

# North America Midstream Infrastructure through 2035: Capitalizing on Our Energy Abundance



**The INGAA Foundation, Inc.**

## **Detailed Study Methodology and Results**

Updated March 26, 2014

Prepared by ICF International for  
The INGAA Foundation, Inc.

Support provided by America's Natural Gas Alliance

INGAA Foundation Final  
Report No. 2014.01

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# Study Overview

# Study Objectives

- The objective of this study is to estimate future midstream infrastructure requirements, including natural gas, natural gas liquids, and oil infrastructure requirements through 2035.
  - Study is based on a detailed supply/demand outlook for North American energy markets.
  - In the context of this analysis, the midstream includes:
    - Natural gas gathering and lease equipment, processing, pipeline transportation and storage, and LNG export facilities.
    - Natural gas liquids (NGLs) pipeline transportation, fractionation, and NGL export facilities.
    - Crude oil gathering and lease equipment, pipeline transportation, and storage facilities.
  - A Low Growth Case is also considered.
  - Study provides an update to the INGAA Foundation's 2011 infrastructure study.
- Study also analyzes the impacts of midstream infrastructure investments on jobs and the economy.
- Study has been initiated to more fully consider recent trends and investigate the impacts of those trends, particularly robust shale gas and tight oil development, on future infrastructure requirements.

# Scope of Work

- This study projects natural gas and liquids infrastructure requirements, by:
  - Considering regional natural gas supply/demand projections that rely on the most current market trends.
  - Considering well completion and production information across major supply areas.
  - Considering gas processing requirements by region.
  - Considering how power plant gas use is likely to change in the future.
  - Reviewing underground natural gas storage requirements by region.
  - Completing an analysis of NGL and oil infrastructure requirements by applying well and production information across major supply areas.
  - Considering a number of new gas uses and additional types of infrastructure that were not considered in the 2011 study (discussed on the next slide)
- This study assesses the economic impacts of midstream infrastructure investments, by:
  - Completing a regional impact analysis that relies on IMPLAN.
  - Considering the direct, indirect, and induced impacts of the infrastructure development.
- This study considers new infrastructure needs. It does not investigate replacement of existing infrastructure, nor does it investigate operations and maintenance of existing infrastructure.

# Similarities to and Differences from the 2011 Study

- Even though this study projects a lower number of gas wells, versus the 2011 study, shale gas production growth is still robust and it continues to yield significant development of natural gas infrastructure.
  - But, the current slate of gas transportation projects generally require less miles of pipe and rely to a greater extent on using existing infrastructure in different ways - for example, adding compression to increase line capacity and reversing lines to accommodate growth from new production areas.
  - Even though less miles of pipe are required, investment in new gas pipelines is close to estimates from the prior study because line costs have continued to rise over the past few years.
- Oil and NGL production growth is projected to be much greater, leading to increased infrastructure needs for oil and NGL processing, transport, and storage.
  - This study considers repurposing of gas infrastructure for transport of oil and NGLs.
- Some production projections for various regions have increased, for example Marcellus gas production is much greater in this current study, leading to more pronounced midstream development within and from that area.
- Beyond differences mentioned above, this study also projects much greater investment and job impacts for new infrastructure because some types of activity that were overlooked in the 2011 study are now considered, including:
  - LNG exports, NGL fractionation, Mexican exports, compression in gas gathering systems, crude oil gathering line and pumping needs, oil storage, and lease equipment requirements.

# Study Methodology

- Study relies on ICF's December 2013 Base Case provided by ICForecast Subscription Service for market and supply projections.
- The case projects market changes over time, more specifically, the amount of gas used by sector and region at gas prices that are computed by ICF's Gas Market Model (GMM).
  - Changes in power generation gas use are computed, and an estimate for the number of new gas power plants is provided.
  - Changes in petrochemical gas use and LNG exports are also considered.
- The case also projects supply development and production growth that occurs at solved market prices.
- Gas production projections from the model are cross-checked with a vintage production analysis using ICF's Detailed Production Report (DPR).
  - ICF's DPR considers the number of wells, well recoveries, and representative decline curves to estimate production trends for almost 60 different supply areas.
- The GMM also projects the amount of gas transmission capacity that is likely to be developed based on the market and supply dynamics.

# Study Methodology (continued)

- From incremental gas production and well completions, the incremental amounts of gathering line and processing capacity have been computed.
  - Gathering line estimates have been derived based on the number of wells, the initial and average production from the wells and well spacing, and by assuming an average mileage of line per well (0.3 miles/well for gas wells and 0.25 miles/well for associated gas from oil wells).
  - Processing plant capacity is computed based on the average production of wells and the characteristics of the production stream.
    - Processing plants requirements are estimated by assuming average plant sizes that are area dependent.
    - The number of pipeline laterals needed and the associated pipeline mileage is derived for processing plants.
- Number of pipeline laterals and the associated pipeline mileage are derived for gas power plants.
- Horsepower requirements are derived separately for each transmission project.
- Storage capacity is added based on market and supply growth and by considering seasonal price spreads.
- Unit cost measures have been derived for pipeline and gathering (\$/inch-mile), horsepower (\$/HP), processing capacity (\$/MMcfd), and storage (\$/Bcf) based on historical expenditure information provided by various sources.
- Unit cost measures are applied to estimate total expenditures for midstream infrastructure.



# Study Methodology (continued)

- Crude oil and natural gas liquids (NGLs) production projections are computed in ICF's Detailed Production Report (DPR).
- The crude oil and NGL pipeline transmission capacity projection is determined by using ICF's Crude Oil Transport Model and ICF's NGL Transport Model, respectively.
  - The Crude Oil Transport Model considers pipeline, rail, truck, and tanker transport of crude oil between 32 regions and over 240 network links in the U.S. and Canada.
  - NGL Transport Model considers pipeline, rail, and truck transport of raw and purity NGLs between 27 regions and over 200 network links in the U.S. and Canada.
  - Pipeline capacity is added based on potential supply and market growth and considering export assumptions.

# Study Methodology (continued)

## ➤ Additional information added in the current study (not considered in the 2011 analysis):

- Compression for gas gathering lines
- Compression for gas storage fields
- Crude oil gathering lines
- Crude oil storage and related pipeline laterals
- NGL fractionation capacity
- NGL export facilities
- Oil and gas lease equipment
- LNG export facilities

## ➤ Compression for gas gathering lines:

- Compression requirements for gas gathering lines are computed based on a historical average (141 HP/MMcfd), obtained from various sources, and considering gas production growth by region.

## ➤ Compression for gas storage fields:

- Compression requirements for gas storage fields are computed based on a historical average by storage type obtained from various sources. The compression requirements are 1,880 HP/Bcf for salt cavern storage, 610 HP/Bcf for depleted reservoir storage, and 1,200 HP/Bcf for aquifer reservoir storage.

# Study Methodology (continued)

## ➤ Crude oil gathering lines:

- Oil gathering line connections are considered for high productivity oil wells.
  - A minimum initial production cutoff (20 barrels per day of production) is assumed to differentiate high productivity wells from low productivity wells.
  - Low productivity wells do not require gathering line as oil production is handled by using local storage and trucks.
  - Expenditures for new trucks are not considered.
- Oil gathering line estimates have been derived based on the number of oil wells assuming an average mileage of line per well (0.25 miles/well).

## ➤ Crude oil storage and related pipeline laterals:

- Crude oil storage capacity is added based on production growth.
  - Number of crude oil tanks is computed based on storage capacity and assuming an average tank size of 5,000 barrels.
  - Number of tank farms is computed based on an average of 750 tanks per farm in the U.S. and 500 tanks per farm in Canada.
- The number of laterals needed for the new oil storage capacity and the associated pipeline mileage is based on average miles of laterals per tank farm (20 miles per tank farm).

## ➤ NGL fractionation capacity:

- NGL fractionation capacity is added based on NGL production growth.
- Capacity cost is computed by applying an average unit cost (\$/BOE) based on historical expenditure information provided by various sources.

# Study Methodology (continued)

## ➤ NGL export facilities:

- Capacity cost is computed by applying an average unit cost (\$/BOE) based on historical expenditure information provided by various sources.

## ➤ LNG export facilities:

- Capacity and costs of LNG export facilities have been obtained from DOE export applications and public sources.
  - The Base Case assumes a total of 9.3 Bcfd of LNG exports from the U.S. and Canada. Current export applications, however, are much greater.

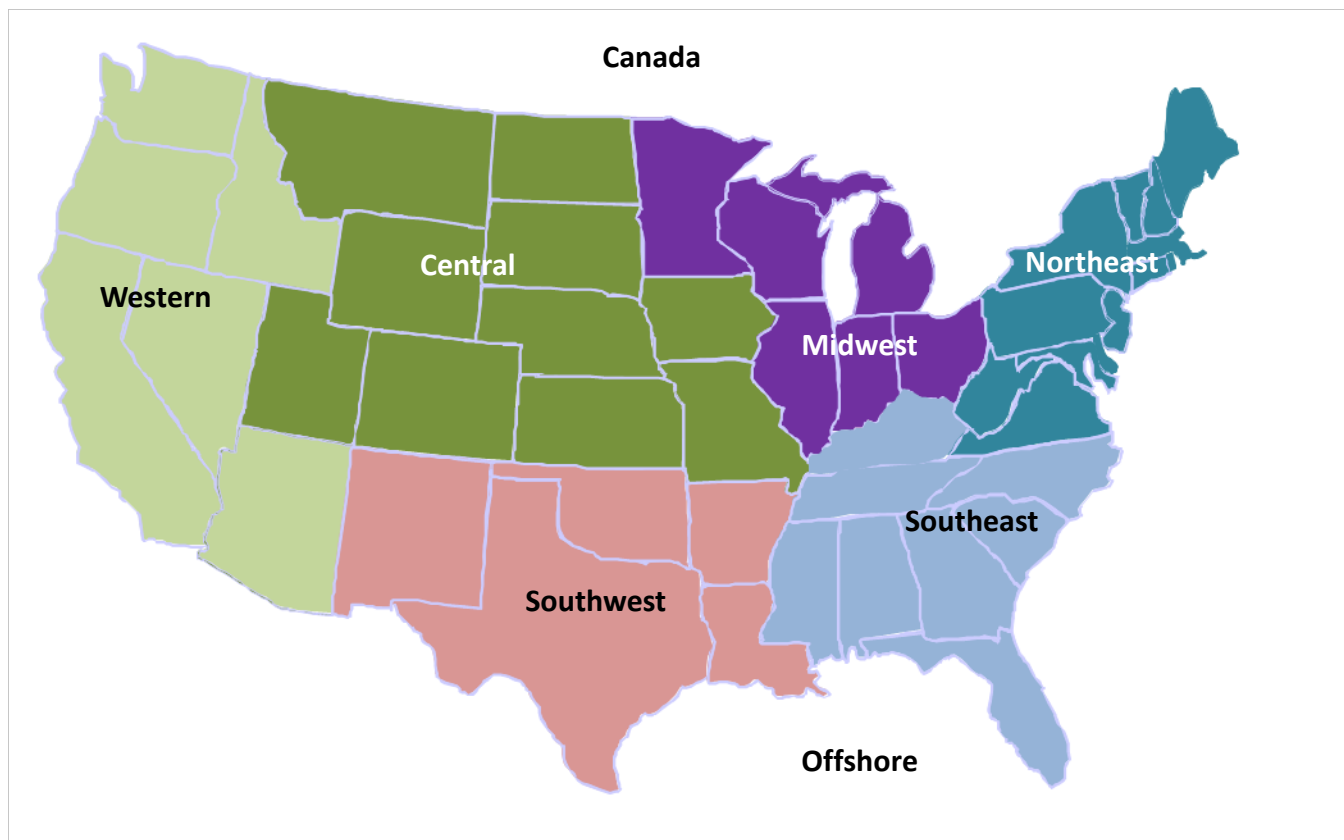
## ➤ Oil and gas lease equipment:

- Lease equipment for oil wells includes accessory equipment, the disposal system, electrification, flowlines, free water knockout units, heater treaters, LACT units, manifolds, producing separators, production pumping equipment, production pumps, production valves and mandrels, storage tanks, and test separators.
- Lease equipment for gas wells includes dehydrators, disposal pumps, electrification, flowlines and connections, the production package, production pumping equipment, production pumps, and storage tanks.
- Lease equipment cost estimates have been derived based on cost per well (\$/well) that is area/play dependent, derived from EIA Oil and Gas Lease Equipment and Operating Costs data.
- The oil and gas lease equipment is assumed to have a life span of 20 years.

# Categories of Pipeline Characterized in Study

- Natural Gas Mainline Pipe
  - New Line – New Greenfield
  - New Line - Extensions
  - Expansion - Looping & Compression
  - Expansion - Compression Only
  - Expansion - Reversal or Repurposing
- Lateral Pipe
  - Power Plant Laterals
  - Gas Storage Field and Oil Storage Tank Laterals
  - Gas Processing Plant Laterals
  - Fractionation Plant Laterals
  - Other Laterals (delivery or receipt area laterals)
- Gathering Pipe for Oil and Gas Wells
- Natural Gas Liquids (NGL) Mainline Pipe
- Oil Mainline Pipe

# Study Regions



Includes EIA's pipeline regions with regions added for Offshore Gulf of Mexico, Canada, and Arctic (Alaska and NWT). This is the same regional format as used in the INGAA 2009 and 2011 Infrastructure Studies.

# Modeling and Cost Assumptions

# Assumptions for the Base Case

- U.S. GDP assumed to grow at 2.6% per year, Canadian GDP grows at 2.5% per year, and population grows at approximately 1% per year after 2014.
- Roughly 4,000 trillion cubic feet (Tcf) of recoverable gas resource. Abundant and cost effective tight oil supplies spread across the U.S. and Canada, and vast amount of oil sands resource in Western Canada.
- Oil prices of \$100 per barrel in Base Case continues to drive “oil-gas price arbitrage” investments. LNG exports, and petrochemical activities, including ammonia production, ethylene production, and propylene production fair well in this environment.
  - U.S. and Canada LNG exports approach 9 billion cubic feet per day (Bcfd) by 2022.
- Relatively high oil price continues to spur oil and NGL focused production activities.
- Electric load growth averages 1.3% per year and coal plant retirements of roughly 60 Gigawatts (GW) in the U.S. and Canada drive interest in gas-fired power generation.
- Midstream infrastructure development driven by supply and demand trends, and assumed to not be a constraining or limiting factor on market development.
  - Projects under construction are completed, and projects planned for development are implemented in response to market needs.



# The North American Natural Gas Resource Base Could Support Current Levels of Gas Use for About 150 Years

- In total, the U.S. and Canada have over 4,000 Tcf of resource that can be economically developed using current exploration and production (E&P) technologies.
  - At current levels of consumption, this is enough resource for about 150 years.
  - As technologies improve and new discoveries are made, the total gas resource is likely to grow.
- Over 50% of the assumed resource is shale gas.

## U.S. and Canada Natural Gas Resource Base<sup>1</sup>

(Tcf of Economically Recoverable Resource, Assuming Current E&P Technologies)

	Proven Reserves	Unproved Plus Discovered Undeveloped	Total Remaining Resource	Shale Resource <sup>2</sup>
Alaska	9.4	153.6	163.0	0.0
West Coast Onshore	2.9	24.6	27.5	0.3
Rockies & Great Basin	81.8	388.3	470.1	37.9
West Texas	20.4	47.7	68.1	17.5
Gulf Coast Onshore	97.6	684.7	782.3	476.9
Mid-continent	65.3	205.0	270.3	133.9
Eastern Interior <sup>3,4</sup>	45.2	1,053.7	1,098.9	986.1
Gulf of Mexico	10.7	238.6	249.3	0.0
U.S. Atlantic Offshore	0.0	32.8	32.8	0.0
U.S. Pacific Offshore	0.8	31.7	32.5	0.0
WCSB	68.8	664.0	732.8	508.8
Arctic Canada	0.0	45.0	45.0	0.0
Eastern Canada Onshore	0.8	15.9	16.7	10.3
Eastern Canada Offshore	0.3	71.8	72.1	0.0
Western British Columbia	0.5	10.9	11.4	0.0
US Total	334.1	2,860.6	3,194.7	1,652.5
Canada Total	70.4	807.6	878.0	519.1
US and Canada Total	404.5	3,668.1	4,072.6	2,171.6

1. ICF updated its gas resource assessment in December 2011; while these regional totals may not fully reflect the current assessment, the U.S./Canada economically recoverable resource is similar.

2. Shale Resource is a subset of Total Remaining Resource

3. Eastern Interior includes Marcellus, Huron, Utica, and Antrim shale.

4. Base Case assumes drilling levels are constant at today's level over time, reflecting restricted access to the full resource development.

# Midstream Infrastructure Cost Assumptions in 2012\$

- Unit costs assumed for midstream infrastructure development remain constant in real terms throughout the projection.
- Average pipeline costs are \$155,000 per inch-mile, varying regionally.
  - The average cost was \$94,000 per inch-mile in the 2011 Study.
- Costs for gathering lines vary by diameter.
- Compression and pumping costs are \$2,600 per horsepower (HP).
- Costs for lease equipment are \$88,000 per gas well and \$210,000 per oil well.
- Gas processing costs (not including compression) are about \$520,000 per million cubic feet per day (MMcfd).
- Costs for NGL fractionation facilities average \$6,500 per barrel of oil equivalent (BOE) of NGL processed.
- Costs for NGL export facilities are purity dependent:
  - \$6,200 per BOE of ethane processed,
  - \$5,000 per BOE of propane processed, and
  - \$5,000 per BOE of Butane processed.
- Costs for crude oil storage tanks average of \$15 per barrel of oil.
- LNG export facility costs average \$5-6 billion per Bcfd of export.

## Pipeline Cost Multipliers

Region	Regional Cost Factors
Canada	0.80
Central	0.69
Midwest	0.85
Northeast	1.46
Offshore	1.00
Southeast	1.09
Southwest	0.68
Western	1.14

## Gathering Line Costs

Diameter (Inches)	Gathering Line Costs (2012\$/inch-mile)
1	\$46,228
2	\$34,671
4	\$28,892
6	\$24,164
8	\$25,215
10	\$39,398
12	\$68,291
14	\$110,316
16	\$122,135

## Compression and Pumping Multipliers

Region	Regional Cost Factors
Canada	1.00
Central	1.06
Midwest	1.16
Northeast	1.24
Offshore	1.00
Southeast	1.00
Southwest	0.98
Western	1.07

## Natural Gas Storage Costs (Millions of 2012\$ per Bcf of Working Gas Capacity)

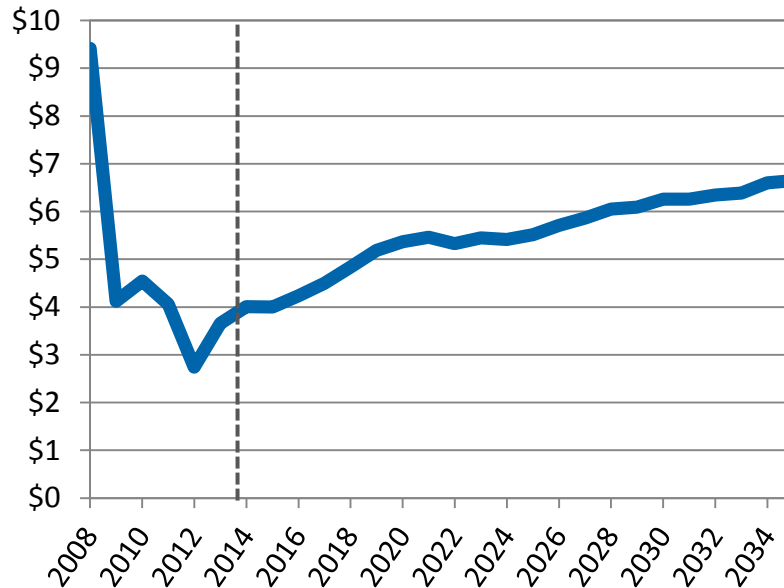
Field Type	Expansion	New
Salt Cavern	\$26	\$31
Depleted Reservoir	\$15	\$18
Aquifer	\$30	\$37



# Summary of Base Case Trends

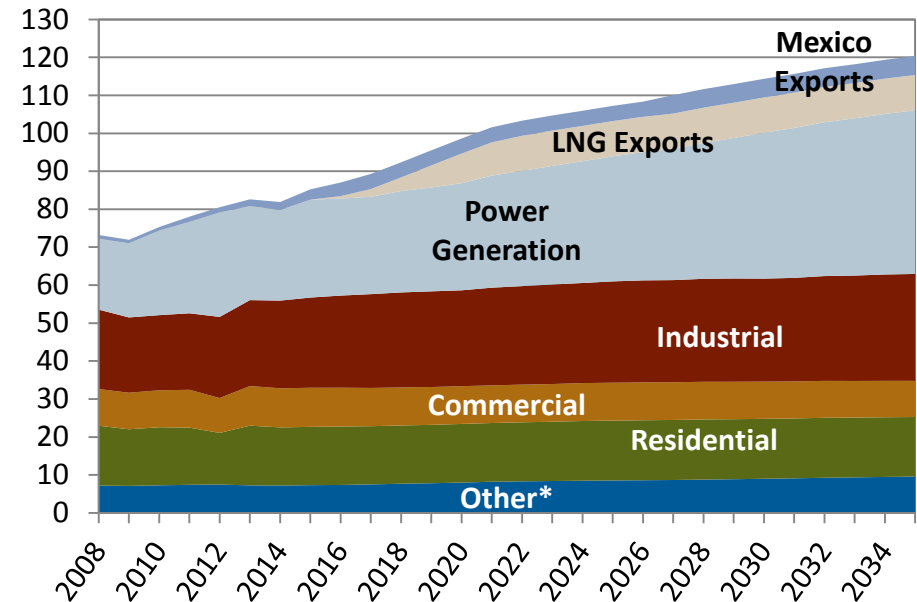
# Projected Natural Gas Price and Demand in the Base Case

**Average Annual Natural Gas Prices at Henry Hub (2012\$/MMBtu)**



- Projected Henry Hub gas prices are likely to average between \$5 and \$6 per million British thermal unit (MMBtu) in the longer term.
- Projected gas prices are high enough to support projected supply development, but not so high as to adversely impact market growth.

**U.S. and Canadian Gas Consumption  
Average Annual Billion Cubic Feet per Day (Bcfd)**

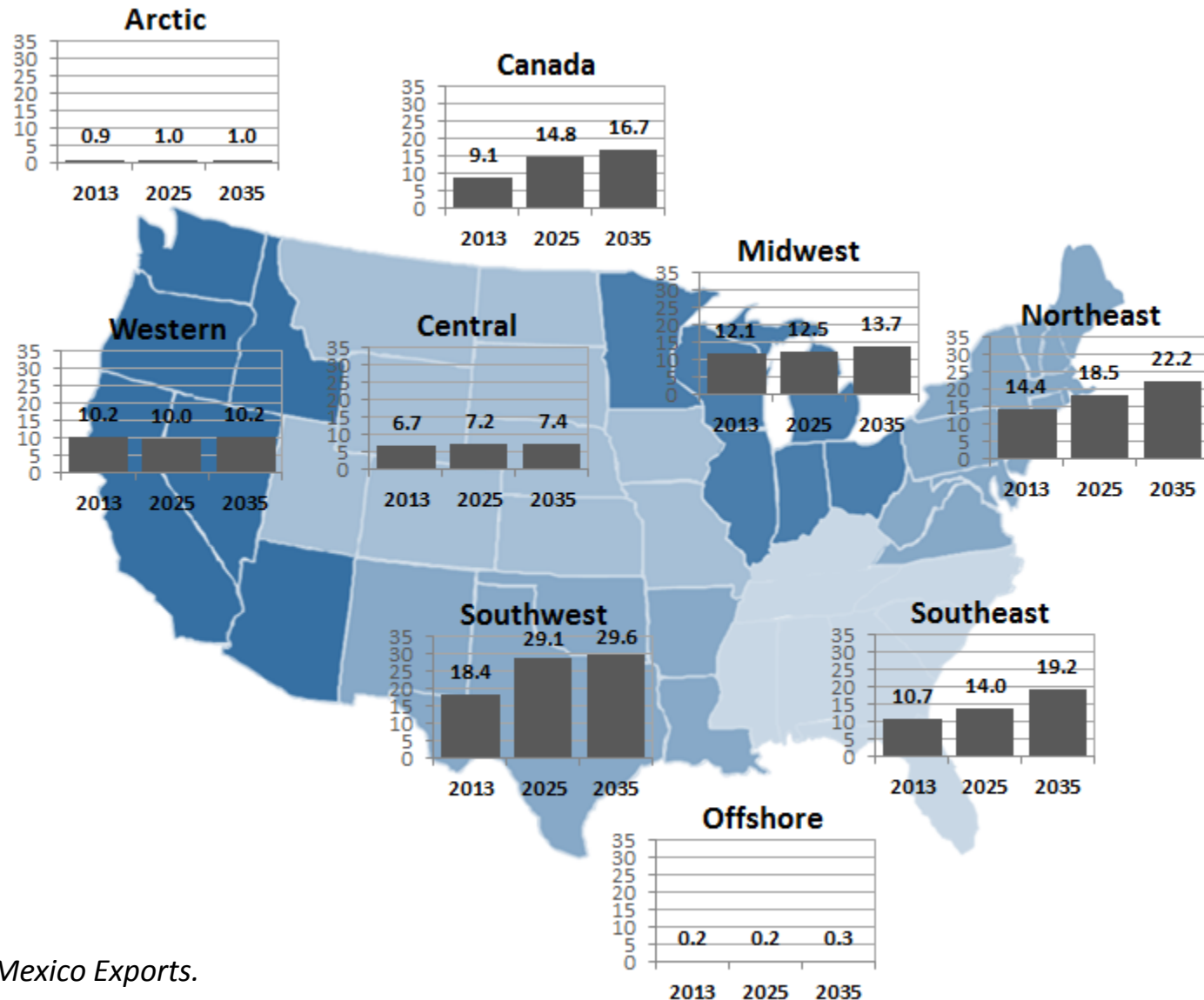


*\*Other includes lease, plant, and pipeline fuel gas use.*

- Total gas consumption (including exports from the U.S. and Canada) is projected to increase at a rate of 1.8% per year
  - By 2035, total gas consumption in the U.S. and Canada is projected to reach an average of almost 120 Bcfd.

# Regional Natural Gas Demand\* (Bcfd)

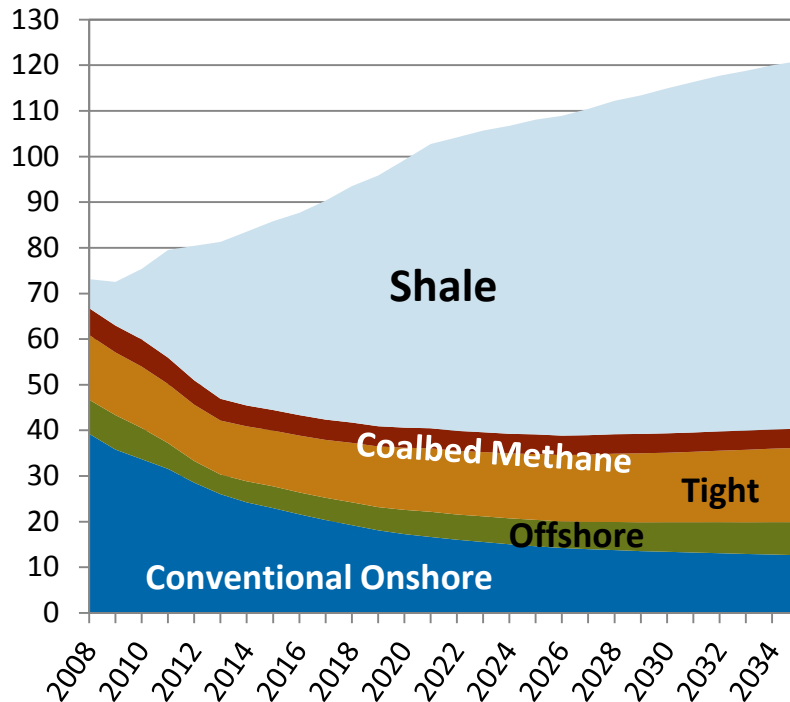
- U.S. Demand increases are due mostly to power generation growth, LNG export, and petrochemical load growth.
- Canada's gas demand growth includes gas used in extracting oil from oil sands and LNG exports.



\*Includes LNG Exports and Mexico Exports.

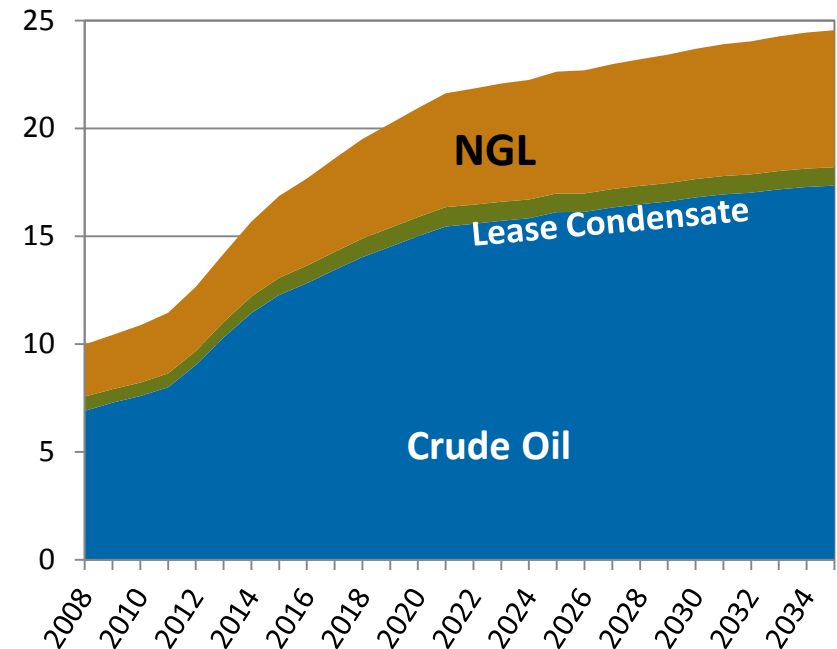
# Natural Gas, Oil, and NGL Production in the Base Case

**U.S. and Canadian Natural Gas Production  
(Average Annual Bcfd)**



- Total gas production increases by 1.8% per year, rising to over 120 Bcfd by 2035.
- Shale gas grows to two-thirds of the total production by 2035, while conventional gas production declines significantly.

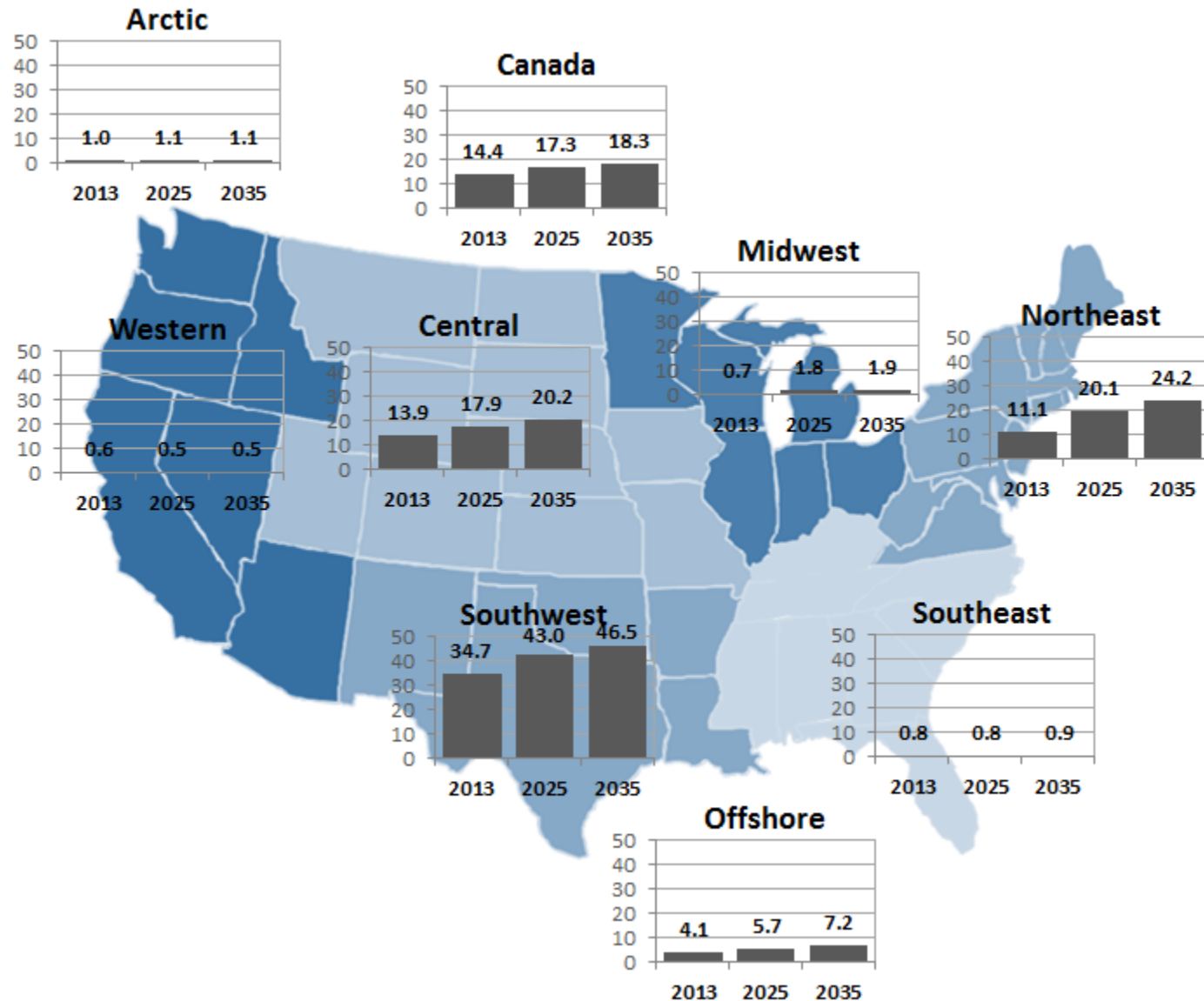
**U.S. and Canadian Liquid Production  
Average Annual Million Barrels per Day (MMBPD)**



- Robust crude oil and condensate production growth in the U.S. and Canada driven by relatively high oil price.
  - Oil and condensate production grows to 18.2 million barrels per day (MMBPD) or by 2.3% per year through 2035
  - Incremental production comes from Western Canada oil sands and tight oil supplies.
- NGL production in the U.S. and Canada grows by 3.2% per year, rising to roughly 6 MMBPD by 2035.

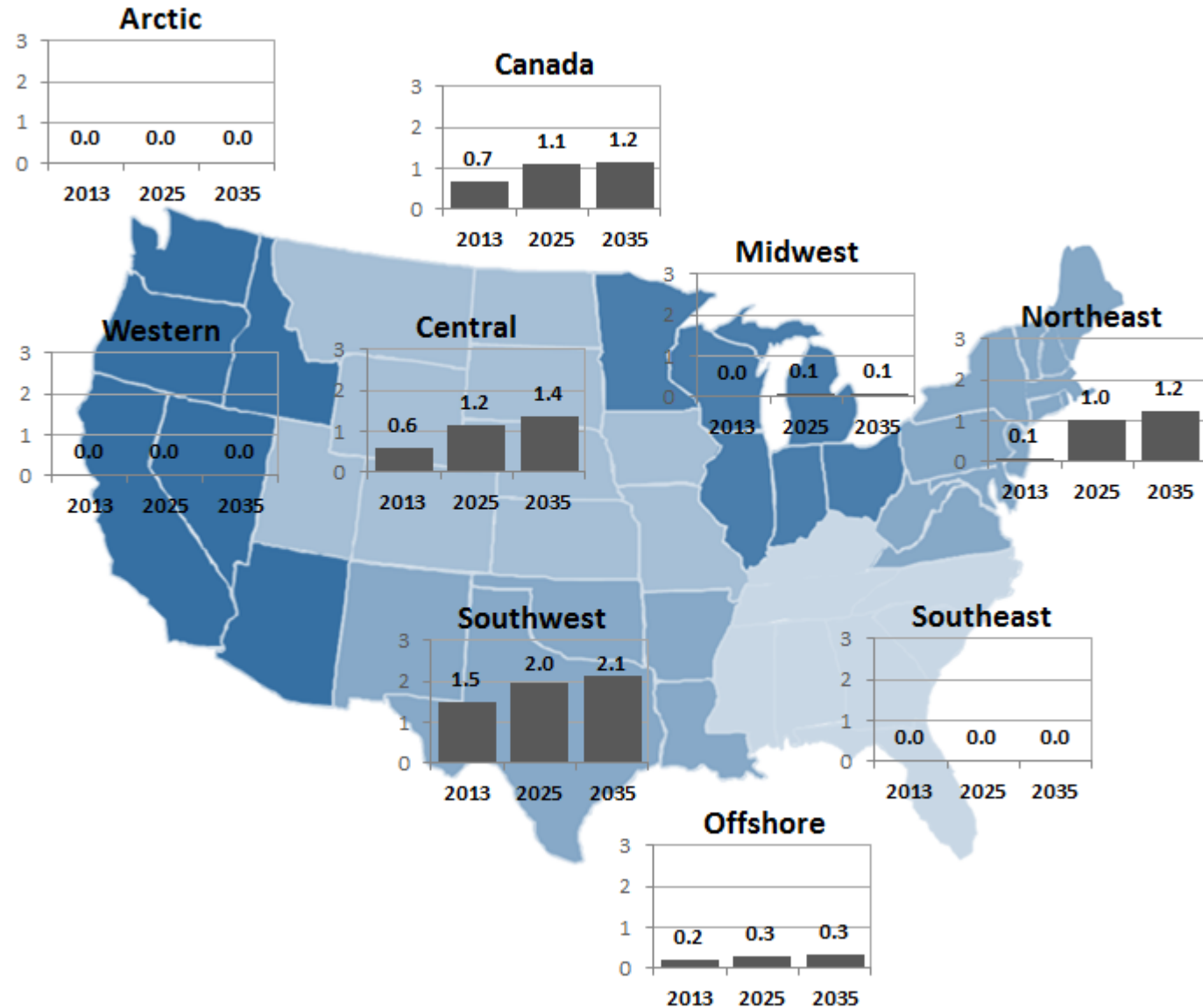
# Regional Natural Gas Production (Bcfd)

- Substantial gas production growth mostly from shale plays in the Northeast, Southwest, and Canada.
  - Northeast growth is mostly from the Marcellus Shale.
  - Growth in the Southwest is driven by production from the Haynesville and Eagle Ford shale plays.
  - Canada production growth is mostly from Horn River and Montney shale plays in British Columbia.
- Production growth in the Central region is mainly from the Rocky Mountain tight gas production and also from the Niobrara shale gas production.



# Regional Natural Gas Liquids Production (MMBPD)

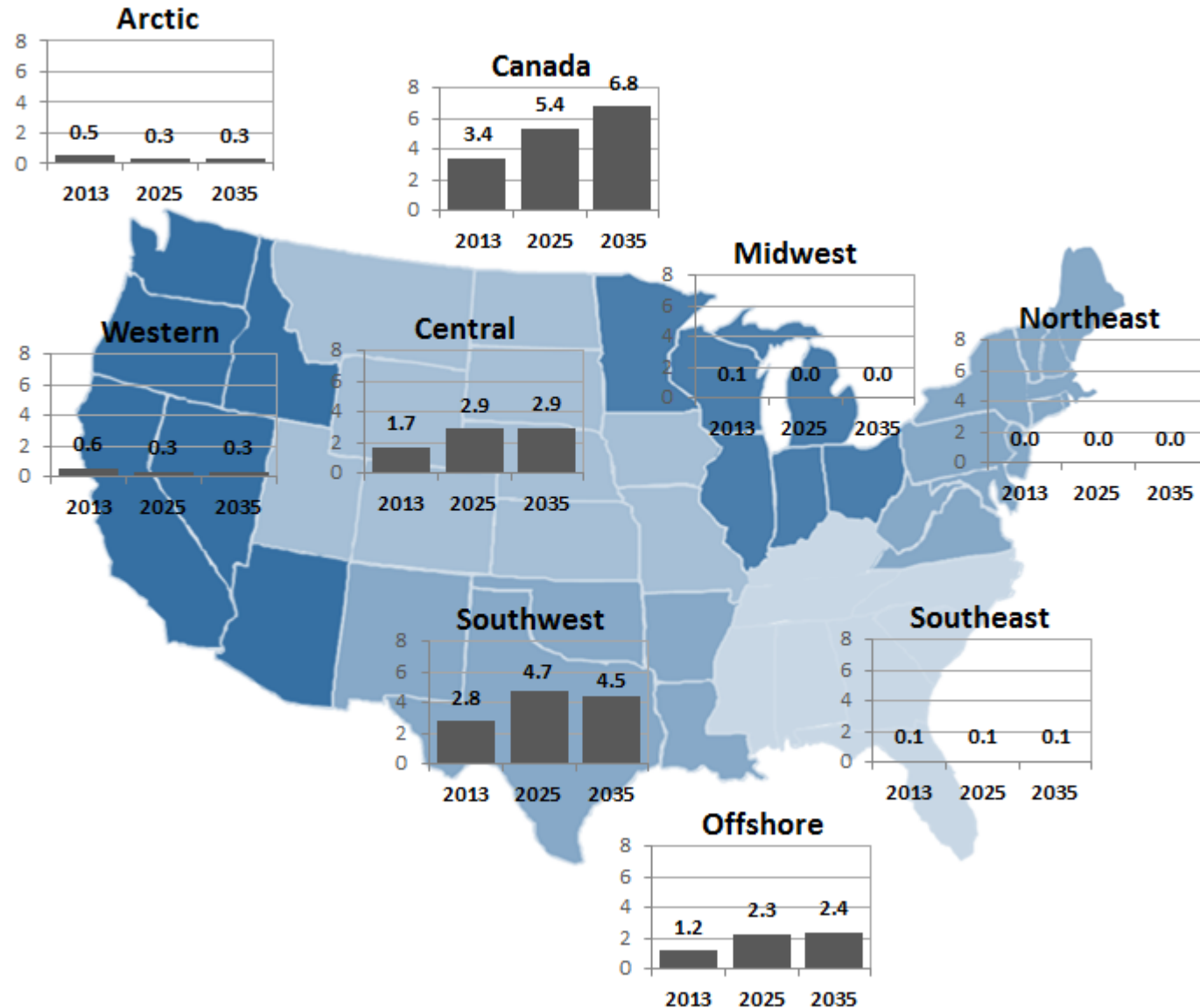
- Major NGL production growth regions include:
  - Marcellus and Utica Shales (Northeast).
  - Western Canada's Shales including the Montney, Horn River, and several smaller plays.
  - Eagle Ford Shale (Southwest).
  - Bakken Shale (Central).





# Regional Crude Oil and Lease Condensate Production (MMBPD)

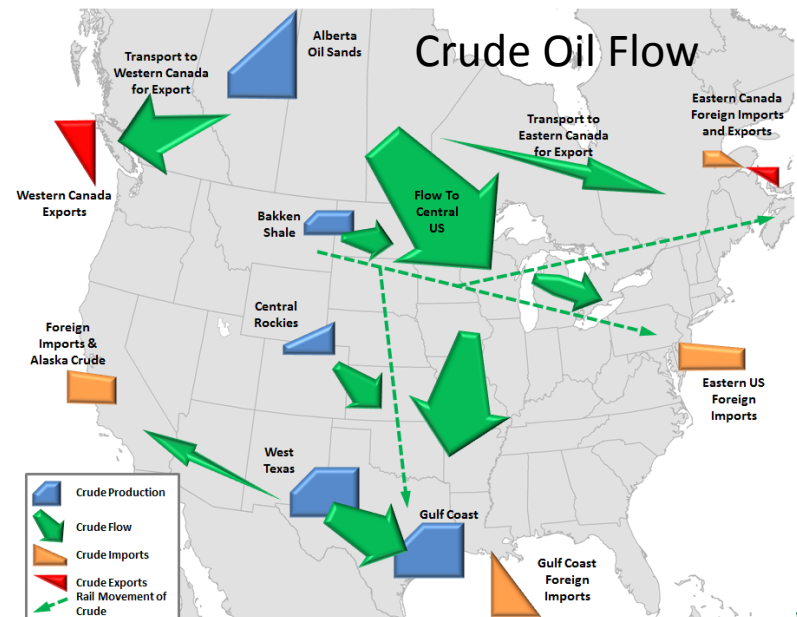
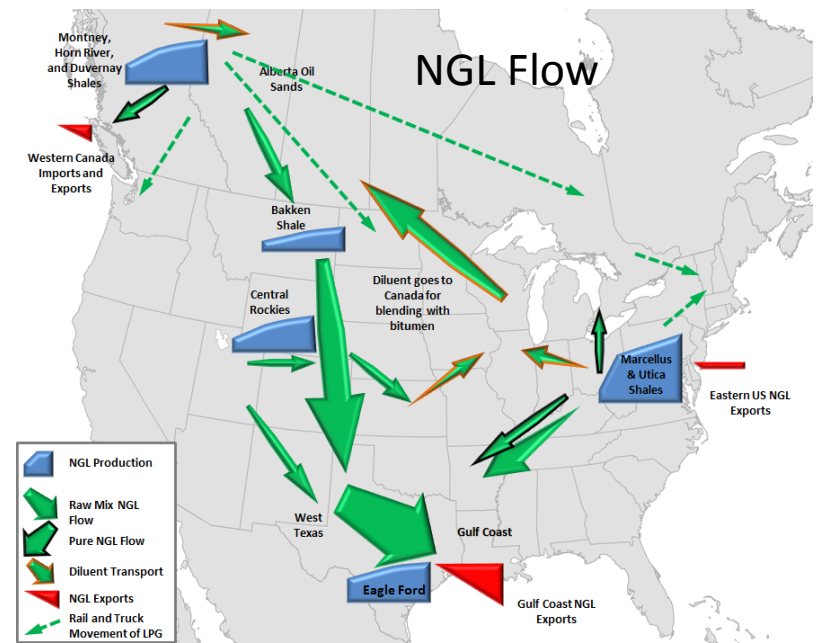
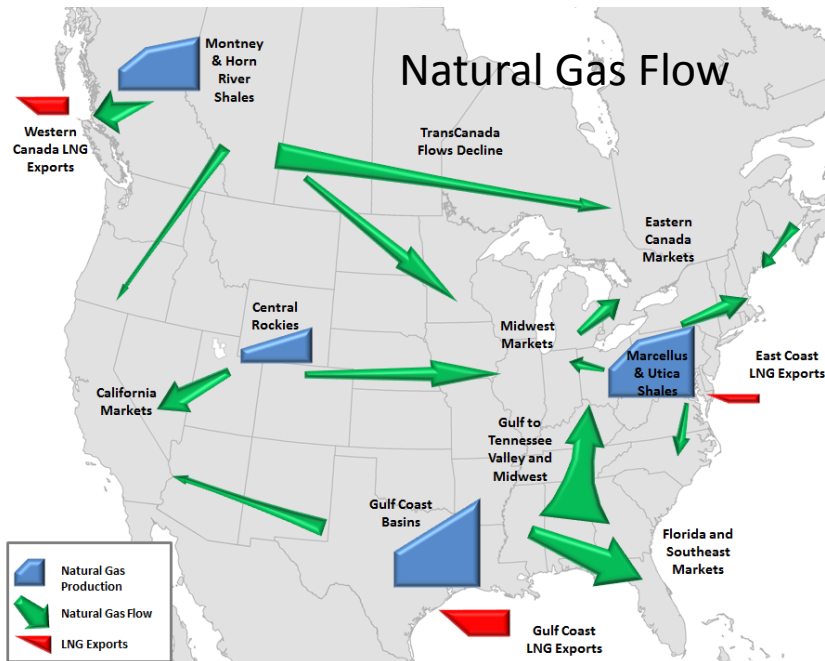
- Largest production growth is from oil sands in Alberta.
- Significant production growth from shale/tight oil plays in the U.S.
  - Southwest shale/tight oil plays include the Eagle Ford and Permian basin's Wolfberry, Cline, Avalon & Bone Springs, and other smaller plays.
  - The Central region includes the Bakken, the largest single tight oil play in North America, and the Niobrara's in the Denver and Powder River basins.
- Production growth from the deepwater Gulf of Mexico is also significant.



# Summary of Key Market Trends in Base Case (Tcf)

U.S. and Canada	2013	2025	2035	% Change 2013 to 2025	% Change 2013 to 2035
Gas Consumption	29.5	34.3	38.7	16%	31%
Gas Use in Power Generation	9.0	12.0	15.7	33%	74%
Industrial Gas Use	8.3	9.7	10.3	18%	24%
Gas Production	29.7	39.4	44.1	33%	49%
Conventional Onshore Gas Production	9.5	5.3	4.6	-44%	-51%
Unconventional Onshore Gas Production	18.6	32.0	36.9	72%	98%
Shale Gas Production	12.6	25.2	29.4	101%	134%
Offshore Production	1.6	2.1	2.6	35%	68%
LNG Imports	0.2	0.2	0.3	11%	31%
LNG Exports	0.0	3.4	3.4	NA	NA
Net Exports to Mexico	0.7	1.5	1.8	124%	179%

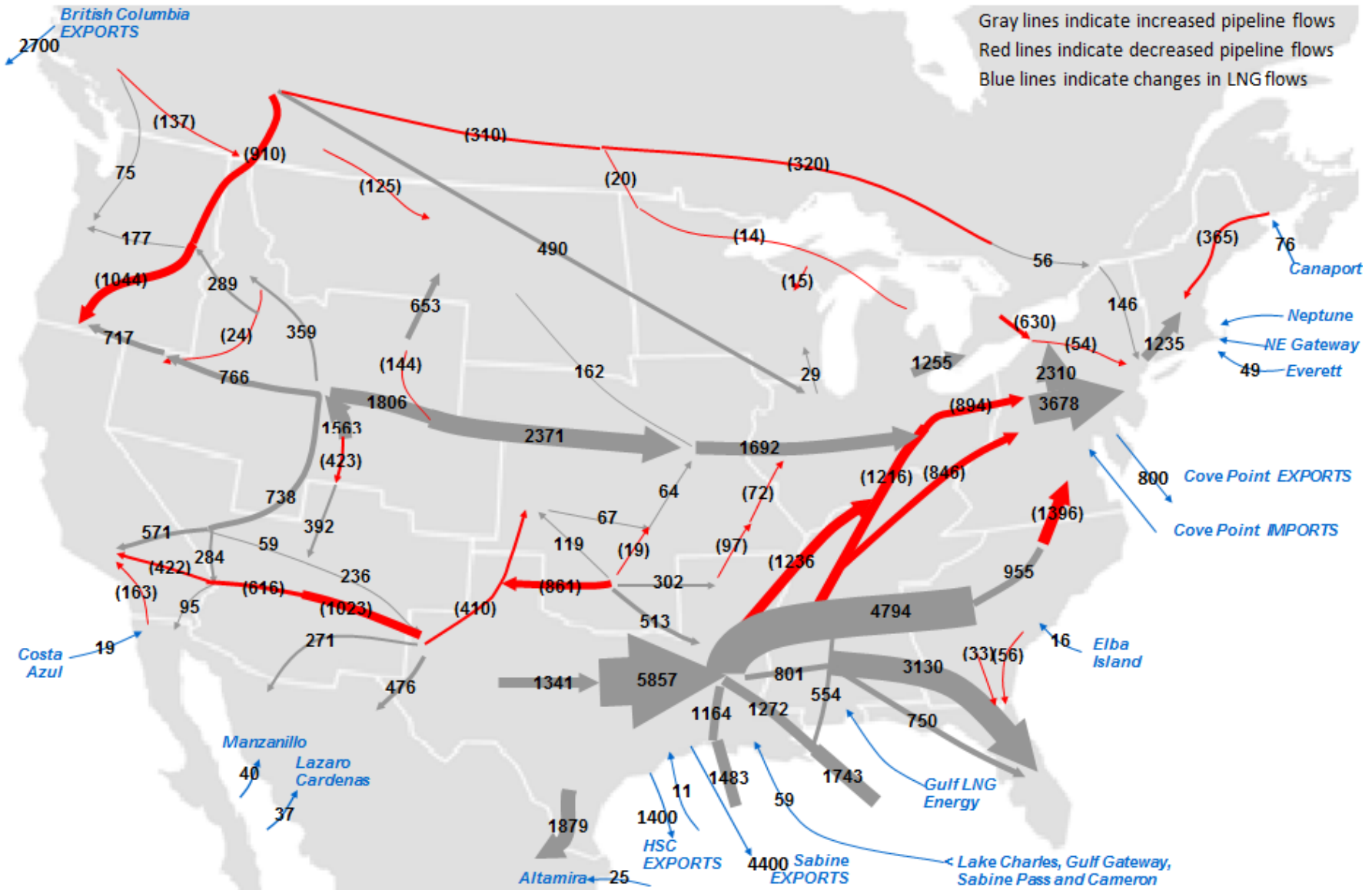
# Natural Gas Flow, NGL, and Crude Oil Flows in the Base Case



The stylistic maps presented here depict the changing flow patterns observed in the models as applied to the base case. Arrows shown on the maps are sized to depict the relative changes in flow from today through 2035. Arrows that increase in width from their origination point to the terminus represent an increasing flow over time, and arrows that decrease in width from their origination point to the terminus represent a declining flow over time. For NGL transport, the arrows are color coded and indicate the type of liquid being transported (raw mix versus pure product versus diluent transport).

The maps also include “production wedges” that depict relative changes in regional production and “import and export wedges” that depict relative changes in import and export activity at various locations. Rail transport corridors are shown as dashed lines on the crude and NGL maps, where applicable.

# Natural Gas Flow Change from 2014 to 2035 (MMcfd)



# Inter-Regional Natural Gas Pipeline Capacity Added in the Base Case (Bcfd)

Originating Region	2014-2020	2021-2025	2026-2030	2031-2035	2014-2035	Average Annual 2014-2035
U.S. and Canada	24.2	6.9	8.4	3.4	42.9	1.9
U.S.	23.2	5.9	7.9	2.9	39.9	1.8
Canada	1.0	1.0	0.5	0.5	3.0	0.1
Central	5.0	-	1.4	0.8	7.2	0.3
Midwest	3.0	0.5	-	-	3.5	0.2
Northeast	6.0	2.3	1.9	-	10.1	0.5
Offshore	-	-	-	-	-	-
Southeast	4.4	0.7	1.7	1.1	7.9	0.4
Southwest	4.8	2.0	2.9	0.5	10.2	0.5
Western	-	0.5	-	0.5	1.0	0.0
Arctic	-	-	-	-	-	-

# Inter-Regional Natural Gas Liquids Pipeline Capacity Added in the Base Case (Million Bbl/d)

Originating Region	2014-2020	2021-2025	2026-2030	2031-2035	2014-2035	Average Annual 2014-2035
U.S. and Canada	3.2	0.2	0.3	-	3.6	0.2
U.S.	2.8	-	0.3	-	3.1	0.1
Canada	0.3	0.2	-	-	0.5	0.0
Central	1.0	-	-	-	1.0	0.0
Midwest	0.3	-	0.1	-	0.4	0.0
Northeast	0.9	-	0.2	-	1.1	0.0
Offshore	-	-	-	-	-	-
Southeast	-	-	-	-	-	-
Southwest	0.7	-	-	-	0.7	0.0
Western	-	-	-	-	-	-
Arctic	-	-	-	-	-	-

# Inter-Regional Crude Oil and Lease Condensate Pipeline Capacity Added in the Base Case (Million Bbl/d)

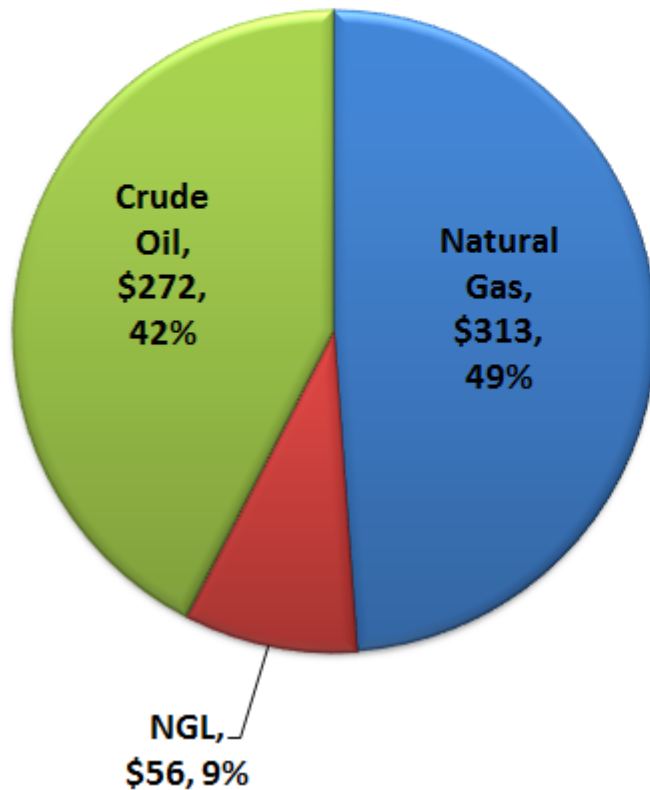
Originating Region	2014-2020	2021-2025	2026-2030	2031-2035	2014-2035	Average Annual 2014-2035
U.S. and Canada	7.4	1.7	0.7	0.4	10.2	0.5
U.S.	5.2	-	0.3	-	5.4	0.2
Canada	2.2	1.7	0.4	0.4	4.7	0.2
Central	0.5	-	0.3	-	0.7	0.0
Midwest	2.7	-	-	-	2.7	0.1
Northeast	0.2	-	-	-	0.2	0.0
Offshore	-	-	-	-	-	-
Southeast	-	-	-	-	-	-
Southwest	1.7	-	-	-	1.7	0.1
Western	-	-	-	-	-	-
Arctic	-	-	-	-	-	-

# Midstream Infrastructure Requirements – Base Case

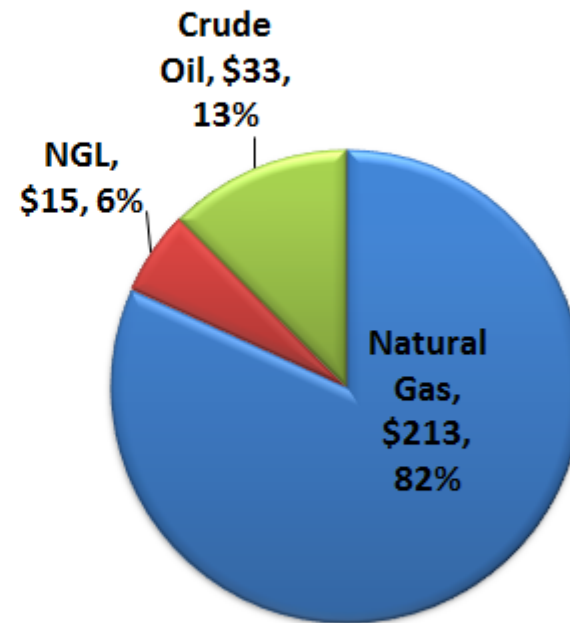


# Summary of Capital Expenditures in the Base Case

**Current Study, 2014-2035**  
**(Billions of 2012\$)**  
**\$641**



**Prior Study, 2011-2035**  
**(Billions of 2012\$)**  
**\$261**



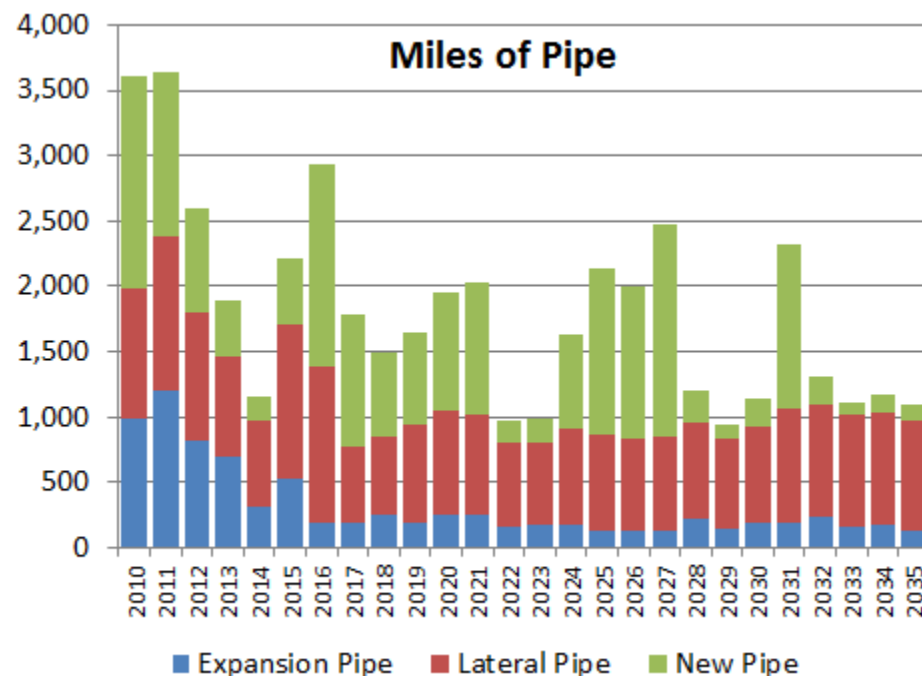
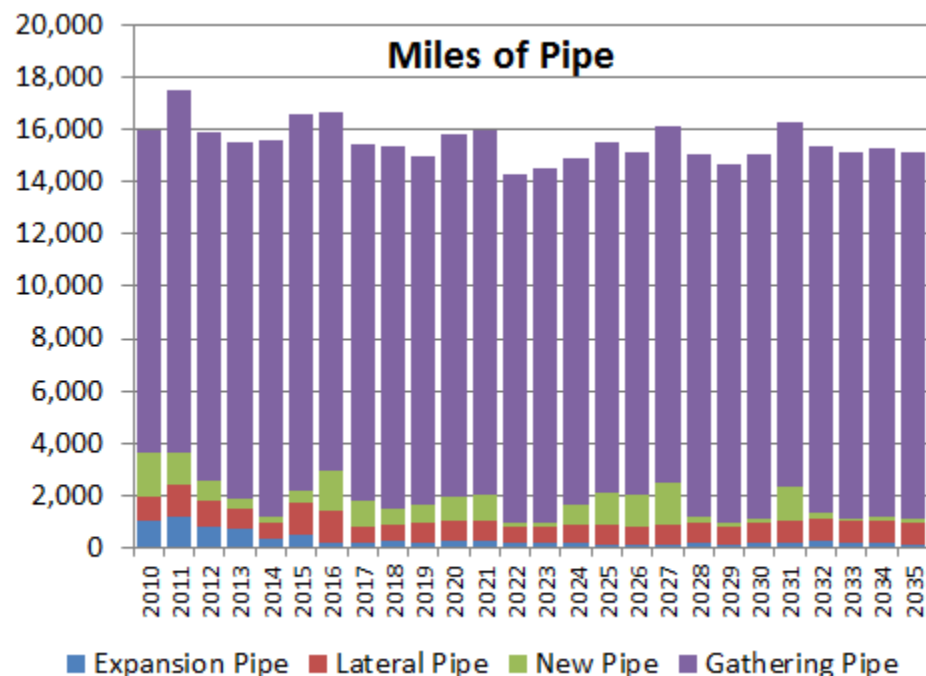
# Pipeline Miles, Compression, and Capital Expenditures by Diameter Class and Type of Transport in the Base Case, 2014-2035

(Thousand Miles)	1" to <= 8"	>8" to <= 16"	>16" to <= 24"	> 24"	Total	% of Total
Natural Gas	291.2	24.3	9.6	13.7	<b>338.8</b>	<b>62%</b>
NGL	0.8	10.3	3.9	0.1	<b>15.1</b>	<b>3%</b>
Crude Oil	171.6	2.0	2.5	12.5	<b>188.6</b>	<b>35%</b>
<b>Total</b>	<b>463.6</b>	<b>36.6</b>	<b>16.0</b>	<b>26.3</b>	<b>542.5</b>	<b>100%</b>

(Thousand HP)	1" to <= 8"	>8" to <= 16"	>16" to <= 24"	> 24"	Total	% of Total
Natural Gas	7,647	3,300	103	1,740	<b>12,790</b>	<b>75%</b>
NGL	397	83	166	16	<b>661</b>	<b>4%</b>
Crude Oil	336	79	243	2,847	<b>3,505</b>	<b>21%</b>
<b>Total</b>	<b>8,380</b>	<b>3,462</b>	<b>512</b>	<b>4,603</b>	<b>16,956</b>	<b>100%</b>

(Billions of 2012\$)	1" to <= 8"	>8" to <= 16"	>16" to <= 24"	> 24"	Total	% of Total
Natural Gas	\$50.1	\$40.9	\$33.7	\$78.3	<b>\$203.0</b>	<b>66%</b>
NGL	\$2.5	\$18.4	\$7.8	\$0.2	<b>\$29.0</b>	<b>9%</b>
Crude Oil	\$13.8	\$2.0	\$7.1	\$54.6	<b>\$77.5</b>	<b>25%</b>
<b>Total</b>	<b>\$66.5</b>	<b>\$61.3</b>	<b>\$48.6</b>	<b>\$133.2</b>	<b>\$309.5</b>	<b>100%</b>

# Miles of New Natural Gas Pipeline Added in Base Case



- Most new pipe (averaging about 15,500 miles per year) is gathering line, which is generally smaller diameter pipe that is planned for and financed as part of upstream project development.
- An average of about 1,650 miles of new gas transmission line are added each year. Roughly 850 miles per year are mainline miles, while about 800 miles per year are for lateral connections mostly to power plants, processing plants, and gas storage fields.

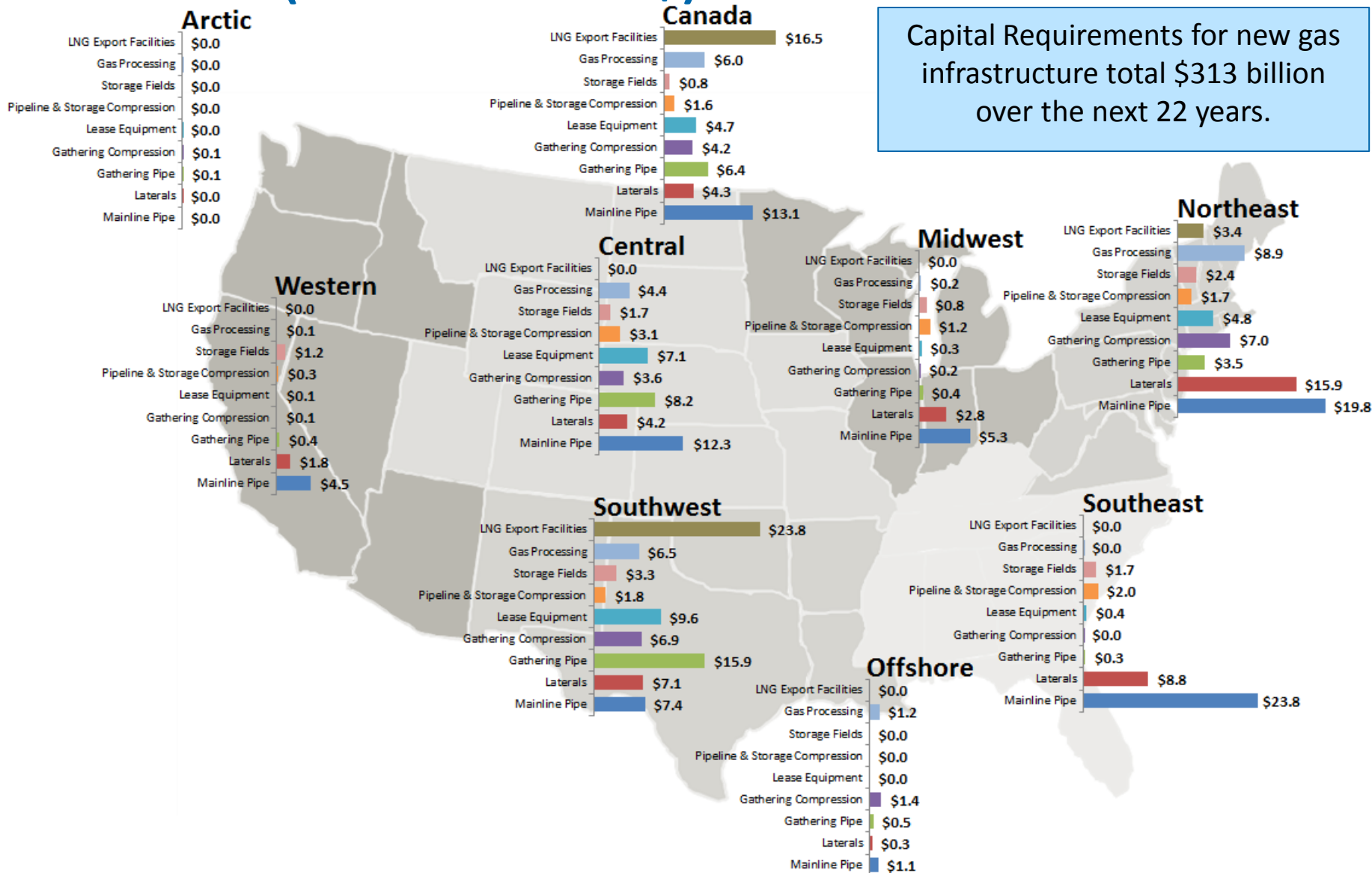
# Natural Gas Capital Expenditures in Base Case Versus Prior Study Values

(Billions of Real Dollars)	Current Study, 2014-2035 (2012\$)	Current Study Average Annual (2012\$)	Prior Study, 2011-2035 (2012\$)*	Prior Study Average Annual (2012\$)*
Gas Transmission Mainline Pipe	\$87.2	\$4.0	\$101.5	\$4.1
Laterals to/from Power Plants, Gas Storage, and Processing Plants	\$45.2	\$2.1	\$31.0	\$1.2
Gathering Line (pipe only)	\$35.6	\$1.6	\$43.3	\$1.8
Gas Gathering Line Compression	\$23.5	\$1.1	NA**	NA**
Gas Lease Equipment	\$26.9	\$1.2	NA**	NA**
Gas Pipeline & Storage Compression	\$11.6	\$0.5	\$9.5	\$0.3
Gas Storage Fields	\$12.0	\$0.5	\$5.0	\$0.2
Gas Processing Capacity	\$27.4	\$1.2	\$23.0	\$0.9
LNG Export Facilities	\$43.7	\$2.0	NA**	NA**
<b>Total Capital Expenditures</b>	<b>\$313.1</b>	<b>\$14.2</b>	<b>\$213.3</b>	<b>\$8.5</b>

\*Capital expenditures reported in the 2011 study were converted from 2010\$ to 2012\$ using a roughly 4% inflation factor.

\*\*NA refers to Not Available.

# Regional Natural Gas Capital Expenditures in Base Case, 2014-2035 (Billions of 2012\$)



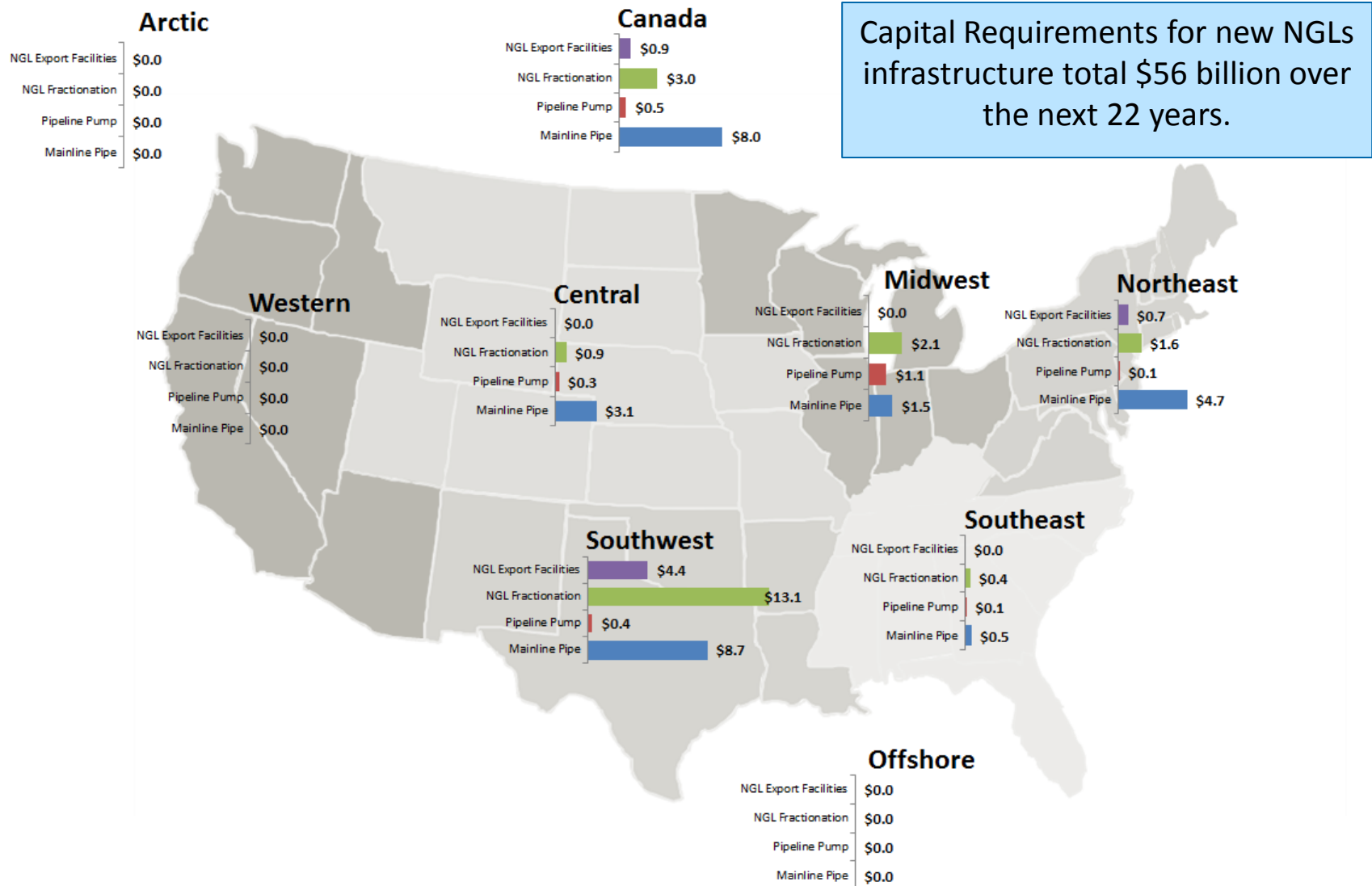
# Natural Gas Metrics in Base Case in Current Study Versus Prior Study Values

	Current Study, 2014-2035	Current Study Average Annual	Prior Study, 2011-2035	Prior Study Average Annual
Gas Well Completions (1000s)	307	14	729	29
Oil Well Completions (1000s)	914	42	777	31
Total Well Completions (1000s)	1,221	56	1,506	60
Miles of Transmission Mainline (1000s)	18.6	0.8	35.6	1.4
Miles of Laterals to/from Power Plants, Storage Fields, and Processing Plants (1000s)	17.1	0.8	13.9	0.6
Miles of Gas Gathering Line (1000s)	303.1	13.8	414	16.5
Inch-Miles of Transmission Mainline (1000s)	568	26	1,043	42
Inch-Miles of Laterals to/from Power Plants, Storage Fields, and Processing Plants (1000s)	279	13	304	12
Inch-Miles of Gathering Line (1000s)	1,095	50	1,518	61
Compression for Pipelines (1000 HP)	4,388	199	4,946	197
Compression for Gathering Line (1000 HP)	8,402	382	NA	NA
Gas Storage (Bcf Working Gas)	823	37	589	24
Processing Capacity (Bcfd)	34.2	1.6	32.5	1.3
LNG Export Facilities (Bcfd)	9.3	0.4	NA	NA

# Natural Gas Liquids (NGL) Capital Expenditures in Base Case in the Current Study Versus Prior Study Values

(Billions of Real Dollars)	Current Study, 2014-2035 (2012\$)	Current Study Average Annual (2012\$)	Prior Study, 2011-2035 (2012\$)	Prior Study Average Annual (2012\$)
NGL Transmission Mainline (pipe and pump)	\$29.0	\$1.3	\$15.1	\$0.6
<i>Pipe</i>	\$26.4	\$1.2	\$14.8	\$0.6
<i>Pump</i>	\$2.5	\$0.1	\$0.3	\$0.0
NGL Fractionation	\$21.1	\$1.0	NA	NA
NGL Export Facilities	\$5.9	\$0.3	NA	NA
<b>Total Capital Expenditures</b>	<b>\$56.0</b>	<b>\$2.6</b>	<b>\$15.1</b>	<b>\$0.6</b>

# Regional Natural Gas Liquids Capital Expenditures in Base Case, 2014-2035 (Billions of 2012\$)





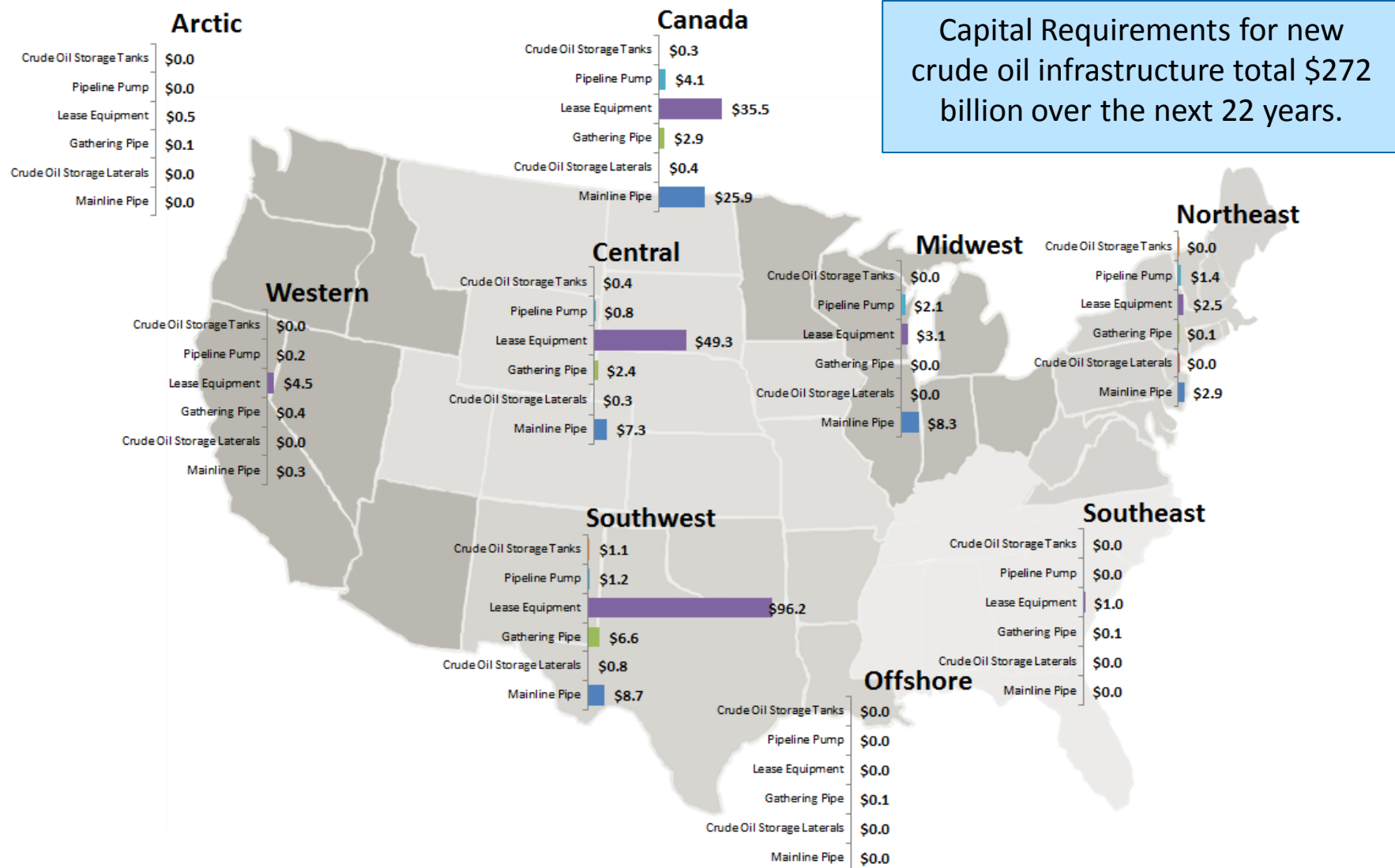
# Natural Gas Liquids Metrics in Base Case in the Current Study Versus Prior Study Values

	Current Study, 2014-2035	Current Study Average Annual	Prior Study, 2011-2035	Prior Study Average Annual
Miles of NGL Transmission Mainline (1000s)	15.1	0.7	12.5	0.5
Inch-Miles of NGL Transmission Mainline (1000s)	220	10	164	7
Pump for NGL Transmission Mainline (1000 HP)	661	30	166	7
Fractionation Capacity Built (MBOE/d)	3,326	151	NA	NA
NGL Export Facility Capacity Built (MBOE/d)	1,402	64	NA	NA

# Crude Oil Capital Expenditures in Base Case in the Current Study Versus Prior Study Values

(Billions of Real Dollars)	Current Study, 2014-2035 (2012\$)	Current Study Average Annual (2012\$)	Prior Study, 2011-2035 (2012\$)	Prior Study Average Annual (2012\$)
Crude Oil Gathering Line (pipe only)	\$12.7	\$0.6	NA	NA
Crude Oil Lease Equipment	\$192.5	\$8.8	NA	NA
Crude Oil Transmission Mainline (pipe and pump)	\$63.3	\$2.9	\$32.6	\$1.4
<i>Pipe</i>	\$53.5	\$2.4	\$31.2	\$1.3
<i>Pump</i>	\$9.8	\$0.4	\$1.5	\$0.1
Crude Oil Storage Laterals	\$1.5	\$0.1	NA	NA
Crude Oil Storage Tanks	\$1.7	\$0.1	NA	NA
<b>Total Capital Expenditures</b>	<b>\$271.8</b>	<b>\$12.4</b>	<b>\$32.6</b>	<b>\$1.4</b>

# Regional Crude Oil Capital Expenditures in Base Case, 2014-2035 (Billions of 2012\$)



# Crude Oil Metrics in Base Case in the Current Study Versus Prior Study Values

	Current Study, 2014-2035	Current Study Average Annual	Prior Study, 2011-2035	Prior Study Average Annual
Oil Well Completions (1000s)	914	42	777	31
Miles of Crude Oil Gathering Line (1000s)	171.6	7.8	NA	NA
Miles of Transmission Mainline (1000s)	16.2	0.7	19.3	0.8
Miles of Crude Oil Storage Laterals (1000s)	0.8	0	NA	NA
Inch-Miles of Crude Oil Gathering Line (1000s)	379	17	NA	NA
Inch-Miles of Transmission Mainline (1000s)	432	20	355	15
Inch-Miles of Crude Oil Storage Laterals (1000s)	14	1	NA	NA
Pump for Transmisson Mainline (1000 HP)	3,505	159	754	31
Crude Storage Capacity Built (MMBbl)	133	6	NA	NA
Number of Crude Storage Tanks Built	26,504	1,205	NA	NA
Number of Crude Storage Farms Built	39	2	NA	NA

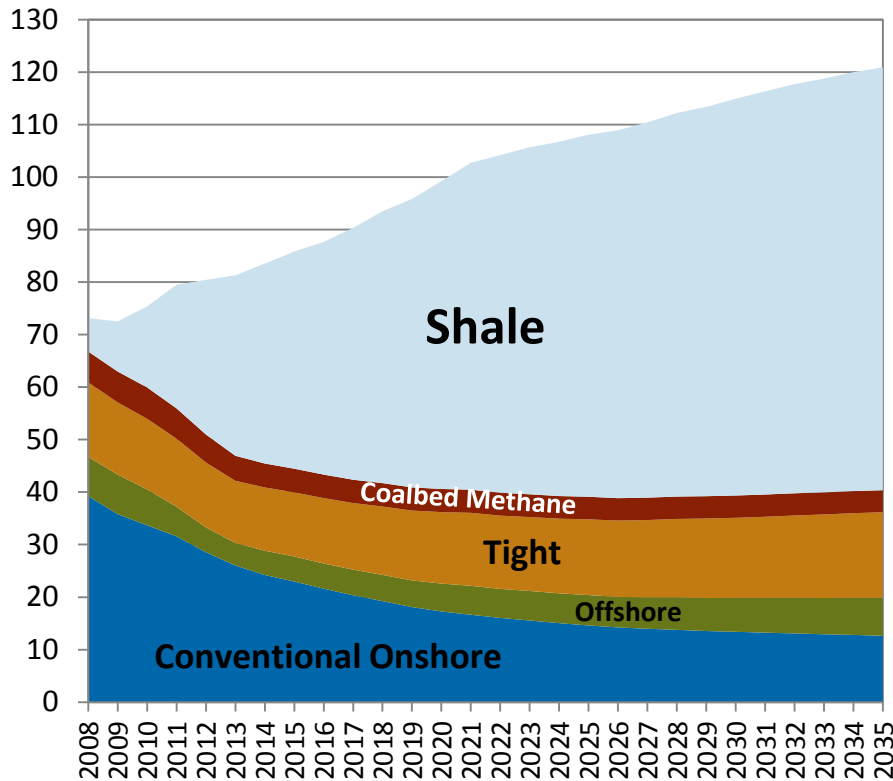
# Midstream Infrastructure Requirements – Low Growth Case

# Assumptions for Low Growth Case

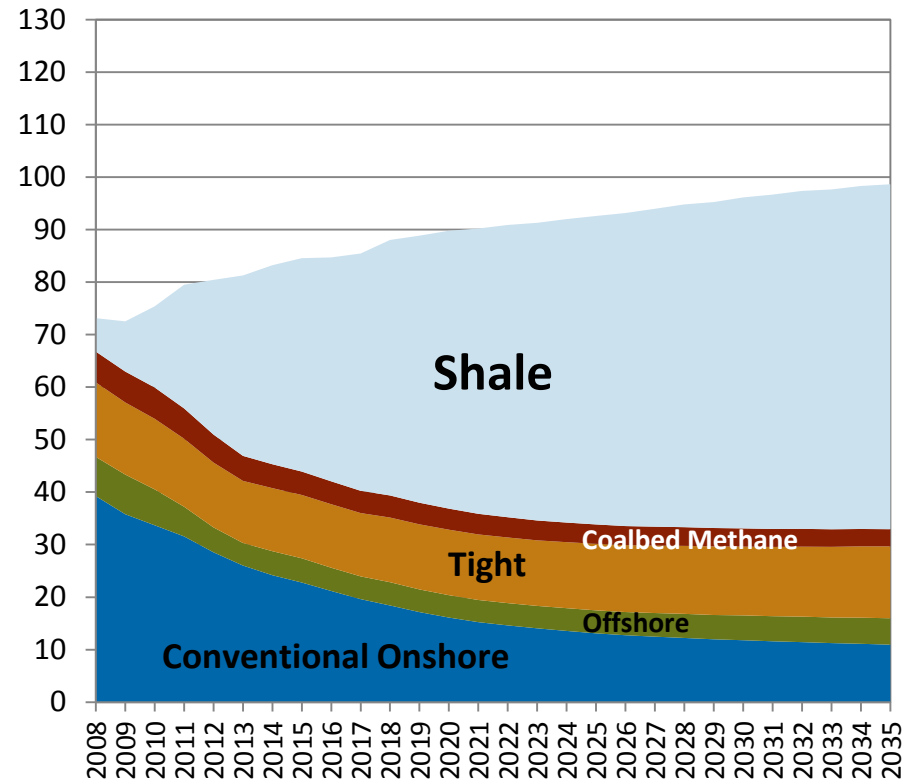
- Economic growth roughly 30% below Base Case levels.
- Gas and oil resource base unchanged, but capital availability reduced, limiting resource development.
- Oil prices fall to \$75 per barrel due to reduced economic activity, creating less incentive for “oil-gas price arbitrage” investments. LNG exports, and petrochemical activities, including ammonia production, ethylene production, and propylene production don’t fair as well in this environment.
  - U.S. and Canada LNG exports are only 4 Bcfd by 2022, versus the Base Level of 9 Bcfd.
- Oil and NGL development not as robust because of lower oil prices.
- Electric load grows more modestly at an average of 1.0% per year, driving less interest in gas-fired power generation.
- As in the Base Case, midstream infrastructure development driven by supply and demand trends and the cost assumptions for the midstream infrastructure are the same as in the Base Case.
  - But, less infrastructure is needed due to the reduced market development.

# U.S. and Canadian Natural Gas Production (Bcfd): An Example of How the Low Growth Case Impacts Markets

**Base Case**



**Low Growth Case**

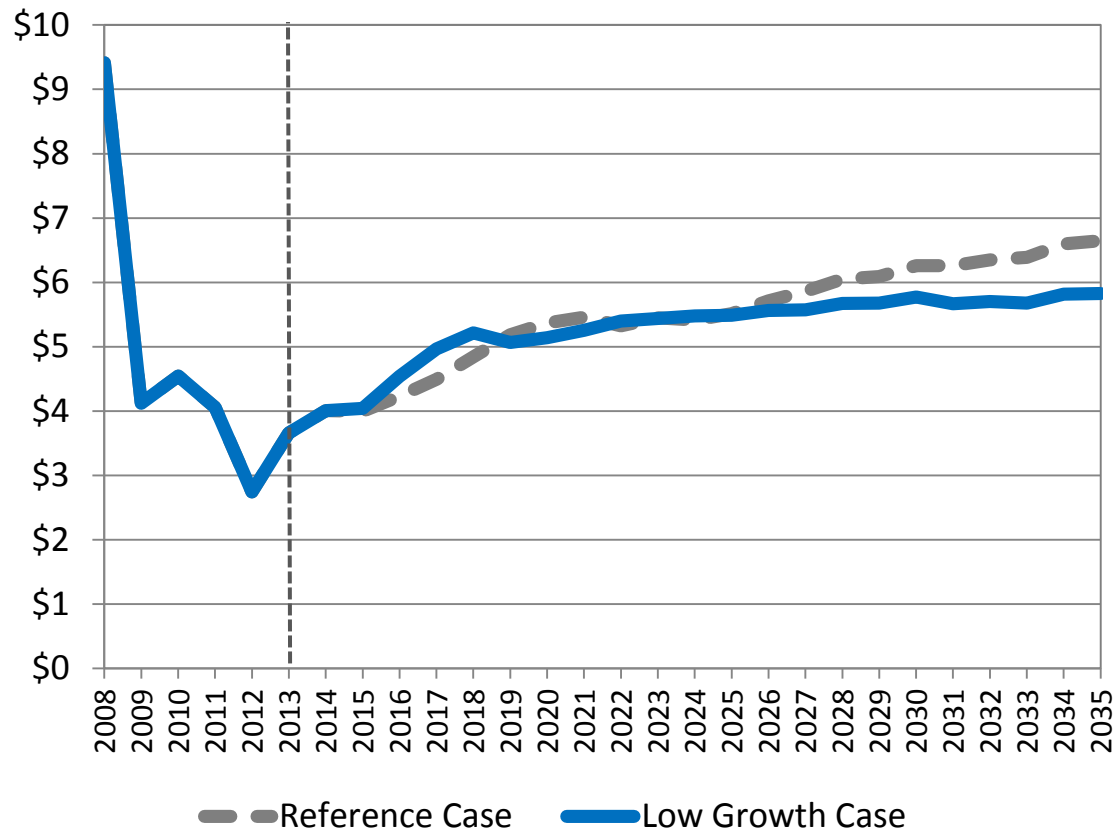


- U.S and Canada gas production in the Low Growth Case grows by a little less than 1% per year, versus 1.8% per year in the Base Case.
  - Total gas production in the Low Growth Case is projected to be 22 Bcfd lower than the Base Case by 2035.

# Projected Natural Gas Price in Low Growth Case

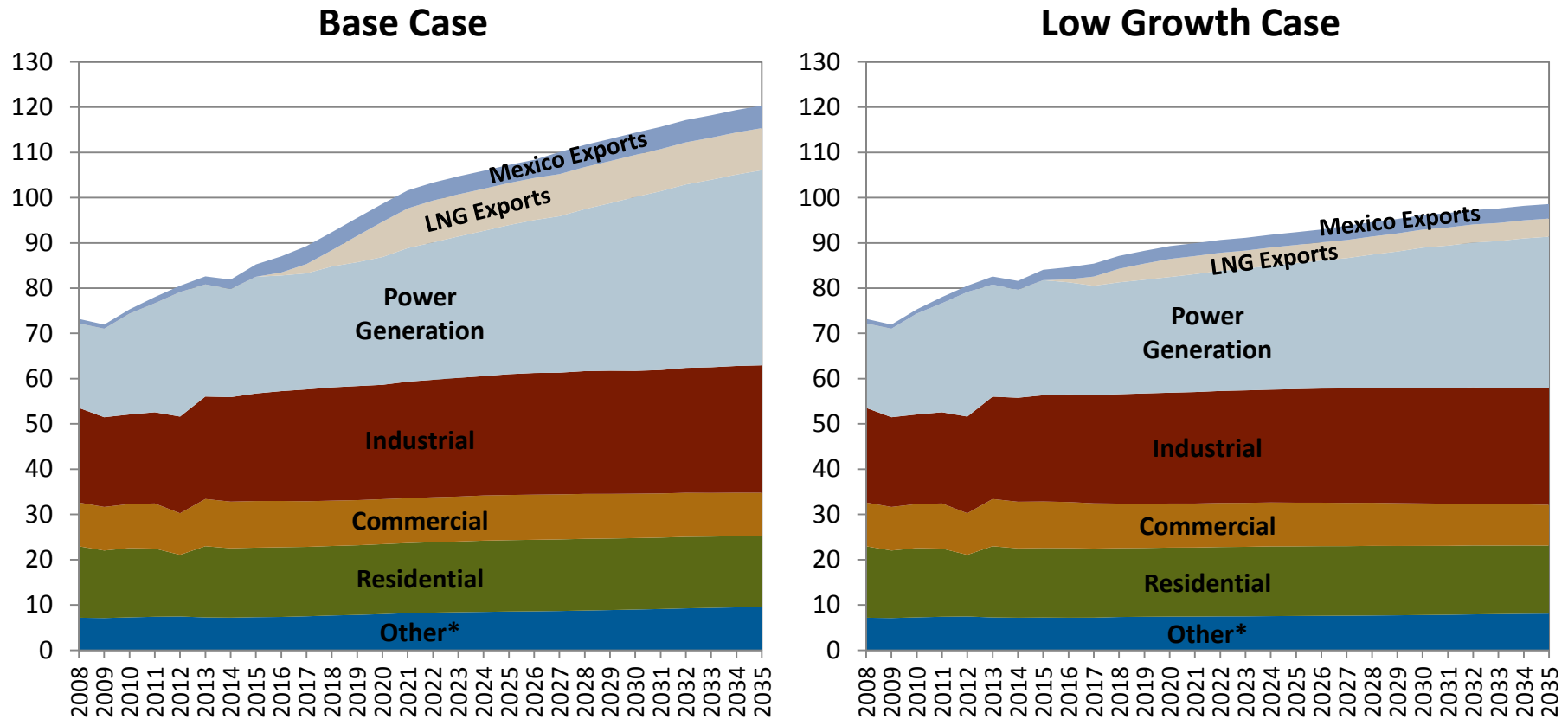
- Higher gas prices in the Low Growth Case in the short-term, between +30 to +40 cents per MMBtu, is due to lower projected oil price and restrictive investment environment.
  - Lower projected oil price, \$75/bbl versus \$100/bbl in the Base Case, cuts back oil development in the tight/shale oil plays, lowers associated gas production from oil wells, and increases gas prices.
  - Restrictive investment environment, due to lower economic growth, increases average cost of capital, results in higher cost for well exploration and development, and increases gas prices.
- Lower gas demand growth in the long-term, due to lower economic growth, yields a downward gas price.
  - Gas prices at Henry Hub average about \$5.50 per MMBtu, 50 cents lower than the Base Case.

**Average Annual Natural Gas Prices at Henry Hub  
(2012\$/MMBtu)**





# U.S. and Canadian Gas Demand (Average Annual Bcfd)

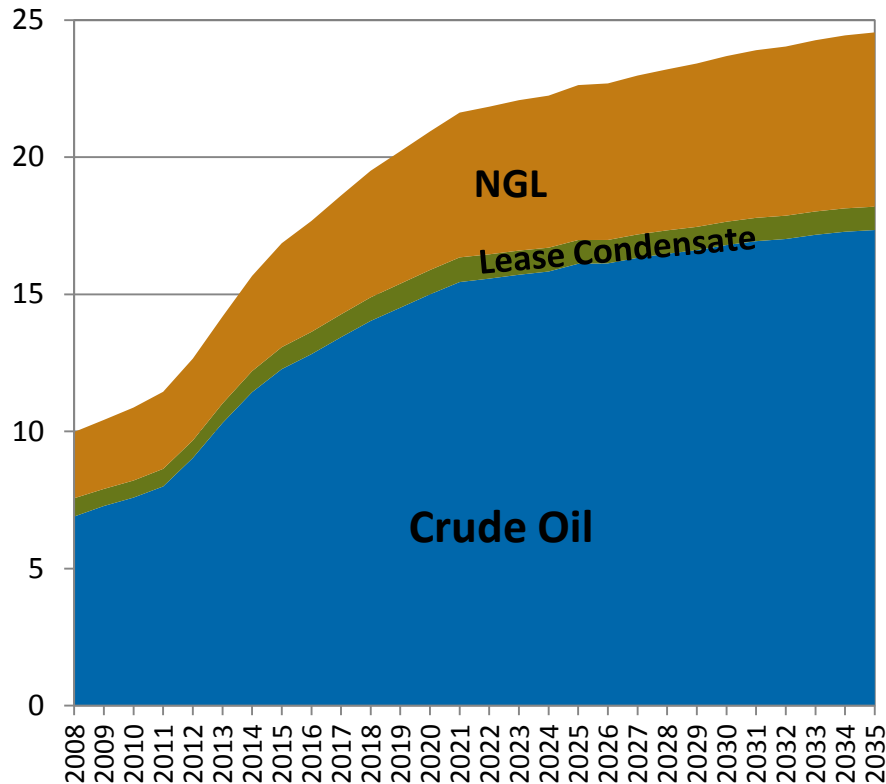


*\*Other includes lease, plant, and pipeline fuel gas use.*

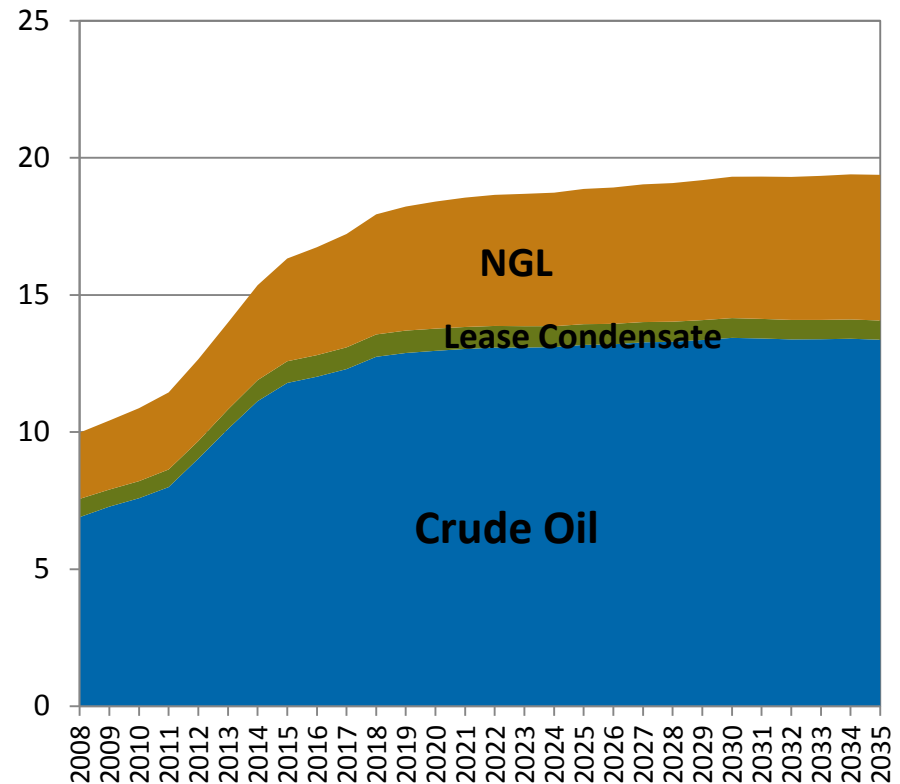
- U.S and Canada gas consumption (including LNG export changes) in the Low Growth Case is projected to be 20 Bcfd lower than the Base Case by 2035.
  - In the Low Growth Case, LNG exports only grow up to 4 Bcfd compared to 9.3 Bcfd in the Base case.

# U.S. and Canadian Liquid Production (Average Annual Million BPD)

**Base Case**



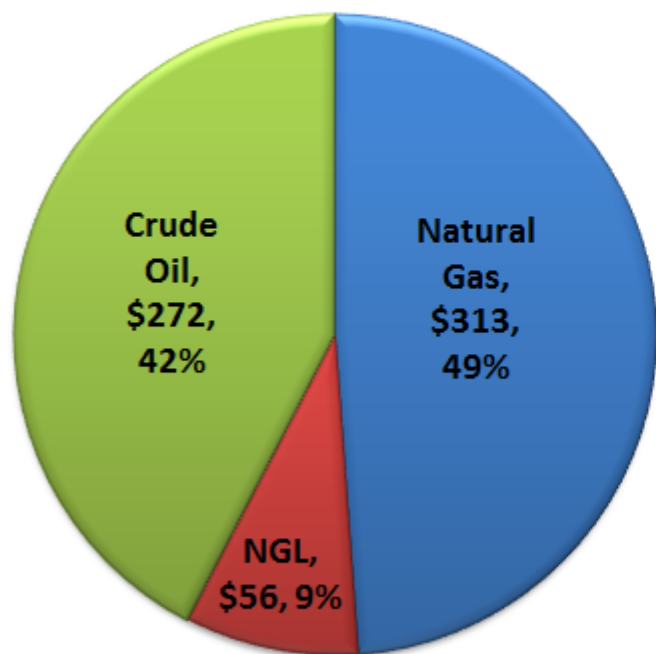
**Low Growth Case**



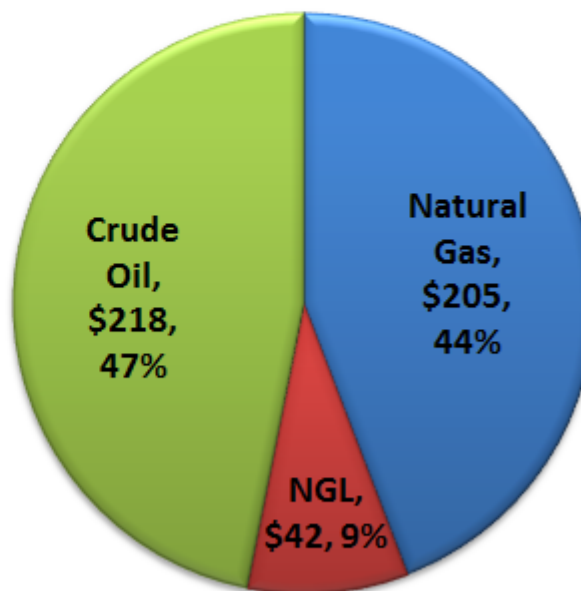
- Lower projected oil price in the Low Growth Case has a large impact on crude oil production.
  - U.S and Canada crude oil production in the Low Growth Case is 4 million BPD lower by 2035; half of the reduction in growth occurs in the Alberta oil sands.
- Projected NGL production in the Low Growth Case is down by 15% by 2035, versus the Base Case.

# Total Capital Expenditures: Low Growth Case Versus the Base Case

Reference Case,  
2014-2035  
(Billions of 2012\$)  
**\$641**



Low Growth Case,  
2014-2035  
(Billions of 2012\$)  
**\$465**  
(down by -27%)



All measures of investment, including dollar amounts and metrics supporting infrastructure development are down by about 30 percent in the Low Growth Case, versus the Base Case.

# Pipeline Capital Expenditures by Diameter Class for Low Growth Case, 2014-2035

(Thousand Miles)	1" to <= 8"	>8" to <= 16"	>16" to <= 24"	> 24"	Total Low Growth Case	Total Base Case
Natural Gas	243.8	17.9	6.9	8.9	277.5	338.8
NGL	0.6	8.3	3.4	0.1	12.5	15.1
Crude Oil	149.1	1.8	2.4	6.5	159.8	188.6
<b>Total</b>	<b>393.5</b>	<b>28.0</b>	<b>12.7</b>	<b>15.6</b>	<b>449.8</b>	<b>542.5</b>

(Thousand HP)	1" to <= 8"	>8" to <= 16"	>16" to <= 24"	> 24"	Total Low Growth Case	Total Base Case
Natural Gas	5,555	2,210	213	875	8,854	12,790
NGL	163	74	143	16	395	661
Crude Oil	336	79	243	1,362	2,020	3,505
<b>Total</b>	<b>6,054</b>	<b>2,363</b>	<b>599</b>	<b>2,253</b>	<b>11,269</b>	<b>16,956</b>

(Billions of 2012\$)	1" to <= 8"	>8" to <= 16"	>16" to <= 24"	> 24"	Total Low Growth Case	Total Base Case
Natural Gas	\$40.3	\$27.4	\$25.2	\$49.9	\$142.8	\$203.0
NGL	\$1.2	\$14.6	\$6.4	\$0.2	\$22.4	\$29.0
Crude Oil	\$12.2	\$1.8	\$6.6	\$32.4	\$53.0	\$77.5
<b>Total</b>	<b>\$53.7</b>	<b>\$43.8</b>	<b>\$38.2</b>	<b>\$82.5</b>	<b>\$218.3</b>	<b>\$309.5</b>

# Comparison of Natural Gas Capital Expenditures in Base Case Versus Low Growth Case

(Billions of Real Dollars)	Base Case, 2014-2035 (2012\$)	Base Case Average Annual (2012\$)	Low Growth Case, 2014-2035 (2012\$)	Low Growth Case Average Annual (2012\$)	Average Annual Change (2012\$)	Average Annual Change (%)
Gas Transmission Mainline Pipe	\$87.2	\$4.0	\$59.2	\$2.7	-\$1.3	-32%
Laterals to/from Power Plants, Gas Storage and Processing Plants	\$45.2	\$2.1	\$29.3	\$1.3	-\$0.7	-35%
Gathering Line (pipe only)	\$35.6	\$1.6	\$29.9	\$1.4	-\$0.3	-16%
Gas Gathering Line Compression	\$23.5	\$1.1	\$16.7	\$0.8	-\$0.3	-29%
Gas Lease Equipment	\$26.9	\$1.2	\$21.9	\$1.0	-\$0.2	-19%
Gas Pipeline & Storage Compression	\$11.6	\$0.5	\$7.6	\$0.3	-\$0.2	-34%
Gas Storage Fields	\$12.0	\$0.5	\$5.9	\$0.3	-\$0.3	-51%
Gas Processing Capacity	\$27.4	\$1.2	\$19.8	\$0.9	-\$0.3	-28%
LNG Export Facilities	\$43.7	\$2.0	\$14.9	\$0.7	-\$1.3	-66%
<b>Total Capital Expenditures</b>	<b>\$313.1</b>	<b>\$14.2</b>	<b>\$205.3</b>	<b>\$9.3</b>	<b>-\$4.9</b>	<b>-34%</b>

# Comparison of Natural Gas Metrics in Base Case Versus Low Growth Case

	Base Case, 2014-2035	Base Case Average Annual	Low Growth Case, 2014- 2035	Low Growth Case Average Annual	Average Annual Change	Average Annual Change (%)
Gas Well Completions (1000s)	307	14	248	11	-3	-19%
Oil Well Completions (1000s)	914	42	776	35	-6	-15%
Total Well Completions (1000s)	1,221	56	1,024	47	-9	-16%
Miles of Transmission Mainline (1000s)	18.6	0.8	12.6	0.6	-0.3	-32%
Miles of Laterals to/from Power Plants, Storage Fields and Processing Plants (1000s)	17.1	0.8	11.4	0.5	-0.3	-33%
Miles of Gas Gathering Line (1000s)	303.1	13.8	253.5	11.5	-2.3	-16%
Inch-Miles of Transmission Mainline (1000s)	568	26	380	17	-9	-33%
Inch-Miles of Laterals to/from Power Plants, Storage Fields and Processing Plants (1000s)	279	13	179	8	-5	-36%
Inch-Miles of Gathering Line (1000s)	1,095	50	923	42	-8	-16%
Compression for Pipelines (1000 HP)	4,388	199	2,884	131	-68	-34%
Compression for Gathering Line (1000 HP)	8,402	382	5,970	271	-111	-29%
Gas Storage (Bcf Working Gas)	823	37	366	17	-21	-56%
Processing Capacity (Bcfd)	34.2	1.6	24.7	1.1	-0.4	-28%
LNG Export Facilities (Bcfd)	9.3	0.4	4.0	0.2	-0.2	-57%

# Comparison of Natural Gas Liquids Capital Expenditures in Base Case Versus Low Growth Case

(Billions of Real Dollars)	Base Case, 2014-2035 (2012\$)	Base Case Average Annual (2012\$)	Low Growth Case, 2014-2035 (2012\$)	Low Growth Case Average Annual (2012\$)	Average Annual Change (2012\$)	Average Annual Change (%)
NGL Transmission Mainline (pipe and pump)	\$29.0	\$1.3	\$22.4	\$1.0	-\$0.3	-23%
<i>Pipe</i>	\$26.4	\$1.2	\$21.0	\$1.0	-\$0.2	-20%
<i>Pump</i>	\$2.5	\$0.1	\$1.3	\$0.1	-\$0.1	-47%
NGL Fractionation	\$21.1	\$1.0	\$15.9	\$0.7	-\$0.2	-25%
NGL Export Facilities	\$5.9	\$0.3	\$3.5	\$0.2	-\$0.1	-42%
<b>Total Capital Expenditures</b>	<b>\$56.0</b>	<b>\$2.5</b>	<b>\$41.7</b>	<b>\$1.9</b>	<b>-\$0.7</b>	<b>-26%</b>

# Comparison of Natural Gas Liquids Metrics in Base Case Versus Low Growth Case

	Base Case, 2014-2035	Base Case Average Annual	Low Growth Case, 2014-2035	Low Growth Case Average Annual	Average Annual Change	Average Annual Change (%)
Miles of Transmission Mainline (1000s)	15.1	0.7	12.5	0.6	-0.1	-18%
Inch-Miles of Transmission Mainline (1000s)	220	10	181	8	-2	-18%
Pump for Transmission Mainline (1000 HP)	661	30	395	18	-12	-40%
Fractionation Capacity Built (MBOE/d)	3,326	151	2,501	114	-37	-25%
NGL Export Facility Capacity Built (MBOE/d)	1,402	64	1,022	46	-17	-27%



# Comparison of Crude Oil Capital Expenditures in Base Case Versus Low Growth Case

(Billions of Real Dollars)	Base Case, 2014-2035 (2012\$)	Base Case Average Annual (2012\$)	Low Growth Case, 2014-2035 (2012\$)	Low Growth Case Average Annual (2012\$)	Average Annual Change (2012\$)	Average Annual Change (%)
Crude Oil Gathering Line (pipe only)	\$12.7	\$0.6	\$11.1	\$0.5	-\$0.1	-13%
Crude Oil Lease Equipment	\$192.5	\$8.8	\$163.7	\$7.4	-\$1.3	-15%
Crude Oil Transmission Mainline (pipe and pump)	\$63.3	\$2.9	\$41.1	\$1.9	-\$1.0	-35%
<i>Pipe</i>	\$53.5	\$2.4	\$35.2	\$1.6	-\$0.8	-34%
<i>Pump</i>	\$9.8	\$0.4	\$5.9	\$0.3	-\$0.2	-40%
Crude Oil Storage Laterals	\$1.5	\$0.1	\$0.9	\$0.0	\$0.0	-43%
Crude Oil Storage Tanks	\$1.7	\$0.1	\$1.0	\$0.0	\$0.0	-40%
<b>Total Capital Expenditures</b>	<b>\$271.8</b>	<b>\$12.4</b>	<b>\$217.8</b>	<b>\$9.9</b>	<b>-\$2.5</b>	<b>-20%</b>

# Comparison of Crude Oil Metrics in Base Case Versus Low Growth Case

	Base Case, 2014-2035	Base Case Average Annual	Low Growth Case, 2014- 2035	Low Growth Case Average Annual	Average Annual Change	Average Annual Change (%)
Oil Well Completions (1000s)	914	42	776	35	-6	-15%
Miles of Crude Oil Gathering Line (1000s)	171.6	7.8	149.1	6.8	-1.0	-13%
Miles of Transmission Mainline (1000s)	16.2	0.7	10.2	0.5	-0.3	-37%
Miles of Crude Oil Storage Laterals (1000s)	0.8	0.0	0.4	0.0	-0.0	-43%
Inch-Miles of Crude Oil Gathering Line (1000s)	379	17	331	15	-2	-13%
Inch-Miles of Transmission Mainline (1000s)	432	20	293	13	-6	-32%
Inch-Miles of Crude Oil Storage Laterals (1000s)	14	1	8	0	0	-43%
Pump for Transmisson Mainline (1000 HP)	3,505	159	2,020	92	-67	-42%
Crude Storage Capacity Built (MMBbl)	133	6	77	3	-3	-42%
Number of Crude Storage Tanks Built	26,504	1,205	15,362	698	-506	-42%
Number of Crude Storage Farms Built	39	2	22	1	-1	-43%

# **Economic Impact Methodology Assumptions**

# Terms Used in IMPLAN Modeling

- Analysis relies on IMPAN modeling.
- **Direct Impacts** – immediate impacts (e.g., employment or value added changes) in a sector due to an increase in output in that sector.
- **Indirect Impacts** – impacts due to the industry inter-linkages caused by the iteration of industries purchasing from other industries, brought about by the changes in direct output.
- **Induced Impacts** – impacts on all local and national industries due to consumers' consumption expenditures rising from the new household incomes that are generated by the direct and indirect effects flowing through to the general economy. The term is used in industry-level input-output modeling and is similar to the term Multiplier Effect used in macroeconomics.

# Sector Allocations of Investment Expenditures (Direct Output) for National-Level Economic Impact Analysis

Industry Sector	Gathering Line (excludes compressors)	Lease Equipment	Gas Processing	Pipeline (excludes compressors and pumps)	Compressors (gathering line, pipeline, and gas storage)	Pumps
Oil, Gas & Other Mining	5.8%	0.0%	0.2%	5.8%	5.3%	5.3%
Construction	36.2%	39.7%	28.0%	36.2%	30.1%	27.6%
Manufacturing	29.4%	22.2%	44.9%	29.4%	37.7%	40.2%
Wholesale and retail trade	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Transportation	2.1%	2.1%	1.5%	2.1%	2.0%	2.0%
Services & All Other	26.5%	36.0%	25.4%	26.5%	24.9%	24.9%
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

Industry Sector	Underground Gas Storage (excludes compressors and pipelines)	LNG Plant	NGL Fractionation Plant	NGL Export Facility	Crude Oil Storage Tanks	All Infrastructures Analyzed
Oil, Gas & Other Mining	69.9%	0.3%	0.2%	0.3%	5.3%	<b>8.9%</b>
Construction	4.5%	28.3%	28.0%	28.3%	31.3%	<b>28.9%</b>
Manufacturing	13.6%	32.9%	44.9%	32.9%	36.5%	<b>33.2%</b>
Wholesale and retail trade	0.1%	0.0%	0.0%	0.0%	0.0%	<b>0.0%</b>
Transportation	8.1%	2.1%	1.5%	2.1%	2.0%	<b>2.5%</b>
Services & All Other	3.7%	36.3%	25.4%	36.3%	24.9%	<b>26.4%</b>
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

# National Tax Rates on Gross Domestic Product (GDP)

	Federal Tax Rate on GDP	Weighted Average State/Provincial and Local Tax Rate on GDP	Total
<b>U.S.</b>			
2014	18.6%	15.3%	33.9%
2020	19.1%	15.6%	34.7%
2025	19.4%	15.8%	35.2%
2030	19.6%	16.0%	35.6%
2035	19.9%	16.2%	36.1%
<b>Canada</b>			
2014-2035	12.1%	19.6%	31.7%

# Distribution of National-Level Economic Impacts Across Regions using Region-Level Allocators

- National-level economic impact results, by individual infrastructure category, are distributed across regions based on region-level “allocators”.
- National “direct” impacts (e.g. direct value added) are distributed to regions based on expenditure allocators.
  - Expenditure allocators are calculated from infrastructure investment expenditures. In this analysis, investment expenditures for the U.S. Offshore region is assumed to be spent in the Southwest region.
- National “indirect” impacts (e.g. indirect value added) are distributed to regions based on a combination of expenditure allocators (60% weight) and Indirect Industrial Jobs allocators (40% weight).
- National “induced” impacts are distributed to regions based on a combination of the “Direct & Indirect Value Added” allocators (40% weight) and State Personal Income in 2010 (60% weight).
  - “Direct & Indirect Value Added” allocators are calculated from the sum of regional direct and the indirect Value Added, as discussed above.

## Region-Level Allocators

Region	Indirect Industrial Jobs <sup>a</sup>	State Personal Income 2010 <sup>b</sup>
Central	6.6%	7.6%
Midwest	26.8%	15.9%
Northeast	25.7%	27.6%
Southeast	16.5%	17.5%
Southwest	12.7%	11.6%
Western	11.6%	19.5%
Arctic	0.0%	0.3%
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>

<sup>a</sup>Weighted average of industries that support construction and equipping industrial activities based on IMPLAN input-output model and U.S. Bureau of Labor statistics data.

<sup>b</sup>State personal income FY 2010 from Tax Policy Center (Urban Institute and Brookings Institution). “State and Local General Revenue as a Percentage of Personal Income 2004-2011.” Tax Policy Center, 20 September, 2013: Washington, DC.

# Distribution of U.S. Tax Revenues Across Regions Using State/Local Tax Allocators

- National-level tax revenues (federal and state/provincial/ local) are calculated from Total Value Added and tax rates on GDP (federal and state/provincial/local).
- For the U.S., total state and local tax revenues are distributed across the regions based on region-level State/Local Tax allocators.

## U.S. State/Local Tax Allocators

Region	State and Local Tax Rate on GDP FY 2011*
Central	15.9%
Midwest	15.5%
Northeast	15.3%
Southeast	14.8%
Southwest	14.8%
Western	15.2%
Arctic	37.8%

\*State and Local General Revenue as a Percentage of Personal Income 2004-2011, Urban Institute and Brookings Institution,  
<http://www.taxpolicycenter.org/taxfacts/displayafact.cfm?Docid=510>



# Results of Economic Impact Analysis Using IMPLAN

# Results of Economic Impact Analysis

## U.S. and Canada: Economic Impacts for Reference Case, 2014-2035

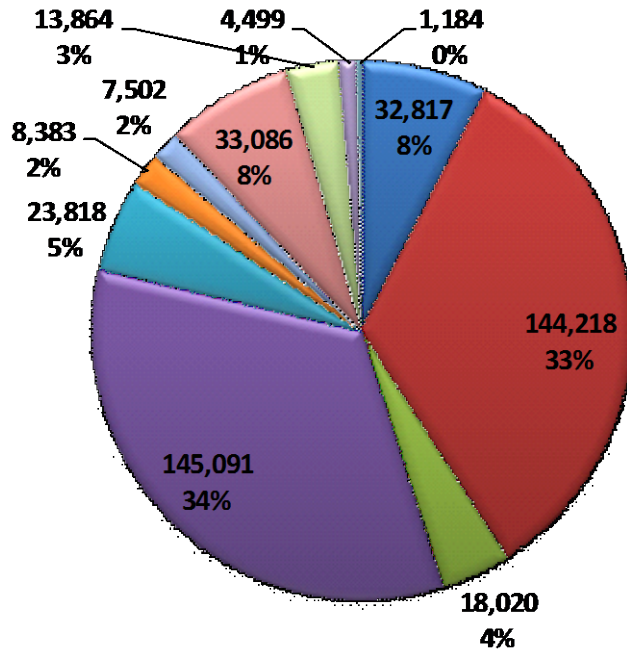
Impact Type	Employment (Jobs per Year)	Annual Wages and Benefits (2012\$ per Job)	Labor Income (Billions of 2012\$)	Value Added (Billions of 2012\$)	State/Provincial and Local Tax Revenues (Billions of 2012\$)	Federal Tax Revenues (Billions of 2012\$)
Direct	144,026	\$75,259	\$238.5	\$290.7		
Indirect	117,298	\$64,070	\$165.3	\$265.6		
Induced	171,158	\$48,844	\$183.9	\$328.8		
<b>Total</b>	<b>432,482</b>	<b>\$61,770</b>	<b>\$587.7</b>	<b>\$885.2</b>	<b>\$146.3</b>	<b>\$156.2</b>

Results for economic impact analysis, calculated by using IMPLAN, represent summed results across direct, indirect, and induced categories.

# Results of Economic Impact Analysis (Continued)

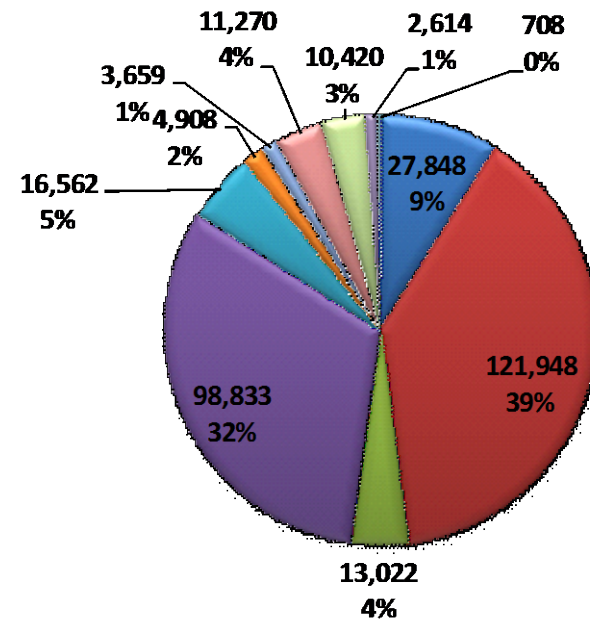
## Total Employment (Jobs per Year)

Reference Case (432,482)



- Gathering Line (excludes compressors)
- Gas Processing
- Compressors (gathering line, pipeline, and gas storage)
- Underground Gas Storage (excludes compressors and pipelines)
- NGL Fractionation Plant
- Crude Oil Storage Tanks

Low Growth Case (311,793)



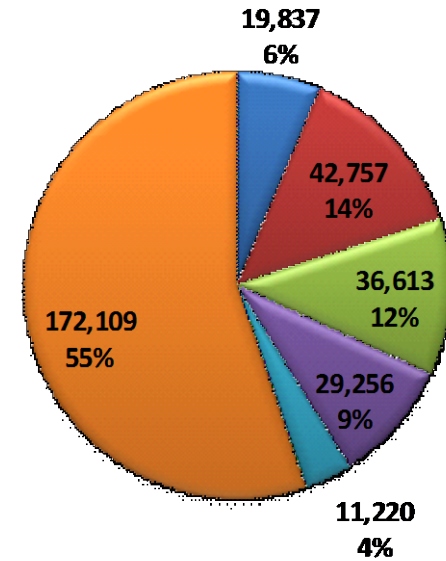
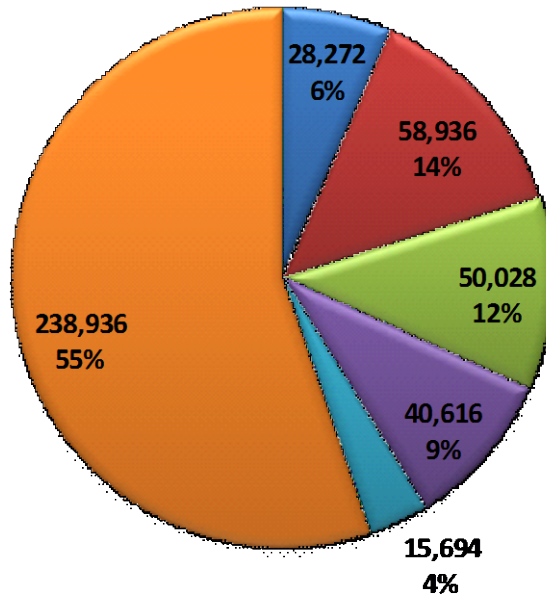
- Lease Equipment
- Pipeline (excludes compressors and pumps)
- Pumps
- LNG Plant
- NGL Export Facility

# Results of Economic Impact Analysis (Continued)

## Total Employment (Jobs per Year)

Reference Case (432,482)

Low Growth Case (311,793)



Oil, Gas & Other Mining

Construction

Manufacturing

Wholesale and retail trade

Transportation

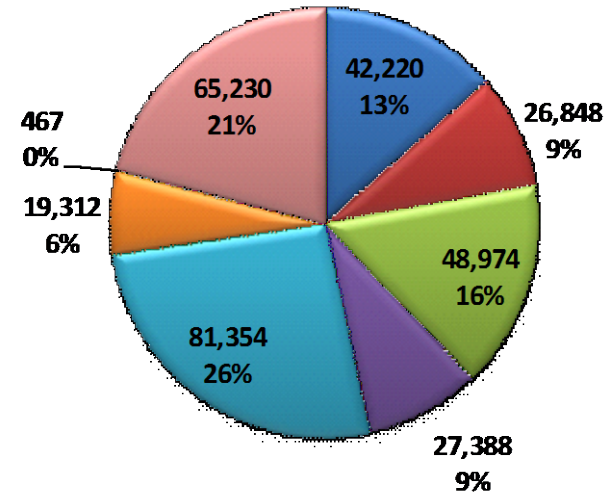
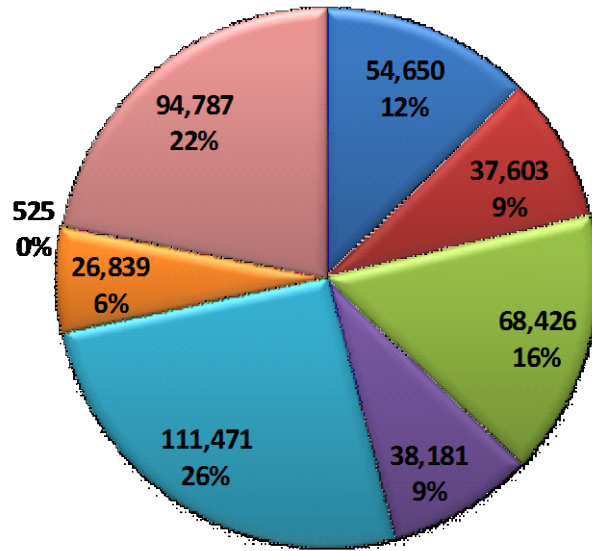
Services & All Other

# Results of Economic Impact Analysis (Continued)

## Total Employment (Jobs per Year)

Reference Case (432,482)

Low Growth Case (311,793)



Central

Midwest

Northeast

Southeast

Southwest

Western

Arctic

Canada

# Conclusions

# Conclusions

The main conclusions in this study are summarized below:

- The base case, which assumes \$100 per barrel of oil and shows gas prices rising from \$4 per MMBtu to an average of \$6 per MMBtu in the longer term, and is considered a middle-of-the-road scenario, projects significant gas market growth. Significant infrastructure will be needed to support this growing gas use.
- The base case projects significant supply development and growth in gas production, primarily from shale resources. Producers are likely to develop shale plays with large quantities of oil and NGL, which also have significant needs for new pipeline infrastructure.
- The base case projects substantial NGL production growth, especially from the Marcellus and Utica shale plays in the northeastern United States and also from other liquid-rich plays in the United States and Canada. A significant number of gas processing, pipeline, and fractionation facilities are required to accommodate growing NGL production.
  - NGL produced in the northeastern United States from Marcellus and Utica shale seek established petrochemical markets along the Gulf Coast.
  - Alberta oil sands have an increasing need for pentanes-plus NGL to dilute bitumen, aiding the transport of it through oil pipelines.
  - Bakken and Central Rockies NGL flow to the Gulf Coast through West Texas. Flows of raw NGL from West Texas to the Gulf Coast are projected to double by 2035.
  - The base case also projects significant growth of NGL exports from the Gulf Coast and Western Canada.
- The base case projects robust growth of crude oil and condensate production, mostly from Alberta oil sands and tight/shale oil plays, driven by relatively high oil prices. A significant number of pipeline expansions and new pipelines are under development, and incremental transport capability is needed to accommodate growing crude oil and condensate production.
  - Alberta oil sands production is projected to nearly triple by 2035. Bakken shale crude oil production will double by 2020 to almost 1.8 million BPD and increase to 2.1 million BPD by 2035. Significant crude production growth is also expected from West Texas and Gulf Coast tight/shale plays.
  - Exports off of the West Coast of Canada will increase by more than 2 million BPD from 2020 through 2035.

# Conclusions (Continued)

From 2014 through 2035, the following approximate amounts of new infrastructure are required:

- Natural gas infrastructure:
  - Approximately 43 Bcfd in new gas transmission capability
  - About 850 miles per year in new gas transmission mainline
  - Over 800 miles per year in new laterals to/from power plants, processing facilities, and storage fields
  - Almost 14,000 miles per year in new gas gathering lines
  - Approximately 35 Bcfd of new processing capability
  - About 40 Bcf per year in new working gas capacity
  - About 600,000 horsepower per year for pipeline compression
  - About 9 Bcfd of new LNG export capacity
- NGL infrastructure:
  - About 3.6 MMBPD in new NGL transmission capacity
  - About 700 miles per year in new NGL transmission line
  - About 30,000 horsepower per year for pumping requirement for pipeline
  - Approximately 55 MMBOE per year in new NGL fractionation capacity
  - Almost 24 MMBOE per year in new NGL export capacity
- Oil infrastructure:
  - More than 10 MMBPD in new oil transmission capacity
  - About 750 miles per year in new oil transmission line
  - About 35 miles per year in new laterals for crude oil storage
  - Approximately 7,800 miles per year in new oil gathering lines
  - About 160,000 horsepower per year of pumping requirement for pipeline
  - Over 6 MMBbl per year in new crude oil storage capacity





# Conclusions (Continued)

Expenditures for the incremental infrastructure projected here are significant:

- More than \$640 billion or about \$30 billion per year, in total capital expenditures are required over the next 22 years for the combined natural gas and liquids outlook.
- \$10 billion per year, or 34 percent of this amount, is required for new oil and gas lease equipment.
- Almost \$9 billion, or 29 percent, is for new or expanded gas and liquids mainline capacity.
- More than \$3 billion per year, or 11 percent, is needed for new oil and gas gathering lines.
- More than \$2 billion per year, or 8 percent, is required for new laterals.
- Roughly \$2.0 billion per year, or 7 percent, is required for new LNG export facilities.
- More than \$1 billion per year, or 4 percent, is required for new processing plants.
- Roughly \$1.0 billion per year, or 3 percent, is required for new NGL fractionation plants.
- The remainder, almost \$1 billion per year, is for underground gas storage, crude oil storage, and NGL export facilities.

This study includes additional new facilities that were not included in the 2011 study:

- These facilities include compression for gas gathering lines, compression for gas storage fields, crude oil gathering lines, crude oil storage and laterals, NGL fractionation, NGL export facilities, oil and gas lease equipment, and LNG export facilities.
- These additional facilities account for about \$330 billion, or more than 50 percent of the total expenditure.

# Conclusions (Continued)

Even the low-growth case shows substantial need of new midstream infrastructure:

- Total midstream expenditures projected in the low-growth case are \$465 billion, 27 percent lower than the reference case.
- Even with lower projected oil prices and lower economic growth in the low-growth case, the expenditures for midstream infrastructure requirements are still very significant.
- Reductions in expenditures are generally similar on a percentage basis across many of the infrastructure categories.

The economic benefits of midstream infrastructure development are significant:

- Every \$100 million of investment in new infrastructure creates an average of about 67 jobs over the projection period and adds roughly \$138 million in value to the U.S. and Canadian economies.
- The base case projects that an average of roughly 432,000 jobs will be needed to accomplish the levels of infrastructure development that occur in the case. The development of the infrastructure will yield a value added of roughly \$885 billion to the U.S. and Canadian economies, and federal, state/provincial, and local taxes totaling roughly \$300 billion.
- The low-growth case, while yielding values that are between 20 percent and 30 percent below the base case values, still provides substantial economic benefits to the U.S. and Canadian economies over time.
- While many of the economic benefits accrue directly to companies active in midstream development, there are many indirect and induced benefits that occur in many other industries, and a substantial number of service sector jobs are created as a result of the midstream development.
- Although many of the economic benefits are concentrated in areas where midstream development has been historically prevalent, the benefits are geographically widespread. All sectors and regions of North America benefit from the infrastructure development.

# Glossary

## Units

Bbl	Barrels
Bcf	Billion Cubic Feet
Bcfd	Billion Cubic Feet per Day
BOE	Barrel of Oil Equivalent
BOE/d	Barrel of Oil Equivalent per Day
BPD	Barrel per Day
Btu	British Thermal Unit
GW	Gigawatts
HP	Horsepower
MBOE/d	Thousand Barrel of Oil Equivalent per Day
MMBbl	Million Barrels
MMBpd	Million Barrels per Day
MMBtu	Million Btu
MMcfd	Million Cubic Feet per Day
Tcf	Trillion Cubic Feet

## Acronyms

DPR	ICF's Detailed Production Report
EIA	Energy Information Administration
GDP	Gross Domestic Product
GMM	ICF's Gas Market Model
GTL	Gas-to-Liquids
LACT	Lease Automatic Custody Transfer
LNG	Liquefied Natural Gas
NGL	Natural Gas Liquids
NWT	Northwest Territories, Canada
R/C	Residential/Commercial Sector
RACC	Refiners' Average Cost of Crude





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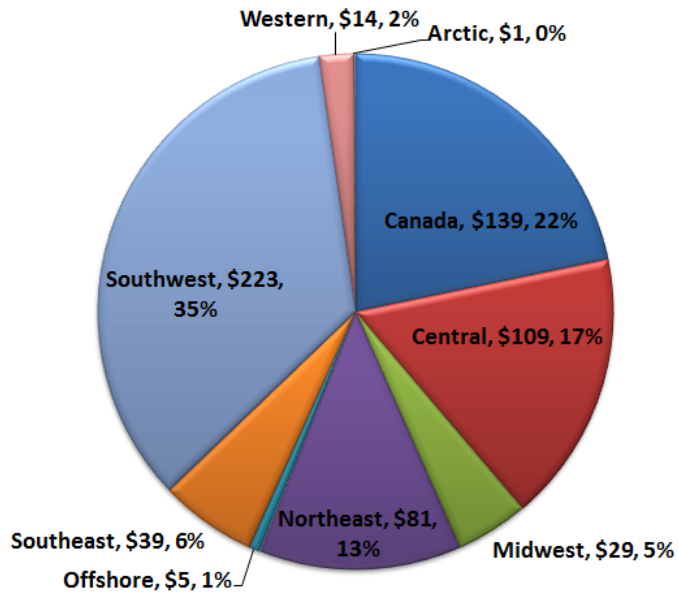
Cathy Landry  
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202.216.5913



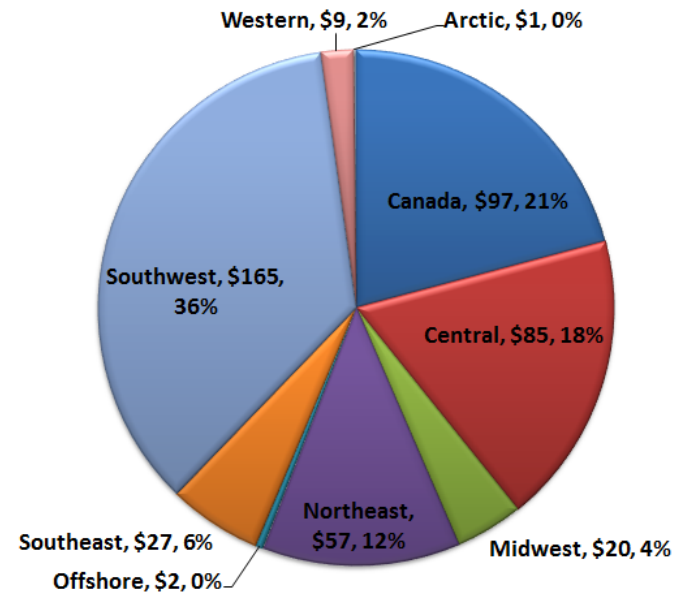
# **Appendix A: Regional Capital Expenditures – Base Case Versus Low Growth Case**

# Regional Total Capital Expenditures

Base Case, 2014-2035 (Billions of 2012\$)  
\$641

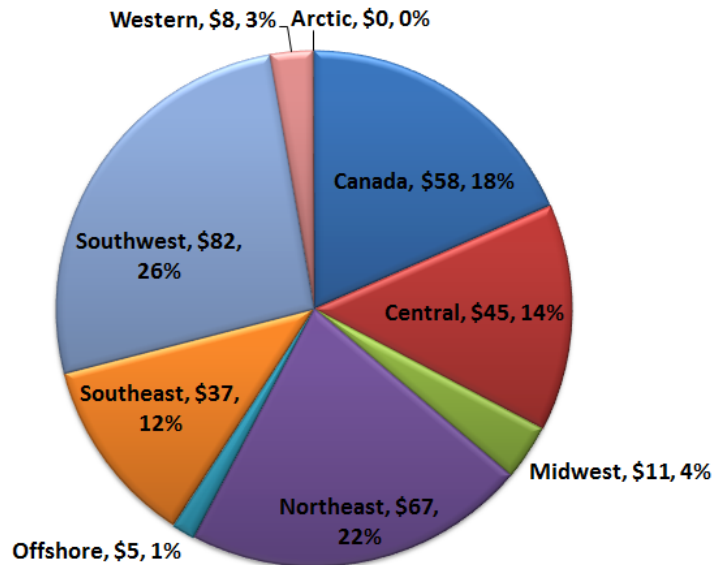


Low Growth Case, 2014-2035 (Billions of 2012\$)  
\$465

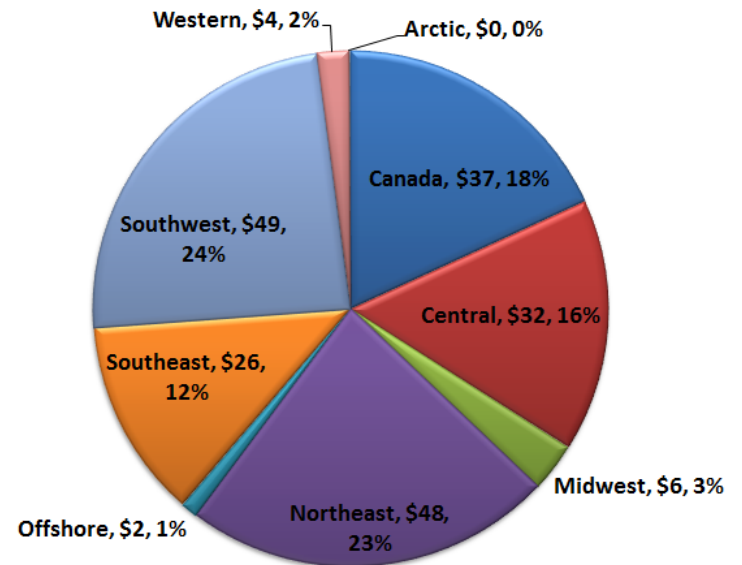


# Regional Natural Gas Capital Expenditures

Base Case, 2014-2035 (Billions of 2012\$)  
\$313

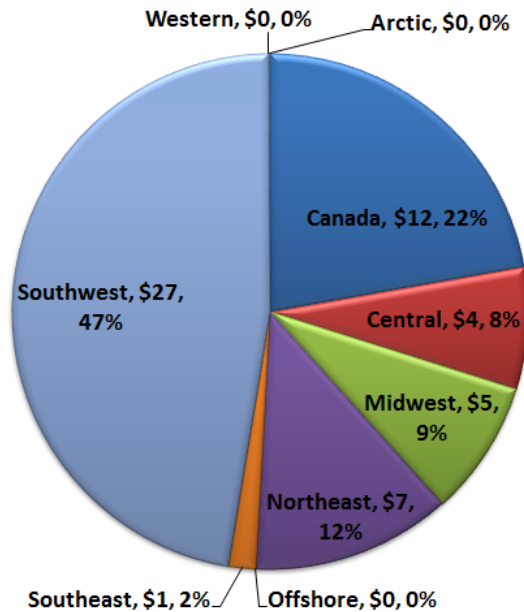


Low Growth Case, 2014-2035 (Billions of 2012\$)  
\$205

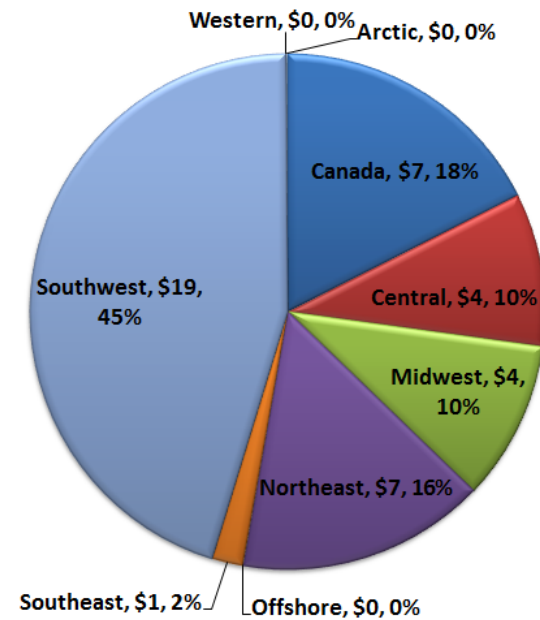


# Regional Natural Gas Liquids Capital Expenditures

Base Case, 2014-2035 (Billions of 2012\$)  
\$56



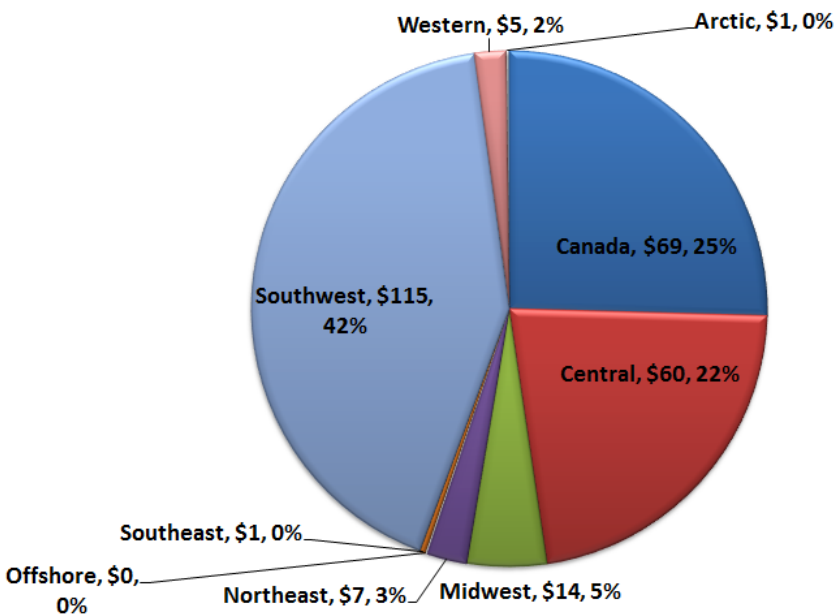
Low Growth Case, 2014-2035 (Billions of 2012\$)  
\$42



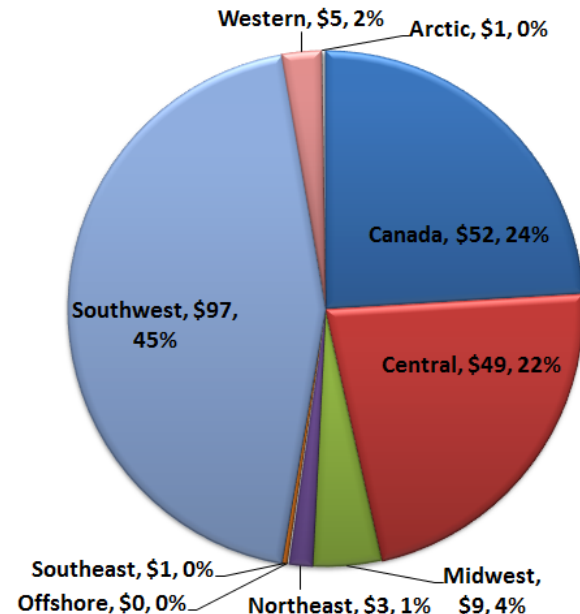


# Regional Crude Oil Capital Expenditures

Base Case, 2014-2035 (Billions of 2012\$)  
\$272



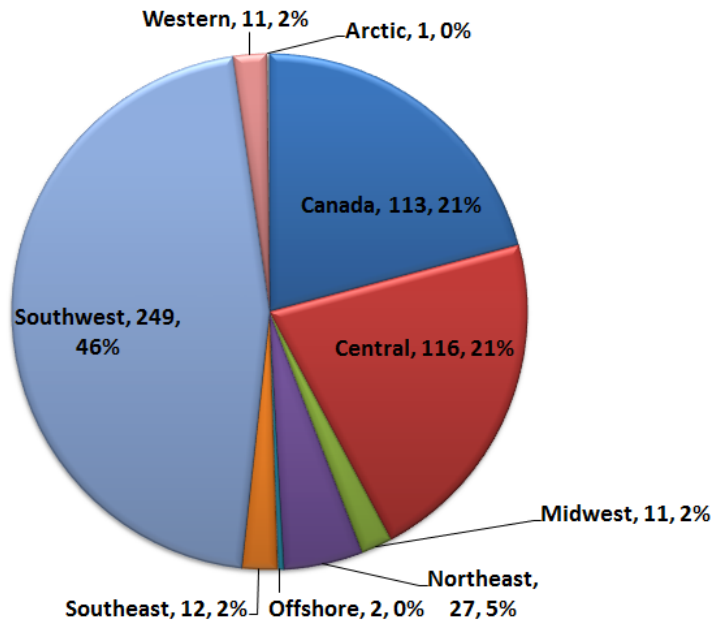
Low Growth Case, 2014-2035 (Billions of 2012\$)  
\$218



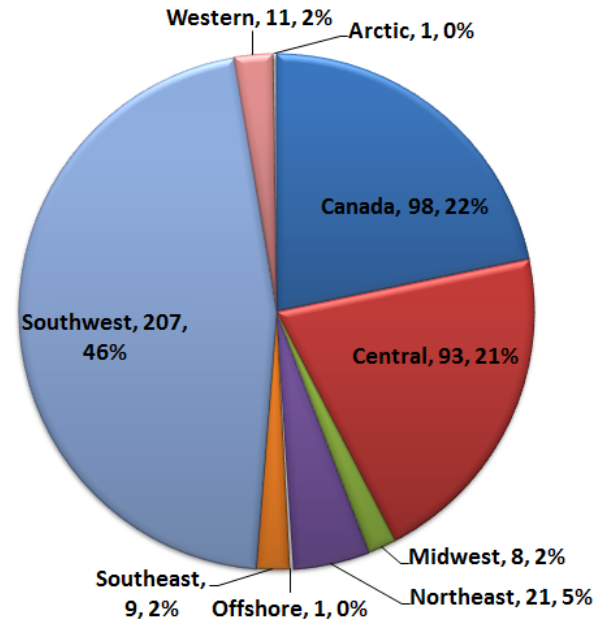
# **Appendix B: Regional Pipeline Miles, Inch-Miles, and Compressor/Pump Horsepower – Base Case Versus Low Growth Case**

# Regional Total Pipeline Miles

Base Case, 2014-2035 (Thousand Miles)  
543

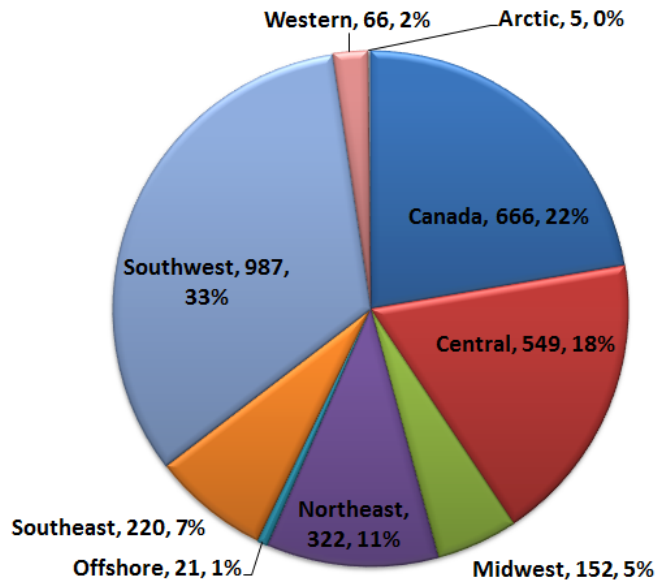


Low Growth Case, 2014-2035 (Thousand Miles)  
450

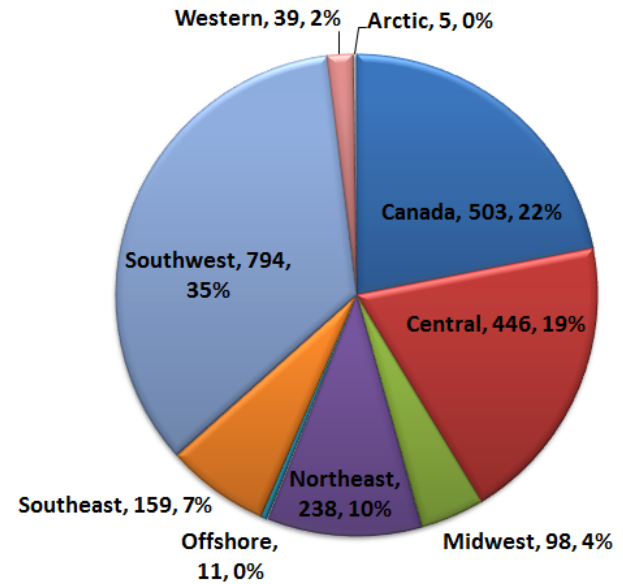


# Regional Total Pipeline Inch-Miles

Base Case, 2014-2035 (Thousand Inch-Miles)  
2,988

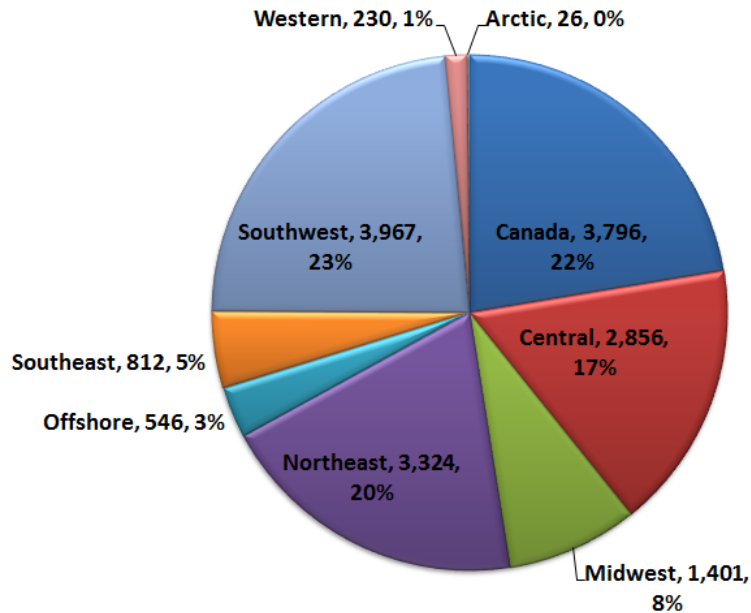


Low Growth Case, 2014-2035  
(Thousand Inch-Miles)  
2,294

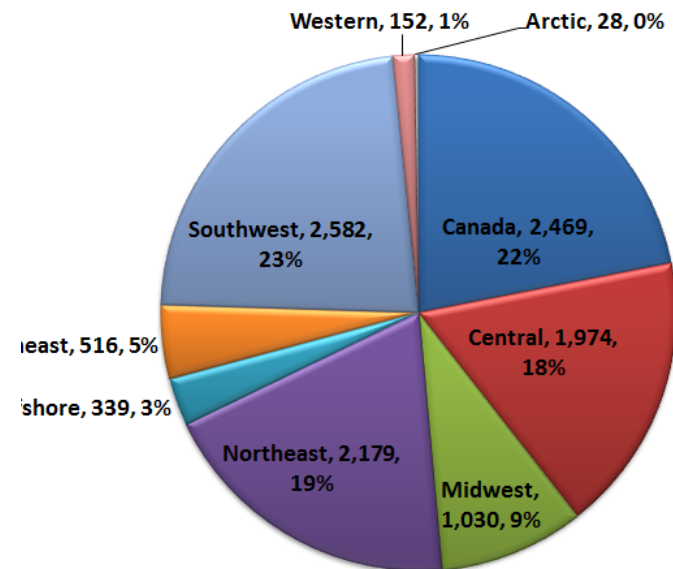


# Regional Total Pipeline Compressor/Pump Horsepower

Base Case, 2014-2035 (Thousand HP)  
16,956



Low Growth Case, 2014-2035 (Thousand HP)  
11,269



# **Appendix C: Detailed Jobs and Economic Impacts for Base Case**

# Economic Impacts for Base Case, 2014-2035

Impact Type	Employment (Jobs per Year)	Annual Wages and Benefits (2012\$ per Job)	Labor Income (Billions of 2012\$)	Value Added (Billions of 2012\$)	State/Provincial and Local Tax Revenues (Billions of 2012\$)	Federal Tax Revenues (Billions of 2012\$)
<b>U.S.</b>						
Direct	112,423	\$75,366	\$186.4	\$227.6		
Indirect	91,778	\$64,114	\$129.5	\$208.0		
Induced	133,495	\$48,875	\$143.5	\$256.6		
<b>Total</b>	<b>337,695</b>	<b>\$61,836</b>	<b>\$459.4</b>	<b>\$692.2</b>	<b>\$108.5</b>	<b>\$132.9</b>
<b>Canada</b>						
Direct	31,603	\$74,878	\$52.1	\$63.2		
Indirect	25,521	\$63,909	\$35.9	\$57.6		
Induced	37,663	\$48,731	\$40.4	\$72.2		
<b>Total</b>	<b>94,787</b>	<b>\$61,535</b>	<b>\$128.3</b>	<b>\$193.0</b>	<b>\$37.8</b>	<b>\$23.3</b>
<b>U.S. and Canada</b>						
Direct	144,026	\$75,259	\$238.5	\$290.7		
Indirect	117,298	\$64,070	\$165.3	\$265.6		
Induced	171,158	\$48,844	\$183.9	\$328.8		
<b>Total</b>	<b>432,482</b>	<b>\$61,770</b>	<b>\$587.7</b>	<b>\$885.2</b>	<b>\$146.3</b>	<b>\$156.2</b>

# Employment by Infrastructure Category for Base Case, 2014-2035 (Jobs/Year)

Infrastructure Category	Direct	Indirect	Induced	Total
<b>U.S.</b>				
Gathering Line (excludes compressors)	8,829	7,213	10,412	<b>26,453</b>
Lease Equipment	39,163	32,637	45,959	<b>117,760</b>
Gas Processing	4,674	3,895	5,485	<b>14,053</b>
Pipeline (excludes compressors and pumps)	36,701	29,983	43,282	<b>109,967</b>
Compressors (gathering line, pipeline, and gas storage)	6,588	5,287	8,036	<b>19,910</b>
Pumps	1,746	1,401	2,130	<b>5,277</b>
Underground Gas Storage (excludes compressors and pipelines)	2,228	1,924	2,827	<b>6,979</b>
LNG Plant	6,930	4,961	8,712	<b>20,603</b>
NGL Fractionation Plant	3,955	3,296	4,641	<b>11,891</b>
NGL Export Facility	1,283	919	1,613	<b>3,815</b>
Crude Oil Storage Tanks	327	262	399	<b>988</b>
<b>Total</b>	<b>112,423</b>	<b>91,778</b>	<b>133,495</b>	<b>337,695</b>
<b>Canada</b>				
Gathering Line (excludes compressors)	2,124	1,735	2,505	<b>6,364</b>
Lease Equipment	8,799	7,333	10,326	<b>26,459</b>
Gas Processing	1,319	1,099	1,548	<b>3,967</b>
Pipeline (excludes compressors and pumps)	11,723	9,577	13,825	<b>35,124</b>
Compressors (gathering line, pipeline, and gas storage)	1,293	1,038	1,577	<b>3,907</b>
Pumps	1,028	825	1,254	<b>3,106</b>
Underground Gas Storage (excludes compressors and pipelines)	167	144	212	<b>523</b>
LNG Plant	4,199	3,006	5,279	<b>12,484</b>
NGL Fractionation Plant	656	547	770	<b>1,973</b>
NGL Export Facility	230	165	289	<b>684</b>
Crude Oil Storage Tanks	65	52	79	<b>196</b>
<b>Total</b>	<b>31,603</b>	<b>25,521</b>	<b>37,663</b>	<b>94,787</b>



# Labor Income by Infrastructure Category for Base Case, 2014-2035 (Billions of 2012\$)

Infrastructure Category	Direct	Indirect	Induced	Total	Annual Wages and Benefits (\$/Job)
<b>U.S.</b>					
Gathering Line (excludes compressors)	\$14.8	\$10.3	\$11.2	\$36.3	\$62,458
Lease Equipment	\$65.0	\$45.8	\$49.6	\$160.4	\$61,928
Gas Processing	\$7.8	\$5.5	\$5.9	\$19.1	\$61,928
Pipeline (excludes compressors and pumps)	\$61.7	\$42.6	\$46.7	\$151.1	\$62,458
Compressors (gathering line, pipeline, and gas storage)	\$10.8	\$7.5	\$8.6	\$26.9	\$61,382
Pumps	\$2.9	\$2.0	\$2.3	\$7.1	\$61,382
Underground Gas Storage (excludes compressors and pipelines)	\$3.9	\$2.9	\$3.1	\$9.9	\$64,167
LNG Plant	\$10.5	\$6.7	\$9.0	\$26.1	\$57,642
NGL Fractionation Plant	\$6.6	\$4.6	\$5.0	\$16.2	\$61,928
NGL Export Facility	\$1.9	\$1.2	\$1.7	\$4.8	\$57,642
Crude Oil Storage Tanks	\$0.5	\$0.4	\$0.4	\$1.3	\$61,382
<b>Total</b>	<b>\$186.4</b>	<b>\$129.5</b>	<b>\$143.5</b>	<b>\$459.4</b>	<b>\$61,836</b>
<b>Canada</b>					
Gathering Line (excludes compressors)	\$3.6	\$2.5	\$2.7	\$8.7	\$62,458
Lease Equipment	\$14.6	\$10.3	\$11.2	\$36.0	\$61,928
Gas Processing	\$2.2	\$1.5	\$1.7	\$5.4	\$61,928
Pipeline (excludes compressors and pumps)	\$19.7	\$13.6	\$14.9	\$48.3	\$62,458
Compressors (gathering line, pipeline, and gas storage)	\$2.1	\$1.5	\$1.7	\$5.3	\$61,382
Pumps	\$1.7	\$1.2	\$1.3	\$4.2	\$61,382
Underground Gas Storage (excludes compressors and pipelines)	\$0.3	\$0.2	\$0.2	\$0.7	\$64,167
LNG Plant	\$6.3	\$4.0	\$5.5	\$15.8	\$57,642
NGL Fractionation Plant	\$1.1	\$0.8	\$0.8	\$2.7	\$61,928
NGL Export Facility	\$0.3	\$0.2	\$0.3	\$0.9	\$57,642
Crude Oil Storage Tanks	\$0.1	\$0.1	\$0.1	\$0.3	\$61,382
<b>Total</b>	<b>\$52.1</b>	<b>\$35.9</b>	<b>\$40.4</b>	<b>\$128.3</b>	<b>\$61,535</b>

# Value Added by Infrastructure Category for Base Case, 2014-2035 (Billions of 2012\$)

Infrastructure Category	Direct	Indirect	Induced	Total
<b>U.S.</b>				
Gathering Line (excludes compressors)	\$16.8	\$16.6	\$20.1	<b>\$53.5</b>
Lease Equipment	\$84.1	\$73.1	\$88.7	<b>\$245.9</b>
Gas Processing	\$10.0	\$8.7	\$10.6	<b>\$29.3</b>
Pipeline (excludes compressors and pumps)	\$69.8	\$69.0	\$83.6	<b>\$222.3</b>
Compressors (gathering line, pipeline, and gas storage)	\$13.5	\$12.1	\$15.3	<b>\$40.8</b>
Pumps	\$3.6	\$3.2	\$4.1	<b>\$10.8</b>
Underground Gas Storage (excludes compressors and pipelines)	\$5.0	\$4.7	\$5.5	<b>\$15.2</b>
LNG Plant	\$13.3	\$10.6	\$16.1	<b>\$40.0</b>
NGL Fractionation Plant	\$8.5	\$7.4	\$9.0	<b>\$24.8</b>
NGL Export Facility	\$2.5	\$2.0	\$3.0	<b>\$7.4</b>
Crude Oil Storage Tanks	\$0.7	\$0.6	\$0.8	<b>\$2.0</b>
<b>Total</b>	<b>\$227.6</b>	<b>\$208.0</b>	<b>\$256.6</b>	<b>\$692.2</b>
<b>Canada</b>				
Gathering Line (excludes compressors)	\$4.0	\$4.0	\$4.8	<b>\$12.9</b>
Lease Equipment	\$18.9	\$16.4	\$19.9	<b>\$55.3</b>
Gas Processing	\$2.8	\$2.5	\$3.0	<b>\$8.3</b>
Pipeline (excludes compressors and pumps)	\$22.3	\$22.0	\$26.7	<b>\$71.0</b>
Compressors (gathering line, pipeline, and gas storage)	\$2.6	\$2.4	\$3.0	<b>\$8.0</b>
Pumps	\$2.1	\$1.9	\$2.4	<b>\$6.4</b>
Underground Gas Storage (excludes compressors and pipelines)	\$0.4	\$0.4	\$0.4	<b>\$1.1</b>
LNG Plant	\$8.0	\$6.4	\$9.8	<b>\$24.2</b>
NGL Fractionation Plant	\$1.4	\$1.2	\$1.5	<b>\$4.1</b>
NGL Export Facility	\$0.4	\$0.4	\$0.5	<b>\$1.3</b>
Crude Oil Storage Tanks	\$0.1	\$0.1	\$0.2	<b>\$0.4</b>
<b>Total</b>	<b>\$63.2</b>	<b>\$57.6</b>	<b>\$72.2</b>	<b>\$193.0</b>

# Tax Revenues by Infrastructure Category for Base Case, 2014-2035 (Billions of 2012\$)

Infrastructure Category	Federal	State/Provincial and Local	Total
<b>U.S.</b>			
Gathering Line (excludes compressors)	\$10.3	\$8.4	\$18.8
Lease Equipment	\$47.5	\$38.8	\$86.3
Gas Processing	\$5.6	\$4.6	\$10.2
Pipeline (excludes compressors and pumps)	\$42.6	\$34.8	\$77.4
Compressors (gathering line, pipeline, and gas storage)	\$7.8	\$6.4	\$14.2
Pumps	\$2.0	\$1.7	\$3.7
Underground Gas Storage (excludes compressors and pipelines)	\$2.9	\$2.4	\$5.3
LNG Plant	\$7.6	\$6.2	\$13.7
NGL Fractionation Plant	\$4.7	\$3.9	\$8.6
NGL Export Facility	\$1.4	\$1.1	\$2.6
Crude Oil Storage Tanks	\$0.4	\$0.3	\$0.7
<b>Total</b>	<b>\$132.9</b>	<b>\$108.5</b>	<b>\$241.4</b>
<b>Canada</b>			
Gathering Line (excludes compressors)	\$1.6	\$2.5	\$4.1
Lease Equipment	\$6.7	\$10.8	\$17.5
Gas Processing	\$1.0	\$1.6	\$2.6
Pipeline (excludes compressors and pumps)	\$8.6	\$13.9	\$22.5
Compressors (gathering line, pipeline, and gas storage)	\$1.0	\$1.6	\$2.5
Pumps	\$0.8	\$1.2	\$2.0
Underground Gas Storage (excludes compressors and pipelines)	\$0.1	\$0.2	\$0.4
LNG Plant	\$2.9	\$4.7	\$7.7
NGL Fractionation Plant	\$0.5	\$0.8	\$1.3
NGL Export Facility	\$0.2	\$0.3	\$0.4
Crude Oil Storage Tanks	\$0.0	\$0.1	\$0.1
<b>Total</b>	<b>\$23.3</b>	<b>\$37.8</b>	<b>\$61.1</b>

# Employment by Industry Sector for Base Case, 2014-2035 (Jobs/Year)

Industry Sector	Direct	Indirect	Induced	Total
<b>U.S.</b>				
Oil, Gas & Other Mining	9,856	9,119	3,289	<b>22,264</b>
Construction	42,601	2,077	1,210	<b>45,888</b>
Manufacturing	17,994	15,124	6,071	<b>39,189</b>
Wholesale and retail trade	6	6,805	24,889	<b>31,699</b>
Transportation	3,170	5,341	3,767	<b>12,278</b>
Services & All Other	38,796	53,312	94,270	<b>186,378</b>
<b>Total</b>	<b>112,423</b>	<b>91,778</b>	<b>133,495</b>	<b>337,695</b>
<b>Canada</b>				
Oil, Gas & Other Mining	2,573	2,505	931	<b>6,009</b>
Construction	12,139	568	340	<b>13,047</b>
Manufacturing	4,914	4,211	1,714	<b>10,839</b>
Wholesale and retail trade	1	1,891	7,024	<b>8,917</b>
Transportation	860	1,495	1,062	<b>3,417</b>
Services & All Other	11,115	14,850	26,592	<b>52,558</b>
<b>Total</b>	<b>31,603</b>	<b>25,521</b>	<b>37,663</b>	<b>94,787</b>

# Labor Income by Industry Sector for Base Case, 2014-2035 (Billions of 2012\$)

Industry Sector	Direct	Indirect	Induced	Total	Annual Wages and Benefits (\$/Job)
<b>U.S.</b>					
Oil, Gas & Other Mining	\$13.1	\$16.0	\$6.1	\$35.3	\$72,043
Construction	\$55.9	\$2.8	\$1.6	\$60.3	\$59,690
Manufacturing	\$34.0	\$25.2	\$9.9	\$69.1	\$80,099
Wholesale and retail trade	\$0.0	\$10.3	\$22.8	\$33.1	\$47,510
Transportation	\$3.8	\$7.0	\$4.7	\$15.5	\$57,309
Services & All Other	\$79.6	\$68.1	\$98.4	\$246.2	\$60,040
<b>Total</b>	<b>\$186.4</b>	<b>\$129.5</b>	<b>\$143.5</b>	<b>\$459.4</b>	<b>\$61,836</b>
<b>Canada</b>					
Oil, Gas & Other Mining	\$3.2	\$4.4	\$1.7	\$9.3	\$70,705
Construction	\$15.8	\$0.8	\$0.4	\$17.0	\$59,226
Manufacturing	\$9.2	\$7.0	\$2.8	\$19.0	\$79,577
Wholesale and retail trade	\$0.0	\$2.9	\$6.4	\$9.3	\$47,224
Transportation	\$1.0	\$2.0	\$1.3	\$4.3	\$57,233
Services & All Other	\$22.8	\$18.9	\$27.7	\$69.4	\$60,047
<b>Total</b>	<b>\$52.1</b>	<b>\$35.9</b>	<b>\$40.4</b>	<b>\$128.3</b>	<b>\$61,535</b>

# Value Added by Industry Sector for Base Case, 2014-2035 (Billions of 2012\$)

Industry Sector	Direct	Indirect	Induced	Total
<b>U.S.</b>				
Oil, Gas & Other Mining	\$14.8	\$26.6	\$10.0	<b>\$51.4</b>
Construction	\$61.1	\$3.0	\$2.1	<b>\$66.2</b>
Manufacturing	\$59.1	\$44.9	\$21.1	<b>\$125.1</b>
Wholesale and retail trade	\$0.0	\$17.7	\$37.1	<b>\$54.8</b>
Transportation	\$4.8	\$9.5	\$6.4	<b>\$20.7</b>
Services & All Other	\$87.7	\$106.3	\$180.0	<b>\$374.0</b>
<b>Total</b>	<b>\$227.6</b>	<b>\$208.0</b>	<b>\$256.6</b>	<b>\$692.2</b>
<b>Canada</b>				
Oil, Gas & Other Mining	\$3.5	\$7.3	\$2.8	<b>\$13.6</b>
Construction	\$17.4	\$0.8	\$0.6	<b>\$18.8</b>
Manufacturing	\$15.7	\$12.4	\$5.9	<b>\$34.1</b>
Wholesale and retail trade	\$0.0	\$4.9	\$10.4	<b>\$15.3</b>
Transportation	\$1.3	\$2.7	\$1.8	<b>\$5.8</b>
Services & All Other	\$25.2	\$29.5	\$50.7	<b>\$105.5</b>
<b>Total</b>	<b>\$63.2</b>	<b>\$57.6</b>	<b>\$72.2</b>	<b>\$193.0</b>

# Tax Revenues by Industry Sector for Base Case, 2014-2035 (Billions of 2012\$)

Industry Sector	Federal	State/Provincial and Local	Total
<b>U.S.</b>			
Oil, Gas & Other Mining	\$9.9	\$8.1	<b>\$17.9</b>
Construction	\$12.7	\$10.4	<b>\$23.1</b>
Manufacturing	\$24.0	\$19.6	<b>\$43.7</b>
Wholesale and retail trade	\$10.5	\$8.6	<b>\$19.1</b>
Transportation	\$4.0	\$3.2	<b>\$7.2</b>
Services & All Other	\$71.8	\$58.6	<b>\$130.4</b>
<b>Total</b>	<b>\$132.9</b>	<b>\$108.5</b>	<b>\$241.4</b>
<b>Canada</b>			
Oil, Gas & Other Mining	\$1.6	\$2.7	<b>\$4.3</b>
Construction	\$2.3	\$3.7	<b>\$5.9</b>
Manufacturing	\$4.1	\$6.7	<b>\$10.8</b>
Wholesale and retail trade	\$1.8	\$3.0	<b>\$4.8</b>
Transportation	\$0.7	\$1.1	<b>\$1.8</b>
Services & All Other	\$12.7	\$20.6	<b>\$33.4</b>
<b>Total</b>	<b>\$23.3</b>	<b>\$37.8</b>	<b>\$61.1</b>

# Employment by Region for Base Case, 2014-2035 (Jobs/Year)

Region	Direct	Indirect	Induced	Total
Central	24,201	14,421	16,029	<b>54,650</b>
Midwest	6,556	13,074	17,974	<b>37,603</b>
Northeast	18,323	18,373	31,729	<b>68,426</b>
Southeast	8,774	10,364	19,043	<b>38,181</b>
Southwest	51,348	29,671	30,451	<b>111,471</b>
Western	3,052	5,787	18,000	<b>26,839</b>
Arctic	169	87	269	<b>525</b>
<b>Total U.S.</b>	<b>112,423</b>	<b>91,778</b>	<b>133,495</b>	<b>337,695</b>
<b>Canada</b>	<b>31,603</b>	<b>25,521</b>	<b>37,663</b>	<b>94,787</b>
<b>Total U.S. and Canada</b>	<b>144,026</b>	<b>117,299</b>	<b>171,158</b>	<b>432,482</b>



# Labor Income by Region for Base Case, 2014-2035

## (Billions of 2012\$)

Region	Direct	Indirect	Induced	Total	Annual Wages and Benefits (\$/Job)
Central	\$40.4	\$20.4	\$17.3	<b>\$78.0</b>	<b>\$64,867</b>
Midwest	\$11.0	\$18.5	\$19.3	<b>\$48.8</b>	<b>\$58,955</b>
Northeast	\$30.5	\$26.0	\$34.1	<b>\$90.6</b>	<b>\$60,168</b>
Southeast	\$14.7	\$14.7	\$20.5	<b>\$49.9</b>	<b>\$59,429</b>
Southwest	\$84.4	\$41.7	\$32.7	<b>\$158.8</b>	<b>\$64,748</b>
Western	\$5.1	\$8.2	\$19.4	<b>\$32.7</b>	<b>\$55,314</b>
Arctic	\$0.3	\$0.1	\$0.3	<b>\$0.7</b>	<b>\$60,011</b>
<b>Total U.S.</b>	<b>\$186.4</b>	<b>\$129.5</b>	<b>\$143.5</b>	<b>\$459.4</b>	<b>\$61,836</b>
<b>Canada</b>	<b>\$52.1</b>	<b>\$35.9</b>	<b>\$40.4</b>	<b>\$128.3</b>	<b>\$61,535</b>
<b>Total U.S. and Canada</b>	<b>\$238.5</b>	<b>\$165.4</b>	<b>\$183.9</b>	<b>\$587.7</b>	<b>\$61,770</b>

# Value Added by Region for Base Case, 2014-2035 (Billions of 2012\$)

Region	Direct	Indirect	Induced	Total
Central	\$49.7	\$32.7	\$30.9	<b>\$113.3</b>
Midwest	\$13.0	\$29.7	\$34.6	<b>\$77.2</b>
Northeast	\$36.3	\$41.8	\$61.0	<b>\$139.1</b>
Southeast	\$17.0	\$23.6	\$36.6	<b>\$77.2</b>
Southwest	\$105.1	\$66.8	\$58.4	<b>\$230.4</b>
Western	\$6.2	\$13.2	\$34.6	<b>\$53.9</b>
Arctic	\$0.4	\$0.2	\$0.5	<b>\$1.1</b>
<b>Total U.S.</b>	<b>\$227.6</b>	<b>\$208.0</b>	<b>\$256.6</b>	<b>\$692.2</b>
<b>Canada</b>	<b>\$63.2</b>	<b>\$57.6</b>	<b>\$72.2</b>	<b>\$193.0</b>
<b>Total U.S. and Canada</b>	<b>\$290.8</b>	<b>\$265.6</b>	<b>\$328.8</b>	<b>\$885.2</b>

# Tax Revenues by Region for Base Case, 2014-2035 (Billions of 2012\$)

Region	Federal	State/ Provincial and Local	Total
Central	\$21.8	\$18.5	<b>\$40.3</b>
Midwest	\$14.8	\$12.2	<b>\$27.0</b>
Northeast	\$26.7	\$22.2	<b>\$48.9</b>
Southeast	\$14.9	\$11.8	<b>\$26.6</b>
Southwest	\$44.2	\$34.8	<b>\$79.0</b>
Western	\$10.4	\$8.6	<b>\$19.0</b>
Arctic	\$0.2	\$0.4	<b>\$0.6</b>
<b>Total U.S.</b>	<b>\$132.9</b>	<b>\$108.5</b>	<b>\$241.4</b>
<b>Canada</b>	<b>\$23.3</b>	<b>\$37.8</b>	<b>\$61.1</b>
<b>Total U.S. and Canada</b>	<b>\$156.2</b>	<b>\$146.3</b>	<b>\$302.5</b>

# **Appendix D: Detailed Jobs and Economic Impacts for Low Growth Case**

# Economic Impacts for Low Growth Case, 2014-2035

Impact Type	Employment (Jobs per Year)	Annual Wages and Benefits (2012\$ Per Job)	Labor Income (Billions of 2012\$)	Value Added (Billions of 2012\$)	State/Provincial and Local Tax Revenues (Billions of 2012\$)	Federal Tax Revenues (Billions of 2012\$)
<b>U.S.</b>						
Direct	82,076	\$75,559	\$136.4	\$166.9		
Indirect	67,315	\$64,146	\$95.0	\$152.6		
Induced	97,172	\$48,947	\$104.6	\$187.1		
<b>Total</b>	<b>246,563</b>	<b>\$61,955</b>	<b>\$336.1</b>	<b>\$506.5</b>	<b>\$79.3</b>	<b>\$97.1</b>
<b>Canada</b>						
Direct	21,732	\$75,442	\$36.1	\$43.9		
Indirect	17,762	\$64,080	\$25.0	\$40.2		
Induced	25,736	\$48,913	\$27.7	\$49.5		
<b>Total</b>	<b>65,230</b>	<b>\$61,882</b>	<b>\$88.8</b>	<b>\$133.6</b>	<b>\$26.2</b>	<b>\$16.1</b>
<b>U.S. and Canada</b>						
Direct	103,808	\$75,534	\$172.5	\$210.7		
Indirect	85,077	\$64,132	\$120.0	\$192.8		
Induced	122,908	\$48,940	\$132.3	\$236.6		
<b>Total</b>	<b>311,793</b>	<b>\$61,940</b>	<b>\$424.9</b>	<b>\$640.1</b>	<b>\$105.5</b>	<b>\$113.2</b>

# Employment by Infrastructure Category for Low Growth Case, 2014-2035 (Jobs/Year)

Infrastructure Category	Direct	Indirect	Induced	Total
<b>U.S.</b>				
Gathering Line (excludes compressors)	7,400	6,046	8,727	<b>22,173</b>
Lease Equipment	32,606	27,173	38,264	<b>98,043</b>
Gas Processing	3,313	2,761	3,888	<b>9,962</b>
Pipeline (excludes compressors and pumps)	25,330	20,694	29,872	<b>75,896</b>
Compressors (gathering line, pipeline, and gas storage)	4,487	3,602	5,474	<b>13,563</b>
Pumps	1,105	887	1,347	<b>3,338</b>
Underground Gas Storage (excludes compressors and pipelines)	1,143	987	1,450	<b>3,580</b>
LNG Plant	2,646	1,894	3,326	<b>7,866</b>
NGL Fractionation Plant	3,058	2,549	3,589	<b>9,196</b>
NGL Export Facility	785	562	987	<b>2,334</b>
Crude Oil Storage Tanks	202	162	247	<b>611</b>
<b>Total</b>	<b>82,076</b>	<b>67,315</b>	<b>97,172</b>	<b>246,563</b>
<b>Canada</b>				
Gathering Line (excludes compressors)	1,894	1,547	2,234	<b>5,675</b>
Lease Equipment	7,950	6,625	9,330	<b>23,905</b>
Gas Processing	1,018	848	1,194	<b>3,060</b>
Pipeline (excludes compressors and pumps)	7,655	6,254	9,028	<b>22,936</b>
Compressors (gathering line, pipeline, and gas storage)	992	797	1,211	<b>3,000</b>
Pumps	519	417	633	<b>1,569</b>
Underground Gas Storage (excludes compressors and pipelines)	25	22	32	<b>79</b>
LNG Plant	1,145	820	1,440	<b>3,405</b>
NGL Fractionation Plant	407	339	478	<b>1,224</b>
NGL Export Facility	94	67	118	<b>280</b>
Crude Oil Storage Tanks	32	26	39	<b>96</b>
<b>Total</b>	<b>21,732</b>	<b>17,762</b>	<b>25,736</b>	<b>65,230</b>

# Labor Income by Infrastructure Category for Low Growth Case, 2014-2035 (Billions of 2012\$)

Infrastructure Category	Direct	Indirect	Induced	Total	Annual Wages and Benefits (\$/Job)
<b>U.S.</b>					
Gathering Line (excludes compressors)	\$12.4	\$8.6	\$9.4	\$30.5	\$62,458
Lease Equipment	\$54.1	\$38.1	\$41.3	\$133.6	\$61,928
Gas Processing	\$5.5	\$3.9	\$4.2	\$13.6	\$61,928
Pipeline (excludes compressors and pumps)	\$42.6	\$29.4	\$32.3	\$104.3	\$62,458
Compressors (gathering line, pipeline, and gas storage)	\$7.4	\$5.1	\$5.8	\$18.3	\$61,382
Pumps	\$1.8	\$1.3	\$1.4	\$4.5	\$61,382
Underground Gas Storage (excludes compressors and pipelines)	\$2.0	\$1.5	\$1.6	\$5.1	\$64,167
LNG Plant	\$4.0	\$2.5	\$3.4	\$10.0	\$57,642
NGL Fractionation Plant	\$5.1	\$3.6	\$3.9	\$12.5	\$61,928
NGL Export Facility	\$1.2	\$0.8	\$1.0	\$3.0	\$57,642
Crude Oil Storage Tanks	\$0.3	\$0.2	\$0.3	\$0.8	\$61,382
<b>Total</b>	<b>\$136.4</b>	<b>\$95.0</b>	<b>\$104.6</b>	<b>\$336.1</b>	<b>\$61,955</b>
<b>Canada</b>					
Gathering Line (excludes compressors)	\$3.2	\$2.2	\$2.4	\$7.8	\$62,458
Lease Equipment	\$13.2	\$9.3	\$10.1	\$32.6	\$61,928
Gas Processing	\$1.7	\$1.2	\$1.3	\$4.2	\$61,928
Pipeline (excludes compressors and pumps)	\$12.9	\$8.9	\$9.7	\$31.5	\$62,458
Compressors (gathering line, pipeline, and gas storage)	\$1.6	\$1.1	\$1.3	\$4.1	\$61,382
Pumps	\$0.9	\$0.6	\$0.7	\$2.1	\$61,382
Underground Gas Storage (excludes compressors and pipelines)	\$0.0	\$0.0	\$0.0	\$0.1	\$64,167
LNG Plant	\$1.7	\$1.1	\$1.5	\$4.3	\$57,642
NGL Fractionation Plant	\$0.7	\$0.5	\$0.5	\$1.7	\$61,928
NGL Export Facility	\$0.1	\$0.1	\$0.1	\$0.4	\$57,642
Crude Oil Storage Tanks	\$0.1	\$0.0	\$0.0	\$0.1	\$61,382
<b>Total</b>	<b>\$36.1</b>	<b>\$25.0</b>	<b>\$27.7</b>	<b>\$88.8</b>	<b>\$61,882</b>

# Value Added by Infrastructure Category for Low Growth Case, 2014-2035 (Billions of 2012\$)

Infrastructure Category	Direct	Indirect	Induced	Total
<b>U.S.</b>				
Gathering Line (excludes compressors)	\$14.1	\$13.9	\$16.8	<b>\$44.8</b>
Lease Equipment	\$70.0	\$60.9	\$73.9	<b>\$204.8</b>
Gas Processing	\$7.1	\$6.2	\$7.5	<b>\$20.8</b>
Pipeline (excludes compressors and pumps)	\$48.2	\$47.6	\$57.7	<b>\$153.4</b>
Compressors (gathering line, pipeline, and gas storage)	\$9.2	\$8.2	\$10.4	<b>\$27.8</b>
Pumps	\$2.3	\$2.0	\$2.6	<b>\$6.8</b>
Underground Gas Storage (excludes compressors and pipelines)	\$2.6	\$2.4	\$2.8	<b>\$7.8</b>
LNG Plant	\$5.1	\$4.0	\$6.2	<b>\$15.3</b>
NGL Fractionation Plant	\$6.6	\$5.7	\$6.9	<b>\$19.2</b>
NGL Export Facility	\$1.5	\$1.2	\$1.8	<b>\$4.5</b>
Crude Oil Storage Tanks	\$0.4	\$0.4	\$0.5	<b>\$1.3</b>
<b>Total</b>	<b>\$166.9</b>	<b>\$152.6</b>	<b>\$187.1</b>	<b>\$506.5</b>
<b>Canada</b>				
Gathering Line (excludes compressors)	\$3.6	\$3.6	\$4.3	<b>\$11.5</b>
Lease Equipment	\$17.1	\$14.8	\$18.0	<b>\$49.9</b>
Gas Processing	\$2.2	\$1.9	\$2.3	<b>\$6.4</b>
Pipeline (excludes compressors and pumps)	\$14.6	\$14.4	\$17.4	<b>\$46.4</b>
Compressors (gathering line, pipeline, and gas storage)	\$2.0	\$1.8	\$2.3	<b>\$6.2</b>
Pumps	\$1.1	\$1.0	\$1.2	<b>\$3.2</b>
Underground Gas Storage (excludes compressors and pipelines)	\$0.1	\$0.1	\$0.1	<b>\$0.2</b>
LNG Plant	\$2.2	\$1.8	\$2.7	<b>\$6.6</b>
NGL Fractionation Plant	\$0.9	\$0.8	\$0.9	<b>\$2.6</b>
NGL Export Facility	\$0.2	\$0.1	\$0.2	<b>\$0.5</b>
Crude Oil Storage Tanks	\$0.1	\$0.1	\$0.1	<b>\$0.2</b>
<b>Total</b>	<b>\$43.9</b>	<b>\$40.2</b>	<b>\$49.5</b>	<b>\$133.6</b>



# Tax Revenues by Infrastructure Category for Low Growth Case, 2014-2035 (Billions of 2012\$)

Infrastructure Category	Federal	State/Provincial and Local	Total
<b>U.S.</b>			
Gathering Line (excludes compressors)	\$8.6	\$7.1	\$15.7
Lease Equipment	\$39.5	\$32.2	\$71.7
Gas Processing	\$4.0	\$3.2	\$7.2
Pipeline (excludes compressors and pumps)	\$29.3	\$23.9	\$53.2
Compressors (gathering line, pipeline, and gas storage)	\$5.3	\$4.3	\$9.7
Pumps	\$1.3	\$1.0	\$2.3
Underground Gas Storage (excludes compressors and pipelines)	\$1.5	\$1.2	\$2.7
LNG Plant	\$2.9	\$2.3	\$5.2
NGL Fractionation Plant	\$3.6	\$3.0	\$6.6
NGL Export Facility	\$0.9	\$0.7	\$1.6
Crude Oil Storage Tanks	\$0.2	\$0.2	\$0.4
<b>Total</b>	<b>\$97.1</b>	<b>\$79.3</b>	<b>\$176.4</b>
<b>Canada</b>			
Gathering Line (excludes compressors)	\$1.4	\$2.2	\$3.6
Lease Equipment	\$6.0	\$9.8	\$15.8
Gas Processing	\$0.8	\$1.3	\$2.0
Pipeline (excludes compressors and pumps)	\$5.6	\$9.1	\$14.7
Compressors (gathering line, pipeline, and gas storage)	\$0.7	\$1.2	\$1.9
Pumps	\$0.4	\$0.6	\$1.0
Underground Gas Storage (excludes compressors and pipelines)	\$0.0	\$0.0	\$0.1
LNG Plant	\$0.8	\$1.3	\$2.1
NGL Fractionation Plant	\$0.3	\$0.5	\$0.8
NGL Export Facility	\$0.1	\$0.1	\$0.2
Crude Oil Storage Tanks	\$0.0	\$0.0	\$0.1
<b>Total</b>	<b>\$16.1</b>	<b>\$26.2</b>	<b>\$42.3</b>

# Employment by Industry Sector for Low Growth Case, 2014-2035 (Jobs/Year)

Industry Sector	Direct	Indirect	Induced	Total
<b>U.S.</b>				
Oil, Gas & Other Mining	6,666	6,704	2,391	<b>15,761</b>
Construction	31,297	1,524	882	<b>33,703</b>
Manufacturing	13,457	11,134	4,417	<b>29,007</b>
Wholesale and retail trade	4	5,010	18,113	<b>23,127</b>
Transportation	2,250	3,892	2,744	<b>8,886</b>
Services & All Other	28,402	39,052	68,625	<b>136,079</b>
<b>Total</b>	<b>82,076</b>	<b>67,315</b>	<b>97,172</b>	<b>246,563</b>
<b>Canada</b>				
Oil, Gas & Other Mining	1,686	1,757	634	<b>4,077</b>
Construction	8,419	401	233	<b>9,053</b>
Manufacturing	3,491	2,944	1,170	<b>7,606</b>
Wholesale and retail trade	1	1,331	4,798	<b>6,129</b>
Transportation	577	1,031	726	<b>2,335</b>
Services & All Other	7,557	10,299	18,175	<b>36,030</b>
<b>Total</b>	<b>21,732</b>	<b>17,762</b>	<b>25,736</b>	<b>65,230</b>

# Labor Income by Industry Sector for Low Growth Case, 2014-2035 (Billions of 2012\$)

Industry Sector	Direct	Indirect	Induced	Total	Annual Wages and Benefits (\$/Job)
<b>U.S.</b>					
Oil, Gas & Other Mining	\$8.7	\$11.8	\$4.5	\$24.9	\$71,746
Construction	\$41.2	\$2.0	\$1.2	\$44.4	\$59,929
Manufacturing	\$25.6	\$18.5	\$7.2	\$51.3	\$80,350
Wholesale and retail trade	\$0.0	\$7.6	\$16.6	\$24.2	\$47,661
Transportation	\$2.6	\$5.1	\$3.4	\$11.2	\$57,303
Services & All Other	\$58.3	\$49.9	\$71.8	\$180.0	\$60,135
<b>Total</b>	<b>\$136.4</b>	<b>\$95.0</b>	<b>\$104.6</b>	<b>\$336.1</b>	<b>\$61,955</b>
<b>Canada</b>					
Oil, Gas & Other Mining	\$2.1	\$3.1	\$1.2	\$6.3	\$70,373
Construction	\$11.1	\$0.5	\$0.3	\$11.9	\$59,827
Manufacturing	\$6.6	\$4.9	\$1.9	\$13.4	\$80,121
Wholesale and retail trade	\$0.0	\$2.0	\$4.4	\$6.4	\$47,619
Transportation	\$0.7	\$1.4	\$0.9	\$2.9	\$57,266
Services & All Other	\$15.7	\$13.2	\$19.0	\$47.8	\$60,313
<b>Total</b>	<b>\$36.1</b>	<b>\$25.0</b>	<b>\$27.7</b>	<b>\$88.8</b>	<b>\$61,882</b>

# Value Added by Industry Sector for Low Growth Case, 2014-2035 (Billions of 2012\$)

Industry Sector	Direct	Indirect	Induced	Total
<b>U.S.</b>				
Oil, Gas & Other Mining	\$9.7	\$19.5	\$7.3	<b>\$36.4</b>
Construction	\$44.9	\$2.2	\$1.5	<b>\$48.7</b>
Manufacturing	\$44.8	\$33.1	\$15.3	<b>\$93.2</b>
Wholesale and retail trade	\$0.0	\$13.0	\$27.1	<b>\$40.1</b>
Transportation	\$3.4	\$6.9	\$4.7	<b>\$15.0</b>
Services & All Other	\$64.1	\$77.9	\$131.1	<b>\$273.1</b>
<b>Total</b>	<b>\$166.9</b>	<b>\$152.6</b>	<b>\$187.1</b>	<b>\$506.5</b>
<b>Canada</b>				
Oil, Gas & Other Mining	\$2.2	\$5.1	\$1.9	<b>\$9.3</b>
Construction	\$12.1	\$0.6	\$0.4	<b>\$13.1</b>
Manufacturing	\$11.5	\$8.7	\$4.1	<b>\$24.3</b>
Wholesale and retail trade	\$0.0	\$3.5	\$7.2	<b>\$10.6</b>
Transportation	\$0.9	\$1.8	\$1.2	<b>\$3.9</b>
Services & All Other	\$17.2	\$20.5	\$34.7	<b>\$72.5</b>
<b>Total</b>	<b>\$43.9</b>	<b>\$40.2</b>	<b>\$49.5</b>	<b>\$133.6</b>

# Tax Revenues by Industry Sector for Low Growth Case, 2014-2035 (Billions of 2012\$)

Industry Sector	Federal	State/Provincial and Local	Total
<b>U.S.</b>			
Oil, Gas & Other Mining	\$7.0	\$5.7	<b>\$12.7</b>
Construction	\$9.3	\$7.6	<b>\$16.9</b>
Manufacturing	\$17.9	\$14.6	<b>\$32.5</b>
Wholesale and retail trade	\$7.7	\$6.3	<b>\$14.0</b>
Transportation	\$2.9	\$2.3	<b>\$5.2</b>
Services & All Other	\$52.3	\$42.8	<b>\$95.1</b>
<b>Total</b>	<b>\$97.1</b>	<b>\$79.3</b>	<b>\$176.4</b>
<b>Canada</b>			
Oil, Gas & Other Mining	\$1.1	\$1.8	<b>\$2.9</b>
Construction	\$1.6	\$2.6	<b>\$4.1</b>
Manufacturing	\$2.9	\$4.8	<b>\$7.7</b>
Wholesale and retail trade	\$1.3	\$2.1	<b>\$3.4</b>
Transportation	\$0.5	\$0.8	<b>\$1.2</b>
Services & All Other	\$8.7	\$14.2	<b>\$22.9</b>
<b>Total</b>	<b>\$16.1</b>	<b>\$26.2</b>	<b>\$42.3</b>

# Employment by Region for Low Growth Case, 2014-2035 (Jobs/Year)

Region	Direct	Indirect	Induced	Total
Central	18,912	11,152	12,156	<b>42,220</b>
Midwest	4,461	9,420	12,966	<b>26,848</b>
Northeast	12,853	13,229	22,893	<b>48,974</b>
Southeast	6,155	7,462	13,771	<b>27,388</b>
Southwest	37,442	21,793	22,119	<b>81,354</b>
Western	2,085	4,174	13,053	<b>19,312</b>
Arctic	168	86	213	<b>467</b>
<b>Total U.S.</b>	<b>82,076</b>	<b>67,315</b>	<b>97,172</b>	<b>246,563</b>
<b>Canada</b>	<b>21,732</b>	<b>17,762</b>	<b>25,736</b>	<b>65,230</b>
<b>Total U.S. and Canada</b>	<b>103,808</b>	<b>85,077</b>	<b>122,908</b>	<b>311,793</b>

# Labor Income by Region for Low Growth Case, 2014-2035 (Billions of 2012\$)

Region	Direct	Indirect	Induced	Total	Annual Wages and Benefits (\$/Job)
Central	\$31.5	\$15.7	\$13.1	\$60.4	\$65,003
Midwest	\$7.5	\$13.3	\$14.0	\$34.7	\$58,797
Northeast	\$21.5	\$18.7	\$24.7	\$64.8	\$60,189
Southeast	\$10.3	\$10.6	\$14.8	\$35.7	\$59,323
Southwest	\$61.9	\$30.6	\$23.8	\$116.3	\$64,975
Western	\$3.5	\$5.9	\$14.1	\$23.4	\$55,186
Arctic	\$0.3	\$0.1	\$0.2	\$0.6	\$61,326
<b>Total U.S.</b>	<b>\$136.4</b>	<b>\$95.0</b>	<b>\$104.6</b>	<b>\$336.1</b>	<b>\$61,955</b>
<b>Canada</b>	<b>\$36.1</b>	<b>\$25.0</b>	<b>\$27.7</b>	<b>\$88.8</b>	<b>\$61,882</b>
<b>Total U.S. and Canada</b>	<b>\$172.5</b>	<b>\$120.0</b>	<b>\$132.3</b>	<b>\$424.9</b>	<b>\$61,940</b>

# Value Added by Region for Low Growth Case, 2014-2035 (Billions of 2012\$)

Region	Direct	Indirect	Induced	Total
Central	\$38.8	\$25.3	\$23.4	\$87.5
Midwest	\$8.9	\$21.4	\$25.0	\$55.2
Northeast	\$25.6	\$30.1	\$44.1	\$99.7
Southeast	\$11.9	\$17.0	\$26.5	\$55.4
Southwest	\$77.1	\$49.1	\$42.5	\$168.7
Western	\$4.3	\$9.5	\$25.1	\$38.9
Arctic	\$0.3	\$0.2	\$0.4	\$1.0
<b>Total U.S.</b>	<b>\$166.9</b>	<b>\$152.6</b>	<b>\$187.1</b>	<b>\$506.5</b>
<b>Canada</b>	<b>\$43.9</b>	<b>\$40.2</b>	<b>\$49.5</b>	<b>\$133.6</b>
<b>Total U.S. and Canada</b>	<b>\$210.8</b>	<b>\$192.8</b>	<b>\$236.6</b>	<b>\$640.1</b>



# Tax Revenues by Region for Low Growth Case, 2014-2035 (Billions of 2012\$)

Region	Federal	State/ Provincial and Local	Total
Central	\$16.8	\$14.3	<b>\$31.1</b>
Midwest	\$10.5	\$8.7	<b>\$19.3</b>
Northeast	\$19.1	\$15.9	<b>\$35.0</b>
Southeast	\$10.6	\$8.4	<b>\$19.1</b>
Southwest	\$32.3	\$25.4	<b>\$57.8</b>
Western	\$7.5	\$6.2	<b>\$13.7</b>
Arctic	\$0.2	\$0.4	<b>\$0.6</b>
<b>Total U.S.</b>	<b>\$97.1</b>	<b>\$79.3</b>	<b>\$176.4</b>
<b>Canada</b>	<b>\$16.1</b>	<b>\$26.2</b>	<b>\$42.3</b>
<b>Total U.S. and Canada</b>	<b>\$113.2</b>	<b>\$105.5</b>	<b>\$218.7</b>