0.55	0.38	0.55	0.38
NGL Production (MMBbl/d)	0.04	0.04	0.04	0.04
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	3,216	5,591	643	294
Gas Gathering Line Diameter (Inch)	3.2	3.9	3.2	3.9
Gas Gathering Line Compressor (1000 HP)	29	71	6	4
Oil Gathering Line Miles	3,132	5,977	626	315
Oil Gathering Line Diameter (Inch)	3.4	3.7	3.4	3.7
Oil & Gas Gathering Line Miles	6,347	11,567	1,269	609
Oil & Gas Gathering Line Diameter (Inch)	3.3	3.8	3.3	3.8
Gas Processing Plant Capacity (Bcfd)	0.2	0.5	0.0	0.0
Gas Processing Plant Compressor (1000 HP)	11	27	2	1
NGL Fractionation Capacity (MBOE/d)	10	13	2	1
Oil, Gas, and NGL Pipelines				
Oil Line Miles	15	47	3	2
Oil Line Diameter (Inch)	15.8	18.0	15.8	18.0
Pump for Oil Lines (1000 HP)	10	37	2	2
NGL Line Miles	3	6	1	0
NGL Line Diameter (Inch)	14.0	14.0	14.0	14.0
Pump for NGL Lines (1000 HP)	0	0	0	0
Gas Line Miles	426	789	85	42
Gas Line Diameter (Inch)	22.1	21.8	22.1	21.8
Compressor for Gas Lines (1000 HP)	39	25	39	25
Oil, Gas, and NGL Line Miles	443	843	89	44
Oil, Gas, and NGL Line Diameter (Inch)	8.8	21.6	8.8	21.6
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	2,436	4,939	487	260
Gas Storage Capacity (Bcf)	90	97	18	5
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	515	2,097	103	110
Oil Product Pipeline Miles	387	474	77	25
Oil Product Pipeline Diameter (Inch)	10.7	12.1	10.7	12.1
Oil Product Pipeline Pump (1000 HP)	130	330	26	17
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	548	146	110	8
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	2.6	1.1	0.5	0.1

Exhibit 65: Western (High Case) - New Infrastructure & E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	85	236	17	12
Oil Well Completions	7,296	8,485	1,459	447
Total Well Completions	7,381	8,721	1,476	459
Gas Production (Bcfd)	0.6	0.5	0.6	0.5
Crude Oil Production (MMBbl/d)	0.55	0.44	0.55	0.44
NGL Production (MMBbl/d)	0.04	0.04	0.04	0.04
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	3,216	5,569	643	293
Gas Gathering Line Diameter (Inch)	3.2	3.9	3.2	3.9
Gas Gathering Line Compressor (1000 HP)	29	72	6	4
Oil Gathering Line Miles	3,132	5,963	626	314
Oil Gathering Line Diameter (Inch)	3.4	3.8	3.4	3.8
Oil & Gas Gathering Line Miles	6,347	11,532	1,269	607
Oil & Gas Gathering Line Diameter (Inch)	3.3	3.8	3.3	3.8
Gas Processing Plant Capacity (Bcfd)	0.2	0.5	0.0	0.0
Gas Processing Plant Compressor (1000 HP)	11	28	2	1
NGL Fractionation Capacity (MBOE/d)	10	13	2	1
Oil, Gas, and NGL Pipelines				
Oil Line Miles	15	47	3	2
Oil Line Diameter (Inch)	15.8	18.0	15.8	18.0
Pump for Oil Lines (1000 HP)	10	37	2	2
NGL Line Miles	3	7	1	0
NGL Line Diameter (Inch)	14.0	14.0	14.0	14.0
Pump for NGL Lines (1000 HP)	0	0	0	0
Gas Line Miles	426	896	85	47
Gas Line Diameter (Inch)	22.1	22.3	22.1	22.3
Compressor for Gas Lines (1000 HP)	39	30	39	30
Oil, Gas, and NGL Line Miles	443	951	89	50
Oil, Gas, and NGL Line Diameter (Inch)	8.8	22.0	8.8	22.0
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	2,436	4,939	487	260
Gas Storage Capacity (Bcf)	89	99	18	5
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	515	2,097	103	110
Oil Product Pipeline Miles	387	770	77	41
Oil Product Pipeline Diameter (Inch)	10.7	12.1	10.7	12.1
Oil Product Pipeline Pump (1000 HP)	130	392	26	21
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	548	146	110	8
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	2.6	1.1	0.5	0.1

New Infrastructure

Exhibit 66: U.S. (Base Case) - New Infrastructure

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	38,609	151,302	7,722	7,963
Oil Well Completions	128,666	306,132	25,733	16,112
Total Well Completions	167,275	457,433	33,455	24,075
Gas Production (Bcfd)	70.3	97.3	70.3	97.3
Crude Oil Production (MMBbl/d)	8.22	8.81	8.22	8.81
NGL Production (MMBbl/d)	2.97	5.04	2.97	5.04
Offshore Platform Capacity (MBOE/d)	3,091	8,454	618	445
Gathering and Processing				
Gas Gathering Line Miles	30,894	67,467	6,179	3,551
Gas Gathering Line Diameter (Inch)	6.7	7.9	6.7	7.9
Gas Gathering Line Compressor (1000 HP)	2,388	7,422	478	391
Oil Gathering Line Miles	18,369	32,371	3,674	1,704
Oil Gathering Line Diameter (Inch)	4.2	5.3	4.2	5.3
Oil & Gas Gathering Line Miles	49,264	99,837	9,853	5,255
Oil & Gas Gathering Line Diameter (Inch)	5.7	7.0	5.7	7.0
Gas Processing Plant Capacity (Bcfd)	20.7	28.7	4.1	1.5
Gas Processing Plant Compressor (1000 HP)	2,070	2,867	414	151
NGL Fractionation Capacity (MBOE/d)	1,520	2,680	304	141
Oil, Gas, and NGL Pipelines				
Oil Line Miles	10,718	4,074	2,144	214
Oil Line Diameter (Inch)	19.4	27.1	19.4	27.1
Pump for Oil Lines (1000 HP)	1,644	648	329	34
NGL Line Miles	13,696	5,674	2,739	299
NGL Line Diameter (Inch)	15.8	13.7	15.8	13.7
Pump for NGL Lines (1000 HP)	385	240	77	13
Gas Line Miles	6,666	20,917	1,333	1,101
Gas Line Diameter (Inch)	24.2	23.9	24.2	23.9
Compressor for Gas Lines (1000 HP)	468	219	468	219
Oil, Gas, and NGL Line Miles	31,080	30,665	6,216	1,614
Oil, Gas, and NGL Line Diameter (Inch)	18.9	22.5	18.9	22.5
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	136,640	21,118	27,328	1,111
Gas Storage Capacity (Bcf)	358	364	72	19
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	3,070	2,092	614	110
Oil Product Pipeline Diameter (Inch)	12.7	13.7	12.7	13.7
Oil Product Pipeline Pump (1000 HP)	544	370	109	19
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	1,365	146	273	8
Export Terminals				
LNG Export Capacity (Bcfd)	1.4	10.3	0.3	0.5
NGL Export Capacity (MBOE/d)	766.7	860.0	153.3	45.3

Exhibit 67: U.S. (High Case) - New Infrastructure

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	38,609	152,205	7,722	8,011
Oil Well Completions	128,666	383,112	25,733	20,164
Total Well Completions	167,275	535,317	33,455	28,175
Gas Production (Bcfd)	70.3	107.3	70.3	107.3
Crude Oil Production (MMBbl/d)	8.22	11.55	8.22	11.55
NGL Production (MMBbl/d)	2.97	5.80	2.97	5.80
Offshore Platform Capacity (MBOE/d)	3,091	9,728	618	512
Gathering and Processing				
Gas Gathering Line Miles	30,894	80,135	6,179	4,218
Gas Gathering Line Diameter (Inch)	6.7	7.5	6.7	7.5
Gas Gathering Line Compressor (1000 HP)	2,388	10,638	478	560
Oil Gathering Line Miles	18,369	37,103	3,674	1,953
Oil Gathering Line Diameter (Inch)	4.2	5.4	4.2	5.4
Oil & Gas Gathering Line Miles	49,264	117,237	9,853	6,170
Oil & Gas Gathering Line Diameter (Inch)	5.7	6.8	5.7	6.8
Gas Processing Plant Capacity (Bcfd)	20.7	41.1	4.1	2.2
Gas Processing Plant Compressor (1000 HP)	2,070	4,112	414	216
NGL Fractionation Capacity (MBOE/d)	1,520	3,898	304	205
Oil, Gas, and NGL Pipelines				
Oil Line Miles	10,718	6,358	2,144	335
Oil Line Diameter (Inch)	19.4	28.6	19.4	28.6
Pump for Oil Lines (1000 HP)	1,644	1,478	329	78
NGL Line Miles	13,696	10,121	2,739	533
NGL Line Diameter (Inch)	15.8	14.4	15.8	14.4
Pump for NGL Lines (1000 HP)	385	337	77	18
Gas Line Miles	6,666	39,874	1,333	2,099
Gas Line Diameter (Inch)	24.2	22.9	24.2	22.9
Compressor for Gas Lines (1000 HP)	468	281	468	281
Oil, Gas, and NGL Line Miles	31,080	56,352	6,216	2,966
Oil, Gas, and NGL Line Diameter (Inch)	18.9	22.1	18.9	22.1
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	136,640	94,271	27,328	4,962
Gas Storage Capacity (Bcf)	358	592	72	31
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	3,070	3,653	614	192
Oil Product Pipeline Diameter (Inch)	12.7	13.8	12.7	13.8
Oil Product Pipeline Pump (1000 HP)	544	647	109	34
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	1,365	146	273	8
Export Terminals				
LNG Export Capacity (Bcfd)	1.4	20.2	0.3	1.1
NGL Export Capacity (MBOE/d)	766.7	1,443.6	153.3	76.0

Exhibit 68: Alaska (Base Case) - New Infrastructure

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	25	53	5	3
Oil Well Completions	490	741	98	39
Total Well Completions	515	793	103	42
Gas Production (Bcfd)	0.9	0.8	0.9	0.8
Crude Oil Production (MMBbl/d)	0.48	0.34	0.48	0.34
NGL Production (MMBbl/d)	0.02	0.02	0.02	0.02
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	64	83	13	4
Gas Gathering Line Diameter (Inch)	11.3	14.5	11.3	14.5
Gas Gathering Line Compressor (1000 HP)	0	1	0	0
Oil Gathering Line Miles	122	185	24	10
Oil Gathering Line Diameter (Inch)	8.0	8.0	8.0	8.0
Oil & Gas Gathering Line Miles	186	268	37	14
Oil & Gas Gathering Line Diameter (Inch)	9.1	10.0	9.1	10.0
Gas Processing Plant Capacity (Bcfd)	0.0	0.0	0.0	0.0
Gas Processing Plant Compressor (1000 HP)	3	1	1	0
NGL Fractionation Capacity (MBOE/d)	3	0	1	0
Oil, Gas, and NGL Pipelines				
Oil Line Miles	2	0	0	0
Oil Line Diameter (Inch)	0.0	18.0	0.0	18.0
Pump for Oil Lines (1000 HP)	0	0	0	0
NGL Line Miles	0	0	0	0
NGL Line Diameter (Inch)	0.0	0.0	0.0	0.0
Pump for NGL Lines (1000 HP)	0	0	0	0
Gas Line Miles	1	0	0	0
Gas Line Diameter (Inch)	30.0	30.0	30.0	30.0
Compressor for Gas Lines (1000 HP)	0	0	0	0
Oil, Gas, and NGL Line Miles	2	0	0	0
Oil, Gas, and NGL Line Diameter (Inch)	15.1	30.0	15.1	30.0
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	283	0	57	0
Gas Storage Capacity (Bcf)	0	0	0	0
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	10	7	2	0
Oil Product Pipeline Diameter (Inch)	8.8	9.4	8.8	9.4
Oil Product Pipeline Pump (1000 HP)	2	1	0	0
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	0	0	0	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 69: Alaska (High Case) - New Infrastructure

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	25	23	5	1
Oil Well Completions	490	571	98	30
Total Well Completions	515	594	103	31
Gas Production (Bcfd)	0.9	0.8	0.9	0.8
Crude Oil Production (MMBbl/d)	0.48	0.59	0.48	0.59
NGL Production (MMBbl/d)	0.02	0.02	0.02	0.02
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	64	61	13	3
Gas Gathering Line Diameter (Inch)	11.3	16.0	11.3	16.0
Gas Gathering Line Compressor (1000 HP)	0	1	0	0
Oil Gathering Line Miles	122	143	24	8
Oil Gathering Line Diameter (Inch)	8.0	8.0	8.0	8.0
Oil & Gas Gathering Line Miles	186	204	37	11
Oil & Gas Gathering Line Diameter (Inch)	9.1	10.4	9.1	10.4
Gas Processing Plant Capacity (Bcfd)	0.0	0.0	0.0	0.0
Gas Processing Plant Compressor (1000 HP)	3	1	1	0
NGL Fractionation Capacity (MBOE/d)	3	0	1	0
Oil, Gas, and NGL Pipelines				
Oil Line Miles	2	0	0	0
Oil Line Diameter (Inch)	0.0	18.0	0.0	18.0
Pump for Oil Lines (1000 HP)	0	0	0	0
NGL Line Miles	0	0	0	0
NGL Line Diameter (Inch)	0.0	0.0	0.0	0.0
Pump for NGL Lines (1000 HP)	0	0	0	0
Gas Line Miles	1	0	0	0
Gas Line Diameter (Inch)	30.0	30.0	30.0	30.0
Compressor for Gas Lines (1000 HP)	0	0	0	0
Oil, Gas, and NGL Line Miles	2	0	0	0
Oil, Gas, and NGL Line Diameter (Inch)	15.1	30.0	15.1	30.0
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	283	0	57	0
Gas Storage Capacity (Bcf)	0	0	0	0
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	10	12	2	1
Oil Product Pipeline Diameter (Inch)	8.8	9.4	8.8	9.4
Oil Product Pipeline Pump (1000 HP)	2	2	0	0
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	0	0	0	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 70: Central (Base Case) - New Infrastructure

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	6,973	20,588	1,395	1,084
Oil Well Completions	38,290	69,050	7,658	3,634
Total Well Completions	45,262	89,638	9,052	4,718
Gas Production (Bcfd)	15.4	15.7	15.4	15.7
Crude Oil Production (MMBbl/d)	1.82	1.72	1.82	1.72
NGL Production (MMBbl/d)	0.57	0.74	0.57	0.74
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	8,496	13,769	1,699	725
Gas Gathering Line Diameter (Inch)	6.9	8.7	6.9	8.7
Gas Gathering Line Compressor (1000 HP)	286	303	57	16
Oil Gathering Line Miles	5,155	12,361	1,031	651
Oil Gathering Line Diameter (Inch)	4.4	4.7	4.4	4.7
Oil & Gas Gathering Line Miles	13,650	26,130	2,730	1,375
Oil & Gas Gathering Line Diameter (Inch)	5.9	6.8	5.9	6.8
Gas Processing Plant Capacity (Bcfd)	2.4	1.6	0.5	0.1
Gas Processing Plant Compressor (1000 HP)	242	162	48	9
NGL Fractionation Capacity (MBOE/d)	172	161	34	8
Oil, Gas, and NGL Pipelines				
Oil Line Miles	3,078	2,004	616	105
Oil Line Diameter (Inch)	17.6	30.3	17.6	30.3
Pump for Oil Lines (1000 HP)	323	313	65	16
NGL Line Miles	1,678	93	336	5
NGL Line Diameter (Inch)	12.7	12.5	12.7	12.5
Pump for NGL Lines (1000 HP)	93	21	19	1
Gas Line Miles	1,047	1,368	209	72
Gas Line Diameter (Inch)	15.9	21.7	15.9	21.7
Compressor for Gas Lines (1000 HP)	31	40	31	40
Oil, Gas, and NGL Line Miles	5,804	3,466	1,161	182
Oil, Gas, and NGL Line Diameter (Inch)	15.9	26.4	15.9	26.4
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	46,104	30	9,221	2
Gas Storage Capacity (Bcf)	87	54	17	3
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	988	278	198	15
Oil Product Pipeline Diameter (Inch)	9.9	9.9	9.9	9.9
Oil Product Pipeline Pump (1000 HP)	175	49	35	3
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	160	0	32	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 71: Central (High Case) - New Infrastructure

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	6,973	20,913	1,395	1,101
Oil Well Completions	38,290	74,350	7,658	3,913
Total Well Completions	45,262	95,263	9,052	5,014
Gas Production (Bcfd)	15.4	16.9	15.4	16.9
Crude Oil Production (MMBbl/d)	1.82	2.15	1.82	2.15
NGL Production (MMBbl/d)	0.57	0.81	0.57	0.81
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	8,496	14,722	1,699	775
Gas Gathering Line Diameter (Inch)	6.9	8.8	6.9	8.8
Gas Gathering Line Compressor (1000 HP)	286	437	57	23
Oil Gathering Line Miles	5,155	13,095	1,031	689
Oil Gathering Line Diameter (Inch)	4.4	4.9	4.4	4.9
Oil & Gas Gathering Line Miles	13,650	27,816	2,730	1,464
Oil & Gas Gathering Line Diameter (Inch)	5.9	7.0	5.9	7.0
Gas Processing Plant Capacity (Bcfd)	2.4	2.7	0.5	0.1
Gas Processing Plant Compressor (1000 HP)	242	269	48	14
NGL Fractionation Capacity (MBOE/d)	172	166	34	9
Oil, Gas, and NGL Pipelines				
Oil Line Miles	3,078	2,641	616	139
Oil Line Diameter (Inch)	17.6	28.5	17.6	28.5
Pump for Oil Lines (1000 HP)	323	361	65	19
NGL Line Miles	1,678	128	336	7
NGL Line Diameter (Inch)	12.7	12.5	12.7	12.5
Pump for NGL Lines (1000 HP)	93	21	19	1
Gas Line Miles	1,047	2,410	209	127
Gas Line Diameter (Inch)	15.9	22.1	15.9	22.1
Compressor for Gas Lines (1000 HP)	31	44	31	44
Oil, Gas, and NGL Line Miles	5,804	5,178	1,161	273
Oil, Gas, and NGL Line Diameter (Inch)	15.9	25.2	15.9	25.2
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	46,104	20,617	9,221	1,085
Gas Storage Capacity (Bcf)	87	79	17	4
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	988	501	198	26
Oil Product Pipeline Diameter (Inch)	9.9	9.9	9.9	9.9
Oil Product Pipeline Pump (1000 HP)	175	89	35	5
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	160	0	32	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 72: Midwest (Base Case) - New Infrastructure

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	109	637	22	34
Oil Well Completions	2,402	763	480	40
Total Well Completions	2,510	1,400	502	74
Gas Production (Bcfd)	0.3	0.3	0.3	0.3
Crude Oil Production (MMBbl/d)	0.04	0.01	0.04	0.01
NGL Production (MMBbl/d)	0.05	0.04	0.05	0.04
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	487	220	97	12
Gas Gathering Line Diameter (Inch)	3.8	6.7	3.8	6.7
Gas Gathering Line Compressor (1000 HP)	5	32	1	2
Oil Gathering Line Miles	0	0	0	0
Oil Gathering Line Diameter (Inch)	0.0	0.0	0.0	0.0
Oil & Gas Gathering Line Miles	487	220	97	12
Oil & Gas Gathering Line Diameter (Inch)	3.8	6.7	3.8	6.7
Gas Processing Plant Capacity (Bcfd)	0.0	0.2	0.0	0.0
Gas Processing Plant Compressor (1000 HP)	5	16	1	1
NGL Fractionation Capacity (MBOE/d)	142	360	28	19
Oil, Gas, and NGL Pipelines				
Oil Line Miles	994	817	199	43
Oil Line Diameter (Inch)	29.9	20.6	29.9	20.6
Pump for Oil Lines (1000 HP)	626	125	125	7
NGL Line Miles	1,734	194	347	10
NGL Line Diameter (Inch)	13.5	10.4	13.5	10.4
Pump for NGL Lines (1000 HP)	75	99	15	5
Gas Line Miles	606	3,723	121	196
Gas Line Diameter (Inch)	24.9	24.2	24.9	24.2
Compressor for Gas Lines (1000 HP)	0	10	0	10
Oil, Gas, and NGL Line Miles	3,334	4,734	667	249
Oil, Gas, and NGL Line Diameter (Inch)	20.5	23.0	20.5	23.0
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	1,810	0	362	0
Gas Storage Capacity (Bcf)	0	62	0	3
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	689	215	138	11
Oil Product Pipeline Diameter (Inch)	11.3	11.0	11.3	11.0
Oil Product Pipeline Pump (1000 HP)	122	38	24	2
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	350	0	70	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 73: Midwest (High Case) - New Infrastructure

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	109	650	22	34
Oil Well Completions	2,402	989	480	52
Total Well Completions	2,510	1,639	502	86
Gas Production (Bcfd)	0.3	0.3	0.3	0.3
Crude Oil Production (MMBbl/d)	0.04	0.01	0.04	0.01
NGL Production (MMBbl/d)	0.05	0.04	0.05	0.04
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	487	260	97	14
Gas Gathering Line Diameter (Inch)	3.8	6.2	3.8	6.2
Gas Gathering Line Compressor (1000 HP)	5	45	1	2
Oil Gathering Line Miles	0	0	0	0
Oil Gathering Line Diameter (Inch)	0.0	0.0	0.0	0.0
Oil & Gas Gathering Line Miles	487	260	97	14
Oil & Gas Gathering Line Diameter (Inch)	3.8	6.2	3.8	6.2
Gas Processing Plant Capacity (Bcfd)	0.0	0.2	0.0	0.0
Gas Processing Plant Compressor (1000 HP)	5	18	1	1
NGL Fractionation Capacity (MBOE/d)	142	587	28	31
Oil, Gas, and NGL Pipelines				
Oil Line Miles	994	993	199	52
Oil Line Diameter (Inch)	29.9	23.3	29.9	23.3
Pump for Oil Lines (1000 HP)	626	217	125	11
NGL Line Miles	1,734	1,034	347	54
NGL Line Diameter (Inch)	13.5	14.9	13.5	14.9
Pump for NGL Lines (1000 HP)	75	119	15	6
Gas Line Miles	606	6,110	121	322
Gas Line Diameter (Inch)	24.9	23.5	24.9	23.5
Compressor for Gas Lines (1000 HP)	0	35	0	35
Oil, Gas, and NGL Line Miles	3,334	8,137	667	428
Oil, Gas, and NGL Line Diameter (Inch)	20.5	22.4	20.5	22.4
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	1,810	219	362	12
Gas Storage Capacity (Bcf)	0	97	0	5
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	689	387	138	20
Oil Product Pipeline Diameter (Inch)	11.3	11.0	11.3	11.0
Oil Product Pipeline Pump (1000 HP)	122	69	24	4
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	350	0	70	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 74: Northeast (Base Case) - New Infrastructure

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	10,391	61,641	2,078	3,244
Oil Well Completions	3,788	7,110	758	374
Total Well Completions	14,179	68,751	2,836	3,618
Gas Production (Bcfd)	15.6	42.0	15.6	42.0
Crude Oil Production (MMBbl/d)	0.06	0.10	0.06	0.10
NGL Production (MMBbl/d)	0.28	1.47	0.28	1.47
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	2,201	6,669	440	351
Gas Gathering Line Diameter (Inch)	10.8	14.0	10.8	14.0
Gas Gathering Line Compressor (1000 HP)	1,356	5,236	271	276
Oil Gathering Line Miles	221	700	44	37
Oil Gathering Line Diameter (Inch)	4.0	4.0	4.0	4.0
Oil & Gas Gathering Line Miles	2,422	7,369	484	388
Oil & Gas Gathering Line Diameter (Inch)	10.2	13.0	10.2	13.0
Gas Processing Plant Capacity (Bcfd)	11.3	21.1	2.3	1.1
Gas Processing Plant Compressor (1000 HP)	1,129	2,111	226	111
NGL Fractionation Capacity (MBOE/d)	385	805	77	42
Oil, Gas, and NGL Pipelines				
Oil Line Miles	317	4	63	0
Oil Line Diameter (Inch)	31.9	18.0	31.9	18.0
Pump for Oil Lines (1000 HP)	97	0	19	0
NGL Line Miles	613	1,502	123	79
NGL Line Diameter (Inch)	19.1	14.8	19.1	14.8
Pump for NGL Lines (1000 HP)	5	27	1	1
Gas Line Miles	1,775	6,986	355	368
Gas Line Diameter (Inch)	26.8	25.2	26.8	25.2
Compressor for Gas Lines (1000 HP)	188	47	188	47
Oil, Gas, and NGL Line Miles	2,706	8,492	541	447
Oil, Gas, and NGL Line Diameter (Inch)	25.7	23.3	25.7	23.3
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	4,561	802	912	42
Gas Storage Capacity (Bcf)	24	46	5	2
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	228	53	46	3
Oil Product Pipeline Diameter (Inch)	16.4	16.0	16.4	16.0
Oil Product Pipeline Pump (1000 HP)	40	9	8	0
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	25	0	5	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.8	0.0	0.0
NGL Export Capacity (MBOE/d)	99.8	178.0	20.0	9.4

Exhibit 75: Northeast (High Case) - New Infrastructure

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	10,391	63,172	2,078	3,325
Oil Well Completions	3,788	12,489	758	657
Total Well Completions	14,179	75,661	2,836	3,982
Gas Production (Bcfd)	15.6	47.3	15.6	47.3
Crude Oil Production (MMBbl/d)	0.06	0.17	0.06	0.17
NGL Production (MMBbl/d)	0.28	1.78	0.28	1.78
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	2,201	7,305	440	384
Gas Gathering Line Diameter (Inch)	10.8	13.7	10.8	13.7
Gas Gathering Line Compressor (1000 HP)	1,356	7,660	271	403
Oil Gathering Line Miles	221	1,301	44	68
Oil Gathering Line Diameter (Inch)	4.0	4.4	4.0	4.4
Oil & Gas Gathering Line Miles	2,422	8,607	484	453
Oil & Gas Gathering Line Diameter (Inch)	10.2	12.3	10.2	12.3
Gas Processing Plant Capacity (Bcfd)	11.3	29.0	2.3	1.5
Gas Processing Plant Compressor (1000 HP)	1,129	2,900	226	153
NGL Fractionation Capacity (MBOE/d)	385	1,182	77	62
Oil, Gas, and NGL Pipelines				
Oil Line Miles	317	415	63	22
Oil Line Diameter (Inch)	31.9	40.6	31.9	40.6
Pump for Oil Lines (1000 HP)	97	473	19	25
NGL Line Miles	613	2,238	123	118
NGL Line Diameter (Inch)	19.1	15.2	19.1	15.2
Pump for NGL Lines (1000 HP)	5	33	1	2
Gas Line Miles	1,775	11,571	355	609
Gas Line Diameter (Inch)	26.8	24.1	26.8	24.1
Compressor for Gas Lines (1000 HP)	188	61	188	61
Oil, Gas, and NGL Line Miles	2,706	14,224	541	749
Oil, Gas, and NGL Line Diameter (Inch)	25.7	23.2	25.7	23.2
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	4,561	4,502	912	237
Gas Storage Capacity (Bcf)	24	66	5	3
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	228	96	46	5
Oil Product Pipeline Diameter (Inch)	16.4	16.0	16.4	16.0
Oil Product Pipeline Pump (1000 HP)	40	17	8	1
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	25	0	5	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.8	0.0	0.0
NGL Export Capacity (MBOE/d)	99.8	178.0	20.0	9.4

Exhibit 76: Offshore (Base Case) - New Infrastructure

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	153	320	31	17
Oil Well Completions	617	1,443	123	76
Total Well Completions	770	1,764	154	93
Gas Production (Bcfd)	3.8	3.6	3.8	3.6
Crude Oil Production (MMBbl/d)	0.00	0.00	0.00	0.00
NGL Production (MMBbl/d)	0.08	0.03	0.08	0.03
Offshore Platform Capacity (MBOE/d)	3,091	8,454	618	445
Gathering and Processing				
Gas Gathering Line Miles	115	193	23	10
Gas Gathering Line Diameter (Inch)	10.9	15.4	10.9	15.4
Gas Gathering Line Compressor (1000 HP)	1	3	0	0
Oil Gathering Line Miles	105	361	21	19
Oil Gathering Line Diameter (Inch)	4.9	7.3	4.9	7.3
Oil & Gas Gathering Line Miles	219	554	44	29
Oil & Gas Gathering Line Diameter (Inch)	8.1	10.1	8.1	10.1
Gas Processing Plant Capacity (Bcfd)	0.2	0.1	0.0	0.0
Gas Processing Plant Compressor (1000 HP)	17	6	3	0
NGL Fractionation Capacity (MBOE/d)	0	0	0	0
Oil, Gas, and NGL Pipelines				
Oil Line Miles	0	0	0	0
Oil Line Diameter (Inch)	0.0	0.0	0.0	0.0
Pump for Oil Lines (1000 HP)	0	0	0	0
NGL Line Miles	0	0	0	0
NGL Line Diameter (Inch)	0.0	0.0	0.0	0.0
Pump for NGL Lines (1000 HP)	0	0	0	0
Gas Line Miles	26	2	5	0
Gas Line Diameter (Inch)	30.0	30.0	30.0	30.0
Compressor for Gas Lines (1000 HP)	0	0	0	0
Oil, Gas, and NGL Line Miles	26	2	5	0
Oil, Gas, and NGL Line Diameter (Inch)	0.0	0.0	0.0	0.0
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	0	0	0	0
Gas Storage Capacity (Bcf)	0	0	0	0
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	0	0	0	0
Oil Product Pipeline Diameter (Inch)	0.0	0.0	0.0	0.0
Oil Product Pipeline Pump (1000 HP)	0	0	0	0
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	0	0	0	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 77: Offshore (High Case) - New Infrastructure

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	153	277	31	15
Oil Well Completions	617	1,326	123	70
Total Well Completions	770	1,603	154	84
Gas Production (Bcfd)	3.8	3.8	3.8	3.8
Crude Oil Production (MMBbl/d)	0.00	0.00	0.00	0.00
NGL Production (MMBbl/d)	0.08	0.04	0.08	0.04
Offshore Platform Capacity (MBOE/d)	3,091	9,728	618	512
Gathering and Processing				
Gas Gathering Line Miles	115	175	23	9
Gas Gathering Line Diameter (Inch)	10.9	15.3	10.9	15.3
Gas Gathering Line Compressor (1000 HP)	1	2	0	0
Oil Gathering Line Miles	105	331	21	17
Oil Gathering Line Diameter (Inch)	4.9	7.2	4.9	7.2
Oil & Gas Gathering Line Miles	219	506	44	27
Oil & Gas Gathering Line Diameter (Inch)	8.1	10.0	8.1	10.0
Gas Processing Plant Capacity (Bcfd)	0.2	0.1	0.0	0.0
Gas Processing Plant Compressor (1000 HP)	17	6	3	0
NGL Fractionation Capacity (MBOE/d)	0	0	0	0
Oil, Gas, and NGL Pipelines				
Oil Line Miles	0	0	0	0
Oil Line Diameter (Inch)	0.0	0.0	0.0	0.0
Pump for Oil Lines (1000 HP)	0	0	0	0
NGL Line Miles	0	0	0	0
NGL Line Diameter (Inch)	0.0	0.0	0.0	0.0
Pump for NGL Lines (1000 HP)	0	0	0	0
Gas Line Miles	26	2	5	0
Gas Line Diameter (Inch)	30.0	30.0	30.0	30.0
Compressor for Gas Lines (1000 HP)	0	0	0	0
Oil, Gas, and NGL Line Miles	26	2	5	0
Oil, Gas, and NGL Line Diameter (Inch)	0.0	0.0	0.0	0.0
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	0	0	0	0
Gas Storage Capacity (Bcf)	0	0	0	0
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	0	0	0	0
Oil Product Pipeline Diameter (Inch)	0.0	0.0	0.0	0.0
Oil Product Pipeline Pump (1000 HP)	0	0	0	0
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	0	0	0	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 78: Southeast (Base Case) - New Infrastructure

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	494	1,398	99	74
Oil Well Completions	754	1,355	151	71
Total Well Completions	1,248	2,753	250	145
Gas Production (Bcfd)	0.6	0.5	0.6	0.5
Crude Oil Production (MMBbl/d)	0.10	0.06	0.10	0.06
NGL Production (MMBbl/d)	0.00	0.00	0.00	0.00
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	250	521	50	27
Gas Gathering Line Diameter (Inch)	6.2	7.2	6.2	7.2
Gas Gathering Line Compressor (1000 HP)	1	2	0	0
Oil Gathering Line Miles	188	339	38	18
Oil Gathering Line Diameter (Inch)	4.4	4.0	4.4	4.0
Oil & Gas Gathering Line Miles	438	860	88	45
Oil & Gas Gathering Line Diameter (Inch)	5.4	5.9	5.4	5.9
Gas Processing Plant Capacity (Bcfd)	0.0	0.0	0.0	0.0
Gas Processing Plant Compressor (1000 HP)	2	1	0	0
NGL Fractionation Capacity (MBOE/d)	1	85	0	4
Oil, Gas, and NGL Pipelines				
Oil Line Miles	11	2	2	0
Oil Line Diameter (Inch)	18.0	18.0	18.0	18.0
Pump for Oil Lines (1000 HP)	0	0	0	0
NGL Line Miles	20	0	4	0
NGL Line Diameter (Inch)	8.0	0.0	8.0	0.0
Pump for NGL Lines (1000 HP)	0	17	0	1
Gas Line Miles	1,708	5,315	342	280
Gas Line Diameter (Inch)	24.5	24.2	24.5	24.2
Compressor for Gas Lines (1000 HP)	170	34	170	34
Oil, Gas, and NGL Line Miles	1,739	5,317	348	280
Oil, Gas, and NGL Line Diameter (Inch)	24.2	24.2	24.2	24.2
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	2,070	343	414	18
Gas Storage Capacity (Bcf)	85	66	17	3
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	295	193	59	10
Oil Product Pipeline Diameter (Inch)	23.5	23.4	23.5	23.4
Oil Product Pipeline Pump (1000 HP)	52	34	10	2
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	70	0	14	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.4	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 79: Southeast (High Case) - New Infrastructure

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	494	1,368	99	72
Oil Well Completions	754	2,172	151	114
Total Well Completions	1,248	3,540	250	186
Gas Production (Bcfd)	0.6	0.5	0.6	0.5
Crude Oil Production (MMBbl/d)	0.10	0.08	0.10	0.08
NGL Production (MMBbl/d)	0.00	0.00	0.00	0.00
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	250	675	50	36
Gas Gathering Line Diameter (Inch)	6.2	6.3	6.2	6.3
Gas Gathering Line Compressor (1000 HP)	1	2	0	0
Oil Gathering Line Miles	188	543	38	29
Oil Gathering Line Diameter (Inch)	4.4	4.0	4.4	4.0
Oil & Gas Gathering Line Miles	438	1,218	88	64
Oil & Gas Gathering Line Diameter (Inch)	5.4	5.3	5.4	5.3
Gas Processing Plant Capacity (Bcfd)	0.0	0.0	0.0	0.0
Gas Processing Plant Compressor (1000 HP)	2	1	0	0
NGL Fractionation Capacity (MBOE/d)	2	42	0	2
Oil, Gas, and NGL Pipelines				
Oil Line Miles	11	5	2	0
Oil Line Diameter (Inch)	18.0	18.0	18.0	18.0
Pump for Oil Lines (1000 HP)	0	0	0	0
NGL Line Miles	20	0	4	0
NGL Line Diameter (Inch)	8.0	0.0	8.0	0.0
Pump for NGL Lines (1000 HP)	0	17	0	1
Gas Line Miles	1,708	10,642	342	560
Gas Line Diameter (Inch)	24.5	22.8	24.5	22.8
Compressor for Gas Lines (1000 HP)	170	55	170	55
Oil, Gas, and NGL Line Miles	1,739	10,647	348	560
Oil, Gas, and NGL Line Diameter (Inch)	24.2	22.8	24.2	22.8
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	2,070	966	414	51
Gas Storage Capacity (Bcf)	85	111	17	6
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	295	347	59	18
Oil Product Pipeline Diameter (Inch)	23.5	23.4	23.5	23.4
Oil Product Pipeline Pump (1000 HP)	52	61	10	3
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	70	0	14	0
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.4	0.0	0.0
NGL Export Capacity (MBOE/d)	0.0	0.0	0.0	0.0

Exhibit 80: Southwest (Base Case) - New Infrastructure

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	20,380	66,386	4,076	3,494
Oil Well Completions	75,030	216,916	15,006	11,417
Total Well Completions	95,410	283,302	19,082	14,911
Gas Production (Bcfd)	33.0	34.0	33.0	34.0
Crude Oil Production (MMBbl/d)	5.18	6.19	5.18	6.19
NGL Production (MMBbl/d)	1.93	2.70	1.93	2.70
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	17,851	44,475	3,570	2,341
Gas Gathering Line Diameter (Inch)	6.3	6.7	6.3	6.7
Gas Gathering Line Compressor (1000 HP)	733	1,829	147	96
Oil Gathering Line Miles	10,768	16,472	2,154	867
Oil Gathering Line Diameter (Inch)	4.1	5.7	4.1	5.7
Oil & Gas Gathering Line Miles	28,619	60,947	5,724	3,208
Oil & Gas Gathering Line Diameter (Inch)	5.4	6.4	5.4	6.4
Gas Processing Plant Capacity (Bcfd)	6.7	5.6	1.3	0.3
Gas Processing Plant Compressor (1000 HP)	669	558	134	29
NGL Fractionation Capacity (MBOE/d)	814	1,269	163	67
Oil, Gas, and NGL Pipelines				
Oil Line Miles	6,314	1,247	1,263	66
Oil Line Diameter (Inch)	18.0	26.3	18.0	26.3
Pump for Oil Lines (1000 HP)	599	210	120	11
NGL Line Miles	9,648	3,879	1,930	204
NGL Line Diameter (Inch)	16.6	13.5	16.6	13.5
Pump for NGL Lines (1000 HP)	212	76	42	4
Gas Line Miles	1,199	3,195	240	168
Gas Line Diameter (Inch)	26.9	21.8	26.9	21.8
Compressor for Gas Lines (1000 HP)	113	58	113	58
Oil, Gas, and NGL Line Miles	17,161	8,320	3,432	438
Oil, Gas, and NGL Line Diameter (Inch)	17.9	18.6	17.9	18.6
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	81,485	19,942	16,297	1,050
Gas Storage Capacity (Bcf)	98	138	20	7
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	500	984	100	52
Oil Product Pipeline Diameter (Inch)	13.7	14.1	13.7	14.1
Oil Product Pipeline Pump (1000 HP)	89	174	18	9
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	212	0	42	0
Export Terminals				
LNG Export Capacity (Bcfd)	1.4	9.1	0.3	0.5
NGL Export Capacity (MBOE/d)	664.3	680.9	132.9	35.8

Exhibit 81: Southwest (High Case) - New Infrastructure

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	20,380	65,567	4,076	3,451
Oil Well Completions	75,030	282,729	15,006	14,880
Total Well Completions	95,410	348,297	19,082	18,331
Gas Production (Bcfd)	33.0	37.2	33.0	37.2
Crude Oil Production (MMBbl/d)	5.18	8.11	5.18	8.11
NGL Production (MMBbl/d)	1.93	3.06	1.93	3.06
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	17,851	55,414	3,570	2,917
Gas Gathering Line Diameter (Inch)	6.3	6.3	6.3	6.3
Gas Gathering Line Compressor (1000 HP)	733	2,472	147	130
Oil Gathering Line Miles	10,768	19,743	2,154	1,039
Oil Gathering Line Diameter (Inch)	4.1	5.7	4.1	5.7
Oil & Gas Gathering Line Miles	28,619	75,157	5,724	3,956
Oil & Gas Gathering Line Diameter (Inch)	5.4	6.2	5.4	6.2
Gas Processing Plant Capacity (Bcfd)	6.7	9.0	1.3	0.5
Gas Processing Plant Compressor (1000 HP)	669	903	134	48
NGL Fractionation Capacity (MBOE/d)	814	1,921	163	101
Oil, Gas, and NGL Pipelines				
Oil Line Miles	6,314	2,303	1,263	121
Oil Line Diameter (Inch)	18.0	28.7	18.0	28.7
Pump for Oil Lines (1000 HP)	599	428	120	23
NGL Line Miles	9,648	6,715	1,930	353
NGL Line Diameter (Inch)	16.6	14.2	16.6	14.2
Pump for NGL Lines (1000 HP)	212	147	42	8
Gas Line Miles	1,199	8,706	240	458
Gas Line Diameter (Inch)	26.9	21.3	26.9	21.3
Compressor for Gas Lines (1000 HP)	113	70	113	70
Oil, Gas, and NGL Line Miles	17,161	17,724	3,432	933
Oil, Gas, and NGL Line Diameter (Inch)	17.9	19.6	17.9	19.6
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	81,485	67,966	16,297	3,577
Gas Storage Capacity (Bcf)	98	237	20	12
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	500	1,654	100	87
Oil Product Pipeline Diameter (Inch)	13.7	14.2	13.7	14.2
Oil Product Pipeline Pump (1000 HP)	89	293	18	15
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	212	0	42	0
Export Terminals				
LNG Export Capacity (Bcfd)	1.4	19.1	0.3	1.0
NGL Export Capacity (MBOE/d)	664.3	1,264.5	132.9	66.6

Exhibit 82: Western (Base Case) - New Infrastructure

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	85	278	17	15
Oil Well Completions	7,296	8,754	1,459	461
Total Well Completions	7,381	9,032	1,476	475
Gas Production (Bcfd)	0.6	0.5	0.6	0.5
Crude Oil Production (MMBbl/d)	0.55	0.38	0.55	0.38
NGL Production (MMBbl/d)	0.04	0.04	0.04	0.04
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	1,432	1,538	286	81
Gas Gathering Line Diameter (Inch)	4.7	7.0	4.7	7.0
Gas Gathering Line Compressor (1000 HP)	6	17	1	1
Oil Gathering Line Miles	1,810	1,952	362	103
Oil Gathering Line Diameter (Inch)	4.0	4.8	4.0	4.8
Oil & Gas Gathering Line Miles	3,242	3,490	648	184
Oil & Gas Gathering Line Diameter (Inch)	4.3	5.8	4.3	5.8
Gas Processing Plant Capacity (Bcfd)	0.0	0.1	0.0	0.0
Gas Processing Plant Compressor (1000 HP)	4	11	1	1
NGL Fractionation Capacity (MBOE/d)	3	0	1	0
Oil, Gas, and NGL Pipelines				
Oil Line Miles	2	0	0	0
Oil Line Diameter (Inch)	0.0	18.0	0.0	18.0
Pump for Oil Lines (1000 HP)	0	0	0	0
NGL Line Miles	3	6	1	0
NGL Line Diameter (Inch)	14.0	14.0	14.0	14.0
Pump for NGL Lines (1000 HP)	0	0	0	0
Gas Line Miles	305	327	61	17
Gas Line Diameter (Inch)	22.2	21.5	22.2	21.5
Compressor for Gas Lines (1000 HP)	16	0	16	0
Oil, Gas, and NGL Line Miles	309	333	62	18
Oil, Gas, and NGL Line Diameter (Inch)	3.2	21.4	3.2	21.4
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	327	0	65	0
Gas Storage Capacity (Bcf)	65	0	13	0
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	360	363	72	19
Oil Product Pipeline Diameter (Inch)	10.5	11.9	10.5	11.9
Oil Product Pipeline Pump (1000 HP)	64	64	13	3
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	548	146	110	8
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	2.6	1.1	0.5	0.1

Exhibit 83: Western (High Case) - New Infrastructure

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Surface and Lease Equipment				
Gas Well Completions	85	236	17	12
Oil Well Completions	7,296	8,485	1,459	447
Total Well Completions	7,381	8,721	1,476	459
Gas Production (Bcfd)	0.6	0.5	0.6	0.5
Crude Oil Production (MMBbl/d)	0.55	0.44	0.55	0.44
NGL Production (MMBbl/d)	0.04	0.04	0.04	0.04
Offshore Platform Capacity (MBOE/d)	0	0	0	0
Gathering and Processing				
Gas Gathering Line Miles	1,432	1,522	286	80
Gas Gathering Line Diameter (Inch)	4.7	7.0	4.7	7.0
Gas Gathering Line Compressor (1000 HP)	6	18	1	1
Oil Gathering Line Miles	1,810	1,947	362	102
Oil Gathering Line Diameter (Inch)	4.0	4.9	4.0	4.9
Oil & Gas Gathering Line Miles	3,242	3,469	648	183
Oil & Gas Gathering Line Diameter (Inch)	4.3	5.8	4.3	5.8
Gas Processing Plant Capacity (Bcfd)	0.0	0.1	0.0	0.0
Gas Processing Plant Compressor (1000 HP)	4	12	1	1
NGL Fractionation Capacity (MBOE/d)	3	0	1	0
Oil, Gas, and NGL Pipelines				
Oil Line Miles	2	0	0	0
Oil Line Diameter (Inch)	0.0	18.0	0.0	18.0
Pump for Oil Lines (1000 HP)	0	0	0	0
NGL Line Miles	3	6	1	0
NGL Line Diameter (Inch)	14.0	14.0	14.0	14.0
Pump for NGL Lines (1000 HP)	0	0	0	0
Gas Line Miles	305	434	61	23
Gas Line Diameter (Inch)	22.2	22.5	22.2	22.5
Compressor for Gas Lines (1000 HP)	16	5	16	5
Oil, Gas, and NGL Line Miles	309	440	62	23
Oil, Gas, and NGL Line Diameter (Inch)	3.2	22.4	3.2	22.4
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	327	0	65	0
Gas Storage Capacity (Bcf)	65	3	13	0
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	360	654	72	34
Oil Product Pipeline Diameter (Inch)	10.5	11.9	10.5	11.9
Oil Product Pipeline Pump (1000 HP)	64	116	13	6
Crude Oil Rails Terminal Loading/Unloading Capacity (1000 BPD)	548	146	110	8
Export Terminals				
LNG Export Capacity (Bcfd)	0.0	0.0	0.0	0.0
NGL Export Capacity (MBOE/d)	2.6	1.1	0.5	0.1

Enhancement, Upgrade, Replacement, and Refurbishment (E/U/R/R)

Exhibit 84: U.S. (Base Case) - E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Gathering and Processing				
Gas Gathering Line Miles	31,162	90,276	6,232	4,751
Gas Gathering Line Diameter (Inch)	4.2	5.0	4.2	5.0
Gas Gathering Line Compressor (1000 HP)	2,734	10,520	547	554
Oil Gathering Line Miles	5,247	28,104	1,049	1,479
Oil Gathering Line Diameter (Inch)	3.6	4.4	3.6	4.4
Oil & Gas Gathering Line Miles	36,409	118,380	7,282	6,231
Oil & Gas Gathering Line Diameter (Inch)	4.1	4.9	4.1	4.9
Gas Processing Plant Capacity (Bcfd)	12.4	41.0	2.5	2.2
Gas Processing Plant Compressor (1000 HP)	533	1,982	107	104
NGL Fractionation Capacity (MBOE/d)	365	2,186	73	115
Oil, Gas, and NGL Pipelines				
Oil Line Miles	233	1,034	47	54
Oil Line Diameter (Inch)	21.5	21.6	21.5	21.6
Pump for Oil Lines (1000 HP)	207	1,090	41	57
NGL Line Miles	187	775	37	41
NGL Line Diameter (Inch)	16.0	24.4	16.0	24.4
Pump for NGL Lines (1000 HP)	106	470	21	25
Gas Line Miles	1,469	5,765	294	303
Gas Line Diameter (Inch)	19.4	19.7	19.4	19.7
Compressor for Gas Lines (1000 HP)	255	306	255	306
Oil, Gas, and NGL Line Miles	1,888	7,575	378	399
Oil, Gas, and NGL Line Diameter (Inch)	19.4	20.4	19.4	20.4
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	70,885	244,292	14,177	12,857
Gas Storage Capacity (Bcf)	194	783	39	41
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	4,590	14,815	918	780
Oil Product Pipeline Miles	291	1,133	58	60
Oil Product Pipeline Diameter (Inch)	12.9	12.9	12.9	12.9
Oil Product Pipeline Pump (1000 HP)	695	2,708	139	143

Exhibit 85: U.S. (High Case) - E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Gathering and Processing				
Gas Gathering Line Miles	31,162	93,202	6,232	4,905
Gas Gathering Line Diameter (Inch)	4.2	5.0	4.2	5.0
Gas Gathering Line Compressor (1000 HP)	2,734	11,454	547	603
Oil Gathering Line Miles	5,247	29,197	1,049	1,537
Oil Gathering Line Diameter (Inch)	3.6	4.4	3.6	4.4
Oil & Gas Gathering Line Miles	36,409	122,399	7,282	6,442
Oil & Gas Gathering Line Diameter (Inch)	4.1	4.9	4.1	4.9
Gas Processing Plant Capacity (Bcfd)	12.4	43.8	2.5	2.3
Gas Processing Plant Compressor (1000 HP)	533	2,106	107	111
NGL Fractionation Capacity (MBOE/d)	365	2,472	73	130
Oil, Gas, and NGL Pipelines				
Oil Line Miles	233	1,058	47	56
Oil Line Diameter (Inch)	21.5	21.8	21.5	21.8
Pump for Oil Lines (1000 HP)	207	1,215	41	64
NGL Line Miles	187	791	37	42
NGL Line Diameter (Inch)	16.0	27.7	16.0	27.7
Pump for NGL Lines (1000 HP)	106	480	21	25
Gas Line Miles	1,469	5,902	294	311
Gas Line Diameter (Inch)	19.4	19.8	19.4	19.8
Compressor for Gas Lines (1000 HP)	255	315	255	315
Oil, Gas, and NGL Line Miles	1,888	7,750	378	408
Oil, Gas, and NGL Line Diameter (Inch)	19.4	20.8	19.4	20.8
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	70,885	270,713	14,177	14,248
Gas Storage Capacity (Bcf)	194	800	39	42
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	4,590	16,198	918	853
Oil Product Pipeline Miles	291	1,155	58	61
Oil Product Pipeline Diameter (Inch)	12.9	12.9	12.9	12.9
Oil Product Pipeline Pump (1000 HP)	695	2,762	139	145

Exhibit 86: Alaska (Base Case) - E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Gathering and Processing				
Gas Gathering Line Miles	58	136	12	7
Gas Gathering Line Diameter (Inch)	7.1	8.6	7.1	8.6
Gas Gathering Line Compressor (1000 HP)	308	596	62	31
Oil Gathering Line Miles	38	185	8	10
Oil Gathering Line Diameter (Inch)	7.5	7.8	7.5	7.8
Oil & Gas Gathering Line Miles	96	320	19	17
Oil & Gas Gathering Line Diameter (Inch)	7.3	8.1	7.3	8.1
Gas Processing Plant Capacity (Bcfd)	1.4	2.7	0.3	0.1
Gas Processing Plant Compressor (1000 HP)	57	111	11	6
NGL Fractionation Capacity (MBOE/d)	0	0	0	0
Oil, Gas, and NGL Pipelines				
Oil Line Miles	11	41	2	2
Oil Line Diameter (Inch)	18.0	18.0	18.0	18.0
Pump for Oil Lines (1000 HP)	9	32	2	2
NGL Line Miles	0	0	0	0
NGL Line Diameter (Inch)	12.0	0.0	12.0	0.0
Pump for NGL Lines (1000 HP)	0	0	0	0
Gas Line Miles	4	17	1	1
Gas Line Diameter (Inch)	11.6	11.6	11.6	11.6
Compressor for Gas Lines (1000 HP)	0	0	0	0
Oil, Gas, and NGL Line Miles	15	58	3	3
Oil, Gas, and NGL Line Diameter (Inch)	16.2	16.2	16.2	16.2
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	1,875	4,349	375	229
Gas Storage Capacity (Bcf)	0	0	0	0
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	48	140	10	7
Oil Product Pipeline Miles	1	2	0	0
Oil Product Pipeline Diameter (Inch)	12.9	12.9	12.9	12.9
Oil Product Pipeline Pump (1000 HP)	1	5	0	0

Exhibit 87: Alaska (High Case) - E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Gathering and Processing				
Gas Gathering Line Miles	58	131	12	7
Gas Gathering Line Diameter (Inch)	7.1	8.6	7.1	8.6
Gas Gathering Line Compressor (1000 HP)	308	596	62	31
Oil Gathering Line Miles	38	176	8	9
Oil Gathering Line Diameter (Inch)	7.5	7.8	7.5	7.8
Oil & Gas Gathering Line Miles	96	308	19	16
Oil & Gas Gathering Line Diameter (Inch)	7.3	8.1	7.3	8.1
Gas Processing Plant Capacity (Bcfd)	1.4	2.7	0.3	0.1
Gas Processing Plant Compressor (1000 HP)	57	111	11	6
NGL Fractionation Capacity (MBOE/d)	0	0	0	0
Oil, Gas, and NGL Pipelines				
Oil Line Miles	11	41	2	2
Oil Line Diameter (Inch)	18.0	18.0	18.0	18.0
Pump for Oil Lines (1000 HP)	9	32	2	2
NGL Line Miles	0	0	0	0
NGL Line Diameter (Inch)	12.0	0.0	12.0	0.0
Pump for NGL Lines (1000 HP)	0	0	0	0
Gas Line Miles	4	17	1	1
Gas Line Diameter (Inch)	11.6	11.6	11.6	11.6
Compressor for Gas Lines (1000 HP)	0	0	0	0
Oil, Gas, and NGL Line Miles	15	58	3	3
Oil, Gas, and NGL Line Diameter (Inch)	16.2	16.2	16.2	16.2
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	1,875	4,349	375	229
Gas Storage Capacity (Bcf)	0	0	0	0
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	48	159	10	8
Oil Product Pipeline Miles	1	2	0	0
Oil Product Pipeline Diameter (Inch)	12.9	12.9	12.9	12.9
Oil Product Pipeline Pump (1000 HP)	1	5	0	0

Exhibit 88: Central (Base Case) - E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Gathering and Processing				
Gas Gathering Line Miles	7,749	23,772	1,550	1,251
Gas Gathering Line Diameter (Inch)	4.5	5.3	4.5	5.3
Gas Gathering Line Compressor (1000 HP)	556	1,551	111	82
Oil Gathering Line Miles	729	7,411	146	390
Oil Gathering Line Diameter (Inch)	4.1	4.5	4.1	4.5
Oil & Gas Gathering Line Miles	8,478	31,183	1,696	1,641
Oil & Gas Gathering Line Diameter (Inch)	4.5	5.1	4.5	5.1
Gas Processing Plant Capacity (Bcfd)	2.9	8.5	0.6	0.4
Gas Processing Plant Compressor (1000 HP)	110	331	22	17
NGL Fractionation Capacity (MBOE/d)	44	218	9	11
Oil, Gas, and NGL Pipelines				
Oil Line Miles	47	238	9	13
Oil Line Diameter (Inch)	24.5	24.4	24.5	24.4
Pump for Oil Lines (1000 HP)	40	246	8	13
NGL Line Miles	44	172	9	9
NGL Line Diameter (Inch)	13.0	15.6	13.0	15.6
Pump for NGL Lines (1000 HP)	20	82	4	4
Gas Line Miles	271	1,036	54	55
Gas Line Diameter (Inch)	16.2	16.3	16.2	16.3
Compressor for Gas Lines (1000 HP)	33	33	33	33
Oil, Gas, and NGL Line Miles	361	1,447	72	76
Oil, Gas, and NGL Line Diameter (Inch)	16.9	17.6	16.9	17.6
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	19,843	68,557	3,969	3,608
Gas Storage Capacity (Bcf)	21	90	4	5
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	318	1,016	64	53
Oil Product Pipeline Miles	65	252	13	13
Oil Product Pipeline Diameter (Inch)	12.9	12.9	12.9	12.9
Oil Product Pipeline Pump (1000 HP)	155	603	31	32

Exhibit 89: Central (High Case) - E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Gathering and Processing				
Gas Gathering Line Miles	7,749	23,969	1,550	1,262
Gas Gathering Line Diameter (Inch)	4.5	5.3	4.5	5.3
Gas Gathering Line Compressor (1000 HP)	556	1,602	111	84
Oil Gathering Line Miles	729	7,554	146	398
Oil Gathering Line Diameter (Inch)	4.1	4.6	4.1	4.6
Oil & Gas Gathering Line Miles	8,478	31,523	1,696	1,659
Oil & Gas Gathering Line Diameter (Inch)	4.5	5.1	4.5	5.1
Gas Processing Plant Capacity (Bcfd)	2.9	8.8	0.6	0.5
Gas Processing Plant Compressor (1000 HP)	110	341	22	18
NGL Fractionation Capacity (MBOE/d)	44	222	9	12
Oil, Gas, and NGL Pipelines				
Oil Line Miles	47	241	9	13
Oil Line Diameter (Inch)	24.5	24.4	24.5	24.4
Pump for Oil Lines (1000 HP)	40	249	8	13
NGL Line Miles	44	172	9	9
NGL Line Diameter (Inch)	13.0	15.6	13.0	15.6
Pump for NGL Lines (1000 HP)	20	82	4	4
Gas Line Miles	271	1,045	54	55
Gas Line Diameter (Inch)	16.2	16.4	16.2	16.4
Compressor for Gas Lines (1000 HP)	33	34	33	34
Oil, Gas, and NGL Line Miles	361	1,458	72	77
Oil, Gas, and NGL Line Diameter (Inch)	16.9	17.6	16.9	17.6
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	19,843	75,899	3,969	3,995
Gas Storage Capacity (Bcf)	21	92	4	5
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	318	1,153	64	61
Oil Product Pipeline Miles	65	255	13	13
Oil Product Pipeline Diameter (Inch)	12.9	12.9	12.9	12.9
Oil Product Pipeline Pump (1000 HP)	155	610	31	32

Exhibit 90: Midwest (Base Case) - E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Gathering and Processing				
Gas Gathering Line Miles	376	1,014	75	53
Gas Gathering Line Diameter (Inch)	5.0	5.0	5.0	5.0
Gas Gathering Line Compressor (1000 HP)	12	41	2	2
Oil Gathering Line Miles	0	0	0	0
Oil Gathering Line Diameter (Inch)	0.0	0.0	0.0	0.0
Oil & Gas Gathering Line Miles	376	1,014	75	53
Oil & Gas Gathering Line Diameter (Inch)	5.0	5.0	5.0	5.0
Gas Processing Plant Capacity (Bcfd)	0.7	1.5	0.1	0.1
Gas Processing Plant Compressor (1000 HP)	22	46	4	2
NGL Fractionation Capacity (MBOE/d)	13	183	3	10
Oil, Gas, and NGL Pipelines				
Oil Line Miles	38	164	8	9
Oil Line Diameter (Inch)	26.7	26.6	26.7	26.6
Pump for Oil Lines (1000 HP)	48	287	10	15
NGL Line Miles	19	98	4	5
NGL Line Diameter (Inch)	17.0	28.5	17.0	28.5
Pump for NGL Lines (1000 HP)	11	68	2	4
Gas Line Miles	202	795	40	42
Gas Line Diameter (Inch)	19.4	19.7	19.4	19.7
Compressor for Gas Lines (1000 HP)	35	45	35	45
Oil, Gas, and NGL Line Miles	259	1,056	52	56
Oil, Gas, and NGL Line Diameter (Inch)	20.3	21.6	20.3	21.6
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	1,029	2,960	206	156
Gas Storage Capacity (Bcf)	52	200	10	11
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	600	2,074	120	109
Oil Product Pipeline Miles	62	238	12	13
Oil Product Pipeline Diameter (Inch)	12.9	12.9	12.9	12.9
Oil Product Pipeline Pump (1000 HP)	147	570	29	30

Exhibit 91: Midwest (High Case) - E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Gathering and Processing				
Gas Gathering Line Miles	376	1,027	75	54
Gas Gathering Line Diameter (Inch)	5.0	5.0	5.0	5.0
Gas Gathering Line Compressor (1000 HP)	12	45	2	2
Oil Gathering Line Miles	0	0	0	0
Oil Gathering Line Diameter (Inch)	0.0	0.0	0.0	0.0
Oil & Gas Gathering Line Miles	376	1,027	75	54
Oil & Gas Gathering Line Diameter (Inch)	5.0	5.0	5.0	5.0
Gas Processing Plant Capacity (Bcfd)	0.7	1.5	0.1	0.1
Gas Processing Plant Compressor (1000 HP)	22	47	4	2
NGL Fractionation Capacity (MBOE/d)	13	249	3	13
Oil, Gas, and NGL Pipelines				
Oil Line Miles	38	166	8	9
Oil Line Diameter (Inch)	26.7	26.7	26.7	26.7
Pump for Oil Lines (1000 HP)	48	306	10	16
NGL Line Miles	19	106	4	6
NGL Line Diameter (Inch)	17.0	34.7	17.0	34.7
Pump for NGL Lines (1000 HP)	11	71	2	4
Gas Line Miles	202	815	40	43
Gas Line Diameter (Inch)	19.4	19.8	19.4	19.8
Compressor for Gas Lines (1000 HP)	35	46	35	46
Oil, Gas, and NGL Line Miles	259	1,087	52	57
Oil, Gas, and NGL Line Diameter (Inch)	20.3	22.3	20.3	22.3
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	1,029	3,050	206	161
Gas Storage Capacity (Bcf)	54	210	11	11
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	600	2,202	120	116
Oil Product Pipeline Miles	62	241	12	13
Oil Product Pipeline Diameter (Inch)	12.9	12.9	12.9	12.9
Oil Product Pipeline Pump (1000 HP)	147	576	29	30

Exhibit 92: Northeast (Base Case) - E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Gathering and Processing				
Gas Gathering Line Miles	4,364	10,858	873	571
Gas Gathering Line Diameter (Inch)	5.0	6.7	5.0	6.7
Gas Gathering Line Compressor (1000 HP)	375	4,188	75	220
Oil Gathering Line Miles	12	311	2	16
Oil Gathering Line Diameter (Inch)	4.0	4.0	4.0	4.0
Oil & Gas Gathering Line Miles	4,377	11,169	875	588
Oil & Gas Gathering Line Diameter (Inch)	5.0	6.6	5.0	6.6
Gas Processing Plant Capacity (Bcfd)	0.4	10.3	0.1	0.5
Gas Processing Plant Compressor (1000 HP)	48	651	10	34
NGL Fractionation Capacity (MBOE/d)	5	436	1	23
Oil, Gas, and NGL Pipelines				
Oil Line Miles	1	7	0	0
Oil Line Diameter (Inch)	30.0	30.5	30.0	30.5
Pump for Oil Lines (1000 HP)	3	22	1	1
NGL Line Miles	4	20	1	1
NGL Line Diameter (Inch)	16.3	16.5	16.3	16.5
Pump for NGL Lines (1000 HP)	3	18	1	1
Gas Line Miles	188	802	38	42
Gas Line Diameter (Inch)	20.6	21.3	20.6	21.3
Compressor for Gas Lines (1000 HP)	44	66	44	66
Oil, Gas, and NGL Line Miles	193	829	39	44
Oil, Gas, and NGL Line Diameter (Inch)	20.6	21.2	20.6	21.2
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	1,392	6,456	278	340
Gas Storage Capacity (Bcf)	20	77	4	4
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	288	973	58	51
Oil Product Pipeline Miles	25	94	5	5
Oil Product Pipeline Diameter (Inch)	12.9	12.9	12.9	12.9
Oil Product Pipeline Pump (1000 HP)	59	224	12	12

Exhibit 93: Northeast (High Case) - E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Gathering and Processing				
Gas Gathering Line Miles	4,364	10,994	873	579
Gas Gathering Line Diameter (Inch)	5.0	6.8	5.0	6.8
Gas Gathering Line Compressor (1000 HP)	375	4,830	75	254
Oil Gathering Line Miles	12	457	2	24
Oil Gathering Line Diameter (Inch)	4.0	4.1	4.0	4.1
Oil & Gas Gathering Line Miles	4,377	11,451	875	603
Oil & Gas Gathering Line Diameter (Inch)	5.0	6.6	5.0	6.6
Gas Processing Plant Capacity (Bcfd)	0.4	12.1	0.1	0.6
Gas Processing Plant Compressor (1000 HP)	48	729	10	38
NGL Fractionation Capacity (MBOE/d)	5	513	1	27
Oil, Gas, and NGL Pipelines				
Oil Line Miles	1	13	0	1
Oil Line Diameter (Inch)	30.0	33.8	30.0	33.8
Pump for Oil Lines (1000 HP)	3	99	1	5
NGL Line Miles	4	22	1	1
NGL Line Diameter (Inch)	16.3	17.2	16.3	17.2
Pump for NGL Lines (1000 HP)	3	19	1	1
Gas Line Miles	188	836	38	44
Gas Line Diameter (Inch)	20.6	21.3	20.6	21.3
Compressor for Gas Lines (1000 HP)	44	69	44	69
Oil, Gas, and NGL Line Miles	193	871	39	46
Oil, Gas, and NGL Line Diameter (Inch)	20.6	21.4	20.6	21.4
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	1,392	7,796	278	410
Gas Storage Capacity (Bcf)	20	77	4	4
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	288	1,042	58	55
Oil Product Pipeline Miles	25	94	5	5
Oil Product Pipeline Diameter (Inch)	12.9	12.9	12.9	12.9
Oil Product Pipeline Pump (1000 HP)	59	226	12	12

Exhibit 94: Offshore (Base Case) - E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Gathering and Processing				
Gas Gathering Line Miles	168	327	34	17
Gas Gathering Line Diameter (Inch)	5.7	7.5	5.7	7.5
Gas Gathering Line Compressor (1000 HP)	149	240	30	13
Oil Gathering Line Miles	41	221	8	12
Oil Gathering Line Diameter (Inch)	5.1	6.0	5.1	6.0
Oil & Gas Gathering Line Miles	209	548	42	29
Oil & Gas Gathering Line Diameter (Inch)	5.6	6.9	5.6	6.9
Gas Processing Plant Capacity (Bcfd)	0.0	0.0	0.0	0.0
Gas Processing Plant Compressor (1000 HP)	2	9	0	0
NGL Fractionation Capacity (MBOE/d)	0	0	0	0
Oil, Gas, and NGL Pipelines				
Oil Line Miles	11	44	2	2
Oil Line Diameter (Inch)	24.0	24.0	24.0	24.0
Pump for Oil Lines (1000 HP)	12	46	2	2
NGL Line Miles	0	0	0	0
NGL Line Diameter (Inch)	0.0	0.0	0.0	0.0
Pump for NGL Lines (1000 HP)	0	0	0	0
Gas Line Miles	9	35	2	2
Gas Line Diameter (Inch)	24.7	24.7	24.7	24.7
Compressor for Gas Lines (1000 HP)	2	2	2	2
Oil, Gas, and NGL Line Miles	20	79	4	4
Oil, Gas, and NGL Line Diameter (Inch)	24.3	24.3	24.3	24.3
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	0	0	0	0
Gas Storage Capacity (Bcf)	0	0	0	0
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	0	0	0	0
Oil Product Pipeline Diameter (Inch)	0.0	0.0	0.0	0.0
Oil Product Pipeline Pump (1000 HP)	0	0	0	0

Exhibit 95: Offshore (High Case) - E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Gathering and Processing				
Gas Gathering Line Miles	168	324	34	17
Gas Gathering Line Diameter (Inch)	5.7	7.4	5.7	7.4
Gas Gathering Line Compressor (1000 HP)	149	240	30	13
Oil Gathering Line Miles	41	217	8	11
Oil Gathering Line Diameter (Inch)	5.1	6.0	5.1	6.0
Oil & Gas Gathering Line Miles	209	541	42	28
Oil & Gas Gathering Line Diameter (Inch)	5.6	6.8	5.6	6.8
Gas Processing Plant Capacity (Bcfd)	0.0	0.0	0.0	0.0
Gas Processing Plant Compressor (1000 HP)	2	9	0	0
NGL Fractionation Capacity (MBOE/d)	0	0	0	0
Oil, Gas, and NGL Pipelines				
Oil Line Miles	11	44	2	2
Oil Line Diameter (Inch)	24.0	24.0	24.0	24.0
Pump for Oil Lines (1000 HP)	12	46	2	2
NGL Line Miles	0	0	0	0
NGL Line Diameter (Inch)	0.0	0.0	0.0	0.0
Pump for NGL Lines (1000 HP)	0	0	0	0
Gas Line Miles	9	35	2	2
Gas Line Diameter (Inch)	24.7	24.7	24.7	24.7
Compressor for Gas Lines (1000 HP)	2	2	2	2
Oil, Gas, and NGL Line Miles	20	79	4	4
Oil, Gas, and NGL Line Diameter (Inch)	24.3	24.3	24.3	24.3
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	0	0	0	0
Gas Storage Capacity (Bcf)	0	0	0	0
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	0	0	0	0
Oil Product Pipeline Miles	0	0	0	0
Oil Product Pipeline Diameter (Inch)	0.0	0.0	0.0	0.0
Oil Product Pipeline Pump (1000 HP)	0	0	0	0

Exhibit 96: Southeast (Base Case) - E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Gathering and Processing				
Gas Gathering Line Miles	457	1,054	91	55
Gas Gathering Line Diameter (Inch)	3.6	4.2	3.6	4.2
Gas Gathering Line Compressor (1000 HP)	27	49	5	3
Oil Gathering Line Miles	55	291	11	15
Oil Gathering Line Diameter (Inch)	3.8	4.1	3.8	4.1
Oil & Gas Gathering Line Miles	512	1,345	102	71
Oil & Gas Gathering Line Diameter (Inch)	3.6	4.1	3.6	4.1
Gas Processing Plant Capacity (Bcfd)	0.5	0.9	0.1	0.0
Gas Processing Plant Compressor (1000 HP)	18	36	4	2
NGL Fractionation Capacity (MBOE/d)	4	38	1	2
Oil, Gas, and NGL Pipelines				
Oil Line Miles	13	49	3	3
Oil Line Diameter (Inch)	18.0	18.0	18.0	18.0
Pump for Oil Lines (1000 HP)	10	38	2	2
NGL Line Miles	7	27	1	1
NGL Line Diameter (Inch)	8.0	8.0	8.0	8.0
Pump for NGL Lines (1000 HP)	3	12	1	1
Gas Line Miles	216	877	43	46
Gas Line Diameter (Inch)	21.3	21.6	21.3	21.6
Compressor for Gas Lines (1000 HP)	43	54	43	54
Oil, Gas, and NGL Line Miles	237	953	47	50
Oil, Gas, and NGL Line Diameter (Inch)	20.7	21.0	20.7	21.0
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	1,000	3,453	200	182
Gas Storage Capacity (Bcf)	15	65	3	3
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	263	768	53	40
Oil Product Pipeline Miles	35	136	7	7
Oil Product Pipeline Diameter (Inch)	12.9	12.9	12.9	12.9
Oil Product Pipeline Pump (1000 HP)	83	324	17	17

Exhibit 97: Southeast (High Case) - E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Gathering and Processing				
Gas Gathering Line Miles	457	1,092	91	57
Gas Gathering Line Diameter (Inch)	3.6	4.1	3.6	4.1
Gas Gathering Line Compressor (1000 HP)	27	49	5	3
Oil Gathering Line Miles	55	339	11	18
Oil Gathering Line Diameter (Inch)	3.8	4.1	3.8	4.1
Oil & Gas Gathering Line Miles	512	1,431	102	75
Oil & Gas Gathering Line Diameter (Inch)	3.6	4.1	3.6	4.1
Gas Processing Plant Capacity (Bcfd)	0.5	0.9	0.1	0.0
Gas Processing Plant Compressor (1000 HP)	18	36	4	2
NGL Fractionation Capacity (MBOE/d)	4	23	1	1
Oil, Gas, and NGL Pipelines				
Oil Line Miles	13	49	3	3
Oil Line Diameter (Inch)	18.0	18.0	18.0	18.0
Pump for Oil Lines (1000 HP)	10	38	2	2
NGL Line Miles	7	27	1	1
NGL Line Diameter (Inch)	8.0	8.0	8.0	8.0
Pump for NGL Lines (1000 HP)	3	12	1	1
Gas Line Miles	216	914	43	48
Gas Line Diameter (Inch)	21.3	21.6	21.3	21.6
Compressor for Gas Lines (1000 HP)	43	56	43	56
Oil, Gas, and NGL Line Miles	237	991	47	52
Oil, Gas, and NGL Line Diameter (Inch)	20.7	21.1	20.7	21.1
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	1,000	3,680	200	194
Gas Storage Capacity (Bcf)	15	67	3	4
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	263	873	53	46
Oil Product Pipeline Miles	35	138	7	7
Oil Product Pipeline Diameter (Inch)	12.9	12.9	12.9	12.9
Oil Product Pipeline Pump (1000 HP)	83	330	17	17

Exhibit 98: Southwest (Base Case) - E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Gathering and Processing				
Gas Gathering Line Miles	16,206	49,064	3,241	2,582
Gas Gathering Line Diameter (Inch)	4.0	4.7	4.0	4.7
Gas Gathering Line Compressor (1000 HP)	1,285	3,802	257	200
Oil Gathering Line Miles	3,051	15,661	610	824
Oil Gathering Line Diameter (Inch)	3.9	4.6	3.9	4.6
Oil & Gas Gathering Line Miles	19,257	64,725	3,851	3,407
Oil & Gas Gathering Line Diameter (Inch)	4.0	4.7	4.0	4.7
Gas Processing Plant Capacity (Bcfd)	6.4	16.6	1.3	0.9
Gas Processing Plant Compressor (1000 HP)	270	782	54	41
NGL Fractionation Capacity (MBOE/d)	293	1,298	59	68
Oil, Gas, and NGL Pipelines				
Oil Line Miles	98	443	20	23
Oil Line Diameter (Inch)	19.0	19.0	19.0	19.0
Pump for Oil Lines (1000 HP)	76	382	15	20
NGL Line Miles	112	457	22	24
NGL Line Diameter (Inch)	17.5	28.2	17.5	28.2
Pump for NGL Lines (1000 HP)	68	289	14	15
Gas Line Miles	457	1,743	91	92
Gas Line Diameter (Inch)	19.3	19.4	19.3	19.4
Compressor for Gas Lines (1000 HP)	74	81	74	81
Oil, Gas, and NGL Line Miles	667	2,643	133	139
Oil, Gas, and NGL Line Diameter (Inch)	18.9	20.8	18.9	20.8
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	43,638	153,578	8,728	8,083
Gas Storage Capacity (Bcf)	62	254	12	13
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	2,557	7,747	511	408
Oil Product Pipeline Miles	77	299	15	16
Oil Product Pipeline Diameter (Inch)	12.9	12.9	12.9	12.9
Oil Product Pipeline Pump (1000 HP)	184	716	37	38

Exhibit 99: Southwest (High Case) - E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Gathering and Processing				
Gas Gathering Line Miles	16,206	51,618	3,241	2,717
Gas Gathering Line Diameter (Inch)	4.0	4.7	4.0	4.7
Gas Gathering Line Compressor (1000 HP)	1,285	4,038	257	213
Oil Gathering Line Miles	3,051	16,438	610	865
Oil Gathering Line Diameter (Inch)	3.9	4.6	3.9	4.6
Oil & Gas Gathering Line Miles	19,257	68,056	3,851	3,582
Oil & Gas Gathering Line Diameter (Inch)	4.0	4.7	4.0	4.7
Gas Processing Plant Capacity (Bcfd)	6.4	17.4	1.3	0.9
Gas Processing Plant Compressor (1000 HP)	270	816	54	43
NGL Fractionation Capacity (MBOE/d)	293	1,452	59	76
Oil, Gas, and NGL Pipelines				
Oil Line Miles	98	456	20	24
Oil Line Diameter (Inch)	19.0	19.2	19.0	19.2
Pump for Oil Lines (1000 HP)	76	409	15	22
NGL Line Miles	112	462	22	24
NGL Line Diameter (Inch)	17.5	32.4	17.5	32.4
Pump for NGL Lines (1000 HP)	68	296	14	16
Gas Line Miles	457	1,778	91	94
Gas Line Diameter (Inch)	19.3	19.4	19.3	19.4
Compressor for Gas Lines (1000 HP)	74	83	74	83
Oil, Gas, and NGL Line Miles	667	2,696	133	142
Oil, Gas, and NGL Line Diameter (Inch)	18.9	21.6	18.9	21.6
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	43,638	170,999	8,728	9,000
Gas Storage Capacity (Bcf)	61	257	12	14
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	2,557	8,672	511	456
Oil Product Pipeline Miles	77	309	15	16
Oil Product Pipeline Diameter (Inch)	12.9	12.9	12.9	12.9
Oil Product Pipeline Pump (1000 HP)	184	739	37	39

Exhibit 100: Western (Base Case) - E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Gathering and Processing				
Gas Gathering Line Miles	1,784	4,053	357	213
Gas Gathering Line Diameter (Inch)	2.1	2.7	2.1	2.7
Gas Gathering Line Compressor (1000 HP)	23	54	5	3
Oil Gathering Line Miles	1,321	4,024	264	212
Oil Gathering Line Diameter (Inch)	2.5	3.2	2.5	3.2
Oil & Gas Gathering Line Miles	3,105	8,077	621	425
Oil & Gas Gathering Line Diameter (Inch)	2.3	3.0	2.3	3.0
Gas Processing Plant Capacity (Bcfd)	0.2	0.4	0.0	0.0
Gas Processing Plant Compressor (1000 HP)	7	16	1	1
NGL Fractionation Capacity (MBOE/d)	6	13	1	1
Oil, Gas, and NGL Pipelines				
Oil Line Miles	13	47	3	2
Oil Line Diameter (Inch)	18.0	18.0	18.0	18.0
Pump for Oil Lines (1000 HP)	10	37	2	2
NGL Line Miles	0	1	0	0
NGL Line Diameter (Inch)	14.0	14.0	14.0	14.0
Pump for NGL Lines (1000 HP)	0	0	0	0
Gas Line Miles	121	462	24	24
Gas Line Diameter (Inch)	22.0	22.1	22.0	22.1
Compressor for Gas Lines (1000 HP)	24	25	24	25
Oil, Gas, and NGL Line Miles	134	510	27	27
Oil, Gas, and NGL Line Diameter (Inch)	21.6	21.7	21.6	21.7
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	2,109	4,939	422	260
Gas Storage Capacity (Bcf)	25	97	5	5
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	515	2,097	103	110
Oil Product Pipeline Miles	28	111	6	6
Oil Product Pipeline Diameter (Inch)	12.9	12.9	12.9	12.9
Oil Product Pipeline Pump (1000 HP)	66	266	13	14

Exhibit 101: Western (High Case) - E/U/R/R

	Total 2012-2016	Total 2017-2035	Average 2012-2016	Average 2017-2035
Gathering and Processing				
Gas Gathering Line Miles	1,784	4,047	357	213
Gas Gathering Line Diameter (Inch)	2.1	2.7	2.1	2.7
Gas Gathering Line Compressor (1000 HP)	23	54	5	3
Oil Gathering Line Miles	1,321	4,017	264	211
Oil Gathering Line Diameter (Inch)	2.5	3.2	2.5	3.2
Oil & Gas Gathering Line Miles	3,105	8,063	621	424
Oil & Gas Gathering Line Diameter (Inch)	2.3	3.0	2.3	3.0
Gas Processing Plant Capacity (Bcfd)	0.2	0.4	0.0	0.0
Gas Processing Plant Compressor (1000 HP)	7	16	1	1
NGL Fractionation Capacity (MBOE/d)	6	13	1	1
Oil, Gas, and NGL Pipelines				
Oil Line Miles	13	47	3	2
Oil Line Diameter (Inch)	18.0	18.0	18.0	18.0
Pump for Oil Lines (1000 HP)	10	37	2	2
NGL Line Miles	0	1	0	0
NGL Line Diameter (Inch)	14.0	14.0	14.0	14.0
Pump for NGL Lines (1000 HP)	0	0	0	0
Gas Line Miles	121	463	24	24
Gas Line Diameter (Inch)	22.0	22.1	22.0	22.1
Compressor for Gas Lines (1000 HP)	24	25	24	25
Oil, Gas, and NGL Line Miles	134	511	27	27
Oil, Gas, and NGL Line Diameter (Inch)	21.6	21.7	21.6	21.7
Oil and Gas Storage				
Crude Oil Storage Capaciy (MBbl)	2,109	4,939	422	260
Gas Storage Capacity (Bcf)	24	96	5	5
Refining and Oil Products Transport				
Refining Capacity Enhancement (1000 BPD)	515	2,097	103	110
Oil Product Pipeline Miles	28	115	6	6
Oil Product Pipeline Diameter (Inch)	12.9	12.9	12.9	12.9
Oil Product Pipeline Pump (1000 HP)	66	276	13	15

Appendix C: Regional Capital Expenditures for Infrastructure Development

Exhibit 102: Total Capital Expenditure (Base Case), Millions of 2015$

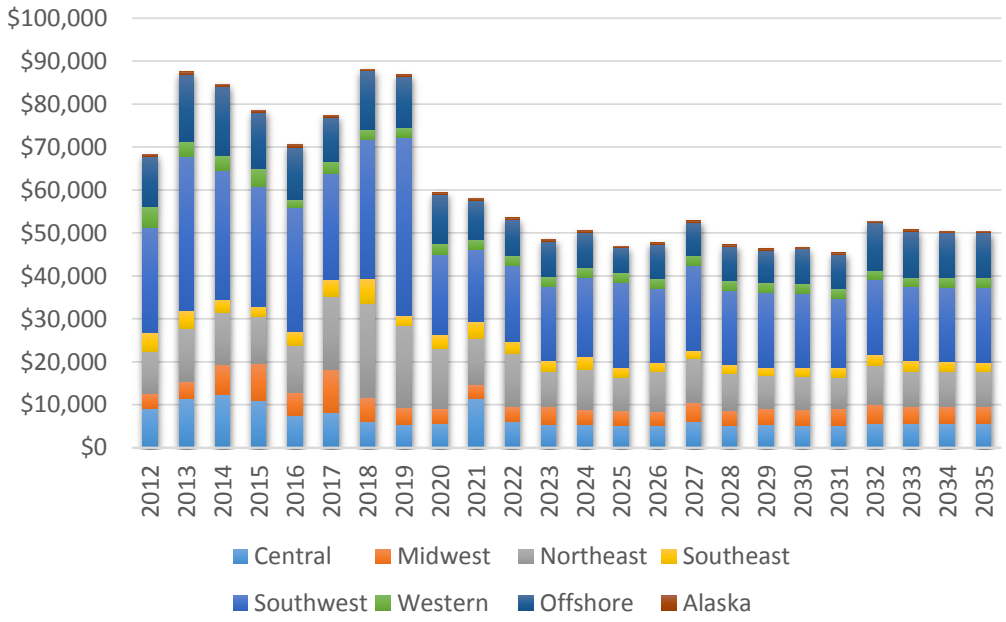


Exhibit 103: Total Capital Expenditures (High Case), Millions of 2015$

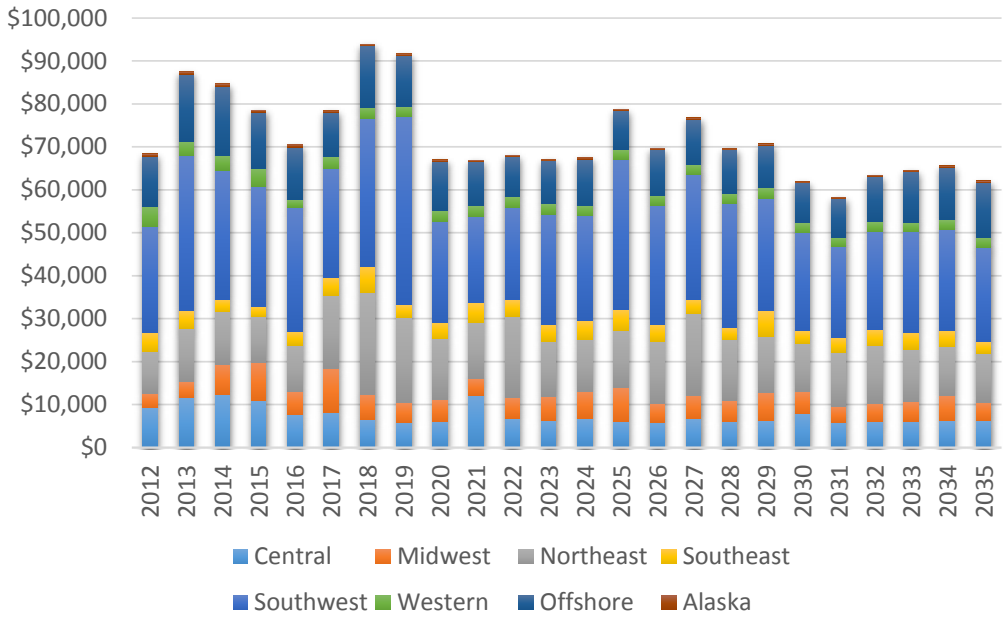


Exhibit 104: Total Capital Expenditure (Base Case), Millions of 2015$

Year	Central	Midwest	Northeast	Southeast	Southwest	Western	Offshore	Alaska	US
2012	$9,200	$3,494	$9,707	$4,342	$24,640	$4,824	$11,586	$582	$68,374
2013	$11,557	$3,805	$12,412	$4,097	$36,004	$3,400	$15,582	$611	$87,467
2014	$12,415	$6,957	$12,165	$3,059	$30,005	$3,333	$16,129	$600	$84,662
2015	$10,957	$8,800	$10,755	$2,371	$27,861	$4,347	$12,929	$578	$78,599
2016	$7,612	$5,353	$10,936	$3,121	$28,913	$1,810	$12,194	$590	$70,530
2017	$8,153	$10,159	$16,877	$4,096	$24,609	$2,765	$10,292	$419	$77,369
2018	$6,218	$5,419	$21,922	$5,756	$32,449	$2,318	$13,678	$411	$88,171
2019	$5,461	$3,943	$18,947	$2,365	$41,610	$2,168	$12,017	$398	$86,907
2020	$5,610	$3,422	$13,946	$3,316	$18,786	$2,571	$11,355	$390	$59,395
2021	$11,504	$3,210	$10,830	$3,909	$16,689	$2,322	$9,192	$387	$58,043
2022	$6,196	$3,270	$12,556	$2,767	$17,574	$2,308	$8,423	$379	$53,474
2023	$5,460	$4,148	$8,180	$2,449	$17,245	$2,346	$8,261	$374	$48,462
2024	$5,511	$3,345	$9,327	$3,132	$18,222	$2,347	$8,305	$370	$50,558
2025	$5,299	$3,273	$7,745	$2,445	$19,637	$2,352	$5,835	$363	$46,949
2026	$5,313	$3,100	$9,271	$2,182	$17,228	$2,275	$8,016	$356	$47,742
2027	$6,047	$4,436	$10,219	$1,961	$19,859	$2,277	$7,682	$348	$52,829
2028	$5,310	$3,438	$8,436	$2,138	$17,289	$2,275	$7,978	$340	$47,204
2029	$5,324	$3,918	$7,544	$1,940	$17,304	$2,364	$7,636	$335	$46,365
2030	$5,244	$3,564	$7,758	$2,146	$17,274	$2,260	$8,016	$327	$46,590
2031	$5,290	$3,874	$7,283	$2,190	$16,169	$2,194	$8,033	$318	$45,351
2032	$5,595	$4,492	$9,101	$2,403	$17,543	$2,200	$11,114	$313	$52,762
2033	$5,585	$3,993	$8,278	$2,382	$17,260	$2,203	$10,738	$309	$50,748
2034	$5,643	$4,080	$8,066	$2,279	$17,286	$2,247	$10,460	$305	$50,365
2035	$5,596	$4,075	$7,988	$2,280	$17,405	$2,297	$10,460	$300	$50,401
Total 2012-2016	**$51,740**	**$28,409**	**$55,974**	**$16,990**	**$147,424**	**$17,714**	**$68,420**	**$2,961**	**$389,633**
Total 2017-2035	**$114,358**	**$79,157**	**$204,273**	**$52,137**	**$381,438**	**$44,088**	**$177,490**	**$6,744**	**$1,059,686**
Average 2012-2016	**$10,348**	**$5,682**	**$11,195**	**$3,398**	**$29,485**	**$3,543**	**$13,684**	**$592**	**$77,927**
Average 2017-2035	**$6,019**	**$4,166**	**$10,751**	**$2,744**	**$20,076**	**$2,320**	**$9,342**	**$355**	**$55,773**

Exhibit 105: Total Capital Expenditures (High Case), Millions of 2015$

Year	Central	Midwest	Northeast	Southeast	Southwest	Western	Offshore	Alaska	US
2012	$9,200	$3,494	$9,706	$4,343	$24,640	$4,824	$11,586	$582	$68,374
2013	$11,557	$3,805	$12,411	$4,098	$36,004	$3,400	$15,582	$611	$87,467
2014	$12,415	$6,957	$12,164	$3,059	$30,005	$3,333	$16,129	$600	$84,662
2015	$10,957	$8,800	$10,754	$2,372	$27,861	$4,347	$12,929	$578	$78,599
2016	$7,612	$5,353	$10,936	$3,121	$28,913	$1,810	$12,194	$590	$70,530
2017	$8,206	$10,296	$17,022	$4,165	$25,212	$2,831	$10,292	$420	$78,445
2018	$6,571	$5,794	$23,705	$6,185	$34,395	$2,565	$14,295	$414	$93,924
2019	$5,832	$4,592	$19,942	$2,859	$43,861	$2,273	$11,899	$407	$91,665
2020	$6,178	$5,077	$14,069	$3,911	$23,319	$2,703	$11,346	$399	$67,001
2021	$12,154	$3,951	$13,053	$4,646	$20,057	$2,355	$10,362	$394	$66,972
2022	$6,805	$4,863	$18,956	$3,747	$21,478	$2,622	$9,213	$388	$68,072
2023	$6,194	$5,778	$12,816	$3,991	$25,523	$2,452	$9,967	$383	$67,104
2024	$6,858	$6,316	$12,134	$4,339	$24,319	$2,402	$10,802	$378	$67,547
2025	$6,182	$7,795	$13,272	$5,010	$34,765	$2,479	$8,942	$371	$78,817
2026	$5,942	$4,200	$14,552	$3,936	$27,845	$2,325	$10,516	$365	$69,682
2027	$6,703	$5,533	$18,898	$3,451	$29,009	$2,288	$10,536	$356	$76,774
2028	$5,996	$4,902	$14,172	$2,899	$28,861	$2,347	$10,109	$349	$69,635
2029	$6,301	$6,517	$13,020	$6,010	$26,227	$2,396	$9,897	$345	$70,712
2030	$7,948	$5,176	$11,253	$2,867	$22,752	$2,279	$9,322	$337	$61,934
2031	$5,972	$3,595	$12,648	$3,429	$21,181	$2,199	$8,919	$329	$58,273
2032	$6,109	$4,238	$13,329	$3,797	$22,905	$2,203	$10,482	$326	$63,389
2033	$6,160	$4,461	$12,328	$3,931	$23,342	$2,219	$11,796	$319	$64,558
2034	$6,229	$5,971	$11,300	$3,798	$23,484	$2,253	$12,253	$316	$65,603
2035	$6,339	$4,214	$11,447	$2,625	$22,005	$2,286	$12,839	$306	$62,060
Total 2012-2016	**$51,740**	**$28,409**	**$55,972**	**$16,992**	**$147,424**	**$17,714**	**$68,420**	**$2,961**	**$389,633**
Total 2017-2035	**$128,678**	**$103,268**	**$277,916**	**$75,598**	**$500,539**	**$45,479**	**$203,787**	**$6,902**	**$1,342,167**
Average 2012-2016	**$10,348**	**$5,682**	**$11,194**	**$3,398**	**$29,485**	**$3,543**	**$13,684**	**$592**	**$77,927**

Exhibit 106: Surface and Lease Equipment (Base Case), Millions of 2015$

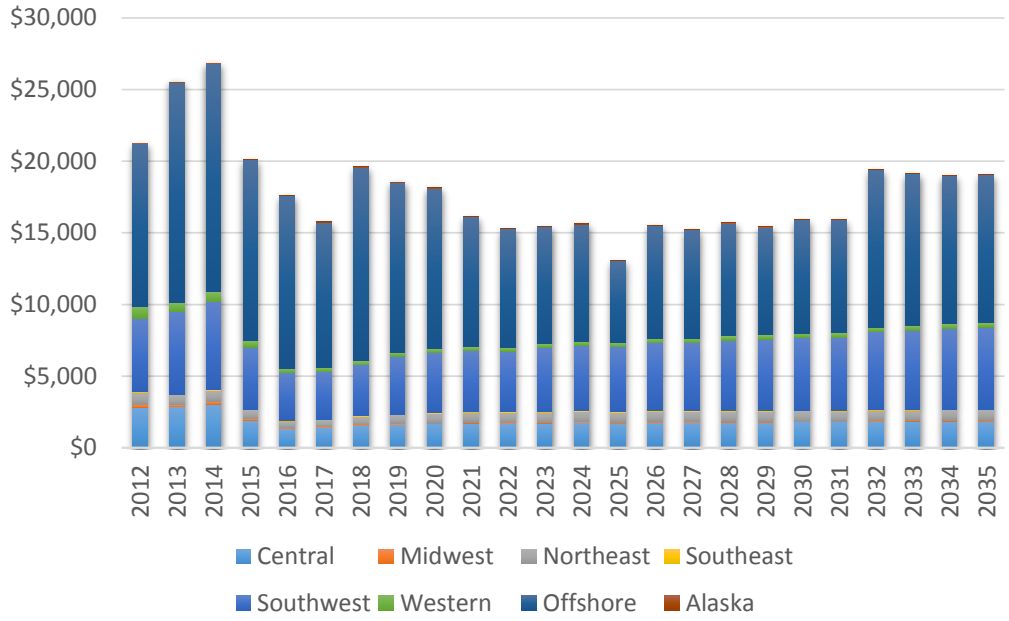


Exhibit 107: Surface and Lease Equipment (High Case), Millions of 2015$

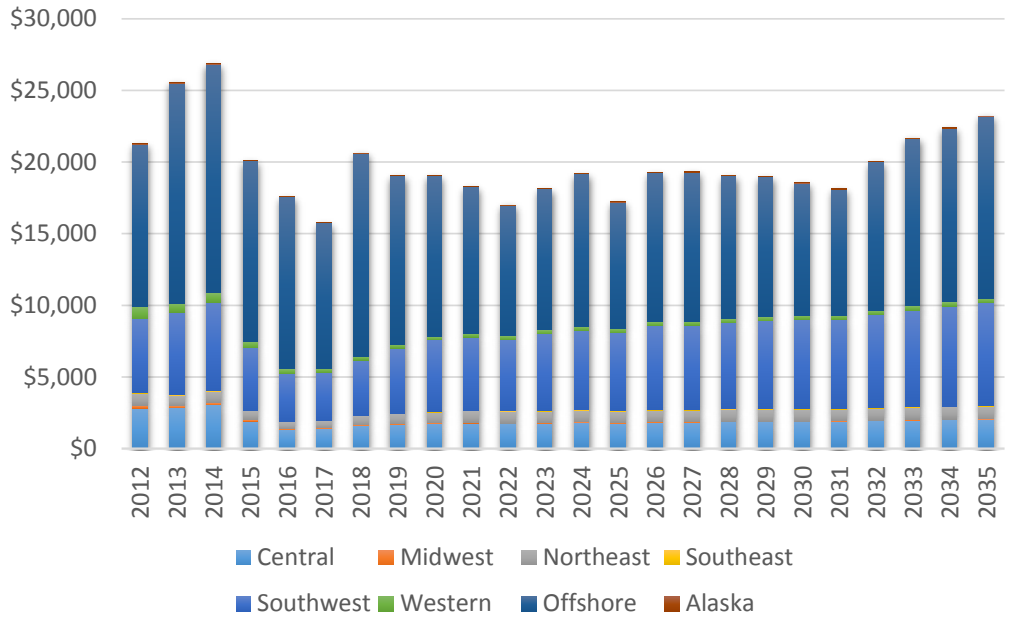


Exhibit 108: Surface and Lease Equipment (Base Case), Millions of 2015$

Year	Central	Midwest	Northeast	Southeast	Southwest	Western	Offshore	Alaska	US
2012	$2,835	$185	$848	$58	$5,113	$843	$11,353	$34	$21,270
2013	$2,839	$169	$680	$71	$5,761	$622	$15,353	$35	$25,531
2014	$3,052	$181	$730	$76	$6,167	$662	$15,935	$38	$26,840
2015	$1,918	$114	$612	$51	$4,328	$444	$12,633	$23	$20,124
2016	$1,329	$76	$456	$37	$3,345	$314	$12,037	$15	$17,611
2017	$1,387	$75	$480	$35	$3,332	$295	$10,152	$15	$15,772
2018	$1,548	$56	$575	$38	$3,556	$278	$13,531	$16	$19,599
2019	$1,614	$52	$641	$38	$4,032	$274	$11,877	$16	$18,544
2020	$1,667	$49	$674	$39	$4,223	$259	$11,214	$16	$18,140
2021	$1,727	$51	$705	$40	$4,256	$270	$9,060	$16	$16,125
2022	$1,691	$52	$717	$39	$4,236	$271	$8,292	$16	$15,315
2023	$1,719	$55	$716	$42	$4,457	$285	$8,132	$17	$15,422
2024	$1,743	$54	$721	$44	$4,581	$295	$8,177	$17	$15,633
2025	$1,712	$52	$707	$42	$4,532	$302	$5,716	$17	$13,079
2026	$1,765	$53	$721	$43	$4,736	$301	$7,891	$17	$15,528
2027	$1,760	$49	$720	$44	$4,765	$304	$7,559	$18	$15,220
2028	$1,783	$49	$718	$44	$4,912	$303	$7,854	$18	$15,681
2029	$1,786	$47	$715	$44	$4,984	$304	$7,515	$19	$15,414
2030	$1,801	$46	$716	$43	$5,103	$302	$7,900	$19	$15,929
2031	$1,803	$46	$709	$42	$5,114	$303	$7,917	$19	$15,952
2032	$1,848	$46	$728	$44	$5,451	$307	$10,985	$19	$19,429
2033	$1,858	$46	$732	$44	$5,529	$309	$10,611	$19	$19,149
2034	$1,862	$46	$736	$45	$5,643	$311	$10,333	$20	$18,995
2035	$1,852	$48	$742	$45	$5,735	$311	$10,332	$20	$19,085
Total 2012-2016	**$11,974**	**$726**	**$3,326**	**$294**	**$24,714**	**$2,886**	**$67,311**	**$145**	**$111,375**
Total 2017-2035	**$32,926**	**$970**	**$13,173**	**$795**	**$89,178**	**$5,584**	**$175,049**	**$335**	**$318,010**
Average 2012-2016	**$2,395**	**$145**	**$665**	**$59**	**$4,943**	**$577**	**$13,462**	**$29**	**$22,275**
Average 2017-2035	**$1,733**	**$51**	**$693**	**$42**	**$4,694**	**$294**	**$9,213**	**$18**	**$16,737**

Exhibit 109: Surface and Lease Equipment (High Case), Millions of 2015$

Year	Central	Midwest	Northeast	Southeast	Southwest	Western	Offshore	Alaska	US
2012	$2,835	$185	$848	$58	$5,113	$843	$11,353	$34	$21,270
2013	$2,839	$169	$680	$71	$5,761	$622	$15,353	$35	$25,531
2014	$3,052	$181	$730	$76	$6,167	$662	$15,935	$38	$26,840
2015	$1,918	$114	$612	$51	$4,328	$444	$12,633	$23	$20,124
2016	$1,329	$76	$456	$37	$3,345	$314	$12,037	$15	$17,611
2017	$1,387	$75	$480	$35	$3,332	$295	$10,152	$15	$15,772
2018	$1,613	$58	$611	$41	$3,848	$280	$14,149	$16	$20,615
2019	$1,683	$54	$696	$44	$4,531	$275	$11,763	$15	$19,061
2020	$1,747	$51	$745	$48	$4,985	$260	$11,210	$15	$19,060
2021	$1,789	$54	$775	$49	$5,106	$271	$10,231	$15	$18,291
2022	$1,736	$56	$780	$48	$4,993	$271	$9,086	$15	$16,984
2023	$1,771	$61	$784	$53	$5,345	$283	$9,840	$15	$18,152
2024	$1,799	$59	$788	$56	$5,535	$292	$10,675	$15	$19,219
2025	$1,755	$56	$775	$55	$5,437	$300	$8,821	$15	$17,215
2026	$1,824	$58	$798	$56	$5,825	$299	$10,392	$15	$19,267
2027	$1,834	$53	$804	$57	$5,840	$302	$10,413	$15	$19,317
2028	$1,857	$53	$807	$57	$5,999	$300	$9,988	$15	$19,076
2029	$1,863	$51	$811	$57	$6,123	$302	$9,777	$15	$18,999
2030	$1,887	$48	$819	$55	$6,201	$299	$9,210	$15	$18,534
2031	$1,889	$48	$816	$54	$6,200	$303	$8,809	$15	$18,134
2032	$1,940	$48	$835	$55	$6,469	$306	$10,367	$16	$20,036
2033	$1,973	$48	$852	$56	$6,729	$309	$11,678	$16	$21,661
2034	$1,997	$49	$865	$57	$6,962	$311	$12,132	$16	$22,388
2035	$2,011	$52	$882	$58	$7,171	$311	$12,716	$16	$23,218
Total 2012-2016	**$11,974**	**$726**	**$3,326**	**$294**	**$24,714**	**$2,886**	**$67,311**	**$145**	**$111,375**
Total 2017-2035	**$34,353**	**$1,032**	**$14,722**	**$991**	**$106,634**	**$5,569**	**$201,409**	**$288**	**$364,997**
Average 2012-2016	**$2,395**	**$145**	**$665**	**$59**	**$4,943**	**$577**	**$13,462**	**$29**	**$22,275**
Average 2017-2035	**$1,808**	**$54**	**$775**	**$52**	**$5,612**	**$293**	**$10,600**	**$15**	**$19,210**

Exhibit 110: Gathering and Processing (Base Case), Millions of 2015$

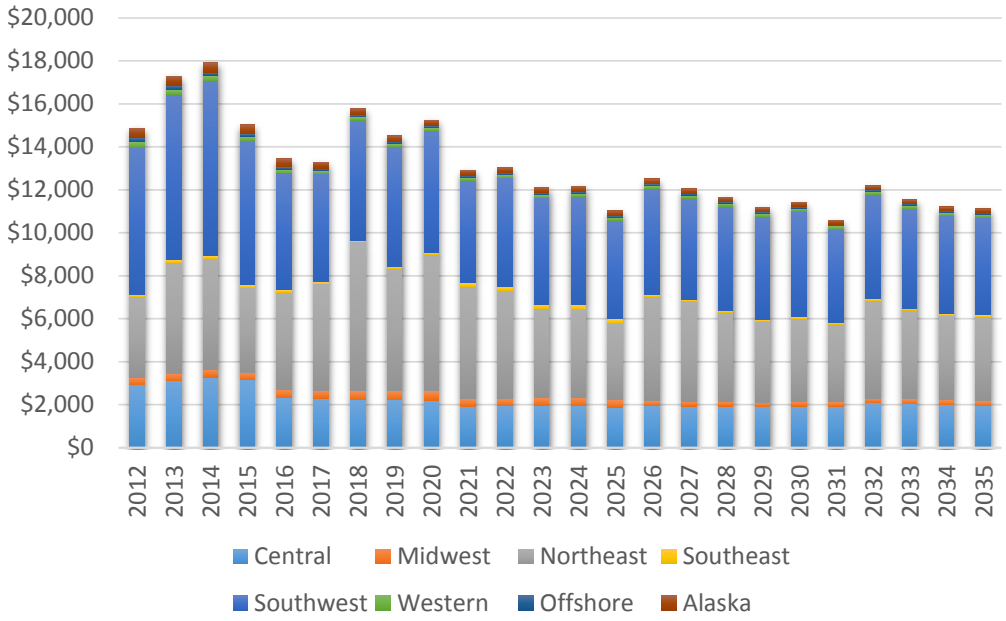


Exhibit 111: Gathering and Processing (High Case), Millions of 2015$

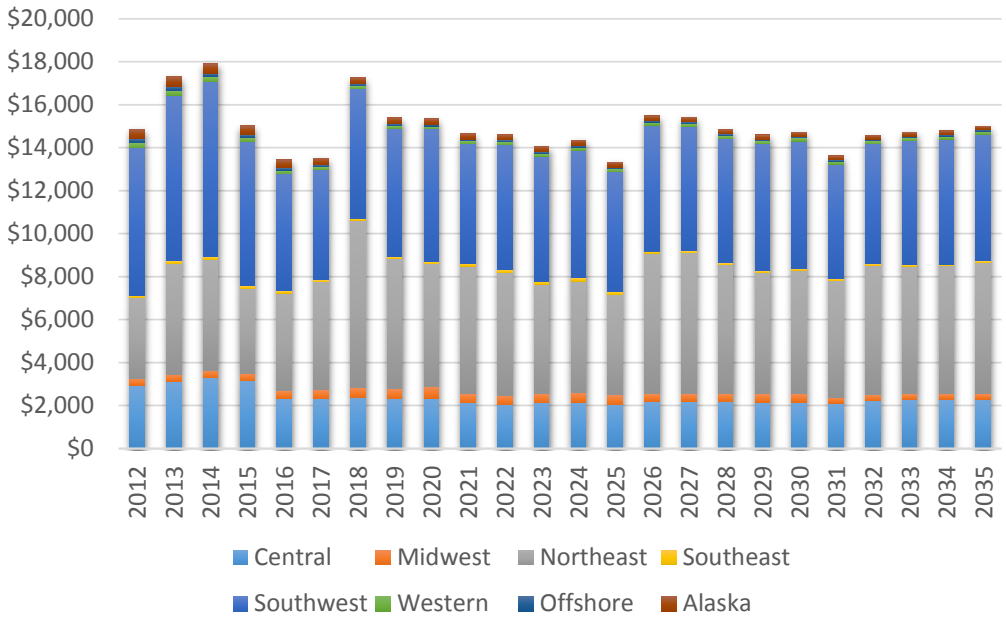


Exhibit 112: Gathering and Processing (Base Case), Millions of 2015$

Year	Central	Midwest	Northeast	Southeast	Southwest	Western	Offshore	Alaska	US
2012	$2,933	$343	$3,744	$130	$6,843	$240	$199	$424	$14,855
2013	$3,110	$360	$5,142	$140	$7,689	$225	$183	$441	$17,290
2014	$3,290	$356	$5,151	$140	$8,128	$244	$162	$438	$17,907
2015	$3,154	$352	$3,948	$136	$6,684	$207	$127	$415	$15,024
2016	$2,330	$391	$4,510	$116	$5,437	$160	$119	$384	$13,448
2017	$2,303	$367	$4,958	$91	$5,040	$142	$102	$293	$13,296
2018	$2,249	$401	$6,922	$91	$5,593	$136	$107	$283	$15,782
2019	$2,231	$427	$5,693	$88	$5,583	$134	$100	$271	$14,528
2020	$2,226	$422	$6,354	$86	$5,673	$130	$97	$262	$15,248
2021	$1,938	$342	$5,209	$195	$4,756	$135	$89	$256	$12,919
2022	$1,948	$341	$5,013	$197	$5,070	$144	$86	$249	$13,048
2023	$1,985	$343	$4,142	$202	$4,972	$146	$84	$244	$12,118
2024	$1,973	$352	$4,113	$207	$5,043	$147	$83	$239	$12,156
2025	$1,880	$351	$3,554	$207	$4,585	$148	$74	$233	$11,033
2026	$1,963	$230	$4,839	$97	$4,922	$147	$80	$227	$12,506
2027	$1,938	$231	$4,646	$95	$4,697	$149	$77	$218	$12,051
2028	$1,944	$228	$4,126	$93	$4,839	$147	$78	$210	$11,665
2029	$1,906	$225	$3,751	$91	$4,781	$147	$75	$204	$11,180
2030	$1,933	$226	$3,847	$90	$4,907	$144	$77	$198	$11,423
2031	$1,922	$219	$3,617	$88	$4,336	$142	$77	$191	$10,590
2032	$2,084	$226	$4,539	$88	$4,848	$142	$89	$186	$12,202
2033	$2,047	$223	$4,138	$88	$4,638	$142	$88	$181	$11,545
2034	$2,009	$220	$3,931	$87	$4,557	$140	$88	$176	$11,207
2035	$1,966	$215	$3,918	$86	$4,539	$141	$88	$171	$11,125
Total 2012-2016	**$14,816**	**$1,801**	**$22,495**	**$661**	**$34,781**	**$1,076**	**$790**	**$2,102**	**$78,524**
Total 2017-2035	**$38,445**	**$5,590**	**$87,312**	**$2,266**	**$93,378**	**$2,702**	**$1,638**	**$4,291**	**$235,621**
Average 2012-2016	**$2,963**	**$360**	**$4,499**	**$132**	**$6,956**	**$215**	**$158**	**$420**	**$15,705**
Average 2017-2035	**$2,023**	**$294**	**$4,595**	**$119**	**$4,915**	**$142**	**$86**	**$226**	**$12,401**

Exhibit 113: Gathering and Processing (High Case), Millions of 2015$

Year	Central	Midwest	Northeast	Southeast	Southwest	Western	Offshore	Alaska	US
2012	$2,933	$343	$3,743	$130	$6,843	$240	$199	$424	$14,855
2013	$3,110	$360	$5,142	$141	$7,689	$225	$183	$441	$17,290
2014	$3,290	$356	$5,150	$140	$8,128	$244	$162	$438	$17,907
2015	$3,154	$352	$3,948	$136	$6,684	$207	$127	$415	$15,024
2016	$2,330	$391	$4,510	$116	$5,437	$160	$119	$384	$13,448
2017	$2,316	$436	$5,005	$91	$5,128	$142	$102	$293	$13,513
2018	$2,375	$476	$7,770	$92	$6,029	$137	$107	$282	$17,267
2019	$2,312	$481	$6,054	$90	$5,964	$135	$96	$270	$15,402
2020	$2,336	$551	$5,716	$88	$6,184	$131	$92	$260	$15,357
2021	$2,129	$439	$5,923	$142	$5,553	$137	$87	$254	$14,662
2022	$2,045	$440	$5,701	$142	$5,812	$143	$82	$248	$14,613
2023	$2,129	$447	$5,079	$146	$5,783	$147	$82	$243	$14,056
2024	$2,155	$460	$5,177	$149	$5,948	$147	$82	$238	$14,356
2025	$2,042	$462	$4,665	$149	$5,558	$149	$76	$231	$13,333
2026	$2,185	$400	$6,508	$93	$5,859	$147	$79	$225	$15,496
2027	$2,177	$407	$6,529	$92	$5,779	$147	$78	$216	$15,423
2028	$2,174	$406	$5,973	$89	$5,782	$145	$76	$208	$14,852
2029	$2,147	$412	$5,633	$88	$5,899	$146	$74	$202	$14,599
2030	$2,148	$416	$5,730	$86	$5,939	$142	$73	$196	$14,729
2031	$2,112	$277	$5,428	$83	$5,335	$142	$71	$188	$13,636
2032	$2,237	$283	$6,002	$83	$5,579	$142	$75	$183	$14,584
2033	$2,277	$284	$5,923	$83	$5,759	$142	$79	$179	$14,725
2034	$2,281	$283	$5,937	$82	$5,821	$141	$81	$173	$14,799
2035	$2,289	$280	$6,082	$82	$5,889	$140	$83	$168	$15,014
Total 2012-2016	**$14,816**	**$1,801**	**$22,493**	**$663**	**$34,781**	**$1,076**	**$790**	**$2,102**	**$78,524**
Total 2017-2035	**$41,864**	**$7,642**	**$110,834**	**$1,948**	**$109,600**	**$2,700**	**$1,575**	**$4,256**	**$280,418**
Average 2012-2016	**$2,963**	**$360**	**$4,499**	**$133**	**$6,956**	**$215**	**$158**	**$420**	**$15,705**
Average 2017-2035	**$2,203**	**$402**	**$5,833**	**$103**	**$5,768**	**$142**	**$83**	**$224**	**$14,759**

Exhibit 114: Oil, Gas, and NGL Pipelines (Base Case), Millions of 2015$

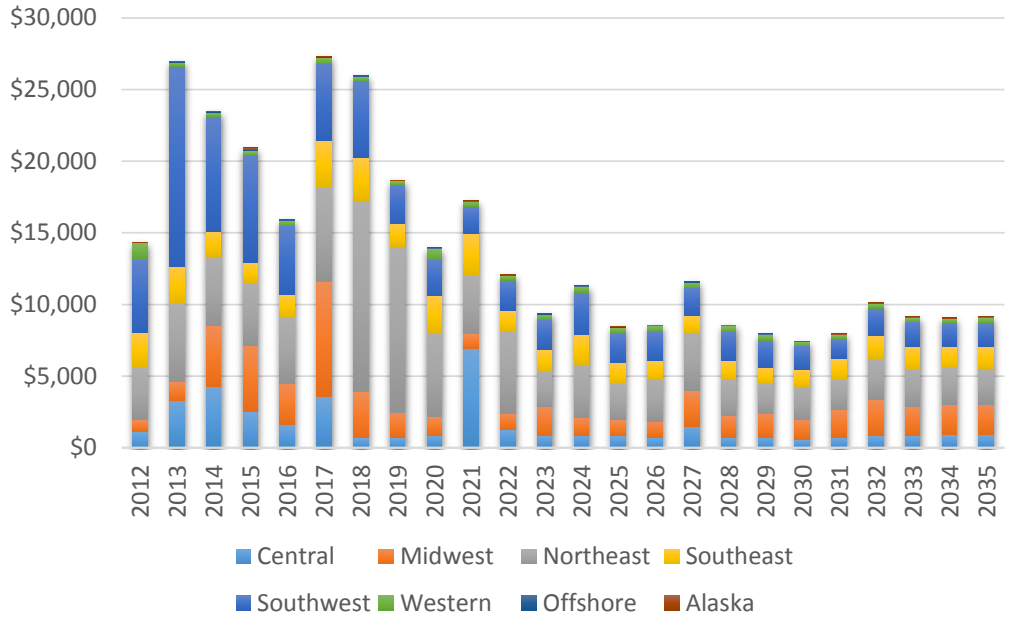


Exhibit 115: Oil, Gas, and NGL Pipelines (High Case), Millions of 2015$

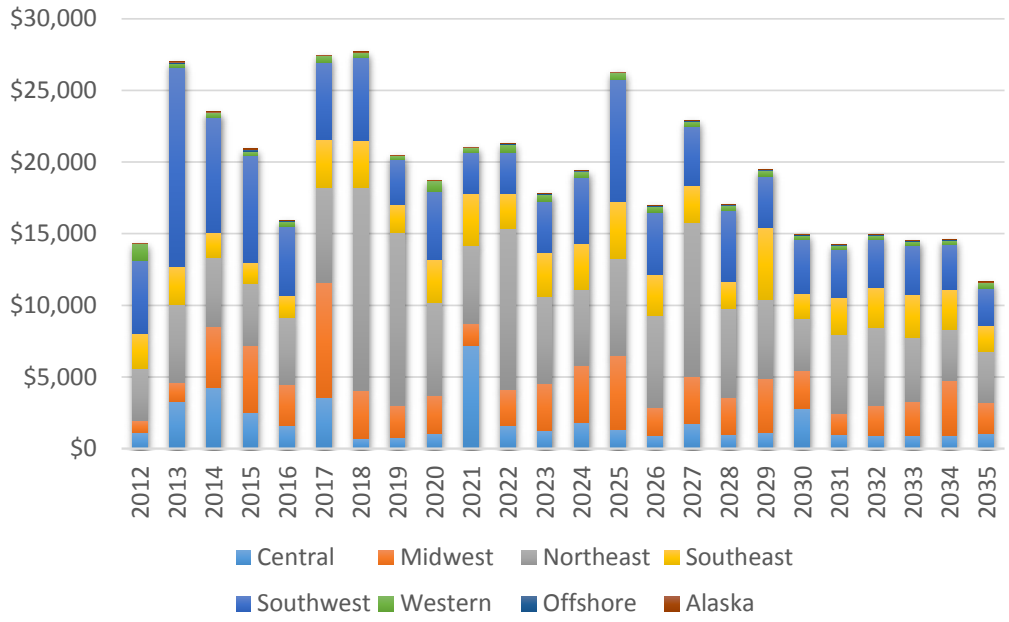


Exhibit 116: Oil, Gas, and NGL Pipelines (Base Case), Millions of 2015$

Year	Central	Midwest	Northeast	Southeast	Southwest	Western	Offshore	Alaska	US
2012	$1,102	$835	$3,672	$2,458	$5,093	$1,142	$34	$14	$14,349
2013	$3,283	$1,303	$5,475	$2,611	$13,945	$295	$46	$21	$26,980
2014	$4,257	$4,243	$4,859	$1,701	$8,046	$339	$32	$14	$23,491
2015	$2,530	$4,638	$4,382	$1,419	$7,463	$304	$169	$18	$20,922
2016	$1,595	$2,882	$4,660	$1,573	$4,809	$354	$38	$17	$15,929
2017	$3,594	$8,008	$6,541	$3,301	$5,364	$453	$38	$16	$27,315
2018	$687	$3,212	$13,344	$3,050	$5,302	$331	$40	$17	$25,982
2019	$728	$1,765	$11,553	$1,585	$2,728	$259	$40	$17	$18,675
2020	$864	$1,293	$5,874	$2,587	$2,546	$741	$44	$19	$13,968
2021	$6,901	$1,045	$4,060	$2,942	$1,913	$324	$44	$19	$17,247
2022	$1,278	$1,122	$5,730	$1,473	$2,096	$326	$44	$19	$12,089
2023	$852	$2,002	$2,484	$1,521	$2,079	$384	$45	$20	$9,387
2024	$880	$1,225	$3,664	$2,132	$2,955	$398	$45	$20	$11,317
2025	$838	$1,109	$2,513	$1,506	$2,036	$430	$45	$20	$8,496
2026	$731	$1,144	$2,899	$1,327	$2,023	$378	$45	$20	$8,567
2027	$1,499	$2,485	$4,042	$1,210	$1,941	$380	$45	$20	$11,622
2028	$734	$1,489	$2,536	$1,323	$2,047	$382	$46	$20	$8,576
2029	$735	$1,646	$2,115	$1,118	$1,896	$383	$46	$20	$7,960
2030	$577	$1,417	$2,305	$1,159	$1,645	$293	$39	$17	$7,451
2031	$719	$1,932	$2,143	$1,445	$1,349	$306	$39	$17	$7,950
2032	$817	$2,543	$2,895	$1,614	$1,878	$307	$40	$17	$10,111
2033	$836	$2,048	$2,594	$1,579	$1,729	$308	$40	$17	$9,150
2034	$906	$2,106	$2,571	$1,495	$1,629	$308	$40	$18	$9,072
2035	$922	$2,115	$2,505	$1,509	$1,654	$374	$40	$18	$9,136
Total 2012-2016	**$12,767**	**$13,902**	**$23,047**	**$9,762**	**$39,356**	**$2,433**	**$319**	**$85**	**$101,670**
Total 2017-2035	**$25,094**	**$39,707**	**$82,365**	**$33,878**	**$44,809**	**$7,063**	**$804**	**$352**	**$234,072**
Average 2012-2016	**$2,553**	**$2,780**	**$4,609**	**$1,952**	**$7,871**	**$487**	**$64**	**$17**	**$20,334**
Average 2017-2035	**$1,321**	**$2,090**	**$4,335**	**$1,783**	**$2,358**	**$372**	**$42**	**$19**	**$12,320**

Exhibit 117: Oil, Gas, and NGL Pipelines (High Case), Millions of 2015$

Year	Central	Midwest	Northeast	Southeast	Southwest	Western	Offshore	Alaska	US
2012	$1,102	$835	$3,672	$2,458	$5,093	$1,142	$34	$14	$14,349
2013	$3,283	$1,303	$5,475	$2,611	$13,945	$295	$46	$21	$26,980
2014	$4,257	$4,243	$4,859	$1,701	$8,046	$339	$32	$14	$23,491
2015	$2,530	$4,638	$4,382	$1,419	$7,463	$304	$169	$18	$20,922
2016	$1,595	$2,882	$4,660	$1,573	$4,809	$354	$38	$17	$15,929
2017	$3,594	$8,027	$6,617	$3,313	$5,407	$451	$38	$16	$27,461
2018	$725	$3,350	$14,169	$3,292	$5,740	$359	$40	$17	$27,691
2019	$799	$2,221	$12,062	$1,935	$3,146	$260	$40	$17	$20,481
2020	$1,060	$2,659	$6,481	$3,011	$4,723	$741	$44	$19	$18,739
2021	$7,153	$1,590	$5,443	$3,638	$2,832	$324	$44	$19	$21,043
2022	$1,595	$2,538	$11,252	$2,440	$2,836	$588	$44	$19	$21,312
2023	$1,259	$3,312	$6,064	$3,037	$3,608	$480	$45	$20	$17,824
2024	$1,841	$3,981	$5,282	$3,208	$4,589	$428	$45	$20	$19,393
2025	$1,370	$5,130	$6,758	$3,962	$8,517	$488	$45	$20	$26,291
2026	$947	$1,949	$6,372	$2,857	$4,391	$391	$45	$20	$16,972
2027	$1,732	$3,311	$10,705	$2,616	$4,099	$393	$45	$20	$22,923
2028	$969	$2,629	$6,201	$1,835	$4,949	$395	$46	$20	$17,044
2029	$1,102	$3,797	$5,484	$5,067	$3,573	$384	$46	$20	$19,474
2030	$2,823	$2,591	$3,671	$1,774	$3,737	$306	$39	$17	$14,959
2031	$989	$1,469	$5,525	$2,580	$3,324	$307	$39	$17	$14,252
2032	$940	$2,097	$5,399	$2,829	$3,315	$308	$40	$17	$14,944
2033	$932	$2,333	$4,491	$2,998	$3,404	$321	$40	$17	$14,536
2034	$942	$3,803	$3,600	$2,791	$3,098	$309	$40	$18	$14,601
2035	$1,081	$2,103	$3,613	$1,785	$2,613	$388	$40	$18	$11,639
Total 2012-2016	**$12,767**	**$13,902**	**$23,047**	**$9,762**	**$39,356**	**$2,433**	**$319**	**$85**	**$101,670**
Total 2017-2035	**$31,854**	**$58,891**	**$129,189**	**$54,967**	**$77,902**	**$7,621**	**$804**	**$352**	**$361,579**
Average 2012-2016	**$2,553**	**$2,780**	**$4,609**	**$1,952**	**$7,871**	**$487**	**$64**	**$17**	**$20,334**
Average 2017-2035	**$1,677**	**$3,100**	**$6,799**	**$2,893**	**$4,100**	**$401**	**$42**	**$19**	**$19,030**

Exhibit 118: Oil and Gas Storage (Base Case), Millions of 2015$

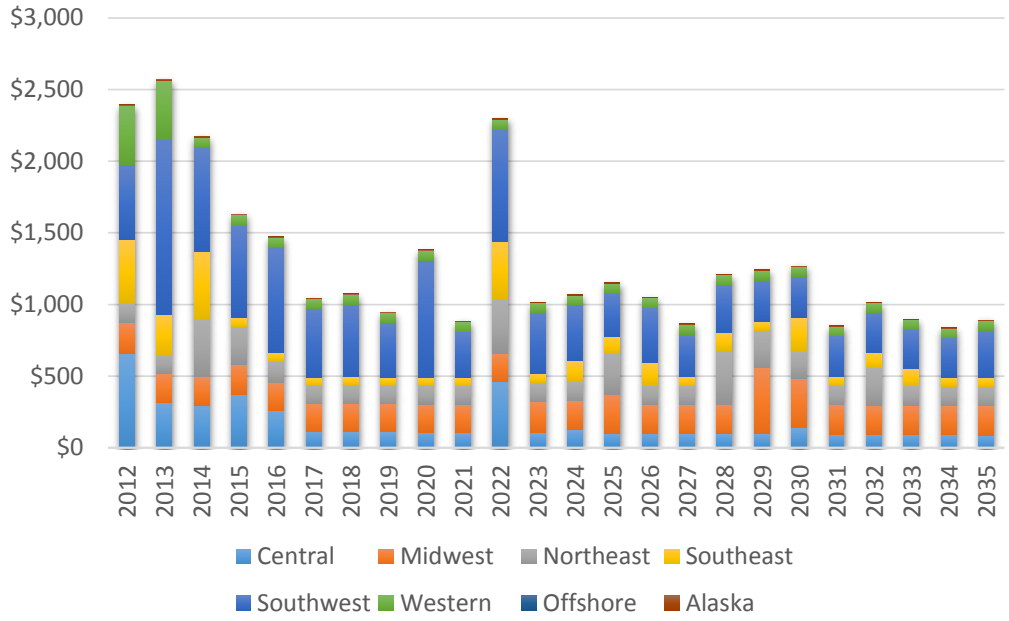


Exhibit 119: Oil and Gas Storage (High Case), Millions of 2015$

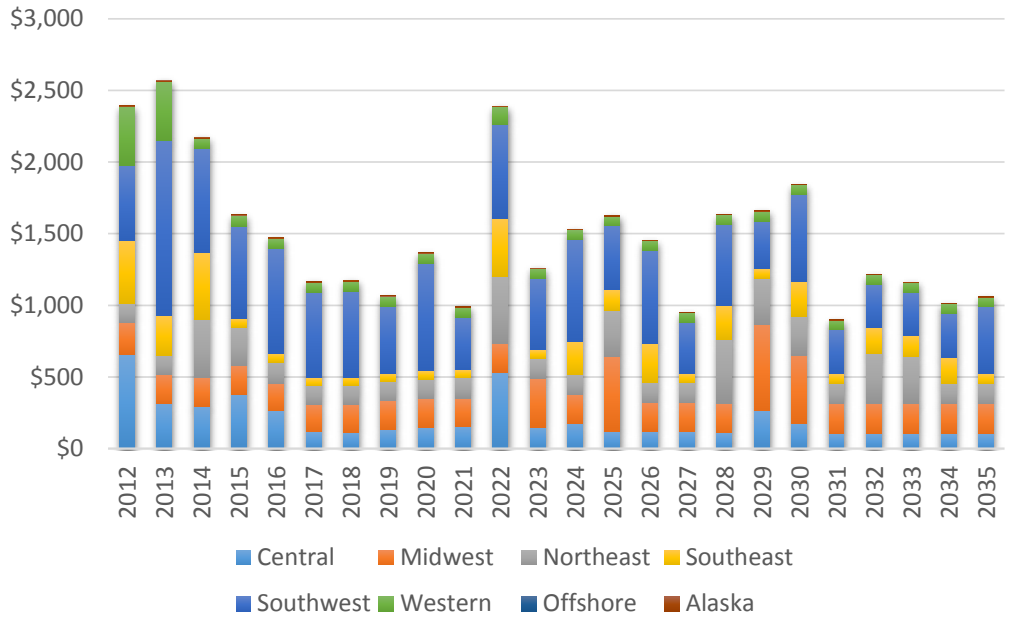


Exhibit 120: Oil and Gas Storage (Base Case), Millions of 2015$

Year	Central	Midwest	Northeast	Southeast	Southwest	Western	Offshore	Alaska	US
2012	$655	$220	$135	$439	$525	$413	$0	$5	$2,394
2013	$313	$206	$133	$275	$1,223	$413	$0	$9	$2,572
2014	$294	$202	$403	$472	$726	$70	$0	$6	$2,172
2015	$376	$202	$266	$64	$646	$71	$0	$6	$1,630
2016	$263	$194	$147	$64	$729	$71	$0	$7	$1,474
2017	$117	$193	$128	$56	$475	$69	$0	$5	$1,044
2018	$114	$194	$130	$58	$503	$69	$0	$5	$1,073
2019	$111	$195	$131	$57	$379	$69	$0	$4	$947
2020	$109	$197	$132	$56	$814	$70	$0	$4	$1,381
2021	$106	$197	$132	$56	$317	$70	$0	$4	$882
2022	$461	$198	$381	$403	$781	$70	$0	$3	$2,297
2023	$106	$217	$133	$59	$428	$70	$0	$3	$1,016
2024	$130	$200	$133	$147	$387	$70	$0	$3	$1,069
2025	$103	$271	$286	$116	$304	$69	$0	$3	$1,152
2026	$101	$201	$134	$162	$379	$69	$0	$3	$1,049
2027	$99	$201	$134	$62	$297	$69	$0	$2	$864
2028	$97	$202	$379	$128	$331	$69	$0	$2	$1,208
2029	$96	$465	$258	$62	$289	$69	$0	$2	$1,242
2030	$138	$347	$189	$238	$286	$69	$0	$2	$1,268
2031	$94	$205	$136	$64	$282	$69	$0	$2	$851
2032	$92	$205	$261	$105	$279	$69	$0	$2	$1,013
2033	$91	$205	$136	$119	$275	$68	$0	$2	$896
2034	$89	$205	$136	$64	$272	$68	$0	$2	$836
2035	$88	$204	$135	$64	$328	$68	$0	$1	$889
Total 2012-2016	**$1,901**	**$1,025**	**$1,084**	**$1,313**	**$3,849**	**$1,038**	**$0**	**$32**	**$10,242**
Total 2017-2035	**$2,342**	**$4,304**	**$3,484**	**$2,075**	**$7,406**	**$1,313**	**$0**	**$54**	**$20,977**
Average 2012-2016	**$380**	**$205**	**$217**	**$263**	**$770**	**$208**	**$0**	**$6**	**$2,048**
Average 2017-2035	**$123**	**$227**	**$183**	**$109**	**$390**	**$69**	**$0**	**$3**	**$1,104**

Exhibit 121: Oil and Gas Storage (High Case), Millions of 2015$

Year	Central	Midwest	Northeast	Southeast	Southwest	Western	Offshore	Alaska	US
2012	$655	$220	$135	$439	$525	$413	$0	$5	$2,394
2013	$313	$206	$133	$275	$1,223	$413	$0	$9	$2,572
2014	$294	$202	$403	$472	$726	$70	$0	$6	$2,172
2015	$376	$202	$266	$64	$646	$71	$0	$6	$1,630
2016	$263	$194	$147	$64	$729	$71	$0	$7	$1,474
2017	$117	$193	$128	$56	$597	$69	$0	$5	$1,166
2018	$114	$194	$133	$59	$598	$69	$0	$5	$1,173
2019	$137	$196	$135	$58	$465	$69	$0	$4	$1,065
2020	$150	$197	$138	$57	$750	$70	$0	$4	$1,366
2021	$156	$198	$140	$57	$367	$70	$0	$4	$990
2022	$532	$199	$469	$403	$658	$124	$0	$3	$2,389
2023	$147	$341	$140	$60	$499	$70	$0	$3	$1,261
2024	$176	$201	$139	$235	$708	$70	$0	$3	$1,531
2025	$119	$523	$320	$144	$447	$70	$0	$3	$1,627
2026	$118	$205	$138	$273	$648	$70	$0	$3	$1,455
2027	$116	$205	$138	$64	$355	$70	$0	$2	$951
2028	$110	$205	$444	$240	$563	$70	$0	$2	$1,634
2029	$264	$601	$323	$66	$334	$69	$0	$2	$1,660
2030	$174	$478	$271	$241	$608	$69	$0	$2	$1,843
2031	$105	$212	$139	$67	$307	$69	$0	$2	$899
2032	$105	$212	$348	$178	$303	$69	$0	$2	$1,216
2033	$105	$211	$324	$151	$299	$69	$0	$2	$1,160
2034	$103	$211	$141	$180	$307	$69	$0	$2	$1,012
2035	$102	$211	$140	$70	$466	$68	$0	$1	$1,059
Total 2012-2016	**$1,901**	**$1,025**	**$1,084**	**$1,313**	**$3,849**	**$1,038**	**$0**	**$32**	**$10,242**
Total 2017-2035	**$2,951**	**$4,994**	**$4,147**	**$2,659**	**$9,278**	**$1,373**	**$0**	**$54**	**$25,456**
Average 2012-2016	**$380**	**$205**	**$217**	**$263**	**$770**	**$208**	**$0**	**$6**	**$2,048**
Average 2017-2035	**$155**	**$263**	**$218**	**$140**	**$488**	**$72**	**$0**	**$3**	**$1,340**

Exhibit 122: Refining and Oil Products Transport (Base Case), Millions of 2015$

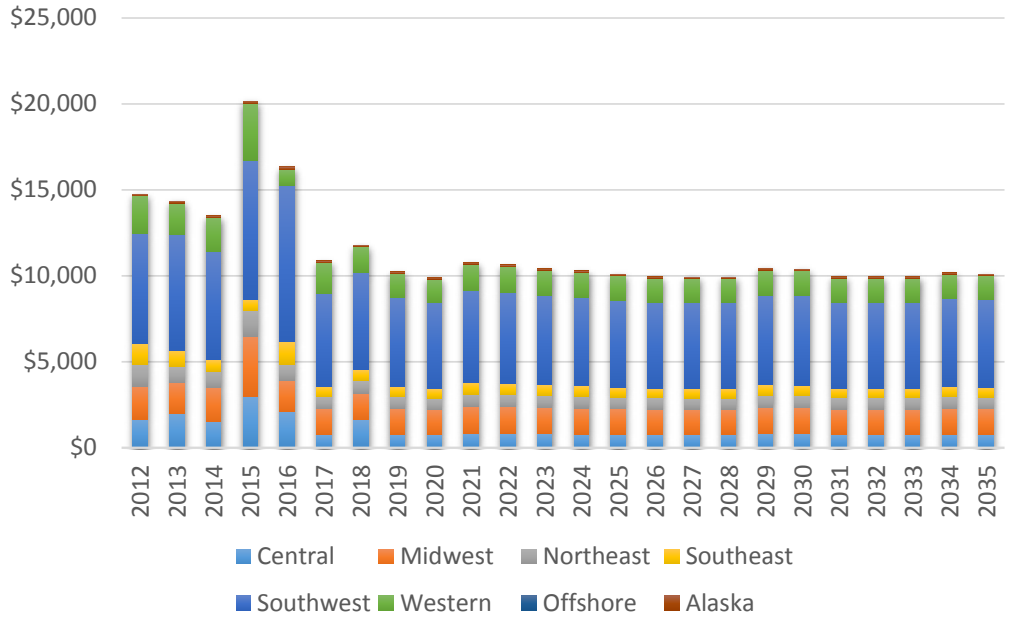


Exhibit 123: Refining and Oil Products Transport (High Case), Millions of 2015$

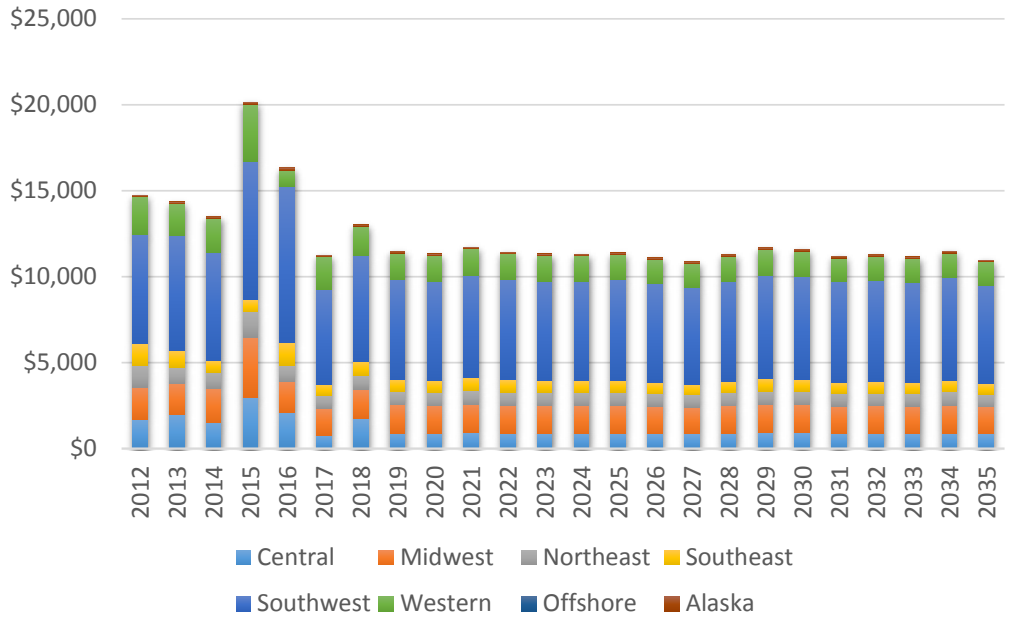


Exhibit 124: Refining and Oil Products Transport (Base Case), Millions of 2015$

Year	Central	Midwest	Northeast	Southeast	Southwest	Western	Offshore	Alaska	US
2012	$1,674	$1,910	$1,237	$1,258	$6,384	$2,183	$0	$104	$14,751
2013	$2,012	$1,767	$912	$1,000	$6,704	$1,842	$0	$105	$14,342
2014	$1,522	$1,975	$954	$670	$6,260	$2,016	$0	$104	$13,500
2015	$2,980	$3,494	$1,478	$701	$8,067	$3,318	$0	$116	$20,154
2016	$2,095	$1,810	$931	$1,330	$9,090	$909	$0	$167	$16,333
2017	$753	$1,516	$697	$613	$5,388	$1,804	$0	$90	$10,861
2018	$1,619	$1,556	$715	$658	$5,650	$1,502	$0	$91	$11,791
2019	$777	$1,503	$692	$596	$5,140	$1,429	$0	$90	$10,227
2020	$745	$1,461	$673	$547	$5,011	$1,371	$0	$89	$9,898
2021	$832	$1,575	$724	$676	$5,351	$1,523	$0	$92	$10,773
2022	$819	$1,557	$716	$655	$5,294	$1,498	$0	$91	$10,630
2023	$798	$1,531	$704	$624	$5,213	$1,461	$0	$91	$10,422
2024	$785	$1,514	$696	$604	$5,159	$1,437	$0	$90	$10,286
2025	$766	$1,489	$685	$574	$5,083	$1,403	$0	$90	$10,091
2026	$753	$1,472	$678	$554	$5,028	$1,378	$0	$89	$9,952
2027	$751	$1,470	$677	$551	$5,020	$1,375	$0	$89	$9,932
2028	$752	$1,470	$677	$551	$5,020	$1,375	$0	$89	$9,934
2029	$800	$1,534	$706	$624	$5,212	$1,461	$0	$91	$10,428
2030	$796	$1,528	$703	$617	$5,193	$1,453	$0	$91	$10,380
2031	$753	$1,472	$678	$551	$5,022	$1,376	$0	$89	$9,941
2032	$753	$1,472	$678	$552	$5,023	$1,376	$0	$89	$9,942
2033	$753	$1,472	$678	$552	$5,023	$1,376	$0	$89	$9,943
2034	$777	$1,504	$692	$589	$5,119	$1,419	$0	$90	$10,190
2035	$768	$1,492	$687	$575	$5,084	$1,404	$0	$90	$10,101
Total 2012-2016	**$10,282**	**$10,956**	**$5,512**	**$4,959**	**$36,505**	**$10,269**	**$0**	**$597**	**$79,081**
Total 2017-2035	**$15,551**	**$28,586**	**$13,154**	**$11,262**	**$98,035**	**$27,422**	**$0**	**$1,712**	**$195,722**
Average 2012-2016	**$2,056**	**$2,191**	**$1,102**	**$992**	**$7,301**	**$2,054**	**$0**	**$119**	**$15,816**
Average 2017-2035	**$818**	**$1,505**	**$692**	**$593**	**$5,160**	**$1,443**	**$0**	**$90**	**$10,301**

Exhibit 125: Refining and Oil Products Transport (High Case), Millions of 2015$

Year	Central	Midwest	Northeast	Southeast	Southwest	Western	Offshore	Alaska	US
2012	$1,674	$1,910	$1,237	$1,258	$6,384	$2,183	$0	$104	$14,751
2013	$2,012	$1,767	$912	$1,000	$6,704	$1,842	$0	$105	$14,342
2014	$1,522	$1,975	$954	$670	$6,260	$2,016	$0	$104	$13,500
2015	$2,980	$3,494	$1,478	$701	$8,067	$3,318	$0	$116	$20,154
2016	$2,095	$1,810	$931	$1,330	$9,090	$909	$0	$167	$16,333
2017	$792	$1,566	$719	$670	$5,540	$1,872	$0	$91	$11,251
2018	$1,744	$1,716	$786	$841	$6,133	$1,719	$0	$94	$13,034
2019	$901	$1,640	$758	$732	$5,805	$1,532	$0	$101	$11,468
2020	$886	$1,620	$749	$707	$5,752	$1,500	$0	$101	$11,314
2021	$927	$1,670	$772	$761	$5,939	$1,554	$0	$103	$11,726
2022	$898	$1,630	$755	$714	$5,829	$1,496	$0	$102	$11,424
2023	$888	$1,616	$749	$696	$5,796	$1,472	$0	$102	$11,320
2024	$887	$1,614	$748	$692	$5,799	$1,465	$0	$103	$11,308
2025	$895	$1,623	$753	$700	$5,836	$1,472	$0	$103	$11,382
2026	$868	$1,587	$737	$657	$5,736	$1,418	$0	$103	$11,106
2027	$844	$1,556	$723	$621	$5,638	$1,377	$0	$102	$10,861
2028	$886	$1,608	$747	$678	$5,822	$1,438	$0	$104	$11,283
2029	$925	$1,657	$769	$732	$5,998	$1,494	$0	$106	$11,682
2030	$916	$1,642	$763	$712	$5,984	$1,463	$0	$106	$11,586
2031	$877	$1,588	$740	$646	$5,855	$1,378	$0	$106	$11,192
2032	$887	$1,597	$745	$653	$5,917	$1,378	$0	$108	$11,286
2033	$874	$1,585	$738	$644	$5,829	$1,379	$0	$106	$11,154
2034	$906	$1,625	$757	$687	$5,976	$1,424	$0	$108	$11,482
2035	$855	$1,568	$729	$630	$5,705	$1,379	$0	$103	$10,970
Total 2012-2016	**$10,282**	**$10,956**	**$5,512**	**$4,959**	**$36,505**	**$10,269**	**$0**	**$597**	**$79,081**
Total 2017-2035	**$17,655**	**$30,710**	**$14,238**	**$13,173**	**$110,890**	**$28,210**	**$0**	**$1,952**	**$216,829**
Average 2012-2016	**$2,056**	**$2,191**	**$1,102**	**$992**	**$7,301**	**$2,054**	**$0**	**$119**	**$15,816**
Average 2017-2035	**$929**	**$1,616**	**$749**	**$693**	**$5,836**	**$1,485**	**$0**	**$103**	**$11,412**

Exhibit 126: Export Terminals (Base Case), Millions of 2015$

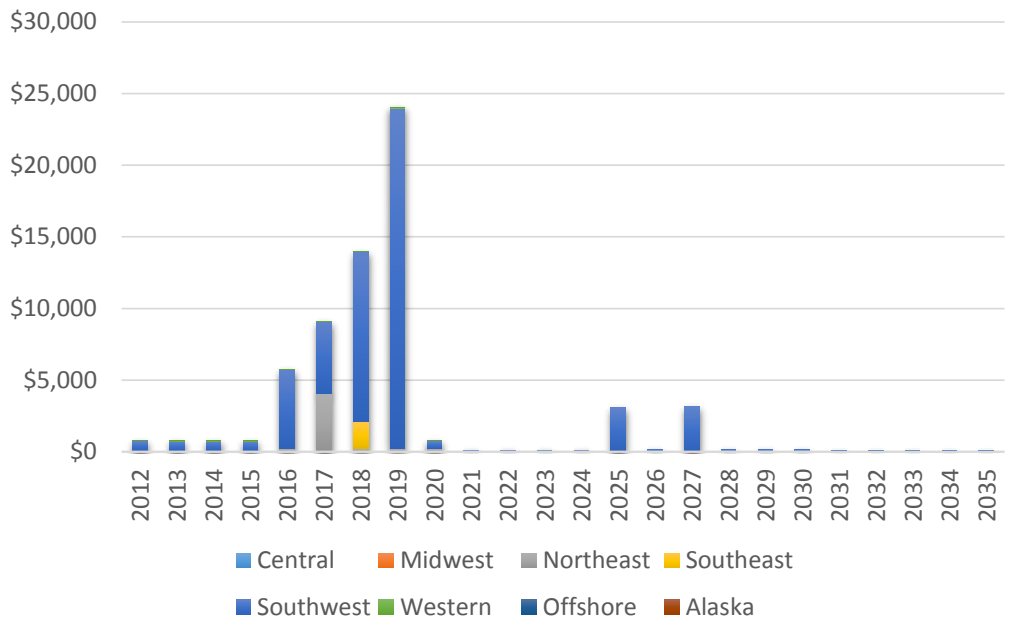


Exhibit 127: Export Terminals (High Case), Millions of 2015$

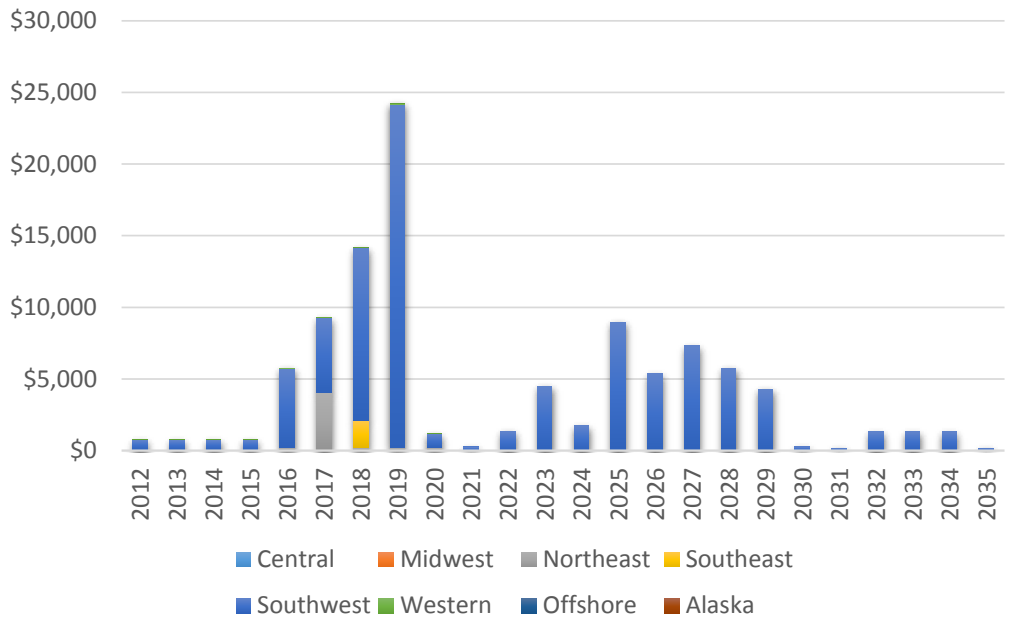


Exhibit 128: Export Terminals (Base Case), Millions of 2015$

Year	Central	Midwest	Northeast	Southeast	Southwest	Western	Offshore	Alaska	US
2012	$0	$0	$70	$0	$683	$3	$0	$0	$756
2013	$0	$0	$70	$0	$680	$3	$0	$0	$753
2014	$0	$0	$70	$0	$679	$3	$0	$0	$752
2015	$0	$0	$69	$0	$673	$3	$0	$0	$745
2016	$0	$0	$232	$0	$5,502	$1	$0	$0	$5,735
2017	$0	$0	$4,073	$0	$5,008	$1	$0	$0	$9,082
2018	$0	$0	$236	$1,861	$11,846	$1	$0	$0	$13,944
2019	$0	$0	$238	$0	$23,747	$1	$0	$0	$23,986
2020	$0	$0	$239	$0	$518	$1	$0	$0	$759
2021	$0	$0	$0	$0	$96	$0	$0	$0	$96
2022	$0	$0	$0	$0	$97	$0	$0	$0	$97
2023	$0	$0	$0	$0	$97	$0	$0	$0	$97
2024	$0	$0	$0	$0	$98	$0	$0	$0	$98
2025	$0	$0	$0	$0	$3,098	$0	$0	$0	$3,098
2026	$0	$0	$0	$0	$140	$0	$0	$0	$140
2027	$0	$0	$0	$0	$3,140	$0	$0	$0	$3,140
2028	$0	$0	$0	$0	$140	$0	$0	$0	$140
2029	$0	$0	$0	$0	$140	$0	$0	$0	$140
2030	$0	$0	$0	$0	$140	$0	$0	$0	$140
2031	$0	$0	$0	$0	$65	$0	$0	$0	$65
2032	$0	$0	$0	$0	$65	$0	$0	$0	$65
2033	$0	$0	$0	$0	$65	$0	$0	$0	$65
2034	$0	$0	$0	$0	$65	$0	$0	$0	$65
2035	$0	$0	$0	$0	$65	$0	$0	$0	$65
Total 2012-2016	**$0**	**$0**	**$511**	**$0**	**$8,218**	**$13**	**$0**	**$0**	**$8,742**
Total 2017-2035	**$0**	**$0**	**$4,786**	**$1,861**	**$48,632**	**$5**	**$0**	**$0**	**$55,284**
Average 2012-2016	**$0**	**$0**	**$102**	**$0**	**$1,644**	**$3**	**$0**	**$0**	**$1,748**
Average 2017-2035	**$0**	**$0**	**$252**	**$98**	**$2,560**	**$0**	**$0**	**$0**	**$2,910**

Exhibit 129: Export Terminals (High Case), Millions of 2015$

Year	Central	Midwest	Northeast	Southeast	Southwest	Western	Offshore	Alaska	US
2012	$0	$0	$70	$0	$683	$3	$0	$0	$756
2013	$0	$0	$70	$0	$680	$3	$0	$0	$753
2014	$0	$0	$70	$0	$679	$3	$0	$0	$752
2015	$0	$0	$69	$0	$673	$3	$0	$0	$745
2016	$0	$0	$232	$0	$5,502	$1	$0	$0	$5,735
2017	$0	$0	$4,073	$0	$5,208	$1	$0	$0	$9,282
2018	$0	$0	$236	$1,861	$12,046	$1	$0	$0	$14,145
2019	$0	$0	$238	$0	$23,949	$1	$0	$0	$24,188
2020	$0	$0	$239	$0	$925	$1	$0	$0	$1,165
2021	$0	$0	$0	$0	$260	$0	$0	$0	$260
2022	$0	$0	$0	$0	$1,350	$0	$0	$0	$1,350
2023	$0	$0	$0	$0	$4,490	$0	$0	$0	$4,490
2024	$0	$0	$0	$0	$1,740	$0	$0	$0	$1,740
2025	$0	$0	$0	$0	$8,969	$0	$0	$0	$8,969
2026	$0	$0	$0	$0	$5,386	$0	$0	$0	$5,386
2027	$0	$0	$0	$0	$7,298	$0	$0	$0	$7,298
2028	$0	$0	$0	$0	$5,746	$0	$0	$0	$5,746
2029	$0	$0	$0	$0	$4,299	$0	$0	$0	$4,299
2030	$0	$0	$0	$0	$283	$0	$0	$0	$283
2031	$0	$0	$0	$0	$161	$0	$0	$0	$161
2032	$0	$0	$0	$0	$1,322	$0	$0	$0	$1,322
2033	$0	$0	$0	$0	$1,322	$0	$0	$0	$1,322
2034	$0	$0	$0	$0	$1,322	$0	$0	$0	$1,322
2035	$0	$0	$0	$0	$160	$0	$0	$0	$160
Total 2012-2016	**$0**	**$0**	**$511**	**$0**	**$8,218**	**$13**	**$0**	**$0**	**$8,742**
Total 2017-2035	**$0**	**$0**	**$4,786**	**$1,861**	**$86,235**	**$5**	**$0**	**$0**	**$92,887**
Average 2012-2016	**$0**	**$0**	**$102**	**$0**	**$1,644**	**$3**	**$0**	**$0**	**$1,748**
Average 2017-2035	**$0**	**$0**	**$252**	**$98**	**$4,539**	**$0**	**$0**	**$0**	**$4,889**

Appendix D: Average Annual Values for Gross State Product and Taxes

Exhibit 130: Average Annual Values for Gross State Products and Taxes from Economic Impact Analysis, Base Case, Millions of 2015$

	Average 2013-2016				Average 2017-2035			
	GDP	State/Local Tax	Federal Tax	Total Tax	GDP	State/Local Tax	Federal Tax	Total Tax
U.S.	**$113,428**	**$17,367**	**$19,810**	**$37,177**	**$78,785**	**$12,442**	**$15,999**	**$28,441**
Alabama	$1,476	$222	$257	**$480**	$974	$152	$198	**$350**
Alaska	$484	$141	$85	**$225**	$259	$78	$53	**$131**
Arizona	$1,120	$153	$195	**$348**	$794	$112	$161	**$273**
Arkansas	$1,066	$159	$186	**$345**	$578	$89	$117	**$206**
California	$7,471	$1,187	$1,304	**$2,491**	$5,015	$825	$1,019	**$1,844**
Colorado	$2,247	$321	$393	**$714**	$1,334	$197	$272	**$469**
Connecticut	$1,053	$144	$184	**$328**	$743	$105	$151	**$256**
Delaware	$311	$54	$54	**$109**	$276	$49	$56	**$106**
District of Columbia	$127	$23	$22	**$46**	$94	$18	$19	**$37**
Florida	$2,318	$311	$405	**$715**	$1,718	$238	$348	**$586**
Georgia	$1,297	$175	$227	**$402**	$1,004	$140	$203	**$343**
Hawaii	$128	$23	$22	**$46**	$89	$17	$18	**$35**
Idaho	$327	$45	$57	**$102**	$260	$37	$53	**$90**
Illinois	$4,212	$644	$737	**$1,380**	$2,514	$397	$510	**$907**
Indiana	$2,818	$420	$492	**$912**	$1,865	$287	$379	**$666**
Iowa	$704	$118	$123	**$241**	$520	$90	$105	**$195**
Kansas	$1,817	$284	$317	**$601**	$1,206	$195	$246	**$441**
Kentucky	$1,141	$168	$199	**$368**	$805	$123	$163	**$286**
Louisiana	$12,934	$1,978	$2,263	**$4,241**	$9,710	$1,539	$1,972	**$3,511**
Maine	$397	$64	$69	**$133**	$284	$47	$58	**$105**
Maryland	$1,075	$154	$188	**$342**	$887	$131	$178	**$309**
Massachusetts	$1,712	$242	$299	**$541**	$1,202	$175	$244	**$420**
Michigan	$3,040	$465	$531	**$996**	$2,075	$328	$421	**$749**
Minnesota	$1,655	$276	$290	**$566**	$1,159	$200	$236	**$436**
Mississippi	$903	$157	$158	**$315**	$609	$109	$124	**$233**
Missouri	$1,084	$145	$189	**$335**	$790	$109	$160	**$270**
Montana	$471	$69	$82	**$151**	$271	$41	$55	**$96**
Nebraska	$447	$69	$78	**$147**	$358	$57	$73	**$129**
Nevada	$284	$40	$50	**$90**	$205	$30	$42	**$72**
New Hampshire	$306	$37	$54	**$91**	$219	$27	$45	**$72**
New Jersey	$2,292	$351	$399	**$750**	$1,533	$242	$311	**$554**
New Mexico	$1,586	$303	$277	**$579**	$938	$185	$191	**$376**
New York	$5,037	$1,018	$880	**$1,898**	$3,485	$727	$707	**$1,434**
North Carolina	$1,968	$298	$344	**$642**	$1,368	$214	$277	**$491**
North Dakota	$1,578	$356	$275	**$631**	$752	$175	$153	**$328**
Ohio	$5,427	$847	$951	**$1,798**	$3,878	$625	$787	**$1,412**
Oklahoma	$3,191	$422	$557	**$979**	$1,899	$259	$387	**$646**
Oregon	$855	$142	$149	**$292**	$581	$100	$118	**$218**
Pennsylvania	$7,264	$1,057	$1,267	**$2,324**	$6,291	$944	$1,276	**$2,221**
Rhode Island	$271	$43	$47	**$90**	$195	$32	$40	**$71**
South Carolina	$1,978	$338	$345	**$682**	$1,400	$247	$284	**$531**
South Dakota	$309	$39	$54	**$93**	$172	$22	$35	**$57**
Tennessee	$1,541	$189	$269	**$458**	$1,102	$140	$224	**$363**
Texas	$17,560	$2,391	$3,062	**$5,453**	$11,470	$1,619	$2,332	**$3,950**
Utah	$1,007	$162	$175	**$337**	$625	$104	$127	**$231**
Vermont	$164	$27	$29	**$56**	$121	$21	$25	**$45**
Virginia	$1,605	$218	$281	**$499**	$1,278	$179	$258	**$438**
Washington	$1,647	$241	$288	**$528**	$1,016	$154	$206	**$360**
West Virginia	$1,208	$213	$211	**$424**	$1,122	$204	$227	**$431**
Wisconsin	$1,665	$257	$291	**$548**	$1,134	$181	$231	**$412**
Wyoming	$850	$170	$148	**$318**	$609	$126	$124	**$250**

Exhibit 131: Average Annual Values for Gross State Products and Taxes from Economic Impact Analysis, High Case, Millions of 2015$

	Average 2013-2016				Average 2017-2035			
	GDP	State/Local Tax	Federal Tax	Total Tax	GDP	State/Local Tax	Federal Tax	Total Tax
U.S.	**$113,428**	**$17,367**	**$19,810**	**$37,177**	**$99,639**	**$15,753**	**$20,299**	**$36,052**
Alabama	$1,476	$222	$257	**$480**	$1,246	$194	$254	**$448**
Alaska	$484	$141	$85	**$225**	$279	$84	$57	**$141**
Arizona	$1,120	$153	$195	**$348**	$990	$140	$202	**$341**
Arkansas	$1,066	$159	$186	**$345**	$859	$133	$176	**$308**
California	$7,471	$1,187	$1,304	**$2,491**	$6,096	$1,004	$1,242	**$2,246**
Colorado	$2,247	$321	$393	**$714**	$1,596	$236	$326	**$562**
Connecticut	$1,053	$144	$184	**$328**	$948	$134	$193	**$327**
Delaware	$311	$54	$54	**$109**	$358	$64	$73	**$137**
District of Columbia	$127	$23	$22	**$46**	$124	$24	$25	**$49**
Florida	$2,318	$311	$405	**$715**	$2,217	$308	$451	**$759**
Georgia	$1,297	$175	$227	**$402**	$1,254	$175	$255	**$430**
Hawaii	$128	$23	$22	**$46**	$112	$21	$23	**$44**
Idaho	$327	$45	$57	**$102**	$313	$45	$64	**$109**
Illinois	$4,212	$644	$737	**$1,380**	$3,217	$509	$655	**$1,164**
Indiana	$2,818	$420	$492	**$912**	$2,391	$369	$487	**$856**
Iowa	$704	$118	$123	**$241**	$647	$112	$131	**$244**
Kansas	$1,817	$284	$317	**$601**	$1,376	$223	$281	**$504**
Kentucky	$1,141	$168	$200	**$368**	$1,162	$178	$237	**$415**
Louisiana	$12,934	$1,978	$2,263	**$4,241**	$12,138	$1,927	$2,474	**$4,401**
Maine	$397	$64	$69	**$133**	$366	$61	$75	**$136**
Maryland	$1,075	$154	$188	**$342**	$1,091	$162	$220	**$382**
Massachusetts	$1,712	$242	$299	**$541**	$1,531	$224	$312	**$536**
Michigan	$3,040	$465	$531	**$996**	$2,619	$415	$533	**$948**
Minnesota	$1,655	$276	$290	**$566**	$1,449	$250	$295	**$545**
Mississippi	$902	$157	$158	**$315**	$778	$140	$159	**$299**
Missouri	$1,084	$145	$189	**$335**	$982	$136	$200	**$336**
Montana	$471	$69	$82	**$151**	$317	$47	$64	**$112**
Nebraska	$447	$69	$78	**$147**	$439	$70	$89	**$159**
Nevada	$284	$40	$50	**$90**	$255	$38	$52	**$89**
New Hampshire	$306	$37	$54	**$91**	$286	$36	$58	**$94**
New Jersey	$2,292	$351	$399	**$750**	$1,910	$303	$389	**$692**
New Mexico	$1,586	$303	$277	**$579**	$1,145	$227	$234	**$460**
New York	$5,037	$1,018	$880	**$1,898**	$4,488	$939	$914	**$1,852**
North Carolina	$1,968	$298	$344	**$642**	$1,720	$270	$350	**$620**
North Dakota	$1,578	$356	$275	**$631**	$825	$193	$168	**$361**
Ohio	$5,427	$847	$951	**$1,798**	$5,011	$810	$1,020	**$1,830**
Oklahoma	$3,191	$422	$557	**$979**	$2,507	$343	$512	**$854**
Oregon	$855	$142	$149	**$292**	$732	$126	$149	**$275**
Pennsylvania	$7,264	$1,057	$1,267	**$2,324**	$8,103	$1,220	$1,651	**$2,871**
Rhode Island	$271	$43	$47	**$90**	$254	$42	$52	**$93**
South Carolina	$1,978	$338	$345	**$682**	$1,779	$314	$362	**$677**
South Dakota	$309	$39	$54	**$93**	$213	$28	$43	**$71**
Tennessee	$1,541	$189	$269	**$458**	$1,538	$195	$314	**$509**
Texas	$17,560	$2,391	$3,062	**$5,453**	$14,367	$2,032	$2,928	**$4,960**
Utah	$1,007	$162	$175	**$337**	$765	$127	$156	**$283**
Vermont	$164	$27	$29	**$56**	$161	$28	$33	**$60**
Virginia	$1,605	$218	$281	**$499**	$1,584	$223	$322	**$544**
Washington	$1,647	$241	$288	**$528**	$1,235	$187	$251	**$438**
West Virginia	$1,208	$213	$211	**$424**	$1,654	$301	$337	**$639**
Wisconsin	$1,665	$257	$291	**$548**	$1,470	$235	$300	**$535**
Wyoming	$850	$170	$148	**$318**	$740	$153	$151	**$305**

Appendix E: Approximate Economic Impacts of Pipeline and Gathering CAPEX

This appendix approximates total U.S. economic impacts of new and E/U/R/R pipeline and gathering line infrastructure. Pipeline infrastructure includes oil, gas, NGL, and petroleum products transmission lines, compressors for gas transmission lines, and pumps for oil, NGL, and petroleum product lines. Gathering infrastructure includes oil and gas gathering pipes and compressors for gas gathering lines.

The approximate economic impacts (employment, GDP, and taxes) are calculated by multiplying the share of total CAPEX – i.e., the ratio of pipeline and gathering line CAPEX to the total oil, gas, and NGL infrastructure CAPEX – times the total oil, gas, and NGL infrastructure impacts. This method assumes the same impact per CAPEX (e.g. employment per dollar CAPEX) between all infrastructure categories. Actual economic impact, however, varies between the type of oil and gas infrastructure on the order of plus/minus 10%.

Exhibit 132 compares economic impacts of pipeline and gathering CAPEX between the Base Case and the High Case. In the Base Case, the projected pipeline and gathering line CAPEX that averages about $394 billion per year or 37% of the total oil, gas, and NGL infrastructure CAPEX over the course of the projection, is estimated to produce an average of over 308,000 U.S. jobs per year. This investment is expected to contribute over $557 billion to U.S. GDP, about $113 billion in Federal taxes, and roughly $88 billion in state and local taxes over the 2017-2035 projection period, which equate to average annual values of roughly $29 billion, $6 billion, and $5 billion, respectively.

The High Case projects $547 billion of pipeline and gathering line CAPEX or 41% of the total oil, gas, and NGL infrastructure CAPEX. This investment would employ an average of roughly 427,000 individuals in the U.S. on an annual basis. The investment is expected to contribute over $771 billion to U.S. GDP, about $157 billion to Federal taxes, and nearly $122 billion to state and local taxes throughout the projection, which equate to average annual values of roughly $41 billion, $8 billion, and $6 billion, respectively.

Exhibit 132: Approximate Economic Impacts of Pipeline and Gathering CAPEX (All Dollar Values in Million 2015$)

BASE CASE	Average Historical, 2013-2016	Average Projected, 2017-2035	Total Historical, 2013-2016	Total Projected, 2017-2035
CAPEX	$31,348	$20,761	$125,392	$394,464
Total Employment	465,400	308,271	NA	NA
Direct Employment	155,507	103,003	NA	NA
Indirect Employment	120,716	79,927	NA	NA
Induced Employment	189,178	125,341	NA	NA
U.S. Gross Domestic Product	$44,261	$29,322	$177,045	$557,124
Federal Taxes	$7,714	$5,946	$30,855	$112,965
State and Local Taxes	$6,776	$4,627	$27,105	$87,919

HIGH CASE	Average Historical, 2013-2016	Average Projected, 2017-2035	Total Historical, 2013-2016	Total Projected, 2017-2035
CAPEX	$31,348	$28,784	$125,392	$546,896
Total Employment	465,400	426,581	NA	NA
Direct Employment	155,507	142,523	NA	NA
Indirect Employment	120,716	110,889	NA	NA
Induced Employment	189,178	173,168	NA	NA
U.S. Gross Domestic Product	$44,261	$40,593	$177,045	$771,259
Federal Taxes	$7,714	$8,267	$30,855	$157,071
State and Local Taxes	$6,776	$6,416	$27,105	$121,905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