



The Potential Economic Benefits of an Appalachian Petrochemical Industry

(Executive Summary)

Full-text report is available at www.americanchemistry.com/Appalachian-Petrochem-Study

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Executive Summary

Chemistry transforms raw materials into the products and processes that make modern life possible. America's chemical industry relies on energy derived from natural gas not only to heat and power its facilities, but also as a raw material, or "feedstock," to develop the thousands of products that make American lives better, healthier, and safer.

Shale Gas – A Game Changer for U.S. Competitiveness

Access to vast, new supplies of natural gas and natural gas liquids (NGLs) from previously untapped shale deposits is one of the most exciting domestic energy developments of the past 50 years. After years of high, volatile natural gas prices, the economics of shale gas have created a decisive competitive advantage for U.S. chemical and plastics manufacturers, leading to greater investment, industry growth, and jobs.

America's chemical companies use ethane, a natural gas liquid derived from shale gas, as a feedstock in numerous applications. Dramatic growth in domestic shale gas production has helped to reduce U.S. natural gas prices, creating a more stable supply of natural gas and ethane and giving U.S. chemical manufacturers an advantage over many competitors around the world who rely on naphtha, a more expensive, oil-based feedstock.

As economic theory teaches and history shows, a reduction in the cost of inputs such as natural gas and ethane leads to enhanced competitiveness and a positive supply response. The supply curve shifts to the right and a higher quantity of output is produced at a lower cost. Economic theory also shows that the lower the cost of a good, the higher the demand by consuming industries. The new competitiveness dynamic has made the United States a cost-advantaged location for chemical and resin production, which fosters overall economic growth and job creation. Much of the investment is geared toward export markets, which can help improve the U.S. trade balance.

Historic Levels of New Chemical Industry Investment

Companies from around the world are investing in projects to expand production in the United States. Since 2010, 301 projects valued at \$181 billion have been announced nationwide, as of March 2017.¹ The projects include new facilities, expansions and process changes to increase capacity. Of these, 46% have been completed or are under construction, while 45% are in the planning phase. Most are geared toward expansion of production capacity for ethylene, ethylene derivatives (i.e., polyethylene, polyvinyl chloride, etc.), ammonia, methanol, propylene, and chlorine.

Fully 62% of the \$181 billion is foreign direct investment, or includes a foreign partner. The fact that such large numbers of firms based abroad are choosing to source their chemistry in the U.S. is unprecedented in recent history and a testament to the value and affordability of America's shale gas and ethane supplies. The U.S. is capturing market share from the rest of the world, and no other country or continent has as bright an outlook when it comes to natural gas.

¹ ACC has been tracking announced investments in shale-advantaged chemical and plastic manufacturing resin capacity since late-2010.

New Report Adds Chapter to Shale Gas Story

This report is the fifth in a series by the American Chemistry Council (ACC) examining the potential economic and employment benefits of natural gas development from shale. The first, published in March 2011, presented the results of an analysis of the potential economic effects of increased petrochemicals production to the U.S. economy. *Shale Gas and New Petrochemicals Investment: Benefits for the Economy, Jobs, and U.S. Manufacturing* discussed the impact of a hypothetical 25 percent increase in ethane supply on growth in U.S. petrochemicals. ACC found that the increase would generate new capital investment and production in the chemical industry, job growth in the chemical industry and in its supplier sectors, expanded output throughout the U.S. economy, and increased federal, state and local tax revenues.

In May 2012, ACC extended the analysis to consider the impact of lower natural gas prices on a wider segment of the U.S. manufacturing base. The report analyzed the effects of renewed competitiveness and the supply response among eight key manufacturing industries: paper, chemicals, plastic and rubber products, glass, iron and steel, aluminum, foundries, and fabricated metal products industries. In that report -- *Shale Gas, Competitiveness and New Investment: Benefits for the Economy, Jobs, and U.S. Manufacturing* -- ACC found an opportunity for shale gas to strengthen U.S. manufacturing, boost economic output, and create jobs across multiple industries.

In May 2013, ACC published a third report -- *Shale Gas, Competitiveness and New U.S. Chemical Industry Investment: An Analysis Based on Announced Projects* -- that returned once again to the chemical industry. It was based on a detailed examination of the 97 chemical industry projects cumulatively valued at \$72 billion that had been announced as of March 2013, and their potential for job creation, increased output, and additional tax revenue at the state, local and federal levels.

In May 2015, ACC published a fourth report -- *The Rising Competitive Advantage of U.S. Plastics* -- which analyzed the economic impact of shale-advantaged resin production on the U.S. plastics industry. Specifically, it quantified the potential impact of new investment to expand capacity in plastic resin; plastics compounding, additives and colorants; and plastics products.

Latest Report Focuses on Appalachian Region

This new (and fifth) report analyzes the potential economic impacts of the development of petrochemical and plastics industries in the Appalachian region, which has the potential to become a major petrochemical and plastic resin-producing region, similar to the U.S. Gulf Coast.

While petrochemical manufacturing began in Appalachia in the 1920's, the Gulf Coast region has been the center of the U.S. petrochemical industry since the mid-20th century. With its abundant supplies of hydrocarbon raw materials and vast network of pipelines and NGL storage structures, it has been the center of chemicals production for the last six decades. Indeed, much of the industry's recent wave of shale-related investment is destined for Texas and Louisiana, with numerous projects completed, planned, or underway. However, announcements of significant petrochemical industry investment in the Appalachian region have been made, with several projects already underway.

The Appalachian region is an ideal location for the emergence of a second major petrochemical manufacturing hub in the United States, offering benefits such as:

- **Proximity to abundant NGL resources** from the Marcellus/Utica and Rogersville shale formations
- **Proximity to manufacturing markets** in the Midwest and along much of the East Coast
- Opportunity to **strengthen the U.S. economy** by providing **employment and supply diversity**
- Opportunity to **enable high-value ethane use** to create U.S.-made products, while **avoiding ethane rejection**

This report presents a hypothetical scenario of the creation of a storage hub for NGLs and petrochemical products, pipeline distribution network, and associated petrochemical, plastics, and potentially other energy infrastructure and manufacturing in a quad-state area consisting of Kentucky, Ohio, Pennsylvania, and West Virginia. It then uses the IMPLAN model to estimate the direct, indirect, and payroll-induced job impacts, as well as tax revenue impacts, of the scenario.²

Study Assumes Investment in NGL Storage, Pipelines

The analysis assumes an initial infrastructure investment that includes a storage facility for ethane, propane, ethylene, and propylene and approximately 500 miles of pipeline running along the Ohio River valley. This storage hub and distribution network will enable market participants (NGL producers, petrochemical manufacturers, plastic resin producers, and others) to source feedstock and ship product among facilities in the region. It is similar in concept to the Mont Belvieu NGL hub in Texas that supports the Gulf Coast chemical industry, and will be the foundation of a robust petrochemical and downstream plastic products industry in the quad-state region.

Government Policies Needed to Fully Realize Potential

Further development of the Appalachian region's shale gas and natural gas liquids (NGLs) can drive an even greater expansion in regional manufacturing capacity and job creation, provided that policymakers develop appropriate policies and regulatory permitting practices. A number of policy avenues could be pursued to support development of the Hub.

New energy infrastructure will be critical to realizing the opportunity for robust growth in petrochemicals and plastic resin production. One of the key barriers to the development of an NGL storage and distribution network in the Appalachian region is uncertainty around financing for such projects. Without existing infrastructure, it's difficult for the region to attract NGL consumers such as manufacturing facilities. At the same time, the absence of an established NGL customer base makes it difficult for pipeline developers to secure loans.

Government agencies can help reduce uncertainty and spur investment by applying existing private-public financing programs to Appalachian energy infrastructure projects. The U.S. Department of Energy (DOE)'s loan programs are important tools to address market gaps and promote energy independence and innovation in our nation's energy sector. Policymakers should affirm that development of a storage and distribution network is eligible for such programs, while taking care to preserve the federal government's overall lending authority.

² Please see the *Methodology and Scope of Study* section for more information.

As Congress and the Administration consider infrastructure modernization legislation, we encourage them to make the Appalachian Hub a priority. Policymakers must also take steps to improve the regulatory permitting process for new infrastructure.

U.S. Senators Shelley Moore Capito (R-W.Va.), Rob Portman (R-Ohio), and Joe Manchin (D-W.Va.) have introduced bipartisan legislation to assess the feasibility and potential benefits of establishing an ethane storage and distribution hub in central Appalachia. The *Appalachian Ethane Storage Hub Study Act of 2017 (S. 1075)* will help inform efforts to maximize America’s domestic energy and manufacturing potential.

ACC supports a comprehensive energy policy that maximizes all domestic energy sources including renewables, alternatives, coal, nuclear, and oil and natural gas; prioritizes greater energy efficiency in homes, buildings and industrial facilities; and employs economically sound approaches to encourage the adoption of diverse energy sources, including energy recovery from plastics and other materials and renewable sources. The United States must ensure that our regulatory policies allow us to capitalize on shale gas as a vital energy source and manufacturing feedstock, while protecting our water supplies and environment.

Key Findings

Petrochemical industry investment in the Appalachian region has already begun. Several firms have announced plans to build ethylene and polyethylene facilities there. While these facilities will bring much-needed economic activity to this part of the country, there is the potential for a great deal more. The abundant supply of energy raw materials could feed at least half a dozen world-scale petrochemical complexes, in addition to a number of smaller facilities.

The contributions of a fully developed Appalachian chemical and plastics products industry could be significant, extending well beyond its direct economic footprint. The analysis found that if companies continue to invest in and build the petrochemical industry in the region, an Appalachian petrochemical hub could generate the following impacts in the quad-state region:

Potential Economic Impacts of An Appalachian Chemical Industry (Permanent, By 2025)				
Capital Investment (\$2016)	Direct Output (\$2016)	Employment	Payroll (\$2016)	Federal, State, and Local Tax Revenue
\$32.4 billion in petrochemicals, resins and derivatives \$3.4 billion in plastic products	\$23 billion in chemicals + plastic resins \$5.4 billion in plastics compounding + plastics products	25,664 direct jobs (chemical and plastics products manufacturing) 43,042 indirect (supply chain) jobs 32,112 “payroll-induced” jobs in local communities where workers spend their wages	\$1.7 billion direct \$3.0 billion indirect (supply chain) \$1.5 billion payroll-induced	\$1.7 billion in federal tax revenue annually \$1.2 billion in state and local tax revenue annually
TOTAL: \$35.8 billion	TOTAL: \$28.4 billion	TOTAL: 100,818 jobs	TOTAL: \$6.2 billion	TOTAL: \$2.9 billion