

Potential Economic Benefits of the Alaska LNG Project

Alaska LNG will revolutionize the Alaska economy, allowing domestic use of Alaska's natural gas resources while developing liquefied natural gas ("LNG") processing facilities so natural gas can be exported. People across the state will benefit, both directly and from multiplier effects through the economy.

The State and local economies will see job creation, an enhanced tax base, increased economic activity, and lower energy prices for individuals, businesses, and government entities. The project will also fuel economic development throughout Alaska as a portion of the revenues are reinvested in affordable energy projects.

~ **40% reduction**
in **state unemployment**

The project would reduce unemployment, both during construction and on an ongoing basis. Other things equal, the project could reduce the unemployment rate to about 4%.

+\$8.7 billion

gross product in Alaska from **project construction**

Benefits during construction will primarily occur in the **Construction industry**, but **Services and Trade industries** will also see large growth.

+31,491

ultimate permanent jobs due to benefits of **affordable energy infrastructure reinvestment**

+\$91.5 billion

gross product in the **Mining industry** over project lifespan

The lower costs of natural gas associated with the project would generate a substantial stimulus to the Mining industry.

\$8-\$10 billion/yr

expected positive effect on **the US balance of trade**

The United States balance of trade (total exports minus imports) will benefit from the project due to increased liquefied natural gas exports.

+24,302

ultimate permanent jobs due to benefits of **lower natural gas prices**

+5,886 ultimate permanent jobs due to **operations & related activities**

+\$3.7 billion/yr

personal income in Alaska at end of project lifespan due to **lower natural gas prices**

Increased supply of natural gas will lower the cost to households, businesses, and state entities.

+32.0 billion

gross product for Alaska during **construction and 30-year project lifespan**

To determine the cumulative benefits from the project, the **initial benefits of the construction phase** were added to **30 years of annual operations & related activities benefits**.



+\$3.5 billion/yr

gross product for Alaska at end of project lifespan from **reinvesting in affordable energy infrastructure**

A portion of revenues from the project will be **reinvested into infrastructure projects** to deliver affordable energy throughout the state, a catalyst that can create additional economic opportunities and growth.



The Perryman Group

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The Perryman Group is a focused team of analysts who know how to address any economic information task and present findings effectively. Our in-house professionals bring expertise in economics, finance, statistics, mathematics, real estate, valuation, systems analysis, engineering, technical communications, and marketing. Dr. Ray Perryman, President and CEO, has 40 years of experience in developing systems, analyzing complex problems, and communicating effectively.

Clients include more than half of the Fortune 100, over two-thirds of the Global Top 25 and the six largest energy companies doing business in the US.

Potential Employment Benefits of the Alaska LNG Project

Job-years

the equivalent of **one person working one job for one year**. Used for discussing **temporary employment over a fixed timeline**.

To convert from job-years to **average annual jobs**, divide the number of job-years by the duration of the job-year timeline.

Permanent jobs

a wage- or salary-paid position of regular employment. Used for discussing **permanent employment**.

To convert from permanent jobs to **job-years**, multiply the number of permanent jobs by the duration of the desired job-year timeline.

Average annual jobs

a wage- or salary-paid position of regular employment. Used for discussing **permanent employment over a fixed timeline**.

To convert from **permanent jobs** to **average annual jobs**, divide the number of jobs by the duration of the desired timeline.

Construction Employment (2019-2027)

Employment is given in **job-years** because of the temporary nature of the benefits timeline, jobs created to build facilities and infrastructure will not be necessary once construction is complete.

88,426

job-years due to project construction over 2019-2027 timeline

To get a rough idea of how many permanent jobs this is, **divide by the timeline duration** to get average annual jobs:

11,053

average annual jobs over 2019-2027 due to project construction

Operations Employment (2027)

Employment at project maturity (2027) is given in **permanent jobs** because a job created due to operational needs of the Alaska LNG Project will continue to exist.

5,886

permanent jobs due to project operations in 2027

To convert this to job-years, **multiply by the expected project lifespan** of thirty years:

176,580

job-years due to project operations over 2027-2056 timeline

Cumulative Employment (2019-2056)

Since we again have a fixed timeline, we utilize **job years** to measure employment. Cumulative employment is job-years due to construction plus job-years due to operations.

265,006

job-years due to construction and operations over 2019-2056 timeline

To get a rough idea of how many permanent jobs this is, **divide by the timeline duration** to get average annual jobs:

7,162

average annual jobs over 2019-2056 due to the Alaska LNG Project

Employment At End of Lifespan (2056)

Employment at end of project lifespan (2056) is given in **permanent jobs** because jobs created due to operational needs of project and spin-off benefits will continue to exist.

31,491

permanent jobs in 2056 due to **affordable energy infrastructure reinvestment**

24,302

permanent jobs in 2056 due to **benefits of lower natural gas prices**

5,886

permanent jobs in 2056 due to **project operation**



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Potential Economic Benefits of the Alaska LNG Project

The Perryman Group

The Perryman Group (TPG) has conducted hundreds of investigations related to oil and gas over the past 40 years.

TPG pioneered many of the techniques used in modern economic development efforts.

Pipeline Assessments

Keystone XL Pipeline
Longhorn Pipeline
Williams Pipeline

LNG Facility Assessments

Golden Pass (Texas)
Sabine Pass (Texas/Louisiana)
Bear Head (Nova Scotia)
Cheniere-Corpus Christi (Texas)

Production Assessments

Permian Basin
Bakken Shale
Haynesville Shale
Eagle Ford Shale
Barnett Shale
Fayette Shale
Marcellus Shale

Clients include:

more than half of
the Fortune 100

over two-thirds of
the Global Top 25

the six largest energy
companies doing
business in the US

Alaska LNG and Its Benefits to Alaska

Alaska LNG is a revolutionary project that will allow for domestic use of Alaska's natural gas resources while developing a liquefied natural gas ("LNG") processing train that will facilitate exportation of natural gas.

People across the state will benefit from the project, with the **State and local economies seeing job creation, an enhanced tax base, increased economic activity, and lower energy prices** for individuals, businesses, and government entities. The project will also **fuel economic development in affordable energy infrastructure** throughout Alaska as a portion of the revenues are reinvested in affordable energy projects.

Permanent job creation

Economic activity

Lower energy prices

Increased tax base

Development opportunities

State Benefits of the Alaska LNG Project

+\$32.0 billion
gross product

+7,162
average annual jobs

From construction and
30 years of operations
& related activities

Alaska LNG Project Operations Benefits

~1,000 jobs
operating the
Alaska LNG
Project*

Increased
natural gas
development

Benefits to
companies
supplying
goods and
services

&

Benefits of
consumer
spending
of earned
income

+5,886 jobs

due to operations & related activities

Note: Alaska LNG, Docket No. PF14-21-000, Resource Report No. 5
Socioeconomics, April 14, 2017

Job Gains from the Alaska LNG Project

+31,491

ultimate permanent jobs due to benefits of affordable energy infrastructure reinvestment

+24,302

ultimate permanent jobs due to benefits of lower natural gas prices

+5,886 ultimate permanent jobs due to operations & related activities

40%
approximate reduction in unemployment

National Benefits

+\$49.1 billion

gross product

+11,519

average annual jobs

from construction and
30 years of operations
& related activities

+\$77.1 billion

annual gross product

+602,788

permanent jobs

by end of project lifespan
from lower natural gas prices

Additional Benefits of the Alaska LNG Project

**\$8-\$10 billion
per year**

expected positive effect
on the US balance of trade
(total exports minus imports)

**+\$238.5 billion
gross product**

growth in the world economy annually
due to lower natural gas prices

Major Components

A **Gas Treatment Plant (“GTP”)** to handle natural gas production of approximately 3.5 billion cubic feet per day

Prudhoe Bay Gas Transmission Line (“PBTL”) and **Point Thomson Gas Transmission Line (“PTTL”)** to connect fields to the plant

An 807-mile **Pipeline (“Mainline”)** to transport natural gas from the North Slope to Southcentral Alaska

A **Liquefaction Facility** near Nikiski to cool and condense gas for exportation

Construction and Operation Timeline



Note: Anticipated dates as of April 2018

Source: Development Committee Summary Report, Alaska Gasline Development Corporation, April 2018

Additional Interconnections

Interconnection points planned along the Mainline will allow for future in-state deliveries of natural gas. AGDC will work with communities and development projects along the route to provide interconnections in accordance with the statutory mission. Three interconnections are currently planned.

These connections will serve at least the **Interior Region**, the **Anchorage/Mat Su Region**, and **South Central Region**, with the potential to reach other areas.



ECONOMIC BENEFITS CONSTRUCTION AND OPERATIONS

Benefits of the Alaska LNG Project

+265,006
job-years* in Alaska

+426,186
job-years* in the US

From construction and
30 years of operations
& related activities

Note: A job-year is the equivalent of one person working for one year

Construction Benefits for Alaska by Region

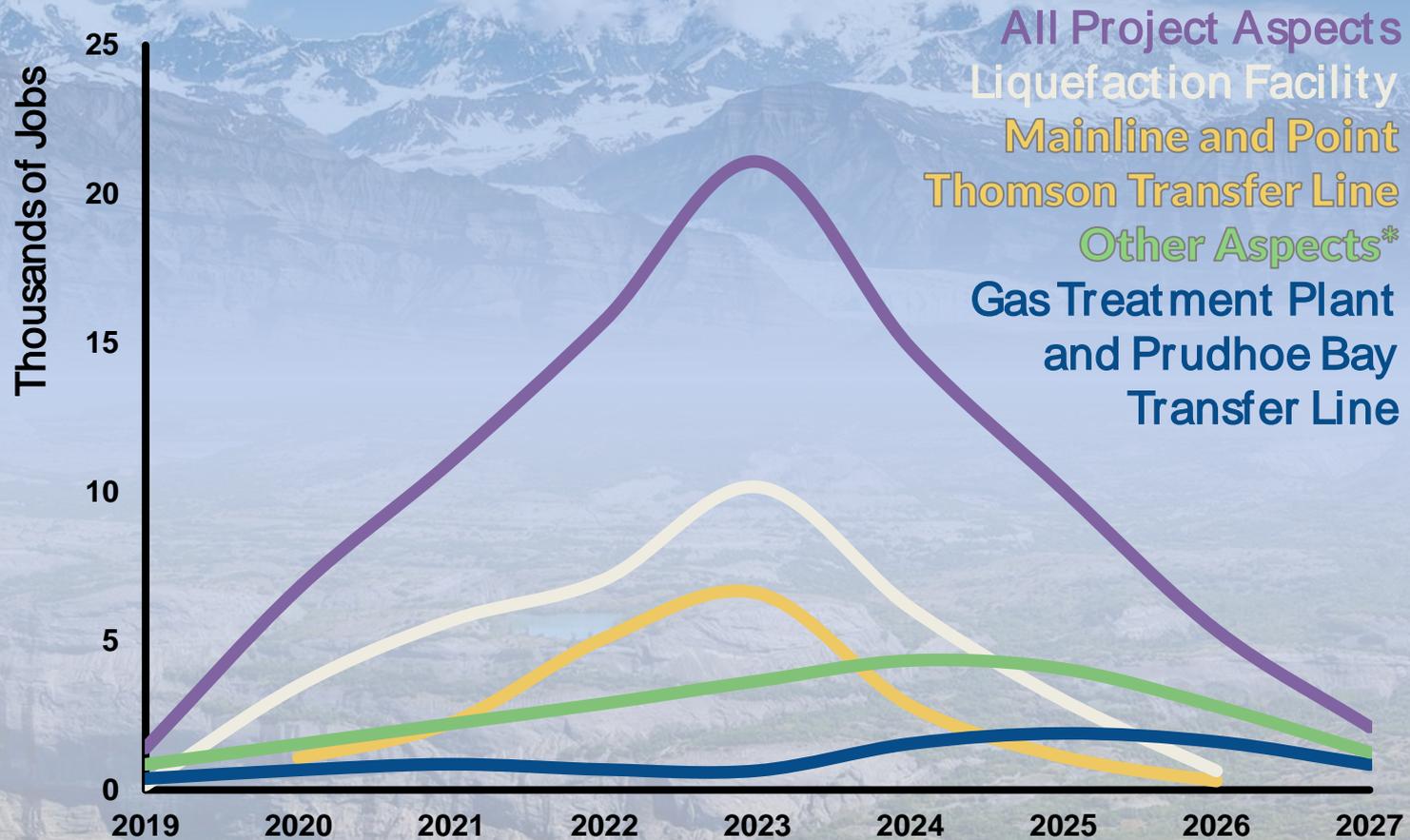
(dollars in billions of 2018 US\$, employment in job-years)

	Total Expenditures	Gross Product	Personal Income	Employment
Northern Region	\$1.58	\$0.73	\$0.58	7,607
Interior Region	\$1.28	\$0.60	\$0.46	6,235
Anchorage/MatSu Region	\$10.69	\$5.58	\$3.81	55,719
Southwest Region	\$0.08	\$0.04	\$0.03	428
South Central Region	\$3.70	\$1.71	\$1.34	17,727
Southeast Region	\$0.15	\$0.07	\$0.05	710
State of Alaska	\$17.47	\$8.72	\$6.25	88,426

Source: US Multi-Regional Impact Assessment System, The Perryman Group

Notes: Benefits are summed annually from 2019-2027 | Values may not sum due to rounding | A job-year is the equivalent of one person working for one year

Alaska Construction Employment by Year



Source: US Multi-Regional Impact Assessment System, The Perryman Group

Notes: Other Aspects includes support infrastructure and personnel and smaller, non-jurisdictional projects

Benefits of Operations & Related Activities for Alaska by Industry

(dollars in millions of 2018 US\$ per year, employment in permanent jobs)

	Total Expenditures	Gross Product	Personal Income	Employment
Commodities*	\$473.30	\$118.24	\$63.85	478
Construction	\$31.01	\$16.10	\$13.27	169
Manufacturing	\$1,771.59	\$184.81	\$93.03	869
Transportation, Utilities, Information*	\$484.22	\$135.03	\$79.32	852
Trade*	\$195.85	\$142.33	\$82.58	1,871
Financial Activities	\$177.78	\$60.56	\$23.13	217
Services	\$196.96	\$117.58	\$96.37	1,430
TOTAL	\$3,330.71	\$774.65	\$451.54	5,886

Source: US Multi-Regional Impact Assessment System, The Perryman Group

Notes: Anticipated annual benefits of operations & related activities at project maturity (2027) | Operations & related activities includes benefits from increased natural gas development in the state | Commodities includes Agriculture, Mining, and Oil & Gas Extraction; Transportation includes Pipelines; Trade includes Restaurants | Values may not sum due to rounding

Cumulative Benefits of the Alaska LNG Project

Construction and 30 years of operations & related activities
(dollars in billions of 2018 US\$, employment in job-years)

	Total Construction		Operations & Related Activities		Operational Lifespan		Cumulative Benefits*
Total Expenditures	\$17.47	+	\$3.33 per year	×	30 years	=	\$117.39
Gross Product	\$8.72	+	\$0.77 per year	×	30 years	=	\$31.96
Personal Income	\$6.26	+	\$0.45 per year	×	30 years	=	\$19.80
Employment	88,426	+	5,886 jobs	×	30 years	=	265,006

Source: US Multi-Regional Impact Assessment System, The Perryman Group

Notes: Cumulative benefits are construction benefits plus operations & related activities benefits over 30-year lifetime of project | Operations & related activities includes benefits from increased natural gas development in the state | A job-year is the equivalent of one person working for one year | Cumulative Benefits column utilizes unrounded numbers and may not sum from other columns

Cumulative Benefits for Alaska by Industry

Construction and 30 years of operations & related activities
(dollars in billions of 2018 US\$, employment in job-years)

	Total Expenditures	Gross Product	Personal Income	Employment
Commodities*	\$14.66	\$3.67	\$1.99	15,235
Construction	\$6.55	\$3.04	\$2.51	31,897
Manufacturing	\$55.59	\$6.36	\$3.28	33,204
Transportation, Utilities, Information*	\$15.79	\$4.65	\$2.71	28,978
Trade*	\$7.92	\$5.77	\$3.35	76,000
Financial Activities	\$6.85	\$2.28	\$0.90	8,456
Services	\$10.03	\$6.19	\$5.07	71,236
TOTAL	\$117.39	\$31.96	\$19.80	265,006

Source: US Multi-Regional Impact Assessment System, The Perryman Group

Notes: Cumulative benefits are construction benefits plus operations & related activities benefits over 30-year lifetime of project | Commodities includes Agriculture, Mining, and Oil & Gas Extraction; Transportation includes Pipelines; Trade includes Restaurants | Values may not sum due to rounding | A job-year is the equivalent of one person working for one year

Cumulative Benefits for Alaska by Region

Construction and 30 years of operations & related activities
(dollars in billions of 2018 US\$, employment in job-years)

	Total Expenditures	Gross Product	Personal Income	Employment
Northern Region	\$29.67	\$5.98	\$3.39	32,177
Interior Region	\$5.38	\$1.74	\$1.17	16,225
Anchorage/MatSu Region	\$47.01	\$18.61	\$11.83	175,869
Southwest Region	\$0.53	\$0.17	\$0.11	1,868
South Central Region	\$33.78	\$5.09	\$3.09	35,637
Southeast Region	\$1.03	\$0.36	\$0.22	3,230
State of Alaska	\$117.39	\$31.96	\$19.80	265,006

Source: US Multi-Regional Impact Assessment System, The Perryman Group

Notes: Cumulative benefits are construction benefits plus operations & related activities benefits over 30-year lifetime of project | Values may not sum due to rounding | A job-year is the equivalent of one person working for one year

Benefits of Alaska LNG Project to the United States

(dollars in billions of 2018 US\$, employment in job-years)

	Total Construction		Operations & Related Activities		Operational Lifespan		Cumulative Benefits*
Total Expenditures	\$28.77	+	\$4.58 per year	×	30 years	=	\$166.05
Gross Product	\$13.52	+	\$1.19 per year	×	30 years	=	\$49.07
Personal Income	\$9.18	+	\$0.69 per year	×	30 years	=	\$29.74
Employment	139,236	+	9,565 jobs	×	30 years	=	426,186

Source: US Multi-Regional Impact Assessment System, The Perryman Group

Notes: Cumulative benefits are construction benefits plus operations & related activities benefits over 30-year lifetime of project | Operations & related activities includes benefits from increased natural gas development in the state | Estimates are for the entire US, including Alaska | Cumulative Benefits column utilizes un-rounded numbers and may not sum from other columns | A job-year is the equivalent of one person working for one year



BEYOND LNG LOWER GAS PRICES

Lower Natural Gas Prices

The Alaska LNG Project will **increase the supply** of natural gas in Alaska and **lower the cost** to households, business, and state entities.

Lower gas prices generate **economic benefits** through enhancing competitiveness and freeing up dollars to be spent in other ways.

Greater use of clean-burning natural gas can also **lower emissions** and improve the environment.

+\$145.3 billion cumulative gross product
over the project lifespan

+24,302 additional jobs
by end of project lifespan

Lower Price Benefits to Alaska

(dollars in billions of 2018 US\$, employment in permanent jobs)

	Total Expenditures	Gross Product	Personal Income	Employment
Commodities*	\$5.91	\$1.70	\$0.80	2,070
Construction	\$0.65	\$0.35	\$0.28	1,751
Manufacturing	\$2.89	\$0.58	\$0.29	1,873
Transportation, Utilities, Information*	\$3.47	\$1.13	\$0.58	2,570
Trade*	\$1.27	\$0.98	\$0.57	7,157
Financial Activities	\$1.93	\$0.70	\$0.20	1,057
Services	\$1.74	\$1.16	\$0.95	7,824
TOTAL	\$17.86	\$6.60	\$3.66	24,302

Source: US Multi-Regional Impact Assessment System, The Perryman Group

Notes: Monetary values are anticipated annual benefits at end of project lifespan (2056) | Employment values are permanent jobs | Commodities includes Agriculture, Mining, and Oil & Gas Extraction; Transportation includes Pipelines; Trade includes Restaurants | Values may not sum due to rounding

Savings from Lower Natural Gas Prices

If the project had been in place last year, overall costs to Alaska businesses and consumers would have been approximately **\$2.8 billion lower**.

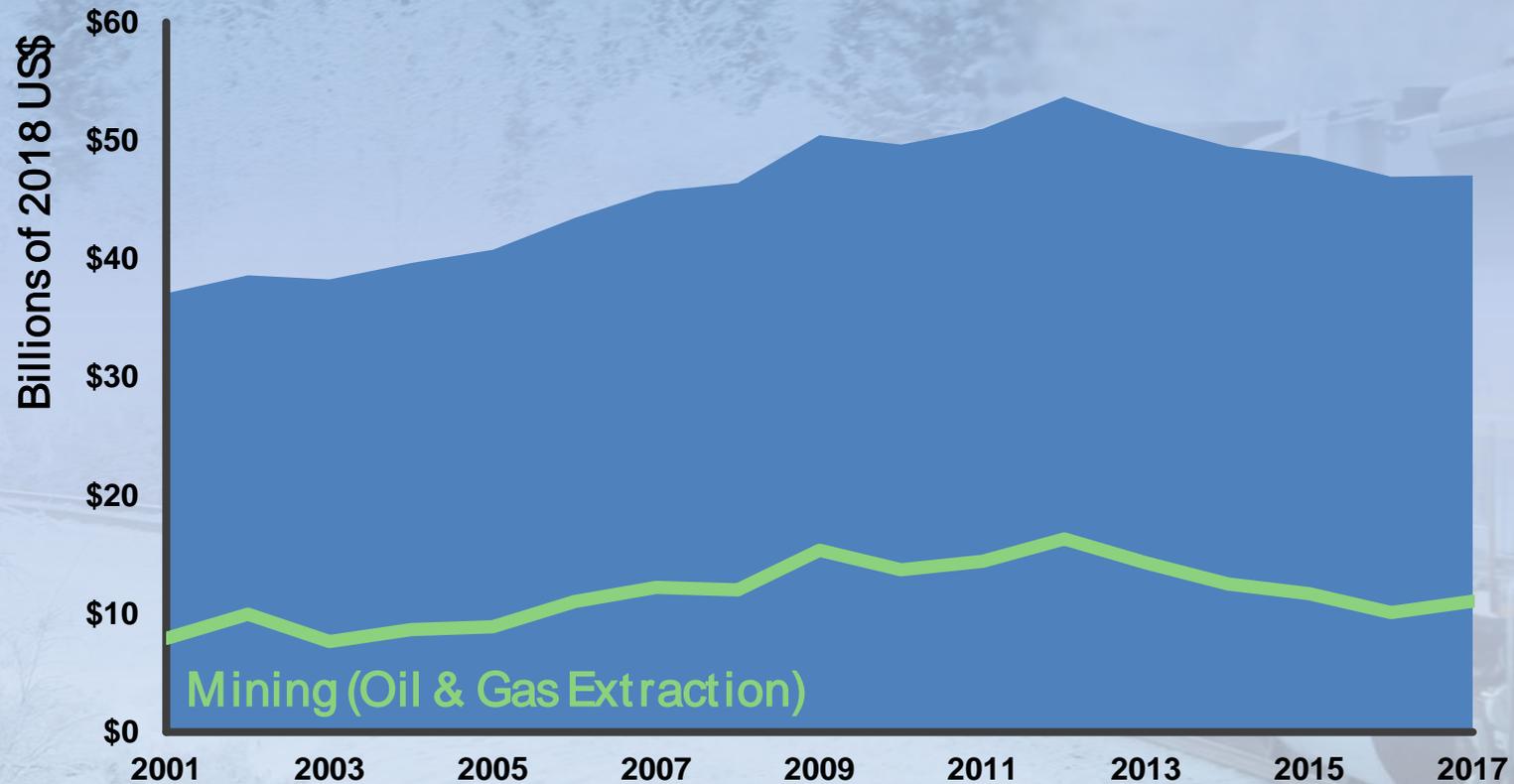
The inflation rate would have been reduced from 4.2% to 1.1% due to the lower cost of natural gas and its effects.

\$2.8 billion
cost savings

1.1%
inflation rate
(down from 4.2%)

Historical State Gross Product

The Alaska economy follows the energy sector, and by stimulating that industry, Alaska LNG will generate economic growth



Source: Bureau of Economic Analysis
Note: Alaska annual Real Gross Product (in 2009 dollars)

Mining Sector Benefits

Lower natural gas prices could stimulate substantial new production in the mining industry. In other areas, such as Australia, lower gas prices have led to significant additional mining activity, and positive outcomes could be expected in Alaska.

If a similar response occurs in Alaska lifespan, the lower costs of natural gas associated with the Alaska LNG Project would generate a substantial stimulus to the mining industry, including **\$151.6 billion in direct cost savings** and **\$266.5 billion in total additional spending** over the project lifespan.

Note: A job-year is the equivalent of one person working for one year

+\$91.5 billion cumulative gross product
over the project lifespan

+496,708 additional job-years*
over the project lifespan

Alaska Marine Highway System

One example of a state entity that could benefit from lower natural gas prices is the state ferry system. Many regional ferry systems are beginning to transition to using the cleaner and lower cost LNG as a fuel instead of ultra low sulfur diesel, which is currently in use by the Alaska Marine Highway System (“AMHS”).

AMHS spent \$15.3 million in marine fuel costs last fiscal year, which amounts to 11.3% of its entire budget. By converting to LNG, AMHS could both lower its fuel costs and reduce emissions.

\$9.2 million
annual savings
on fuel costs
if AMHS fleet
converts to LNG

Source: Alaska Marine Highway Fund, Annual Financial Report, 2017;
The Perryman Group

Benefits of AMHS Savings to Southeast Alaska

(dollars in millions of 2018 US\$ per year, employment in permanent jobs)

	Total Expenditures	Gross Product	Personal Income	Employment
Commodities*	\$0.72	\$0.18	\$0.11	1
Construction	\$0.44	\$0.24	\$0.20	2
Manufacturing	\$2.39	\$0.72	\$0.42	5
Transportation, Utilities, Information*	\$15.01	\$4.74	\$3.04	36
Trade*	\$2.71	\$2.01	\$1.17	28
Financial Activities	\$2.44	\$0.75	\$0.34	3
Services	\$2.47	\$1.43	\$1.18	18
TOTAL	\$26.18	\$10.07	\$6.44	93

Source: US Multi-Regional Impact Assessment System, The Perryman Group

Notes: Monetary values are anticipated annual benefits at project maturity (2027) and does not include initial conversion cost | Employment values are permanent jobs | Commodities includes Agriculture, Mining, and Oil & Gas Extraction; Transportation includes Pipelines; Trade includes Restaurants | Values may not sum due to rounding

Alaska Coastal Communities

Coastal communities and others not located proximate to the pipeline would also benefit from lower natural gas prices as they permeate through the economy.

For example, savings from lower natural gas prices to the AMHS could be expected to generate **\$10.1 million** in gross product each year and **94 jobs** in the Southeast Region.

\$10.1 million
annual increase
in gross product
in the Southeast
Region

Interior Region Benefits

In parts of the state, high costs of heating oil during some periods of time have strained household and corporate budgets.

For the Interior Region, one response to high heating oil prices has been to burn wood, causing notable pollution problems. Additional gas supplies would help alleviate this problem.

The lower costs of natural gas associated with the Alaska LNG Project would generate an estimated **\$613.4 million per year** in direct cost savings as well as a substantial economic stimulus.

**+\$725.6
million
annual
gross product**
at project maturity

**+4,536
additional
jobs**
at project maturity

Alaska LNG Benefits to the United States

The increased supply of natural gas entering the world economy will also benefit business activity in the US.

Lower natural gas prices enhance the productive capacity of the economy, free up dollars to be spent in more productive ways, and enhance the competitiveness of US products on global markets.

Exporting natural gas will also have a positive effect on the US balance of trade (total exports minus imports) of an expected \$8-10 billion per year.

+\$77.1 billion
gross product annually
at project maturity

+602,788
additional jobs
at project maturity

Source: The Perryman Group

Benefits to the US from Increased Gas Supply

(dollars in billions of 2018 US\$ per year, employment in permanent jobs)

	Total Expenditures	Gross Product	Personal Income	Employment
Commodities*	\$13.39	\$3.69	\$1.89	16,831
Construction	\$6.75	\$3.63	\$2.87	31,089
Manufacturing	\$44.56	\$12.90	\$7.89	71,977
Transportation, Utilities, Information*	\$27.63	\$9.20	\$4.90	42,155
Trade*	\$17.56	\$13.60	\$7.96	168,221
Financial Activities	\$39.49	\$15.15	\$5.30	46,633
Services	\$28.66	\$18.97	\$16.01	225,882
TOTAL	\$178.03	\$77.15	\$46.82	602,788

Source: US Multi-Regional Impact Assessment System, The Perryman Group

Notes: Annual estimates reflect the size and structure of the US economy as of 2018 | Monetary values are anticipated annual benefits at project maturity (2027) | Employment values are permanent jobs | Commodities includes Agriculture, Mining, and Oil & Gas Extraction; Transportation includes Pipelines; Trade includes Restaurants | Values may not sum due to rounding



BEYOND LNG

AFFORDABLE ENERGY

INFRASTRUCTURE REINVESTMENT

Energy Infrastructure Reinvestment

A portion (at least 20%) of the revenues from the natural gas royalties from the Alaska LNG Project will be reinvested into infrastructure projects to deliver affordable energy throughout the state. The availability of low-cost energy can be a catalyst to create additional economic opportunities and growth.

This analysis illustrates the potential benefits to the state from such energy infrastructure reinvestment and anticipated economic responses based on the lower bound of actual performance from a similar program in another state (fully adjusted for differences in economic structure).

**+\$3.5
billion
gross product
annually**
at end of project lifespan

**+31,491
permanent
jobs**
by end of project lifespan

Affordable Energy Infrastructure Reinvestment Benefits by Industry

(dollars in billions of 2018 US\$, employment in permanent jobs)

	Total Expenditures	Gross Product	Personal Income	Employment
Commodities*	\$0.25	\$0.07	\$0.04	418
Construction	\$0.09	\$0.05	\$0.04	519
Manufacturing	\$1.25	\$0.38	\$0.23	2,944
Transportation, Utilities, Information*	\$1.10	\$0.56	\$0.33	3,538
Trade*	\$1.48	\$1.04	\$0.60	11,143
Financial Activities	\$0.93	\$0.41	\$0.21	2,100
Services	\$1.59	\$1.01	\$0.83	10,829
TOTAL	\$6.68	\$3.53	\$2.28	31,491

Source: US Multi-Regional Impact Assessment System, The Perryman Group

Notes: Benefits from hypothetical scenario of reinvesting a portion of natural gas royalties in accordance with SB 138 | Monetary values are anticipated annual benefits at end of project lifespan (2056) | Employment values are permanent jobs | Commodities includes Agriculture, Mining, and Oil & Gas Extraction; Transportation includes Pipelines; Trade includes Restaurants | Values may not sum due to rounding



THE FUTURE OF ALASKA INCORPORATING THE BENEFITS

Alaskan Economic Forecast

The Perryman Group projected employment and gross product in Alaska with and without the Alaska LNG Project and its continuing benefits.

Benefits would begin immediately, and as of the end of the project lifespan, employment would be approximately **61,679 higher** with the project in place, while gross product would be around **\$10.9 billion higher**.

The Alaska LNG Project will serve as a catalyst to continued expansion and diversification of the economy in the future, significantly enhancing the growth potential of the Alaska economy.

+\$10.9 billion

in gross product
by end of project lifespan

+61,679

permanent jobs
by end of project lifespan

Unemployment Rate Reduction

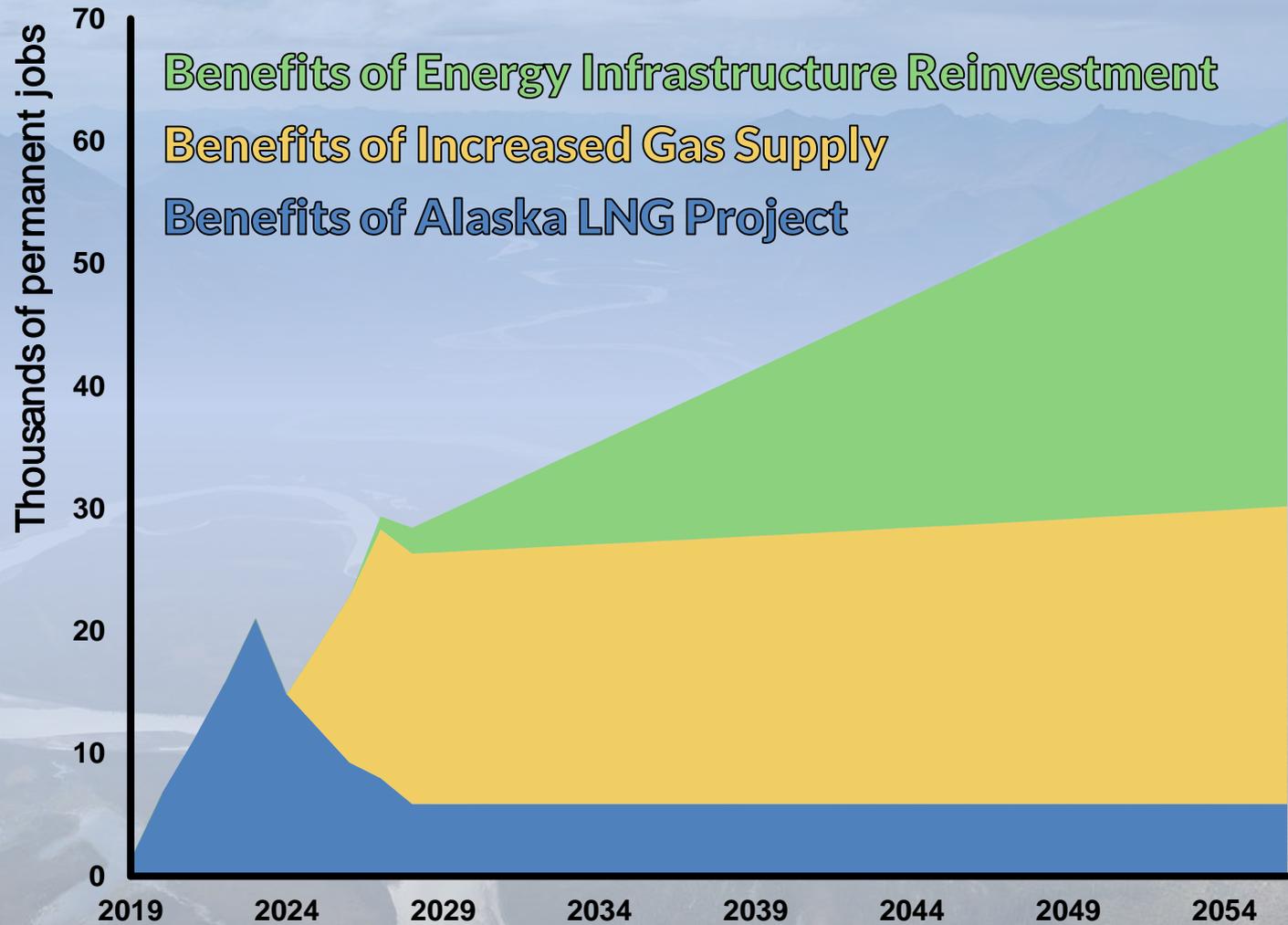
Alaska had the **highest** unemployment rate of all states in July 2018 at **6.9%**.

Alaska LNG would reduce unemployment significantly, both during construction (as was observed during previous periods of pipeline construction) and on an ongoing basis.

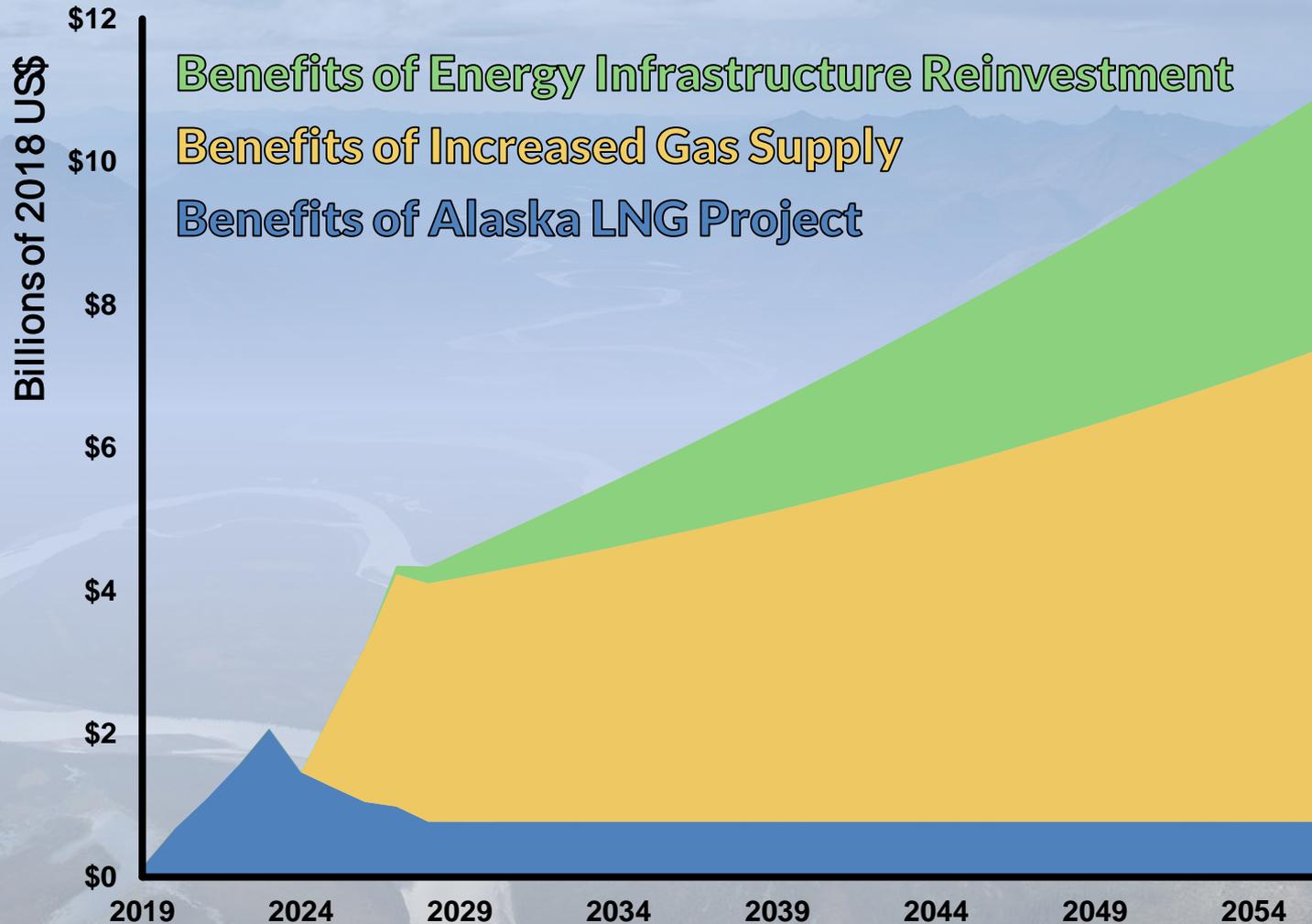
Other things equal, the implementation of Alaska LNG could reduce the unemployment rate to about 4% at project maturity, a reduction of approximately 40%.

40%
approximate
reduction in
unemployment

Projected Employment in Alaska



Projected Gross Product in Alaska



Conclusion

The Alaska LNG Project will transform the Alaskan economy, with benefits beginning almost immediately due to construction, operations, and increased natural gas drilling activity.

Over the long term, the reduced costs of living and doing business due to lower natural gas prices will continue to improve the economy, and reinvesting revenues into economic development projects leads to further gains.

This project will fundamentally alter the course of Alaska's future and bring notable benefits to residents across all regions of the state.

Effective economic research tailored for you

The Perryman Group provides the economic insights you need for the board room, the courtroom, or any other room where decisions are made

We are a focused team of analysts who know how to address complex economic information tasks and present our findings effectively.

Our in-house professionals bring expertise in **economics, finance, statistics, mathematics, real estate, valuation, systems analysis, engineering, technical communications, and marketing**. Dr. Ray Perryman, President and CEO, has 40 years of experience in developing systems, analyzing complex problems, and communicating effectively. We have considerable pride in what we do. Our enthusiasm is both unbridled and contagious; every day brings a new opportunity for us to tackle a different problem or create a product or service specifically tailored to our clients.

Alaska LNG Project Resources

Alaska LNG, Docket No. PF14-21-000, Resource Report No. 5 Socioeconomics, April 14, 2017, Document No. USAI-PE-SRREG-00-000005-000

Alaska LNG Project Integrated Labor Study, Bechtel, December 22, 2015, Document No. USAI-BE-BRZZZ-00-000001-000, Rev 1

The Alaska Liquefied Natural Gas Pipeline Workforce Plan, Alaska Department of Labor and Workforce Development, March 2017

Development Committee Summary Report, Alaska Gasline Development Corporation, April 2018

Alaska LNG Competitiveness Study, Wood Mackenzie, August 2016

Alaska LNG, Socioeconomic/Local Content Plan: Local (Alaska) Content Plan, March 22, 2016, Document No. USAI-PE-SPSOC-00-000001-000, Rev 1

The Perryman Group

The Perryman Group has conducted hundreds of investigations related to the oil and gas industry over the past 40 years. These analyses have included, among others, **forecasts, impact assessments, regulatory and environmental issues, and legislative and policy initiatives.**

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** (Permian Basin, Bakken, Haynesville, Eagle Ford, Barnett, Fayette, and Marcellus) and **numerous major pipeline projects** (including Keystone XL) and **various LNG facilities** in Texas, Louisiana, and Nova Scotia, some of which are currently approved, under construction, or operational (Golden Pass, Sabine, Pass, Bear Head, and Cheniere-Corpus Christi).

The Perryman Group has also analyzed economic and socioeconomic impacts of several other proposed liquefaction export projects and pioneered many of the techniques used in modern economic development efforts.

Overall Methodology

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; this process was described within the report. 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, capacity, and likely hiring at the project facilities was provided by Alaska Gasline Development Corporation and reviewed by The Perryman Group for reasonableness. All input values are consistent with those in the Alaska LNG Resource Report No. 5 Socioeconomics (Document No.: USAI-PE-SRREG-00-000005-000). Adjustments were incorporated to account for the labor and procurement that is expected to occur in other parts of the United States based on capacity and proximity (based on gravity modeling).

Overall Methodology (cont.)

The second major phase of the analysis is the simulation of the input-output system to measure overall economic effects as the stimulus ripples through the economy. The Perryman Group developed the US Multi-Regional Impact Assessment System (USMRIAS) for this purpose more than 35 years ago and has consistently maintained and updated it since that time. The specific submodels used in the current application reflects the specific structure of the regional, Alaska, and United States economies.

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 reflect the specific industrial characteristics of Alaska and have been thoroughly tested for reasonableness and historical reliability.

Overall Methodology (cont.)

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, health care services, utilities, housing, recreation, and other items. Typical purchasing patterns in the relevant areas are obtained from the Council for Community and Economic Research 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.

Overall Methodology (cont.)

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, Alaska LNG Resource Report No. 5 Socioeconomics (April 2017), Alaska LNG Project Integrated Labor Study (Bechtel, December 2015), Development Committee Summary Report (AGDC, April 2018), The Alaska Liquefied Natural Gas Pipeline Workforce Plan (ADOLWD, March 2017), 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.

Impacts were measured in constant 2018 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.

Overall Methodology (cont.)

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 Alaska 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.

Overall Methodology (cont.)

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 final aggregates used are **Permanent Jobs** and **Job-Years of Employment**. The Job-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 2017 and \$1 million in 2018, it is appropriate to say that \$2 million was achieved in the 2017-2018 period. If the same area has 100 people working in 2017 and 100 in 2018, 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 Job-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.

Benefits of Lower Natural Gas Prices

Methodology

As a part of this analysis, TPG prepared and evaluated a scenario to illustrate the potential benefits of expanded in-state natural gas supplies on business activity. This assessment was based on the volumes and prices that are anticipated in the Alaska Gas Development Corporation financial plans for the Alaska LNG Project.

The potential benefits to the state economy stem from both the cost savings freeing up resources for additional investment and the induced usage that is stimulated by lower costs. This type of response is particularly beneficial with respect to sectors that are intensive users of natural gas. The potential direct savings were allocated across approximately 500 detailed industrial sectors using the relevant requirements coefficients from the USMRIAS and the consensus estimate of the long-run price elasticity derived from a comprehensive recent meta-analysis to gauge a reasonable level of response [1]. The resulting savings were then simulated to determine the total effects using the USMRIAS in the manner described in the preceding section.

In a similar manner, the increase in gas usage was determined based on the long-term response to lower prices and fully adjusted for the incremental effects on other energy sources. The allocations were determined using the method described above. Because these responses span the entire economy, it is not necessary to conduct a separate impact assessment.

[1] Labandeira, Xavier, Jose M. Labeaga, and Xiral Lopez-Otero, A Meta-Analysis on the Price Elasticity of Energy Demand, Robert Schuman Centre for Advanced Studies Florence School of Regulation Climate, EUI Working Paper RSCAS 2016/25, 2016.

Benefits of Lower Natural Gas Prices

Methodology (cont.)

The aggregate direct savings may also be used to simulate the effects of current inflation rates in Alaska if this incremental level of gas supply were currently available. Specifically, the incremental reduction in costs to produce the current level of gross state product was used to compute a gross product (implicit price) deflator for the current economy with reduced gas costs. This estimate was then compared with current inflation patterns to determine the net effects.

In measuring the effects on the US economy, the overall supply change provided into the market (excluding in-state consumption) was projected for the relevant area, defined as the Organisation for Economic Co-operation and Development (OECD) countries and the non-OECD Asian countries, and used to determine the overall price effects in a manner analogous to that described above.[2] The US direct effects, overall price impacts, as well as the incremental consumption that is stimulated, are estimated using the US coefficients and sub-model of the USMRIAS using the same methodological approach as that described for Alaska. In addition, the effect on the US Balance of Trade was projected based on the volumes and anticipated prices of export sales in a general equilibrium context that accounted for secondary effects. The global gross product estimate was approximated based on the relative output, usage, and productivity in the relevant market in comparison to the estimated effects in the US.

[2] US Energy Information Administration, International Energy Outlook 2017, World Natural Gas Consumption by Region 2015-2050, www.eia.gov/outlooks/archive/ieo17/.

Benefits of Lower Natural Gas Prices

Methodology (cont.)

Impacts on the AMHS were estimated based on fuel expenditures by the AMHS and the relative costs of diesel and natural gas. The mining sector stimulus was estimated based on outcomes in other areas (such as Australia) adjusted for the situation in Alaska.[3] Benefits to the interior region were calculated based on typical spending patterns and differentials in heating oil and projected natural gas prices. In each of these illustrations, once the direct effects were savings were determined, the overall benefits were estimated using the USMRIAS in the manner described above.

It should be noted that actual outcomes could differ in either direction for myriad reasons.

[3] Lawrence, Kurt and Micah Nehring, "Market Structure Differences Impacting Australian Iron Ore and Metallurgical Coal Industries," *Minerals* 2015, 5, 473-487; doi:10.3390/min5030473

Benefits of Affordable Energy Infrastructure Reinvestment Methodology

One benefit of the Alaska LNG initiative is the ability to use a portion of the resources generated for the State government as a mechanism to promote economic competitiveness and quality of life through the development of infrastructure designed to assure affordable energy in all parts of the state. While it is impossible to know precisely what such a plan might ultimately involve, it is useful to provide a hypothetical illustration of its potential efficacy.

In order to create a representative scenario, TPG patterned the potential growth in various areas after the actual results from a local initiative to enhance competitiveness that has been in place throughout Texas which generated about \$7 billion in its first 25 years. This initiative was selected because (1) a detailed study of its impacts has been conducted [4]; (2) it reflects a wide range of geographic areas of varying size, structure, and complexity; (3) it incorporates a variety of investments; and (4) it has experienced both successes and failures over the years, which is typical of any long-term effort. While there are certain similarities between Texas and Alaska, such as a large oil and gas sector, areas of limited population density and activity, the presence of major ports, and the infrastructure challenges that come with size, it must also be recognized that Texas has a much larger population and economic base that creates certain advantages that could not be easily duplicated.

[4] Catalyst for Growth: The Importance of 25 Years of Projects Facilitated by the Texas Sales Tax for Economic Development, September 2014, The Perryman Group.

Benefits of Affordable Energy Infrastructure Reinvestment Methodology (cont.)

TPG implemented two major adjustments to this analysis to account for the differences in the two states. First, a control measure was implemented based on the relative scores of Texas and Alaska on the recent CNBC business climate rankings [5]. This measure is widely used and accepted and systematically accounts for the differences across states on a wide range of measures of growth potential and competitiveness. Second, the 99% lower confidence bound for the Texas outcomes was employed, which should account for any other impediments. The model used in the assessment, which was described above, also fully incorporated the unique economic and demographic patterns within the state of Alaska, which are distinct from those of Texas. In addition, the scenario fully conforms to the requirements for affordable energy infrastructure investments from the natural gas royalties of the project as set out in SB 138.

Obviously, the actual gains ultimately realized from any infrastructure investment program would depend on the level of resources invested, the types of initiatives that were supported, and their ultimate success. This representative approach demonstrates that there is substantial merit in using some portion of the public funds provided by the Alaska LNG Project for the broader benefits of the people and communities throughout the state.

[5] America's Top States for Business 2018, CNBC, July 10, 2018,
<https://www.cnbc.com/2018/07/10/americas-top-states-for-business-2018.html>.