



CAPITALIZING ON ENERGY ABUNDANCE

Reaping the benefits will require a multi-billion dollar investment

BY RICH HOFFMANN

When it comes to the shale revolution, the United States and Canada are clearly among the fastest growing production areas. The unprecedented pace of natural gas and crude oil development in North America has turned the U.S. into the world's largest natural gas producer. As a result, it has become possible to envision a world in which America, once heavily reliant upon foreign crude oil, becomes a net oil and liquefied natural gas (LNG) exporter within a couple of decades. However, getting there will require a vast investment in midstream infrastructure, according to a study released in April by the Interstate Natural Gas Association of America (INGAA) Foundation. America's Natural Gas Alliance was a joint sponsor of the infrastructure study.

The study, *North American Midstream Infrastructure through 2035: Capitalizing on Our Energy Abundance*, found that companies will need to invest \$641 billion over the next two decades in pipelines, processing plants, pumps and other infrastructure to keep up with the natural gas, crude oil and natural gas liquids (NGL) flowing from U.S. fields.

The INGAA Foundation, which represents pipeline operators and the entire value chain of contractors that support them, has done this flagship natural gas infrastructure study for over 20 years. This and the 2011 report, both prepared by ICF International, broke new ground by including crude oil and natural gas liquids infrastructure, thereby providing

Economic Effects of Midstream Infrastructure Development in U.S. and Canada

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		
Total	432,482	\$61,770	\$587.7	\$885.2	\$146.3	\$156.2

a broader perspective on how prices and production of the three commodities can impact the market and infrastructure development. The 2011 report was the first to explore how the shale revolution was transforming the overall midstream sector. According to the 2014 study, oil and gas price levels will remain high enough to continue encouraging shale development, but not high enough to limit the market growth of oil and natural gas.

Investment Spending Predictions

The objective of this new study is to inform industry, policymakers and stakeholders about the new dynamics of North America's energy markets and the infrastructure needed to ensure that consumers benefit from this energy abundance. This is particularly relevant as policymakers seek to promote job growth and economic development, protect the environment, increase energy security and reduce the trade deficit.

The 2014 infrastructure analysis predicts almost half of the projected spending—\$14.2 billion per year—would accommodate new natural gas supplies by connecting the new gas shale plays with existing infrastructure and yet-to-be-built facilities, including power plants, industrial plants and LNG export facilities. All told, the market will require about \$4 billion of spending each year in the natural gas midstream sector to add 43 billion cubic feet per day of additional pipeline capacity and 35,000 miles of new natural gas transmission pipeline. Another 303,000 miles of gas gathering lines, at an average annual cost of \$1.6 billion, are needed to get the gas into the transmission network. The report also predicts additional investment to fund laterals to and from

power plants, gas storage and processing plants (about \$2.1 billion each year), gas-gathering line compressors (about \$1.1 billion annually), gas processing capacity (about \$1.2 billion annually) and gas lease equipment (about \$1.2 billion annually). Another \$43.7 billion total, or \$2 billion per year, is expected to be spent to build LNG facilities that will allow U.S. and Canadian natural gas to be exported overseas.

A Proven Track Record

With the ever-changing supply picture, midstream infrastructure development is crucial for efficient delivery of growing supplies to market. The good news is that the natural gas industry has a proven track record of being able to finance and construct infrastructure.

In the decade between January 2003 and March 2014, some 12,400 miles of new interstate natural gas pipeline capacity were added to the U.S. network. Much of this was “supply push” pipeline that relieved upstream constraints and enabled producers to get new natural gas supply to liquid trading points, so-called market hubs, where they could collect the market-clearing price for natural gas.

Producers have learned from past experience that the consequences of insufficient infrastructure for gas transport are severe, and that pipeline transportation costs are relatively small compared with the revenues lost as a result of price reductions or well shut-ins when producers are unable to access liquid pricing points. Consumers will benefit because adequate infrastructure contributes to a competitive natural gas market made possible by abundant and geographically diverse supply.

Shifting Pipeline Flows

Because of expected increases in production from the Marcellus region, as well as from shale plays in the Southwest United States and Western Canada, natural gas pipeline flows are expected to shift over the coming decades. Historically, natural gas has moved from production areas in the Gulf Coast and Gulf of Mexico region north, and from Canada to the lower 48 states, to major consuming areas, including the Northeast and Midwest.

The report states that increasing production from the Marcellus shale play will displace gas transported to the U.S. Northeast and provide incremental supply to Eastern Seaboard, Midwest and southeastern gas markets. New England's increasing gas needs will be met by the Marcellus production, displacing flows from both Western and Eastern Canada and from the Gulf Coast region. Flows through the Tennessee Valley that originate from the Gulf Coast also will decline over time as a result of Marcellus production, displacing transport into the area.

Meanwhile, production will continue to grow in the shale regions of the Gulf Coast, but most of that gas will stay in the area to meet local demand. The Gulf Coast region of Texas and Louisiana will become home to most of the LNG exports from North America, with additional exports from the East Coast and Western Canada. Growing Rocky Mountain production mostly flows to the West Coast to offset declines in transport from Western Canada and the Permian Basin of West Texas.

In Canada, despite significantly growing production from Western Canada's shale

plays, flows out of that area will decline significantly, as much of the incremental production remains in the area to fuel its oil sands development. As incremental production flows to British Columbia's coastline are exported as LNG, Ontario's increasing gas needs will be met via transport from the U.S. as flows into the province from Western Canada decline.

In some cases, pipelines will reverse flows to accomplish these new flow paths. Smaller projects will also be constructed, including looping and compression to boost capacity on discrete portions of existing pipeline systems.

One major difference from the 2011 report is that gas pipeline projects will generally span shorter distances, largely because new supply sources are on the doorstep of the major consuming areas. As a result, the study predicts more, but shorter lines and lower overall natural gas pipeline mileage than in the past. Still, the total level of natural gas investment is similar because of escalating pipeline costs, which have risen from \$94,000 per inch-mile on average in 2011 to about \$155,000 per inch-mile in 2014. A number of factors are contributing to the higher costs, most notably increasing labor and materials costs.

Oil and NGL Infrastructure

On the oil side, the study predicts that companies will add 10.2 million barrels per day of capacity and pour \$12.4 billion per year into crude oil lease equipment and infrastructure, including pipelines, valves, manifolds and separators. Of this total, the study finds that 1.3 million barrels per day of oil capacity is needed from Canada. It is worth noting that Keystone XL's maximum capacity is about 830,000 barrels per day. The new oil transmission capacity will require over 730 miles per year of new oil transmission pipeline. In addition, some 7,800 miles per year of new oil gathering line is projected.

To accommodate another 3.6 million barrels per day of added NGL pipeline capacity, roughly \$2.5 billion will be needed annually for infrastructure associated with natural gas liquids such as ethane, butane and propane. The report finds that almost 700

Total Infrastructure Expenditures

(Billions of Real Dollars)	2014-2035 (2012\$)	Average Annual (2012\$)
New Oil & Gas Lease Equipment	\$219.5	\$10.0
New or Expanded Gas and Liquids Mainline Capacity	\$188.8	\$8.6
New Oil and Gas Gathering Lines	\$71.80	\$3.3
New Laterals	\$48.9	\$2.2
LNG Export Facilities	\$43.7	\$2.0
Processing Plants	\$27.4	\$1.2
NGL Fractionation Plants	\$21.1	\$1.0
Other (Underground Gas Storage, Crude Oil Storage and NGL Export Facilities)	19.7	\$0.9
Total	\$640.9	\$29.1

miles per year of new NGL transmission lines and about 30,000 horsepower per year of additional pumping are needed to support the NGL infrastructure. Most of the NGL pipeline capacity — some 3.2 million barrels a day — will be needed by 2020. Approximately 3.3 million barrels per day of new NGL fractionation capacity and just over 1.4 million barrels per day of new NGL export capacity also will be required through 2035.

Significant Economic Benefits

The infrastructure investment foreseen in this study clearly will be great news for the North American economy. The study predicts that midstream infrastructure spending will generate 432,000 jobs per year and roughly \$300 billion in tax revenue in the U.S. and Canada. The investment will create an estimated \$588 billion in labor income, with salaries averaging \$61,800 across all impacted industries. Natural gas, NGL and oil midstream investment will contribute \$885 billion in value added to the U.S. and Canadian economy, as well as \$302 billion in combined tax revenue.

It's important to note that if spending was to fall short, oil and gas development—and the resultant jobs and economic benefits to the U.S. economy—could be constrained. This report makes clear that pipelines have made the shale revolution possible.

Without pipelines and the future midstream infrastructure requirements, Americans will not be equipped to reap the benefits of these bountiful domestic resources. ✪

For additional information, the full report is available on the INGAA Foundation website at www.ingaa.org/2035report.aspx



Rich has served as Executive Director of the INGAA Foundation Inc. since 2008. Previously, he spent 34 years with the Federal Energy Regulatory Commission in Washington, DC.