# APPENDIX E

## The Perryman Group, Economic and Fiscal Benefits of the Proposed Bear Head LNG Project in Nova Scotia: An Analysis with Emphasis on the Effects on the United States (January 2015 )

January 2015

# Economic and Fiscal Benefits of the Proposed Bear Head LNG Project in Nova Scotia:

## An Analysis with Emphasis on the Effects on the United States


**THE PERRYMAN GROUP**

510 N. Valley Mills Dr., Suite 300

Waco, TX 76710

ph. 254.751.9595, fax 254.751.7855

*info@perrymangroup.com*

*www.perrymangroup.com*

# Contents

# Introduction and Overview

Demand for natural gas continues to rise, both in the United States and internationally, as a result of its thermal efficiencies and clean-burning qualities. Natural gas is viewed as environmentally superior to coal and fuel oils, and has become the fuel of choice for numerous end-use applications. Thus, many nations are looking for additional sources of the fuel.

At the same time, the supply of natural gas in North America is increasing rapidly due to improvements in recovery techniques and the ongoing exploration and production from shale formations. Such formations contain huge quantities of gas, but prior to recent technological advances, economically viable production was not possible. Converting natural gas to liquefied natural gas (LNG) for export helps ensure the ongoing development of North American natural gas resources by providing access to world markets. Because of the excess supply in the United States (US) and Canada at present, prices are currently much lower than those found in many other areas.

Bear Head LNG Corporation (Bear Head Corp.) is developing a facility near Point Tupper, Nova Scotia, (the Bear Head LNG Project or Project) with the capacity to produce 8 to 12 million tonnes of LNG for export each year, but a maximum of 8 million tonnes of LNG would be derived from US feedstock.. Planned investment in the Bear Head LNG Project is expected to occur over approximately the next five years and total about $4 billion. Although the Project is located in Nova Scotia, much of the investment is expected to occur in the United States, leading to substantial economic benefits (including job creation) over the development period as well as increased tax revenues at the federal, State, and local levels.

Direct investments to design and construct the Project would lead to a sizable (though transitory) stimulus in a variety of sectors, as well as generating spillover benefits for an even wider range of businesses. Once in operation, the Project would enhance demand for natural gas, thus stimulating industry investment in exploration and production and leading to ongoing economic and fiscal benefits. It is anticipated that the natural gas inputs for the Project may be acquired from US production basins, including the Marcellus Shale Region, which would bring an ongoing domestic economic and fiscal stimulus.

At the request of Bear Head Corp., The Perryman Group (TPG) conducted an analysis of the proposed Project, utilizing the firm's proprietary US Multi-Regional Impact Assessment System and input-output models from Statistics Canada, to quantify key aspects of the total economic and fiscal benefits of the Project. The primary focus of the study was to consider the economic effects stemming from the Project that would enure to the benefit of the US economy. As the

Project will be located in Canada, the effects of its development on the Canadian economy were also quantified. This report presents the findings from the assessment.

## Highlights of Study Findings

The Bear Head LNG Project would generate notable economic gains in Canada and the United States, both during the construction and development stages, and once operational. Key results from The Perryman Group's analysis are summarized below, with additional detail in subsequent sections and the Appendices to this report.

- **Construction and preoperational spending** associated with the proposed Bear Head LNG Project would lead to estimated total economic gains of almost **$1.140 billion** in gross product and **16,969** person-years of employment in the **United States**. For **Louisiana**, where manufacturing of a significant portion of necessary equipment is likely to take place, the construction and preoperational spending for the proposed Project has the potential to lead to an increase in gross product of **$0.407 billion** and **4,445** person-years of employment.

- For **Canada, construction and preoperational spending** would generate an increase in business activity of some **$3.312 billion** in gross product and **36,263** person-years of employment. Activity would be concentrated in Nova Scotia, where construction and preoperational spending for the proposed Project would likely generate a gain in business activity of about **$2.415 billion** in gross product and **24,302** person-years of employment.

- Once fully operational, the Bear Head LNG Project's export operations would stimulate **additional natural gas exploration and production** (and, hence, incremental economic and fiscal benefits stemming from the industry). Considerable incremental tax receipts would also be realized by taxing entities at the local, State, and federal levels assuming that the gas is acquired from the United States. The Perryman Group quantified these benefits (1) cumulative over the first 25 years of operations and (2) on an average annual basis through the first 25 years.

- **Cumulative economic gains** stemming from enhanced natural gas production over the first 25 years of Project operations would include an estimated increase in gross product for the **United States** of some **$93.814 billion** as well as **988,553** person-years of employment (**$3.753 billion** in gross product and **39,542** jobs on an **average annual** basis). Fiscal effects include gains of $6.835 billion to the federal government over the 25-year period, with $4.529 billion to states and $2.319 billion to local governments.
- While the natural gas utilized could come from virtually any gas-producing area across the United States or Canada, if it came from the nearby **Marcellus Shale Region**, the cumulative 25-year economic benefits to the area of additional natural gas production stemming from the Bear Head LNG Project include an estimated **$86.459 billion** in gross product each year as well as **920,099** person-years of employment in the Region (**$3.458 billion** in gross product and **36,804** jobs on an average annual basis).

The Perryman Group is an economic research and analysis firm with more than 30 years of experience in assessing economic impacts, including hundreds of corporate expansions and several LNG projects similar to the one proposed by Bear Head Corp. For further information regarding the firm, see Appendix A.

# The Proposed Bear Head LNG Project and Regions Affected

## The Proposed Bear Head LNG Project

Bear Head Corp. is a subsidiary of Liquefied Natural Gas Limited which also has LNG facilities under development in Louisiana and Queensland, Australia. Bear Head Corp. is planning to construct a natural gas liquefaction facility in Nova Scotia with annual production capacity of 8 to 12 million tonnes of LNG, as well as a marine terminal, tanks, and other necessary infrastructure. The overall investment is likely to be in the range of $4 billion over the next several years. Construction and procurement will be concentrated in Nova Scotia, but will also include significant spending in the United States for engineering and major equipment.

## Socioeconomic Conditions in Affected Regions

Two regions of the United States with the potential to experience particularly notable economic effects from the construction and operations of the Bear Head LNG Project are (1) the area of Louisiana where manufacturers of key equipment (modules and cold boxes) are located and (2) natural gas-production regions in the Marcellus Shale formation relatively proximate to Nova Scotia. The Perryman Group compiled basic socioeconomic indicators for these areas.

Louisiana's economy has not fully recovered since the recent recession, with total employment only slightly higher now than in November 2008.[1] Although lower than the peak of 7.8% in late 2010, unemployment rates have been trending upward since April 2014 and, at 6.5% as of November 2014, currently stand above the national average of 5.8%.[2] However, since November 2013, employment in the state has increased 59,419, equating to a monthly gain of

[1] Louisiana – Local Area Unemployment Statistics, Bureau of Labor Statistics, (n.d.), http://data.bls.gov/timeseries/LASST220000000000003?data_tool=XGtable.
[2] Louisiana – Local Area Unemployment Statistics, Bureau of Labor Statistics, (n.d.), http://data.bls.gov/timeseries/LASST220000000000003?data_tool=XGtable; Regional and State Employment and Unemployment, Bureau of Labor Statistics, November 2014, http://www.bls.gov/news.release/laus.nr0.htm.

nearly 5,000 jobs.[3] Median household income in the state was $44,164 in 2013, compared to $52,250 in the United States.[4]

Iberia Parish, where manufacturing of Project components is likely to occur, has been outperforming the state as a whole. The population of the Parish as of July 2013 was estimated by the US Census Bureau to be 73,878. Employment in the Parish was 33,017 in September 2014, with an unemployment rate of 5.5% (not seasonally adjusted). Median household income averaged $44,262 over the 2009-2013 time period, but had fallen to $39,793 in 2013 (according to US Census Bureau data). By this measure, the area is well below the national average.

Recent forecasts for Louisiana indicate that real GDP will grow at a moderate rate of 2.5% over the next two years, which is approximately equal to the projected national growth rate. Employment in Louisiana is expected to experience much more robust growth. During the next two years, projections indicate that Louisiana will add 34,200 jobs in 2014 and 33,600 jobs in 2015. Louisiana, for the first time in state history, is expected to surpass 2 million overall jobs in 2015.[5]

The Marcellus Shale lies beneath several states in the northeastern United States, with primary production in West Virginia and Pennsylvania. The economic vitality of the region varies widely, from relatively healthy performance in some areas to depressed incomes and high unemployment in others. In general, income levels are below national averages, and activity within the Marcellus Shale has been an important source of economic stimulus. (See Appendix C for a table of population, employment, unemployment rate, and median household income by county for the region.)

[3] Louisiana – Local Area Unemployment Statistics, Bureau of Labor Statistics, (n.d.), http://data.bls.gov/timeseries/LASST220000000000003?data_tool=XGtable.
[4] U.S. Census Bureau, 2013 American Community Survey 1-Year Estimates
[5] Scott, Lauren C. and James A. Richardson, The Louisiana Economic Outlook: 2014 and 2015, Louisiana State University, October 2013, p. iii, vi, 3, 111.

# Study Parameters and Methods Used

The Perryman Group measured the impacts of construction and preoperational activity as well as potential additional natural gas production. As noted, additional natural gas production stems from expanding the capacity for producing LNG for export and the associated incremental demand for natural gas. Exports stimulate domestic production at times when US market prices might not otherwise do so, encouraging activity in the industry and resulting in incremental economic benefits.

## Summary of Methods Used

Any investment or corporate activity generates multiplier effects throughout the economy. Construction and development of a facility lead to purchases ranging from concrete to engineering services to landscaping. Ongoing operations also stimulate business activity through purchases and expenditures by employees of payroll dollars for various goods and services.

In addition, the construction and operation of a liquefaction facility will encourage further development of natural gas resources by providing a ready market for LNG exports. Exploration, drilling, production, servicing, pipeline development and operations, royalty payments, and other direct expenditures associated with natural gas exploration and production involve substantial gains.

The Perryman Group's input-output assessment model uses a variety of data (from surveys, industry information, and other sources) to describe the various goods and services (known as resources or inputs) required to produce another good or service. An associated fiscal model allows for estimation of tax receipts to state and local entities. The submodels used in the current analysis reflect the specific industrial composition and characteristics of the study areas.

Impacts were quantified for the following measures of business activity:

- **Total expenditures** (or total spending) measures the dollars changing hands as a result of the economic stimulus.
- **Gross product** (or output) is production of goods and services that will come about in each area as a result of the activity. This measure is parallel to the gross domestic product numbers commonly reported by various media outlets and is a subset of total expenditures.
- **Personal income** is dollars that end up in the hands of people in the area; the vast majority of this aggregate derives from the earnings of employees, but payments such as interest and rents are also included.
- **Job gains** are expressed as **person-years** of employment (one person working for one year) for temporary projects (such as construction of a facility or cumulative assessments over time) or as **permanent jobs** when evaluating ongoing annual effects.

All results are expressed in constant (2014) dollars. Additional information is provided in the Appendices to this report. It should be noted that the planning of this Project is in its early stages; as a result, some of the detail within various categories was estimated based on current expectations of the developers based on similar projects and patterns consistently observed in other LNG facilities analyzed by TPG.

# Economic and Fiscal Benefits of Construction of the Proposed Project

## Construction Impact: United States

**Construction and preoperational spending** associated with the proposed Bear Head LNG Project would lead to estimated total economic gains of over **$1.140 billion** in gross product and **16,969** person-years of employment in the **United States**. For **Louisiana**, where manufacturing of a significant portion of necessary equipment (modules and cold boxes) is likely to take place, the construction and preoperational spending for the proposed Project has the potential to lead to an increase in gross product of **$0.407 billion** and **4,445** person-years of employment. It is also expected that the generators and compressors and a number of other components will be procured from US sources.

Incremental tax receipts stemming from construction and preoperational activity are also significant. Fiscal benefits include an estimated $0.192 billion to the federal government, $0.111 billion to state governments, and $0.058 to local governments.

| The Anticipated Impact Associated with the Construction of the Proposed Bear Head LNG Project on Domestic Business Activity* (Monetary Values in Billions of Constant 2014 Dollars) | | |
|---|---|---|
| | **Louisiana** | **United States** |
| Total Expenditures | $0.933 billion | $3.680 billion |
| Gross Product | $0.407 billion | $1.140 billion |
| Personal Income | $0.257 billion | $1.127 billion |
| Retail Sales | $0.096 billion | $0.394 billion |
| Employment (Person-Years) | 4,445 | 16,969 |
| **FISCAL EFFECTS** | | |
| Local Governments | | $0.058 billion |
| State Governments | | $0.111 billion |
| Federal Government | | $0.192 billion |

SOURCE: The Perryman Group

* Assumes that the LNG modules and cold boxes are produced in Louisiana. According to Project sponsors, this scenario is highly probable. While other items could be manufactured in the state, the locations are not yet determined. Also assumes that manufacturing and procurement of compressors and turbines, and other equipment and items occurs in the US as well as a substantial segment of the engineering and related work. The assumed magnitudes reflect best estimates by Project sponsors and are consistent with patterns in other similar Projects and the capacity of relevant sectors.

## Construction Impact: Canada

For **Canada, construction and preoperational** spending would generate an increase in business activity of some **$3.312 billion** in gross product and **36,263** person-years of employment. Activity would be concentrated in Nova Scotia, where construction and preoperational spending for the proposed Project would likely generate a gain in business activity of about **$2.415 billion** in gross product and **24,302** person-years of employment.

| The Anticipated Impact Associated with the Construction of the Proposed Bear Head LNG Project on Business Activity in Canada*<br>(Monetary Values in Constant 2014 Dollars) | | |
|---|---|---|
| | **Canada** | **Nova Scotia** |
| Total Expenditures | $7.142 billion | $5.160 billion |
| Gross Product | $3.312 billion | $2.415 billion |
| Personal Income | $2.202 billion | $1.530 billion |
| Retail Sales | $0.836 billion | $0.519 billion |
| Employment (Person-Years) | 36,263 | 24,302 |
| **FISCAL EFFECTS** | | |
| Local Governments | | $0.122 billion |
| Provincial | | $0.277 billion |
| Federal Government | | $0.324 billion |

SOURCE: The Perryman Group

* Assumes that engineering, procurement, and construction activity in Canada conforms to current expectations by Project sponsors. Values are expressed in US currency.

# Economic and Fiscal Benefits of Enhanced Natural Gas Drilling and Production

In order to estimate the direct economic stimulus stemming from incremental natural gas drilling and production, data regarding permits and completions and typical costs were utilized to determine the likely volume of activity required. Based on typical requirements to generate incremental production of significant magnitude, the initial years would likely require additional exploration and drilling investments, with later years focused on production and maintenance with somewhat lower levels of capital outlays.[6] Well costs and performance patterns calibrated to the Marcellus Shale Region were utilized, although they do not differ markedly from those in other major formations.

## Cumulative 25-Year Impact

**Assuming that it occurs domestically, cumulative economic gains** stemming from enhanced natural gas production over the first 25 years of Project operations would include an estimated increase in **United States** gross product[7] of some **$93.814 billion** as well as **988,553** person-years of employment. The natural gas utilized could come from virtually any gas-producing region across the United States or Canada, however, if it came from the nearby **Marcellus Region**, the cumulative 25-year economic benefits **to the region** of additional natural gas production stemming from the Bear Head LNG Project include an estimated **$86.459 billion** in gross product each year as well as **920,099** person-years of employment in the **Region**. Fiscal effects include gains of **$6.835 billion** to the federal government over the 25-year period, with **$4.529 billion** to states and **$2.319 billion** to local governments.

[6] See, for example, Hefley, William E, et al. "The Economic Impact of the Value Chain of a Marcellus Shale Well." University of Pittsburgh: Pitt Business, August 2011.

[7] Gross product, as described on page 7 and the Appendices, is the production that will come about due to the Project. As used herein, it is analogous to the relevant segment of the regularly reported US and Canadian gross domestic product numbers.

| The Potential Cumulative Impact (Over 25 Years) of the Incremental Natural Gas Drilling and Extraction Associated with the Implementation of the Proposed Bear Head LNG Project on Business Activity*<br>(Monetary Values in Billions of Constant 2014 Dollars) | | |
|---|---|---|
| | **Northern Marcellus Shale Region** | **United States** |
| Total Expenditures | $197.805 billion | $219.897 billion |
| Gross Product | $86.459 billion | $93.814 billion |
| Personal Income | $57.706 billion | $61.803 billion |
| Retail Sales | $20.850 billion | $22.343 billion |
| Employment (Person-Years) | 920,099 | 988,553 |
| **FISCAL EFFECTS** | | |
| Local Governments | | $2.319 billion |
| State Governments | | $4.529 billion |
| Federal Government | | $6.835 billion |

SOURCE: The Perryman Group

* This scenario assumes that the natural gas inputs for the operation of the Project will be obtained from the proximate natural gas production in the Marcellus Shale Region of the United States. Outlays are based on a typical pattern of allocation between capital and maintenance and operations outlays over an extended development period in constant (2014) dollars.

## Average Annual Impact

On an average annual basis, economic benefits of enhanced natural gas production stemming from the Bear Head LNG Project include **$3.458 billion** in gross product and **36,804** jobs in the Marcellus Shale Region (if that is where the gas is produced), with results for the nation as a whole (including the Marcellus Shale Regional effects) of **$3.753 billion** in gross product and **39,542** jobs. Fiscal benefits are estimated to be **$0.273 billion** to the federal government,

**$0.181 billion** to states, and **$0.093 billion** to local governments (on average over the first 25 years of operation).

**The Potential Average Annual Impact of the Incremental Natural Gas Drilling and Extraction Associated with the Implementation of the Proposed Bear Head LNG Project on Domestic Business Activity***
**(Monetary Values in Billions of Constant 2014 Dollars)**

| | Northern Marcellus Shale Region | United States |
|---|---|---|
| Total Expenditures | $7.912 billion | $8.796 billion |
| Gross Product | $3.458 billion | $3.753 billion |
| Personal Income | $2.308 billion | $2.472 billion |
| Retail Sales | $0.834 billion | $0.894 billion |
| Employment (Average Annual) | 36,804 | 39,542 |
| **FISCAL EFFECTS** | | |
| Local Governments | | $0.093 billion |
| State Governments | | $0.181 billion |
| Federal Government | | $0.273 billion |

SOURCE: The Perryman Group

* This scenario assumes that the natural gas inputs for the operation of the Project will be obtained from the proximate natural gas production in the Marcellus Shale Region of the United States. Outlays are based on a typical pattern of allocation between capital and maintenance and operations outlays over an extended development period in constant (2014) dollars.

Further sectoral details can be found in the Appendices.

# Other Potential Considerations

## Potential Consumer Price Effects

The potential effect of this Project on consumer prices of natural gas was examined in a summary manner as a component of this study. Future prices of natural gas will depend on many highly uncertain factors including the pace of technology implementation for broader applications, the magnitude of new supply discoveries, the development of new methods for extraction, the supply and price of alternative fuels, and many others.

While a full-scale pricing analysis is beyond the scope of this study and is the subject of analysis by other consultants, some basic comparisons to reference cases developed by the Energy Information Administration (EIA), market responses (elasticities), projected future demand and supply, and related information suggest a potential price increase of $0.036-$0.043 per thousand cubic feet (mcf) over the next several decades,[8] or an average price effect of $0.039 over the long term.[9] A similar analysis which incorporated Canadian supply and demand yielded a comparable average impact of $0.031 per mcf. These findings are consistent with those of Ziff Energy's report prepared for the Bear Head LNG Project.[10] It should be noted that this amount is below the variation in projected prices among reputable sources and would lie within the 95% confidence interval ("margin of error") of any major forecasting model presently available. Moreover, given the anticipated large expansion in natural gas discovery and development in the coming decades, it could well be that excess domestic supply will virtually eliminate even these small price effects.

Over the past few years, US natural gas prices have decreased, largely as a result of an abundant domestic supply.[11] From 2009 to 2013, total production of natural gas increased from less than 26.1 trillion to 30.0 trillion cubic feet, and total supply of natural gas increased

[8] The relevant supply and demand elasticities were obtained from the following sources: Ponce, Micaela and Anne Neumann, Elasticities of Supply for the US Natural Gas Market, DIW Berlin, German Institute for Economic Research, 2014 and Arora, Vipin, Estimates of the Price Elasticities of Natural Gas Supply and Demand in the United States, U.S. Energy Information Administration, 2014, http://mpra.ub.uni-muenchen.de/54232/.
[9] Annual Energy Outlook 2014, U.S. Energy Information Administration, 2014, http://www.eia.gov/forecasts/aeo/pdf/0383(2014).pdf.
[10] Long-Term Natural Gas Supply and Demand Forecast to 2050 for Bear Head LNG, Ziff Energy, 2014.
[11] Annual Energy Outlook 2014, U.S. Energy Information Administration, 2014, http://www.eia.gov/forecasts/aeo/pdf/0383(2014).pdf, p. MT-21; Natural Gas Annual, U.S. Energy Information Administration, 2013, http://www.eia.gov/naturalgas/annual/pdf/nga13.pdf, p. 1-2, 63.

from 27.7 to 30.9 trillion cubic feet. Furthermore, there have been increases in proved reserves.[12] In 2013, total proved dry natural gas reserves significantly increased and climbed to a new record high of 354 trillion cubic feet.[13] In response to the increasing domestic supply, natural gas prices have dropped from 2009 to 2013. In 2009, residential consumers paid $12.14 per thousand cubic feet of natural gas, but by 2013, they paid only $10.32. Likewise, the average price for natural gas exports dropped from $4.47 in 2009 to $4.08 in 2013.[14] Prices have continued to fall since that time.

The EIA projects that total natural gas production will increase by 56% from 2012 to 2040. This growth in production is expected to meet increasing demand and exports, as well as compensate for a drop in natural gas imports.[15] These considerations, coupled with the extreme volatility in prices in recent years, suggest that any impact is likely to be insignificant relative to market expectations.

## Balance of Trade Benefits

The Bear Head LNG Project would help improve the US balance of trade by providing an additional export market for natural gas. The Perryman Group estimates that exports utilized by the Project would improve the US balance of payments by $1.7 billion-$3.8 billion per year (in constant dollars) based on EIA baseline natural gas price projections.

The actual amount will depend on destination, transportation costs, and other market factors. Improving the US balance of trade is a stated policy goal of the current administration, and the Bear Head LNG Project would help move in that direction.

[12] Natural Gas Annual, U.S. Energy Information Administration, 2013, http://www.eia.gov/naturalgas/annual/pdf/nga13.pdf, p. 1.
[13] U.S. Crude Oil and Natural Gas Proved Reserves, U.S. Energy Information Administration, December 4, 2014, http://www.eia.gov/naturalgas/crudeoilreserves/pdf/uscrudeoil.pdf.
[14] Natural Gas Annual, U.S. Energy Information Administration, 2013, http://www.eia.gov/naturalgas/annual/pdf/nga13.pdf, p. 2.
[15] Annual Energy Outlook 2014, U.S. Energy Information Administration, 2014, http://www.eia.gov/forecasts/aeo/pdf/0383(2014).pdf, p. MT-21 – MT-26.

# Conclusion

The supply of natural gas in North America increased rapidly as a result of improvements in recovery techniques and the ongoing exploration of and production from shale formations. However, natural gas prices have now fallen to levels that limit the economic viability of further drilling. Providing greater access to world markets through the Bear Head LNG Project would help ensure the ongoing development of North American natural gas resources.

In addition, the Bear Head LNG Project would generate notable economic gains in Canada and the United States, both during construction and development stages and once the Project is operational. The Perryman Group estimates that construction and preoperational spending associated with the proposed Project would lead to estimated total economic gains of almost **$1.140 billion** in gross product and **16,969** person-years of employment in the United States. For Canada, preoperational phases would generate a projected increase in business activity of some **$3.312 billion** in gross product and **36,263** person-years of employment.

On an average annual basis, economic benefits of enhanced natural gas production stemming from the Bear Head LNG Project include almost **$3.458 billion** in gross product and **36,804** jobs in the Marcellus Shale Region (assuming that is where the gas is produced), with results for the nation as a whole (including the Marcellus Shale Regional effects) of **$3.753 billion** in gross product and **39,542** jobs.

This economic stimulus, in turn, would generate significant incremental tax receipts to federal, state/provincial, and local government entities in both Canada and the United States. US balance of payments is also improved, and effects on natural gas prices would likely be minimal, if any, given current and projected market conditions. The Bear Head LNG Project thus offers a notable potential stimulus to the US economy.

# APPENDICES

# APPENDIX A: About The Perryman Group

The Perryman Group is an economic research and analysis firm based in Waco, Texas. The firm has more than 30 years of experience in assessing the economic impact of corporate expansions, regulatory changes, real estate developments, public policy initiatives, and myriad other factors affecting business activity. TPG has conducted hundreds of impact analyses for local areas, regions, and states throughout the United States. Impact studies have been performed for hundreds of clients including many of the largest corporations in the world, governmental entities at all levels, educational institutions, major health care systems, utilities, and economic development organizations.

Dr. M. Ray Perryman, founder and President of the firm, developed the US Multi-Regional Impact Assessment System (used in this study) in the early 1980s and has consistently maintained, expanded, and updated it since that time. The model has been used in hundreds of diverse applications and has an excellent reputation for reliability.

The firm has conducted numerous investigations related to the oil and gas industry. These analyses have included, among others, forecasts, impact assessments, regulatory and environmental issues, and legislative and policy initiatives. Previous work by The Perryman Group includes an assessment of the effects of offshore drilling for the US Department of the Interior, several studies of specific production areas, and projections of natural gas prices and output. Information has been prepared for the Interstate Oil Compact Commission, the US Department of Energy, the Texas Railroad Commission, and numerous legislative committees regarding energy policy.

Additionally, over the past several years, TPG has performed multiple comprehensive assessments of the impact of oil and gas exploration and production on regional economies including assessments of the Barnett Shale's effects on the local northeast Texas area and the state of Texas and a detailed analysis of the labor market in the Permian Basin oil and gas producing area of west Texas. The firm has also completed in-depth analyses of numerous refineries and petrochemical facilities, international pipeline projects, various aspects of natural gas taxation, and numerous studies specifically dealing with changes in the cost of energy resources (including electricity, oil, and natural gas) on both a regional and national basis. The Perryman Group has also analyzed economic and socioeconomic impacts of several other proposed liquefaction export projects.

# APPENDIX B: Methods Used

The basic modeling technique employed in this study is known as dynamic input-output analysis. This methodology essentially uses extensive survey data, industry information, and a variety of corroborative source materials to create a matrix describing the various goods and services (known as resources or inputs) required to produce one unit (a dollar's worth) of output for a given sector. Once the base information is compiled, it can be mathematically simulated to generate evaluations of the magnitude of successive rounds of activity involved in the overall production process.

There are two essential steps in conducting an input-output analysis once the system is operational. The first major endeavor is to accurately define the levels of direct activity to be evaluated. In the case of a prospective evaluation, it is necessary to first calculate reasonable estimates of the direct activity. In this instance, data regarding construction costs and schedules and capacity was provided by Project sponsors and reviewed by The Perryman Group for reasonableness relative to similar initiatives, though TPG did not conduct any independent verification.

Although the Project is still in the process of permitting, current estimated cost allocations of the assumed $4 billion total investment include 10% engineering, 35% procurement, and 55% construction (labor and labor-related equipment). The 10% engineering ($400 million) was assumed to be split with 8% in the United States and 2% in Canada. The 35% procurement ($1.4 billion) was assumed to be divided with 12.5% to US firms, 5% Canadian, and 17.5% to other countries. It was assumed that $300 million would be spent for the construction of modules likely to occur in Louisiana. The Project includes storage tanks on site and a marine terminal. Major equipment including turbines and compressors is anticipated to be provided by US vendors, with cold boxes likely being produced in Louisiana. Pipes, valves, and fittings were assumed to primarily come from locations outside of the US and Canada. Allocations to specific model categories were based on detailed cost information from an analogous project and those found in other LNG projects analyzed by TPG.

A variety of sources of data regarding natural gas markets, oil and gas exploration and production patterns, and other information necessary to the analysis were collected and analyzed by The Perryman Group. TPG made use of available studies by major private groups and the Energy Information Administration regarding natural gas supplies and pricing. In addition, allocations of local direct contributions made use of extensive databases from the

Bureau of Economic Analysis. Studies prepared by other consultants in the Bear Head LNG Project application process were also utilized where applicable.

The second major phase of the analysis is the simulation of the input-output system to measure overall economic effects. The US portion of the present study was conducted within the context of the US Multi-Regional Impact Assessment System (USMRIAS) which was developed and is maintained by The Perryman Group. This model has been used in hundreds of diverse applications across the country and has an excellent reputation for accuracy and credibility. For Canada, TPG utilized impact models developed by Statistics Canada, with modifications to account for the full effects of various outlays in a manner consistent with the USMRIAS and to convert all monetary values to (2014) US dollars. Allocations to Nova Scotia were based on gravity modeling, a technique which assigns production to geographic areas based on distance and capacity to supply various inputs. The systems used in the current simulations reflect the unique industrial structure and characteristics of the economies of the regions studied.

The USMRIAS is somewhat similar in format to the Input-Output Model of the United States and the Regional Input-Output Modeling System, both of which are maintained by the US Department of Commerce. The model developed by TPG, however, incorporates several important enhancements and refinements. Specifically, the expanded system includes (1) comprehensive 500-sector coverage for any county, multi-county, or urban region; (2) calculation of both total expenditures and value-added by industry and region; (3) direct estimation of expenditures for multiple basic input choices (expenditures, output, income, or employment); (4) extensive parameter localization; (5) price adjustments for real and nominal assessments by sectors and areas; (6) measurement of the induced impacts associated with payrolls and consumer spending; (7) embedded modules to estimate multi-sectoral direct spending effects; (8) estimation of retail spending activity by consumers; and (9) comprehensive linkage and integration capabilities with a wide variety of econometric, real estate, occupational, and fiscal impact models. Moreover, the model uses specific local taxing patterns to estimate the fiscal effects of activity on a detailed sectoral basis. The models used for the present investigation have been thoroughly tested for reasonableness and historical reliability.

The impact assessment (input-output) process essentially estimates the amounts of all types of goods and services required to produce one unit (a dollar's worth) of a specific type of output. For purposes of illustrating the nature of the system, it is useful to think of inputs and outputs in dollar (rather than physical) terms. As an example, the construction of a new building will require specific dollar amounts of lumber, glass, concrete, hand tools, architectural services, interior design services, paint, plumbing, and numerous other elements. Each of these

suppliers must, in turn, purchase additional dollar amounts of inputs. This process continues through multiple rounds of production, thus generating subsequent increments to business activity. The initial process of building the facility is known as the *direct effect*. The ensuing transactions in the output chain constitute the *indirect effect*.

Another pattern that arises in response to any direct economic activity comes from the payroll dollars received by employees at each stage of the production cycle. As workers are compensated, they use some of their income for taxes, savings, and purchases from external markets. A substantial portion, however, is spent locally on food, clothing, healthcare services, utilities, housing, recreation, and other items. Typical purchasing patterns in the relevant areas are obtained from the *ACCRA Cost of Living Index*, a privately compiled inter-regional measure which has been widely used for several decades, and the *Consumer Expenditure Survey* of the US Department of Labor. These initial outlays by area residents generate further secondary activity as local providers acquire inputs to meet this consumer demand. These consumer spending impacts are known as the *induced effect*. The USMRIAS is designed to provide realistic, yet conservative, estimates of these phenomena.

Sources for information used in this process include the Bureau of the Census, the Bureau of Labor Statistics, the Regional Economic Information System of the US Department of Commerce, and other public and private sources. The pricing data are compiled from the US Department of Labor and the US Department of Commerce. The verification and testing procedures make use of extensive public and private sources. Note that all monetary values are given in constant (2014) dollars to eliminate the effects of inflation.

The USMRIAS generates estimates of the effect on several measures of business activity. The most comprehensive measure of economic activity used in this study is **Total Expenditures**. This measure incorporates every dollar that changes hands in any transaction. For example, suppose a farmer sells wheat to a miller for $0.50; the miller then sells flour to a baker for $0.75; the baker, in turn, sells bread to a customer for $1.25. The Total Expenditures recorded in this instance would be $2.50, that is, $0.50 + $0.75 + $1.25. This measure is quite broad, but is useful in that (1) it reflects the overall interplay of all industries in the economy, and (2) some key fiscal variables such as sales taxes are linked to aggregate spending.

A second measure of business activity frequently employed in this analysis is that of **Gross Product**. This indicator represents the regional equivalent of Gross Domestic Product, the most commonly reported statistic regarding national economic performance. In other words, the Gross Product of Arkansas is the amount of US output that is produced in that state; it is defined as the value of all final goods produced in a given region for a specific period of time. Stated differently, it captures the amount of value-added (gross area product) over

intermediate goods and services at each stage of the production process, that is, it eliminates the double counting in the Total Expenditures concept. Using the example above, the Gross Product is $1.25 (the value of the bread) rather than $2.50. Alternatively, it may be viewed as the sum of the value-added by the farmer, $0.50; the miller, $0.25 ($0.75 - $0.50); and the baker, $0.50 ($1.25 - $0.75). The total value-added is, therefore, $1.25, which is equivalent to the final value of the bread. In many industries, the primary component of value-added is the wage and salary payments to employees.

The third gauge of economic activity used in this evaluation is **Personal Income**. As the name implies, Personal Income is simply the income received by individuals, whether in the form of wages, salaries, interest, dividends, proprietors' profits, or other sources. It may thus be viewed as the segment of overall impacts which flows directly to the citizenry.

The fourth measure, **Retail Sales**, represents the component of Total Expenditures which occurs in retail outlets (general merchandise stores, automobile dealers and service stations, building materials stores, food stores, drugstores, restaurants, and so forth). Retail Sales is a commonly used measure of consumer activity.

The final aggregates used are **Permanent Jobs and Person-Years of Employment**. The Person-Years of Employment measure reveals the full-time equivalent jobs generated by an activity. It should be noted that, unlike the dollar values described above, Permanent Jobs is a "stock" rather than a "flow." In other words, if an area produces $1 million in output in 2010 and $1 million in 2011, it is appropriate to say that $2 million was achieved in the 2010-2011 period. If the same area has 100 people working in 2010 and 100 in 2011, it only has 100 Permanent Jobs. When a flow of jobs is measured, such as in a construction project or a cumulative assessment over multiple years, it is appropriate to measure employment in Person-Years (a person working for a year). This concept is distinct from Permanent Jobs, which anticipates that the relevant positions will be maintained on a continuing basis.

# Appendix C: Socioeconomic Data

## Socioeconomic Data for Louisiana

| | Estimated Population as of July 1, 2013 | Employment as of September 2014* | Unemployment Rate as of September 2014* | Median Household Income |
|---|---|---|---|---|
| | | | | |
| Iberia Parish, Louisiana | 73,878 | 33,017 | 5.5% | $39,793 |
| State of Louisiana | 4,625,470 | 2,029,831 | 6.1% | $44,164 |

*Note: Employment and unemployment rates for local areas (such as Iberia Parish) are not available on a seasonally adjusted basis; Louisiana data for employment and unemployment rate in this table are not seasonally adjusted to facilitate comparison between the Parish and state as a whole.
Sources: Population: US Census Bureau, Population Division;
Employment, and Unemployment Rate: Bureau of Labor Statistics;
Median Income: US Census Bureau, 2013 1-Year Estimate, American Community Survey

## Socioeconomic Data for the Marcellus Shale Region

| | Estimated Population as of July 1, 2013 | Employment as of September 2014 | Unemployment Rate as of September 2014 | Median Household Income |
|---|---|---|---|---|
| | | | | |
| Allegany County, Maryland | 73,521 | 33,329 | 6.4% | $39,293 |
| Garrett County, Maryland | 29,889 | 15,777 | 5.5% | $45,206 |
| Passaic County, New Jersey | 505,672 | 220,184 | 7.6% | $57,654 |
| Sussex County, New Jersey | 145,992 | 76,031 | 5.3% | $87,335 |
| Warren County, New Jersey | 107,379 | 54,612 | 5.3% | $70,912 |
| Allegany County, New York | 48,109 | 22,274 | 5.3% | $42,445 |
| Broome County, New York | 197,534 | 81,741 | 6.0% | $45,958 |
| Cattaraugus County, New York | 78,892 | 35,767 | 5.8% | $42,603 |
| Cayuga County, New York | 79,477 | 36,496 | 5.1% | $51,581 |
| Chemung County, New York | 88,506 | 35,122 | 6.1% | $48,804 |
| Chenango County, New York | 49,503 | 22,459 | 5.4% | $43,941 |
| Cortland County, New York | 48,976 | 22,006 | 5.5% | $47,151 |
| Delaware County, New York | 46,722 | 18,726 | 6.0% | $44,470 |
| Greene County, New York | 48,455 | 20,934 | 5.6% | $49,655 |
| Livingston County, New York | 64,705 | 28,843 | 4.9% | $53,518 |
| Ontario County, New York | 109,103 | 51,566 | 4.9% | $56,479 |
| Orange County, New York | 375,592 | 159,628 | 5.5% | $70,458 |
| Otsego County, New York | 61,683 | 28,301 | 5.0% | $47,765 |
| Schoharie County, New York | 31,844 | 13,686 | 5.7% | $53,245 |
| Schuyler County, New York | 18,460 | 9,256 | 5.1% | $46,976 |
| Seneca County, New York | 35,409 | 15,243 | 5.0% | $47,618 |
| Steuben County, New York | 98,650 | 39,683 | 6.4% | $47,476 |
| Sullivan County, New York | 76,665 | 29,734 | 6.3% | $48,089 |
| Tioga County, New York | 50,243 | 21,817 | 5.8% | $55,726 |
| Tompkins County, New York | 103,617 | 55,163 | 3.9% | $51,393 |
| Ulster County, New York | 180,998 | 78,772 | 5.8% | $58,590 |
| Yates County, New York | 25,156 | 12,485 | 4.3% | $49,335 |
| Belmont County, Ohio | 69,571 | 31,235 | 5.2% | $41,534 |
| Carroll County, Ohio | 28,275 | 12,918 | 5.0% | $43,779 |
| Columbiana County, Ohio | 105,893 | 47,797 | 5.5% | $42,300 |
| Guernsey County, Ohio | 39,636 | 18,629 | 5.2% | $38,841 |
| Harrison County, Ohio | 15,622 | 7,354 | 4.7% | $39,002 |
| Jefferson County, Ohio | 67,964 | 27,133 | 7.1% | $40,577 |
| Mahoning County, Ohio | 233,869 | 102,236 | 5.5% | $41,058 |
| Monroe County, Ohio | 14,585 | 4,497 | 10.1% | $40,573 |
| Noble County, Ohio | 14,628 | 5,419 | 6.0% | $38,290 |
| Washington County, Ohio | 61,310 | 29,433 | 4.9% | $42,834 |
| Allegheny County, Pennsylvania | 1,231,527 | 626,523 | 4.5% | $51,366 |
| Armstrong County, Pennsylvania | 68,107 | 31,605 | 5.0% | $45,241 |
| Beaver County, Pennsylvania | 170,115 | 85,431 | 5.3% | $49,217 |
| Bedford County, Pennsylvania | 49,055 | 21,837 | 5.1% | $43,290 |
| Blair County, Pennsylvania | 126,314 | 61,031 | 4.3% | $42,992 |

| | Estimated Population as of July 1, 2013 | Employment as of September 2014 | Unemployment Rate as of September 2014 | Median Household Income |
|---|---|---|---|---|
| Bradford County, Pennsylvania | 62,316 | 32,390 | 4.0% | $46,963 |
| Butler County, Pennsylvania | 185,476 | 96,776 | 4.2% | $58,230 |
| Cambria County, Pennsylvania | 140,499 | 61,337 | 5.4% | $41,730 |
| Cameron County, Pennsylvania | 4,886 | 1,977 | 6.1% | $41,410 |
| Carbon County, Pennsylvania | 64,786 | 29,798 | 5.6% | $48,900 |
| Centre County, Pennsylvania | 155,403 | 74,182 | 3.6% | $50,336 |
| Clarion County, Pennsylvania | 39,155 | 18,240 | 4.9% | $42,389 |
| Clearfield County, Pennsylvania | 81,174 | 37,424 | 5.0% | $41,030 |
| Clinton County, Pennsylvania | 39,954 | 19,425 | 5.1% | $42,184 |
| Columbia County, Pennsylvania | 66,797 | 36,416 | 4.2% | $44,807 |
| Crawford County, Pennsylvania | 37,376 | 40,097 | 4.5% | $42,504 |
| Elk County, Pennsylvania | 31,479 | 16,157 | 4.0% | $45,767 |
| Fayette County, Pennsylvania | 134,999 | 59,439 | 5.0% | $39,115 |
| Forest County, Pennsylvania | 7,631 | 2,172 | 5.4% | $36,556 |
| Greene County, Pennsylvania | 37,838 | 20,751 | 3.8% | $44,388 |
| Indiana County, Pennsylvania | 87,745 | 45,362 | 4.3% | $43,997 |
| Jefferson County, Pennsylvania | 44,966 | 20,960 | 4.5% | $41,262 |
| Lackawanna County, Pennsylvania | 213,931 | 98,264 | 5.6% | $46,044 |
| Lawrence County, Pennsylvania | 89,333 | 40,232 | 5.1% | $43,546 |
| Luzerne County, Pennsylvania | 320,103 | 146,437 | 6.1% | $44,402 |
| Lycoming County, Pennsylvania | 116,754 | 59,974 | 4.8% | $45,430 |
| McKean County, Pennsylvania | 42,979 | 19,864 | 4.7% | $41,834 |
| Mercer County, Pennsylvania | 115,195 | 50,556 | 5.6% | $44,301 |
| Pike County, Pennsylvania | 56,591 | 24,428 | 5.8% | $59,340 |
| Potter County, Pennsylvania | 17,497 | 7,152 | 5.5% | $41,547 |
| Somerset County, Pennsylvania | 76,520 | 33,926 | 5.3% | $43,597 |
| Sullivan County, Pennsylvania | 6,351 | 3,327 | 4.0% | $40,964 |
| Susquehanna County, Pennsylvania | 42,286 | 23,662 | 4.0% | $48,231 |
| Tioga County, Pennsylvania | 42,463 | 20,482 | 5.0% | $44,187 |
| Venango County, Pennsylvania | 53,907 | 23,822 | 4.8% | $41,977 |
| Warren County, Pennsylvania | 40,885 | 20,003 | 4.2% | $43,764 |
| Washington County, Pennsylvania | 208,206 | 103,145 | 4.5% | $53,693 |
| Wayne County, Pennsylvania | 51,548 | 23,542 | 4.4% | $49,313 |
| Westmoreland County, Pennsylvania | 362,437 | 181,930 | 4.4% | $50,736 |
| Wyoming County, Pennsylvania | 28,003 | 12,999 | 5.4% | $48,482 |
| Barbour County, West Virginia | 16,770 | 6,454 | 5.5% | $37,327 |
| Braxton County, West Virginia | 14,502 | 5,025 | 7.2% | $31,848 |
| Brooke County, West Virginia | 23,737 | 9,412 | 6.5% | $42,493 |
| Calhoun County, West Virginia | 7,564 | 2,635 | 7.1% | $31,679 |
| Clay County, West Virginia | 9,244 | 2,828 | 8.3% | $31,613 |
| Doddridge County, West Virginia | 8,344 | 3,149 | 5.0% | $34,817 |
| Gilmer County, West Virginia | 8,672 | 3,002 | 6.1% | $38,442 |
| Grant County, West Virginia | 11,759 | 4,548 | 7.4% | $41,368 |

| | Estimated Population as of July 1, 2013 | Employment as of September 2014 | Unemployment Rate as of September 2014 | Median Household Income |
|---|---|---|---|---|
| Greenbrier County, West Virginia | 35,644 | 14,225 | 5.8% | $37,895 |
| Hancock County, West Virginia | 30,291 | 12,367 | 6.8% | $38,522 |
| Hardy County, West Virginia | 13,920 | 6,095 | 5.3% | $32,723 |
| Harrison County, West Virginia | 68,972 | 31,038 | 4.8% | $43,183 |
| Lewis County, West Virginia | 16,452 | 7,929 | 5.1% | $36,199 |
| Marion County, West Virginia | 56,868 | 25,873 | 5.4% | $42,152 |
| Marshall County, West Virginia | 32,459 | 13,564 | 6.4% | $40,681 |
| Mineral County, West Virginia | 27,704 | 12,850 | 5.8% | $31,163 |
| Monongalia County, West Virginia | 102,274 | 51,899 | 4.0% | $44,173 |
| Nicholas County, West Virginia | 25,965 | 9,149 | 7.9% | $40,064 |
| Ohio County, West Virginia | 43,727 | 19,596 | 5.2% | $41,025 |
| Pendleton County, West Virginia | 7,471 | 3,234 | 4.3% | $34,175 |
| Pleasants County, West Virginia | 7,577 | 2,945 | 5.4% | $41,859 |
| Pocahontas County, West Virginia | 8,669 | 2,959 | 7.8% | $33,779 |
| Preston County, West Virginia | 33,859 | 15,669 | 4.7% | $45,413 |
| Randolph County, West Virginia | 29,415 | 11,290 | 6.3% | $37,276 |
| Ritchie County, West Virginia | 10,073 | 4,385 | 5.2% | $35,769 |
| Roane County, West Virginia | 14,656 | 4,835 | 7.8% | $28,513 |
| Taylor County, West Virginia | 16,973 | 7,253 | 5.2% | $39,536 |
| Tucker County, West Virginia | 6,968 | 2,519 | 7.0% | $37,635 |
| Tyler County, West Virginia | 8,995 | 3,462 | 7.8% | $39,206 |
| Upshur County, West Virginia | 24,665 | 9,936 | 5.2% | $39,381 |
| Webster County, West Virginia | 8,893 | 2,675 | 8.7% | $27,645 |
| Wetzel County, West Virginia | 16,204 | 5,906 | 9.5% | $37,969 |
| Wirt County, West Virginia | 5,901 | 2,201 | 7.6% | $34,702 |
| Wood County, West Virginia | 86,569 | 36,897 | 5.3% | $42,287 |
| | | | | |

Sources: Population: US Census Bureau, Population Division;
Employment, and Unemployment Rate: Bureau of Labor Statistics;
Median Income: US Census Bureau, 2009-2013 5-Year American Community Survey

# Appendix D: Detailed Sectoral Results

# Anticipated Impact Associated with Construction of the Proposed Bear Head LNG Project

## The Anticipated Impact Associated with the Construction of the Proposed Bear Head LNG Project on Business Activity in the United States*

| Sector | Total Expenditures | Real Gross Product | Personal Income | Employment |
|---|---|---|---|---|
| | *(2014 Dollars)* | *(2014 Dollars)* | *(2014 Dollars)* | *(Person-Years)* |
| Agriculture | $50,669,256 | $14,337,570 | $9,352,666 | 141 |
| Mining | $43,206,316 | $10,419,093 | $6,406,091 | 37 |
| Construction | $55,097,911 | $29,501,681 | $24,311,223 | 327 |
| Nondurable Manufacturing | $511,633,687 | $139,538,500 | $72,369,206 | 1,142 |
| Durable Manufacturing | $1,088,559,171 | $104,996,055 | $338,671,972 | 3,690 |
| Transportation and Utilities | $266,678,924 | $106,662,912 | $62,257,453 | 674 |
| Information | $65,955,472 | $40,586,225 | $17,492,595 | 155 |
| Wholesale Trade | $124,309,532 | $84,112,256 | $48,499,877 | 518 |
| Retail Trade | $394,020,975 | $294,343,150 | $170,891,441 | 5,026 |
| Finance, Insurance, and Real Estate | $379,537,566 | $96,144,255 | $38,816,117 | 384 |
| Business Services | $440,037,953 | $70,347,538 | $215,296,231 | 2,437 |
| Health Services | $88,718,716 | $62,074,908 | $52,484,907 | 828 |
| Other Services | $171,774,329 | $87,430,894 | $70,399,803 | 1,611 |
| **TOTAL** | **$3,680,199,810** | **$1,140,495,036** | **$1,127,249,582** | **16,969** |

*Assumes that (1) the LNG modules are produced in the US; (2) manufacturing and procurement of compressors and turbines, cold boxes, and other equipment and items occurs in the US; and (3) a substantial segment of the engineering and related work is conducted in the US. The assumed magnitudes reflect best estimates by Project sponsors and are consistent with patterns in other similar projects and the capacity of relevant sectors.
Source: US Multi-Regional Impact Assessment System, The Perryman Group

## The Anticipated Impact Associated with the Construction of the Proposed Bear Head LNG Project on Business Activity in Louisiana*

| Sector | Total Expenditures | Real Gross Product | Personal Income | Employment |
|---|---|---|---|---|
| | *(2014 Dollars)* | *(2014 Dollars)* | *(2014 Dollars)* | *(Person-Years)* |
| Agriculture | $11,563,716 | $3,268,553 | $2,133,178 | 32 |
| Mining | $11,393,162 | $2,749,076 | $1,680,664 | 10 |
| Construction | $14,976,219 | $8,100,263 | $6,675,122 | 90 |
| Nondurable Manufacturing | $67,995,675 | $19,597,571 | $10,290,067 | 161 |
| Durable Manufacturing | $447,638,141 | $168,385,479 | $109,985,828 | 1,760 |
| Transportation and Utilities | $58,581,887 | $24,366,561 | $14,437,895 | 161 |
| Information | $14,933,311 | $9,159,161 | $3,951,089 | 35 |
| Wholesale Trade | $37,874,691 | $25,628,489 | $14,777,615 | 158 |
| Retail Trade | $95,609,273 | $72,113,004 | $41,987,913 | 1,217 |
| Finance, Insurance, and Real Estate | $85,475,816 | $22,472,459 | $9,437,006 | 95 |
| Business Services | $24,691,160 | $15,043,250 | $12,271,437 | 143 |
| Health Services | $22,530,229 | $15,776,519 | $13,339,194 | 210 |
| Other Services | $39,944,951 | $20,481,973 | $16,439,793 | 374 |
| **TOTAL** | **$933,208,231** | **$407,142,359** | **$257,406,799** | **4,445** |

*Assumes that LNG modules and cold boxes are produced in Louisiana. According to Project sponsors, this scenario is highly probable. While other items could be manufactured in the state, the locations are not yet determined.
Source: US Multi-Regional Impact Assessment System, The Perryman Group

## The Anticipated Impact Associated with the Construction of the Proposed Bear Head LNG Project on Business Activity in Canada*

| Sector | Total Expenditures | Real Gross Product | Personal Income | Employment |
|---|---|---|---|---|
| | *(2014 Dollars)* | *(2014 Dollars)* | *(2014 Dollars)* | *(Person-Years)* |
| Agriculture | $95,887,053 | $27,568,558 | $18,190,368 | 276 |
| Mining | $102,368,910 | $25,796,369 | $14,895,473 | 93 |
| Construction | $1,260,488,206 | $586,735,933 | $483,506,954 | 6,509 |
| Nondurable Manufacturing | $599,255,768 | $168,614,517 | $88,154,628 | 1,400 |
| Durable Manufacturing | $1,549,551,149 | $609,636,559 | $398,542,768 | 5,932 |
| Transportation and Utilities | $472,081,863 | $197,888,771 | $117,556,596 | 1,315 |
| Information | $126,356,001 | $77,729,420 | $33,544,376 | 299 |
| Wholesale Trade | $269,732,494 | $182,522,485 | $105,244,088 | 1,123 |
| Retail Trade | $836,288,659 | $629,273,430 | $366,147,689 | 10,646 |
| Finance, Insurance, and Real Estate | $818,657,130 | $200,654,804 | $80,570,493 | 801 |
| Business Services | $463,614,795 | $288,926,590 | $235,690,061 | 2,737 |
| Health Services | $194,090,474 | $135,835,513 | $114,850,183 | 1,811 |
| Other Services | $353,876,536 | $181,116,737 | $145,363,123 | 3,320 |
| **TOTAL** | **$7,142,249,038** | **$3,312,299,686** | **$2,202,256,799** | **36,263** |

*Assumes that engineering, procurement, and construction activity in Canada conforms to current expectations by Project sponsors. Values are expressed in US currency.
Source: US Multi-Regional Impact Assessment System, The Perryman Group

| The Anticipated Impact Associated with the Construction of the Proposed Bear Head LNG Project on Business Activity in Nova Scotia* | | | | |
|---|---|---|---|---|
| **Sector** | **Total Expenditures** | **Real Gross Product** | **Personal Income** | **Employment** |
| | *(2014 Dollars)* | *(2014 Dollars)* | *(2014 Dollars)* | *(Person-Years)* |
| Agriculture | $46,036,637 | $13,314,893 | $7,665,060 | 116 |
| Mining | $49,858,129 | $12,354,113 | $5,292,962 | 33 |
| Construction | $1,217,288,320 | $563,728,068 | $460,880,208 | 6,205 |
| Nondurable Manufacturing | $392,495,603 | $110,464,987 | $50,610,021 | 804 |
| Durable Manufacturing | $1,300,768,944 | $515,448,906 | $325,367,575 | 4,866 |
| Transportation and Utilities | $280,715,125 | $125,491,375 | $66,550,202 | 769 |
| Information | $78,685,747 | $48,413,403 | $18,288,960 | 162 |
| Wholesale Trade | $168,001,171 | $113,682,970 | $57,411,550 | 613 |
| Retail Trade | $519,426,267 | $393,332,307 | $200,828,399 | 5,782 |
| Finance, Insurance, and Real Estate | $435,138,564 | $114,387,138 | $42,476,720 | 424 |
| Business Services | $335,176,455 | $208,883,304 | $154,287,972 | 1,792 |
| Health Services | $121,371,206 | $84,942,448 | $62,902,175 | 992 |
| Other Services | $214,808,204 | $110,218,374 | $77,395,831 | 1,744 |
| **TOTAL** | **$5,159,770,371** | **$2,414,662,288** | **$1,529,957,634** | **24,302** |

*Assumes that engineering, procurement, and construction activity in Canada conforms to current expectations by Project sponsors. Values are expressed in US currency.
Source: US Multi-Regional Impact Assessment System, The Perryman Group

# The Potential Cumulative Impact (Over 25 Years) of the Incremental Natural Gas Drilling and Extraction Associated with the Operation of the Proposed Bear Head LNG Project

## The Potential Cumulative Impact (Over 25 Years) of the Incremental Natural Gas Drilling and Extraction Associated with the Operation of the Proposed Bear Head LNG Project on Business Activity in the United States*

| Sector | Total Expenditures | Real Gross Product | Personal Income | Employment |
|---|---|---|---|---|
| | *(2014 Dollars)* | *(2014 Dollars)* | *(2014 Dollars)* | *(Person-Years)* |
| Agriculture | $2,839,148,603 | $807,694,898 | $529,015,716 | 7,983 |
| Mining | $64,794,377,594 | $23,650,686,724 | $18,423,882,387 | 234,863 |
| Construction | $3,602,711,931 | $1,925,802,564 | $1,586,981,064 | 21,366 |
| Nondurable Manufacturing | $30,654,103,553 | $8,042,987,389 | $4,133,544,816 | 63,597 |
| Durable Manufacturing | $17,552,214,964 | $6,456,042,497 | $4,311,315,771 | 59,719 |
| Transportation and Utilities | $17,345,397,738 | $7,542,211,029 | $4,534,181,717 | 51,774 |
| Information | $3,459,801,706 | $2,123,548,136 | $915,434,712 | 8,101 |
| Wholesale Trade | $7,304,437,809 | $4,943,442,790 | $2,850,433,108 | 30,424 |
| Retail Trade | $22,342,800,683 | $16,797,561,138 | $9,771,207,285 | 284,511 |
| Finance, Insurance, and Real Estate | $25,678,395,841 | $7,613,192,754 | $3,327,810,455 | 34,334 |
| Business Services | $8,870,000,151 | $5,208,949,247 | $4,249,167,749 | 49,347 |
| Health Services | $5,153,719,081 | $3,604,865,254 | $3,047,947,018 | 48,061 |
| Other Services | $10,299,907,366 | $5,097,328,327 | $4,122,293,789 | 94,474 |
| **TOTAL** | **$219,897,017,022** | **$93,814,312,746** | **$61,803,215,586** | **988,553** |

*This scenario assumes that the natural gas inputs for the operation of the Project will be obtained from the United States (most likely the production area of the Marcellus Shale Region). Outlays are based on a typical pattern of allocation between capital and maintenance and operations outlays over an extended development period in constant (2014) dollars.
Source: US Multi-Regional Impact Assessment System, The Perryman Group

## The Potential Cumulative Impact (Over 25 Years) of the Incremental Natural Gas Drilling and Extraction Associated with the Operation of the Proposed Bear Head LNG Project on Business Activity in the Northern Marcellus Shale Region*

| Sector | Total Expenditures | Real Gross Product | Personal Income | Employment |
|---|---|---|---|---|
| | *(2014 Dollars)* | *(2014 Dollars)* | *(2014 Dollars)* | *(Person-Years)* |
| Agriculture | $2,390,160,350 | $681,301,017 | $445,647,068 | 6,722 |
| Mining | $64,255,338,081 | $23,529,541,124 | $18,362,906,221 | 234,555 |
| Construction | $3,472,441,268 | $1,856,167,361 | $1,529,597,326 | 20,593 |
| Nondurable Manufacturing | $18,181,780,608 | $4,917,033,718 | $2,545,114,120 | 38,992 |
| Durable Manufacturing | $16,965,346,230 | $6,223,246,885 | $4,159,204,397 | 57,714 |
| Transportation and Utilities | $15,219,072,165 | $6,849,596,563 | $4,158,836,194 | 48,289 |
| Information | $3,153,284,634 | $1,935,368,147 | $834,372,325 | 7,386 |
| Wholesale Trade | $6,809,809,710 | $4,608,692,084 | $2,657,412,872 | 28,364 |
| Retail Trade | $20,850,169,711 | $15,715,354,635 | $9,148,680,310 | 265,332 |
| Finance, Insurance, and Real Estate | $23,478,570,717 | $6,959,688,415 | $3,041,685,164 | 31,249 |
| Business Services | $8,462,915,530 | $4,969,886,892 | $4,054,154,128 | 47,082 |
| Health Services | $4,915,530,837 | $3,438,260,029 | $2,907,080,755 | 45,840 |
| Other Services | $9,650,827,141 | $4,774,370,017 | $3,861,067,709 | 87,980 |
| **TOTAL** | **$197,805,246,982** | **$86,458,506,885** | **$57,705,758,589** | **920,099** |

*This scenario assumes that the natural gas inputs for the operation of the Project will be obtained from the proximate natural gas production in the Marcellus Shale Region. Outlays are based on a typical pattern of allocation between capital and maintenance and operations outlays over an extended development period in constant (2014) dollars.
Source: US Multi-Regional Impact Assessment System, The Perryman Group

# The Potential Average Annual Impact of the Incremental Natural Gas Drilling and Extraction Associated with the Operation of the Proposed Bear Head LNG Project

## The Potential Average Annual Impact of the Incremental Natural Gas Drilling and Extraction Associated with the Operation of the Proposed Bear Head LNG Project on Business Activity in the United States*

| Sector | Total Expenditures | Real Gross Product | Personal Income | Employment |
|---|---|---|---|---|
| | *(2014 Dollars)* | *(2014 Dollars)* | *(2014 Dollars)* | *(Average Annual)* |
| Agriculture | $113,565,944 | $32,307,796 | $21,160,629 | 319 |
| Mining | $2,591,775,104 | $946,027,469 | $736,955,295 | 9,395 |
| Construction | $144,108,477 | $77,032,103 | $63,479,243 | 855 |
| Nondurable Manufacturing | $1,226,164,142 | $321,719,496 | $165,341,793 | 2,544 |
| Durable Manufacturing | $702,088,599 | $258,241,700 | $172,452,631 | 2,389 |
| Transportation and Utilities | $693,815,910 | $301,688,441 | $181,367,269 | 2,071 |
| Information | $138,392,068 | $84,941,925 | $36,617,388 | 324 |
| Wholesale Trade | $292,177,512 | $197,737,712 | $114,017,324 | 1,217 |
| Retail Trade | $893,712,027 | $671,902,446 | $390,848,291 | 11,380 |
| Finance, Insurance, and Real Estate | $1,027,135,834 | $304,527,710 | $133,112,418 | 1,373 |
| Business Services | $354,800,006 | $208,357,970 | $169,966,710 | 1,974 |
| Health Services | $206,148,763 | $144,194,610 | $121,917,881 | 1,922 |
| Other Services | $411,996,295 | $203,893,133 | $164,891,752 | 3,779 |
| **TOTAL** | **$8,795,880,681** | **$3,752,572,510** | **$2,472,128,623** | **39,542** |

*This scenario assumes that the natural gas inputs for the operation of the Project will be obtained from the United States (most likely the production area of the Marcellus Shale Region). Outlays are based on a typical pattern of allocation between capital and maintenance and operations outlays over an extended development period in constant (2014) dollars.
Source: US Multi-Regional Impact Assessment System, The Perryman Group

## The Potential Average Annual Impact of the Incremental Natural Gas Drilling and Extraction Associated with the Operation of the Proposed Bear Head LNG Project on Business Activity in the Northern Marcellus Shale Region*

| Sector | Total Expenditures | Real Gross Product | Personal Income | Employment |
|---|---|---|---|---|
| | *(2014 Dollars)* | *(2014 Dollars)* | *(2014 Dollars)* | *(Average Annual)* |
| Agriculture | $95,606,414 | $27,252,041 | $17,825,883 | 269 |
| Mining | $2,570,213,523 | $941,181,645 | $734,516,249 | 9,382 |
| Construction | $138,897,651 | $74,246,694 | $61,183,893 | 824 |
| Nondurable Manufacturing | $727,271,224 | $196,681,349 | $101,804,565 | 1,560 |
| Durable Manufacturing | $678,613,849 | $248,929,875 | $166,368,176 | 2,309 |
| Transportation and Utilities | $608,762,887 | $273,983,863 | $166,353,448 | 1,932 |
| Information | $126,131,385 | $77,414,726 | $33,374,893 | 295 |
| Wholesale Trade | $272,392,388 | $184,347,683 | $106,296,515 | 1,135 |
| Retail Trade | $834,006,788 | $628,614,185 | $365,947,212 | 10,613 |
| Finance, Insurance, and Real Estate | $939,142,829 | $278,387,537 | $121,667,407 | 1,250 |
| Business Services | $338,516,621 | $198,795,476 | $162,166,165 | 1,883 |
| Health Services | $196,621,233 | $137,530,401 | $116,283,230 | 1,834 |
| Other Services | $386,033,086 | $190,974,801 | $154,442,708 | 3,519 |
| **TOTAL** | **$7,912,209,879** | **$3,458,340,275** | **$2,308,230,344** | **36,804** |

*This scenario assumes that the natural gas inputs for the operation of the Project will be obtained from the proximate natural gas production in the Marcellus Shale Region. Outlays are based on a typical pattern of allocation between capital and maintenance and operations outlays over an extended development period in constant (2014) dollars.
Source: US Multi-Regional Impact Assessment System, The Perryman Group