Executive Summary

The purpose of this study is to estimate the economic impact of the $200 billion (2011 dollars) in midstream investments that will be required to accommodate the development of natural gas, oil and natural gas liquid (NGL)[1] resources from 2012 through 2035. Near-term estimates through 2013 and through 2016 also are developed. The estimated economic impact of these investments is measured in terms of employment creation, income generation, output, taxes generated and value added to the US economy and study regions.

MIDSTREAM INVESTMENTS IN THE LOWER 48 STATES OF $200 BILLION THROUGH 2035

Midstream natural gas, oil, and NGL investments evaluated in this study include expenditures for the following:

- Gathering pipe
- Lateral pipelines
- Mainline pipeline
- Compression equipment
- Processing facilities
- Natural gas storage facilities

The base information for this report is the 2011 INGAA Foundation report *North American Midstream Infrastructure Through 2035 – A Secure Energy Future* (the *2035 Midstream Report*). [2] The study found that, in 2010 dollars, natural gas midstream infrastructure capital investment in North America for the next 25 years is estimated to be over $205 billion with an additional $46 billion in capital investment for NGL and oil pipeline infrastructure. As a result of this investment, an average of 2,000 miles of new natural gas transmission lines and laterals are anticipated to be added each year through 2035 in combination with more than 200,000 horsepower of compression, 24 billion cubic feet (Bcf) of gas storage capacity and 1.3 Bcf per day (Bcf/d) of annual processing capacity additions. An additional 1,300 miles of oil and NGL transmission pipeline would also be constructed each year, on average.

In the current study, the data was narrowed to include only the US lower 48 states and offshore Gulf of Mexico investments, which were divided into six regions. The starting year of the study was changed to 2012, and expenditures were converted to 2011 dollars. When adjusted to 2011 dollars, total investments in the selected US regions will total just over $200 billion from 2012 through 2035.

The largest expenditure category ($90 billion) will be for natural gas mainline pipeline. This is large diameter pipeline (20" to 42") that is projected to have an all-in average installed cost per mile of $2.8 million in the *2035 Midstream Report*. This expenditure category is followed in dollars spent by expenditures for small diameter (0.5" to 6") gathering pipeline ($29 billion) and lateral pipeline (6" to 24" diameter, $26 billion) pipeline. These pipelines are estimated to have an all-in average installed cost per mile of approximately $100,000 (for gathering pipeline) and $2.2 million (for lateral pipeline).

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[1] NGLs are widely used as feedstock in the petrochemical industry. See Section 2 for more discussion.

[2] *North American Midstream Infrastructure Through 2035 – A Secure Energy Future*, ICF International, June 28, 2011.

TOTAL MIDSTREAM ECONOMIC IMPACTS THROUGH 2035

The economic impacts through 2035 include those impacts associated with construction as well as those impacts associated with operation and maintenance (O&M). These impacts are presented separately below and then combined.

Total Midstream Investment and Benefit Projections Through 2035

Based on an economic impact analysis of the midstream infrastructure investments, the results for the 2012 through 2035 period are summarized in Table ES-1 and include (all in 2011 dollars):

- The $200 billion investment in 2012 through 2035 midstream projects will help support an annual average of 104,579 jobs.[3]
- The cumulative 2012 through 2035 midstream investments are estimated to create $141 billion in labor income (which includes wages and benefits) at an average of $56,300 per job across all impacted industries. This compares to an average US average of approximately $53,100 per job in 2011.[4]
- The cumulative 2012 through 2035 midstream investments in the US are estimated to contribute nearly $218 billion in value added. Value added for a firm is their sales revenue less the costs of goods and services purchased. The sum of value added in all industries is the gross domestic product (GDP), or the total value of all final goods and services produced in the nation.[5]
- The cumulative 2012 through 2035 midstream investments in the US are estimated to account for nearly $425 billion in total economic output, which is the total value of production from all industries impacted by the midstream investment expenditures. Virtually all industries will be impacted by midstream investments; some (e.g., pipeline and compressor manufacturers) will directly supply equipment and materials for midstream construction and other industries (e.g., fast food and tourism) as workers spend their income on goods and services.[6]
- Total state and local taxes generated due to 2012 through 2035 investment activity will be $16.8 billion and total federal tax revenues generated will be $30.9 billion.

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[3] The annual average job figures used in this study are calculated as the total job-years created during the study period as determined by IMPLAN, divided by the years in the study period. IMPLAN's glossary of terms defines a "job" as "the annual average of monthly jobs in that industry" but also points out that this can be "one job lasting 12 months" or "two jobs lasting six months each" or "three jobs lasting four months each" and also explains that "a job can be either full-time or part-time."

[4] Labor income includes all forms of employment income, including employee compensation (wages and benefits) and proprietor income. See Section 5.1.1 for an explanation of how the average US figure is derived.

[5] The IMPLAN glossary defines "value added" as "the difference between an industry's or an establishments total output and the cost of its intermediate inputs. It equals gross output (sales or receipts and other operating income, plus inventory change) minus intermediate inputs (consumption of goods and services purchased from other industries or imported)." As a simplified example, if a pipeline manufacturer purchased a steel plate for $10,000 then transformed this into a pipeline segment that was then sold for $50,000 then the value added would be $40,000 (ignoring other intermediate inputs and their costs).

[6] The IMPLAN glossary defines "output" as "the value of industry production…in producer prices. For manufacturers this would be sales plus/minus change in inventory. For service sectors production = sales…." As explained more fully in Section 4 of this report, output in this study includes the direct production of goods and services associated with pipeline and other facility construction, the indirect impacts arising from increased production by industries providing inputs during the construction phase, and the increased production in virtually all industries impacted by the expenditure of income by project workers, called induced impacts. This study does not measure the value of natural gas, oil, and NGL that will flow through the pipelines.

Total Midstream Operations and Maintenance Projections Through 2035

Added to the investment impacts at the national level are those from O&M expenditures once the midstream facilities are placed into operation. This study estimates that midstream O&M expenditures over the 2012 through 2035 study horizon will be $28.9 billion, which will generate the following (all in 2011 dollars):

- The cumulative $28.9 billion expenditure for O&M in the 2012 through 2035 period for new investments will help support an annual average of 20,760 jobs.
- The cumulative 2012 through 2035 O&M expenditures are estimated to create $29.7 billion in labor income (an average of nearly $60,000/job across all sectors).
- The cumulative 2012 through 2035 midstream O&M expenditures in the US are estimated to contribute $43.1 billion in value added.
- The cumulative 2012 through 2035 midstream O&M expenditures in the US are estimated to account for $87.0 billion in total output.
- Total state and local taxes generated due to cumulative 2012 through 2015 O&M activity will be $3.3 billion and total federal tax revenues generated will be $6.0 billion.

Combined Investment and O&M Expenditures

The $229.1 billion in combined midstream investment and O&M expenditures in the 2012 through 2035 study period will result in the following benefits:

- An annual average of 125,339 jobs.
- $171.0 billion in cumulative labor income.
- $260.7 billion in cumulative value added and $511.5 billion in cumulative output.
- Cumulative state and local tax revenue of $20.1 billion
- Cumulative federal tax revenues of $36.9 billion.

NATURAL GAS IMPACTS DOMINATE

Investments and economic benefits in natural gas projects will account for approximately 83 percent of the 2012 through 2035 US total, while oil investments will account for approximately 10 percent and NGL investments will account for approximately 7 percent of the US total. The results in Table ES-2 indicate that natural gas investments and O&M expenditures alone will account for:

- An annual average of 103,029 jobs.
- $140.6 billion in cumulative labor income.
- More than $214 billion in cumulative value added.
- More than $420 billion in cumulative total output.
- Cumulative state and local tax revenue of $16.5 billion.
- Cumulative federal tax revenues of more than $30 billion.

Table ES-1 **US Midstream Investment Impact Summary for the 2012-2035 Period (Cumulative Impacts in Billions of 2011 Dollars, Employment is Average Annual Jobs Supported)**

MIDSTREAM INVESTMENTS		MIDSTREAM O&M EXPENDITURES		COMBINED IMPACT	
US Investment	$200.2	Total O&M Expenditures	$28.9	Expenditures	$229.1
Results		**Results**		**Results**	
Avg. Annual Employment	104,579	Avg. Annual Employment	20,760	Avg. Annual Employment	125,339
Income	$141.3	Income	$29.7	Income	$171.0
Value Added	$217.6	Value Added	$43.1	Value Added	$260.7
Output	$424.5	Output	$87.0	Output	$511.5
State and Local Taxes	$16.8	State and Local Taxes	$3.3	State and Local Taxes	$20.1
Federal Taxes	$30.9	Federal Taxes	$6.0	Federal Taxes	$36.9

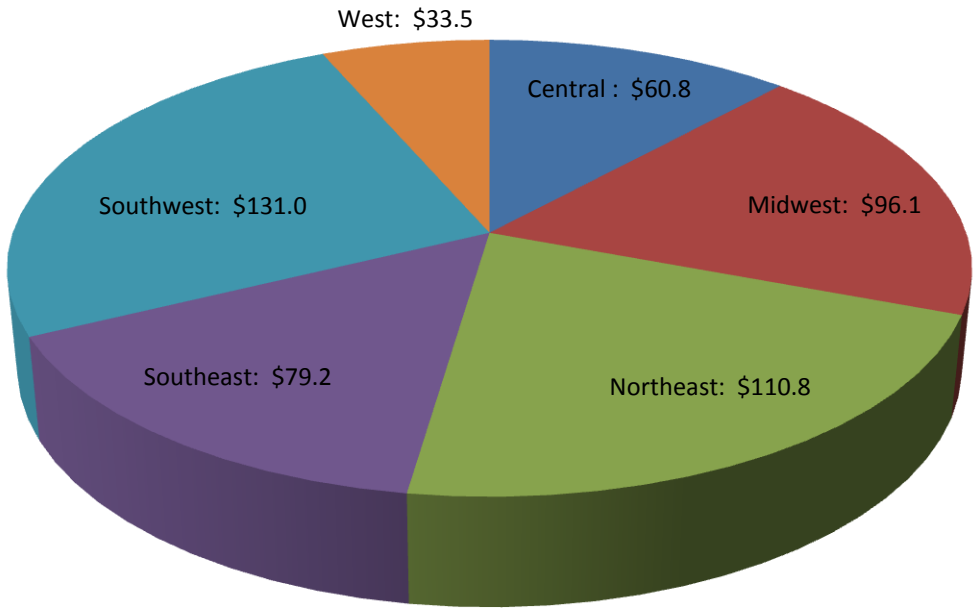
Table ES-2 **US Midstream Investment and O&M Expenditures by Energy Type, Impact Summary for the 2012-2035 Period (Cumulative Impacts in Billions of 2011 Dollars, Employment is Average Annual Jobs Supported)**

NATURAL GAS INVESTMENT PLUS O&M IMPACTS		OIL INVESTMENT PLUS O&M IMPACTS		NATURAL GAS LIQUIDS (NGL) INVESTMENT PLUS O&M IMPACTS		TOTAL
Investment, $ Billions (Lower 48)	$190.3	Investment $ Billions (Lower 48)	$22.7	Investment $ Billions (Lower 48)	$16.1	$229.1
Results		**Results**		**Results**		**Results**
Avg. Annual Employment	103,029	Avg. Annual Employment	12,659	Avg. Annual Employment	9,651	125,339
Income	$140.6	Income	$17.3	Income	$13.2	$171.1
Value Added	$214.3	Value Added	$26.3	Value Added	$20.1	$260.7
Output	$420.4	Output	$51.7	Output	$39.4	$511.5
State and Local Taxes	$16.5	State and Local Taxes	$2.0	State and Local Taxes	$1.6	$20.1
Federal Taxes	$30.3	Federal Taxes	$3.7	Federal Taxes	$2.8	$36.8

WIDESPREAD AND SIGNIFICANT REGIONAL BENEFITS

The benefits materializing through the 2035 time frame will be divided among all six of the Energy Information Administration (EIA) US regions studied. Regions having high levels of investment (such as the Northeast) and having a strong employment base in the natural gas sector (such as the Southwest) will benefit the most from midstream investments. Yet, the economic impact will be widespread due to the economic linkages between natural gas and oil pipeline companies and suppliers of materials and services (pipe, compressors, etc.).

Figure ES-1 shows the projected anticipated value of total output projected for the six EIA regions due to midstream construction and O&M expenditures. Figure ES-2 shows the anticipated total number of jobs created by these expenditures. These results demonstrate that the combined effect of midstream investment and O&M expenditures on the US economy will have a significant and beneficial impact on the national economy and all US regions over many decades.



US total output due to midstream investment is $424.5 billion in $2011. In addition, total US output from O&M is $87 billion in $2011

Figure ES-1 Total Value of Regional Output Due to Midstream Investments and O&M, 2012-2035 (in Billions of $2011)

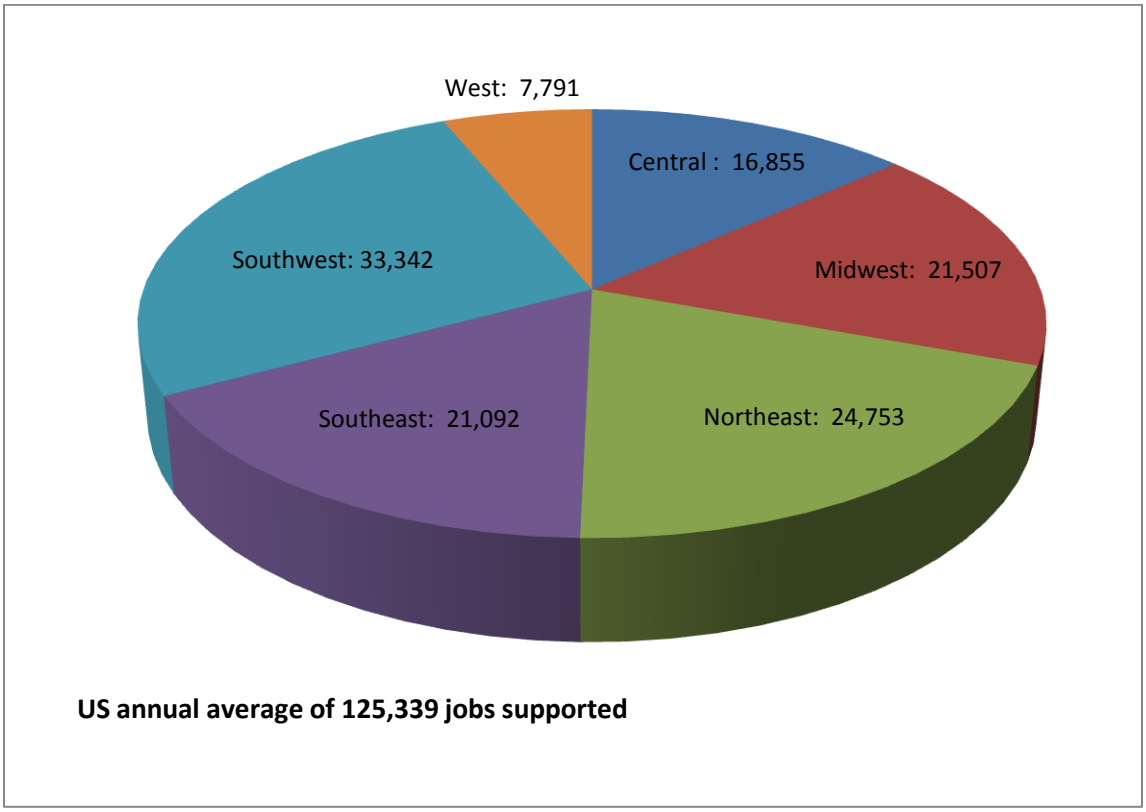


Figure ES-2 Annual Average Job Supported in Each Region Due to Midstream Investments and O&M Expenditures, 2012-2035

NEAR-TERM BENEFITS IN THE 2012-2013 AND 2012-2016 TIME FRAMES

The near-term effects over the 2012 through 2013 time frame and the 2012 through 2016 time frame are a subset of the overall impacts through 2035, and the near-immediate boost these impacts will have on the current economy are important. Table ES-3 lists the average annual job impacts of project investments and O&M expenditures over the two-year and five-year time frame. In the 2012 through 2013 period, an annual average of 159,653 jobs will be supported and $18.4 billion in cumulative worker income will be generated, as will $55.2 billion in output and $6 billion in combined federal, state, and local taxes. In the 2012 through 2016 period, an annual average of 135,633 jobs will be supported and $38.3 billion in cumulative worker income will be generated, as will $114 billion in cumulative output and more than $13 billion in combined federal, state, and local taxes.

OTHER CONSIDERATIONS

While economic impact studies consistently have found large benefits associated with natural gas development, they have received some criticism for failing to directly address certain issues of concern such as the socioeconomic impact and disruption to local communities when projects are constructed. Specific concerns include a "boom to bust" impact and harm done to local roadways, especially during the well drilling phase. While input-output models are not designed to specifically address such issues, such concerns serve as a call for local decision makers to recognize that natural gas development will have local impacts that can require mitigation efforts. It is clear from the impact analysis that there will be substantial tax revenues generated at the federal, state

Table ES-3 US Midstream Investment Impact Summary: 2012-2013 and 2012-2016 Period Results (All Impacts in Billions of 2011 Dollars, Employment is the Number of Jobs Supported)

MIDSTREAM INVESTMENTS		MIDSTREAM O&M EXPENDITURES		COMBINED INVESTMENT PLUS O&M IMPACTS	
2012-2013 EXPENDITURES AND IMPACTS					
US Investment	$26.8	Total O&M Expenditures	$.1	Total US Investment plus O&M	$26.9
Results		**Results**		**Results**	
Avg. Annual Employment	158,730	Avg. Annual Employment	923	Avg. Annual Employment	159,653
Income	$18.33	Income	$.11	Income	$18.44
Value Added	$28.15	Value Added	$.16	Value Added	$28.31
Output	$54.90	Output	$.33	Output	$55.23
State and Local Taxes	$2.13	State and Local Taxes	$.01	State and Local Taxes	$2.14
Federal Taxes	$3.84	Federal Taxes	$.02	Federal Taxes	$3.86
2012-2016 EXPENDITURES AND IMPACTS					
US Investment	$56.8	Total O&M Expenditures	$1.0	Total US Investment plus O&M	$57.9
Results		**Results**		**Results**	
Avg. Annual Employment	132,190	Avg. Annual Employment	3,443	Avg. Annual Employment	135,633
Income	$37.29	Income	$1.02	Income	$38.31
Value Added	$57.24	Value Added	$1.48	Value Added	$58.72
Output	$111.08	Output	$3.00	Output	$114.08
State and Local Taxes	$4.53	State and Local Taxes	$.12	State and Local Taxes	$4.65
Federal Taxes	$8.41	Federal Taxes	$.21	Federal Taxes	$8.62

and local levels as upstream and midstream investments occur. With proper coordination and timing, it is possible that local impacts can be minimized through the allocation of development-induced tax revenue to impacted areas.

Another criticism of input-output studies is they fail to predict the timing of the economic impacts and rounds of spending associated with investment. This is true, as models such as IMPLAN provide an "all at once" mathematical solution. While the timing of impacts is not projected by input-output models, economic theory and practical experience tell us that the impact of a

construction project is not permanent and a construction project likely will generate the vast majority of economic impacts in a three- to four-year period. What is interesting about the projected upstream and midstream investments, however, is that the number and magnitude of projects projected to be built through 2035 are so large (and projects are generally contiguous) that, as a whole, the construction of upstream and downstream projects will tend to have a fairly steady impact on the national economy and many regions will experience sizable expenditures for new projects for decades to come.

The long-term nature of such projects impacts imply that state and local governments could further benefit by teaming with private industry and local institutions to ensure that an increased share of local workers have training opportunities for the well-paying jobs associated with future natural gas development. Employment of local workers will help local populations benefit directly from regional development. Similarly, if regions with the large natural gas plays can attract new natural gas and oil related industry and supplier investment, the ripple effects shown for any region in this analysis would increase over the projections made in this study.

CONCLUSIONS

The results of the impact analysis are explained in more detail in the main body of the report. Even with this short summary, however, it is clear that there will be short-term and long-term benefits associated with midstream facility construction and operation. Indeed, every region of the US stands to realize substantial economic benefits as the midstream investments unfold. Benefits and impacts will be greatest for those regions containing large gas plays that will be economical to develop, but this analysis also shows that there will be significant economic benefits to those regions having an industrial base that supplies the midstream natural gas and oil pipeline industries with goods and materials such as pipe, compressors, etc. Given the competitive advantage of being in close proximity to natural gas investment locations, midstream infrastructure development presents an opportunity for suppliers of materials used in such investments to reverse or at least slow the decades-long decline seen in most manufacturing in the US.

In addition to the economic impacts quantified in this study, other studies have concluded that there will be other national benefits in the form of lower prices for energy, increased energy security, and lower emissions from natural gas fired power plants and industrial processes. These benefits can be brought quickly to the marketplace to benefit, by direct and indirect means, the entire US economy