



Shell Petrochemical Complex (“Cracker”) Project Overview

The First Step in Establishing a Regional Petrochemical Sector

October 2016

In June 2016, Shell formally announced their decision to move forward with building the ethane cracker plant and petrochemical complex in Beaver County, PA (Shell Cracker). This announcement has been referred to as a “game changer” by Governor Wolf - the project represents the first ethane cracker in the northeastern US and a significant economic development catalyst for Pennsylvania.

In an ongoing effort to support and promote economic opportunities from Pennsylvania’s natural gas assets, this paper was developed by John Siggins of the Ben Franklin Technology Partners of Central & Northern PA (BFTP CNP) through their entity the Shale Gas Innovation & Commercialization Center (www.sgicc.org).

The BFTP program seeks to maximize tech-based job creation across the Commonwealth, and the Shale Gas Innovation & Commercialization Center (SGICC) focuses on maximizing job creation through innovation related to the shale gas industry. The SGICC has also played a role as a major supporter of the utilization of the shale energy resource, having co-sponsored a regional Natural Gas Utilization Conference for the last 5 years. That conference has focused on not just the uses of natural gas, but the natural gas liquids (NGLs) as well. The SGICC has also released a series of papers/studies on other topics of high interest to this sector, including papers on wastewater management, conversion of natural gas to methanol, use of natural gas in transportation, and a report that focuses on analyzing how small companies and innovators can best deliver a new product or service to the industry. These papers can be accessed on our web site (www.sgicc.org) at the “Research & Reports” button.

As part of an economic development organization, coupled with the center’s focus on the shale energy industry, the SGICC is well suited to shine a light on the coming buildout of the petrochemical industry in the region surrounding the significant volumes of NGLs being produced in portions of the Marcellus and Utica basin. Additionally, there is no doubt that new technologies that are tied to this opportunity will continue to be developed. As examples, we might expect the following to be developed: new or improved catalysts to aid in the conversion processes, and improved technologies for separating the NGLs.

The SGICC has built a network of stakeholders that spans large and small companies engaged in all aspects of the shale energy industry. Thus we bring a unique perspective to the table, aware of the viewpoints of major shale energy E&P companies, the midstream sector, the downstream users of the resource, and lastly the entrepreneurial community seeking to take advantage of the opportunities this relatively new industry in our region continues to offer. It is with this unique viewpoint that we approached this report; as an information provider and with the overall goal to inform the Commonwealth's existing companies and entrepreneurial community on a great opportunity coming to the region. We also believe the impact of this industry buildout will be felt statewide, not just in southwestern PA, with a "ripple effect" providing opportunities for decades to come across the Commonwealth.

Just as the discovery, extraction, and use of the natural gas from the Marcellus and Utica formations has fundamentally and positively changed the energy landscape of the entire region, so will the use of the NGLs. The Shell Cracker is in essence the first step in the buildout of an entire petrochemical industry in the region surrounding where the NGLs are being produced from the Marcellus and Utica basins. But it is important to note that a much broader geographic region that includes significant portions of the Northeastern and Upper Midwestern U.S. will benefit from the buildout of this petrochemical industry. Though the major cracker facilities are likely to be centered in close proximity to southwestern PA, or the bordering areas in Ohio or West Virginia, use of some of the NGLs and products/intermediates from the cracker facilities will benefit companies throughout the Northeastern and Upper Midwestern U.S.

To put the impact the shale energy revolution is having on a national scale in perspective, a September 14, 2016 Bloomberg BNA blog quotes Alan Kovski's special report titled "Shale Gas Surge Triggers U.S. Petrochemicals Wave". Mr. Kovski notes:

*"High volumes of natural gas from shale, combined with moderate prices, have given a strong economic advantage to companies that turn gas and natural gas liquids into intermediate chemicals and an array of finished synthetic products that are among the most commonplace manufactured objects in modern life. He continues, Some 268 petrochemical and fertilizer plant projects linked to shale gas, with an estimated investment of \$170 billion, are in various stages of study or construction, Kevin Swift, chief economist with the trade group American Chemistry Council, told Bloomberg BNA. At the end of 2010, less than \$10 billion in such projects had been announced."*¹

The Shell Cracker is a first step forward towards the buildout of a regional petrochemical hub and manufacturing renaissance in the plastics and chemicals sector in the Commonwealth that will lead to new business creation and expansions not just in this sector, but in many sectors that provide support products and services to it. Both new and existing companies will take advantage of the polyethylene being produced by the Shell Cracker and polyethylene and intermediates produced from other potential regional cracker facilities.

This paper goes beyond simply focusing on the Shell Cracker. We believe this project is a catalyst for future use and development of significant volumes of NGLs available in the Marcellus and

Utica basin. We attempt to both define the scope, construction details as known today, and the projected timeline for Shell's construction, as well as estimate the value of the project, and the overall expected buildout of the petrochemical sector in the region. This includes details on the ancillary downstream development possibilities to utilize the NGLs and the product streams from NGL conversion that will be available in the region. We also highlight the many supporting industries that will experience growth to supply the materials and maintenance needs of this new sector in the region.

Shell Cracker Overview

The Shell website notes the following regarding what they refer to as the "Shell Appalachian Petrochemical Project":

*"The proposed complex would be the first major U.S. project of its type to be built outside the Gulf Coast region in 20 years. Locating the facility close to both supply and markets would reduce economic and environmental transportation costs and provide regional plastic manufacturers with more flexibility, shorter supply chains and enhanced supply dependability."*²

Regarding the scope and key components that will make up the manufacturing complex it further notes that, "...the facility would include:

- *an ethane cracker with an approximate annual average capacity of 3.2 billion pounds of ethylene;*
- *three polyethylene units with a combined annual production of approximately 3.5 billion pounds; and*
- *power and steam generation, storage, logistics, cooling water and water treatment, emergency flare, buildings and warehouses."*²

Details on the Key Plant Design Features and Partners on the Shell Cracker:

Shell's facility would first "crack," or break apart ethane's large molecules and re-arrange the carbon and hydrogen atoms to create ethylene. This is accomplished by heating the ethane to very high temperatures, greater than 1500°F (800°C), in one of the cracker's seven furnaces. Natural gas and "tail gas" (a hydrogen and natural gas combination from the furnace that is recycled) are used to fuel the process. The ethylene will be further processed to create different types of polyethylene.² Polyethylene is a building block for the plastics industry.

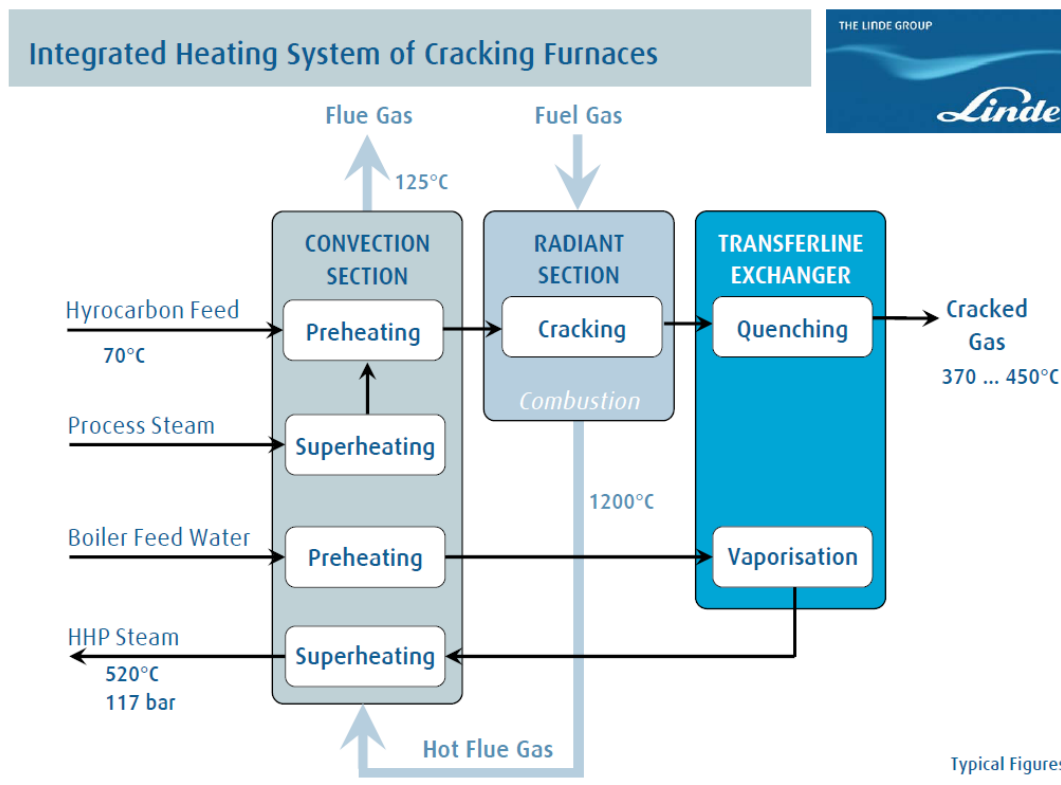
The plant will use approximately 100,000 barrels equivalent/day of ethane. Numerous fractionation plants (plants used to process and separate the NGLs in to its various components – ethane, propane, butane, etc.) have been built already in Pennsylvania, West Virginia, and Ohio and more are expected to be built as the volume of NGLs extracted grows. It is reported that Shell has signed contracts with 10 entities to provide the ethane.³

Cracking furnaces are the heart of ethylene plants, and it is reported that Shell's cracker will be utilizing steamcracking technology offered by Linde Engineering North America, Inc., headquartered in Houston, Texas.⁴



Photo from Linde Brochure: Seven ethane cracking furnaces by Linde Engineering North America for Saudi Ethylene and Polyethylene Company ⁴

Below is a typical furnace design of a steamcracking furnace provided by Linde on the company's website.



Linde AG Engineering Division

The engineering, procurement, and construction contractor (EPC) on the Shell project is Bechtel Oil, Gas, and Chemicals. The combination of Linde and Bechtel is the same partnership chosen by Exxon to build their olefins recovery units at the ExxonMobil Baytown Olefins Plant located in Baytown, Texas that was announced in August, 2014. ⁵

In addition to the two major prime contractors for the key components of the overall project, Jacobs Field Service North America, Inc. (Houston, Texas) has been chosen to handle all permitting aspects for the project, and it is understood that there will be as many as 6 additional EPC contracts for specific projects (such as the wastewater treatment plant) that will be undertaken as part of the overall project.

Timeline & Scale of the Project:

The Shell Cracker is what is referred to as a “World Scale” petrochemical plant, and the scale of the project exceeds any recent major petrochemical plant built or undertaken in the state or outside of the Gulf region in many years. For that reason, it has taken Shell several years to make the decision to move forward, and they’ve spent in the range of \$500 million in advance of their final investment decision to prepare the site for the project, including moving a section of Route 18 and constructing a bridge across the highway to alleviate traffic issues.

The projected budget for building the entire cracker plant and polyethylene (PE) units, plus all supporting units (power plant, wastewater treatment facility, etc.) is projected to be \$6 billion, but may vary substantially, depending on many factors that arise during the final design/build stages of a project of this scale. The projected project timeline is as follows:

- Continued site preparation – Through 4Q 2017
- Letting of contracts and beginning building of ancillary support units – Beginning in late 2016 and continuing throughout construction period
- Initiating main construction of cracker and polyethylene units and other facilities – Estimated to begin in 18 months
- Anticipated project completion – 2020/2021 timeframe

What makes this project so important to the Commonwealth and Surrounding Region?

Shell’s decision to select Beaver County, PA for their cracker positions the Pennsylvania/Ohio/West Virginia tri-state area to derive substantial benefit in the near term from the building of the Shell Cracker. The complex itself will provide an estimated 600 full time jobs when operational, and an estimated 6,000 construction jobs at peak construction while the plant is being built.

It is the operation of the cracker – in which 1.6 million metric tons of polyethylene will be produced annually in our region - that is so important. Polyethylene is the initial building block for so many products, and the other byproduct streams that will be produced in much smaller quantities from the operation also will be converted to various high value chemicals and fuels. Prior to the Shell Cracker, the Gulf Coast has been the US “Hub” for cracker plants and petrochemical plants, and the corresponding production of large volumes of polyethylene and other petrochemicals. Bringing this scale of plant to the region is truly a “game changer” as it not only will produce large quantities of low cost polyethylene, a “building block” for so many plastic products, right in our region, but it will also open the door for an entire petrochemical industry to develop.

As noted on the Shell website, the polyethylene pellets will be shipped to manufacturers to make many of the plastic products we use every day. They note:

*“Different grades of polyethylene make different types of products: Low-density polyethylene (LDPE) and linear low-density polyethylene (LLDPE) are the raw materials for items like food packaging, film, trash bags, diapers, toys and housewares; and High-density polyethylene (HDPE) is used to create “stiffer” products such as crates, drums, bottles, food containers and other types of housewares.”*²

We anticipate that Shell has negotiated supply contracts for a portion of the LLDPE and HDPE polyethylene that Shell will be producing at this facility in order to financially support their investment. But even if only a portion of the polyethylene remains available for new or existing businesses, this will be significant. Shell has not identified who the potential buyers of the polyethylene will be, but we anticipate that the majority of the polyethylene will be sold to existing proximate customers (within a 700 mile radius).

Although the ultimate disposition of the polyethylene from the Shell cracker is unknown, having polyethylene available in large quantities right in the region close to the largest end use markets in the nation, one would anticipate that this will spawn some level of additional polymer processing plants to be built in the region. Having access to the polyethylene may also lead to new niche opportunities spawning smaller manufacturing opportunities. This could enable the production of lower cost plastic pieces that go in to many of the final products being manufactured by companies across the region, lowering their overall manufacture cost.

It is also important to note that there are already other cracker plants and NGL end use conversion opportunities in the planning stages for the region, and in all likelihood one or more crackers will be built, especially now that Shell has committed to the Beaver County complex. Critical regional infrastructure will be built to support the cracker, and critical capabilities developed to support the cracker industry. This makes it very likely that one or more of the proposed crackers will announce their intentions to build in the near term. The following lists three major cracker projects that are in various stages of planning in the region:

- PTT Global Chemical---Belmont County, Ohio
- Appalachian Resin-----Monroe County, Ohio
- Braskem Ethane Cracker—Near Parkersburg, West Virginia

At a recent regional conference, it was reported that initial site preparation activities at the PTT Global Chemical proposed site located on the Ohio River in Ohio has begun. They are decommissioning a coal fired power plant and hoping to start construction on the cracker plant in the 2017/2018 timeframe.

Thus, it would appear that the Shell announcement is just a first in a series of projects to be announced. Thus it is important for regional planners and the existing industries in the region to understand what the possibilities are, and to develop strategic plans to maximize the opportunities that will present themselves.

Project Energy Requirements

The Shell Cracker will require substantial electricity to power it (equivalent to the power needed by roughly 100,000 homes). Shell will be building their own natural gas-powered electric generating plant on the site, and excess electricity generated will be sold back to the local grid. The plant will be a Combined Heat & Power (CHP) or Combined Cycle Co-Generation plant to provide both the steam and electricity the plant will require. The CHP facility will include three combustion turbines with duct burners and heat recovery steam generators providing the electricity and steam for use on site. Total generating capacity will be about 250 MW with enough excess electricity to be sold to the grid to classify the power plant as an electric utility.

Bechtel has the contract to build the Combined Cycle Power Plant, and will be releasing contracts to vendors to assist them with the construction by the fall. In an article titled “*Shell nears permit for 250 MW power plant in Pennsylvania*”⁶, dated March 30, 2015, by Barry Cassell, Chief Analyst, in “Power Engineering” magazine, it provides a detailed extensive list of the major equipment pieces that will be installed during the building of the petrochemical complex, including the power plant.

Delivery of the Ethane to the Shell Petrochemical Complex & NGLs Overview

Natural Gas Intelligence’s article “*Shell At Work on Three-State Ethane Pipeline System to Feed PA Cracker*”³ details how Shell plans to deliver the bulk of the ethane to the complex. It also highlights some of the existing pipelines in place to move NGLs out of the region.

In order to deliver the ethane to the complex, it was publicly announced in August, 2016 that Shell, through its affiliate Shell Pipeline Company LP is developing a 94-mile ethane transport system. The “Falcon Ethane Pipeline System” will be a common carrier pipeline system with construction to begin in late 2018. It will be located in southwestern Pennsylvania and extend into West Virginia and Ohio. Ethane will be collected from MarkWest Energy Partners LP's Houston Processing and Fractionation facility in Washington County, PA, and from MarkWest’s Cadiz Complex in Harrison County, OH. The system will also receive ethane from Utica East Ohio Midstream via their Harrison Hub fractionation plant in Scio, OH. Shell has identified ten ethane suppliers, and several have signed 10-20 year agreements to provide ethane to Shell.³

According to the article, the Falcon system will be comparable in size to the entire existing Appalachian Basin's current NGL infrastructure. The article notes that currently, the Appalachia-to-Texas Express (ATEX) pipeline, which carries Marcellus and Utica ethane to Mont Belvieu, TX, has an expandable capacity of 125,000 b/d. The Mariner East 1 pipeline, which carries ethane and propane from Western Pennsylvania to the Marcus Hook Industrial Complex near Philadelphia for domestic and international distribution, has a capacity of 70,000 b/d. And the Mariner West pipeline carries 50,000 b/d of ethane from the basin to Michigan and Canada.³ The proposed Mariner East 2 pipeline(s) that are in the permitting process, and that are to be built adjacent to the Mariner East 1 pipeline seeks to increase the total capacity of the Mariner East pipelines up to 675,000 barrels per day of NGLs.⁷

As one example of the buildout of just the infrastructure necessary to support the processing and distribution of the NGLs being extracted from the wet gas Marcellus and Utica region, the article

in Natural Gas Intelligence provides the following. *“Kevin Hawkins, MPLX’s senior manager of investor relations, said the company was not yet ready to provide specifics about how it might meet Shell’s demands. The company highlighted plans to invest between \$500 million to \$1 billion in ethane solutions over the next five years on its second quarter earnings call. Management said there will likely be a “number of de-ethanization facility investment opportunities” and added that those would go beyond Shell’s cracker.”*³

S&P Global Platts addresses projected volumes of NGLs coming out of the Marcellus and Utica region over the next few years. They note, *“US ethane supply from gas plants (before rejection) in the Marcellus and Utica has grown from 5,000 b/d in 2013 to about 276,000 b/d in 2015, according to Platts Bentek. ethane production is estimated to grow to 387,000 b/d in 2017 and 443,000 b/d in 2018, according to Platts Bentek Market Call: North American NGLs, 1Q2016.”*⁸

It is difficult to surmise the total volume of economically recoverable NGLs that are available in the wet gas region of the Marcellus and Utica basin. But it’s logical to conclude that based on the level of interest and activity of major players like Shell, Braskem, and others to develop major NGL use projects in the region, their analysis indicates that there are sufficient volumes to supply multiple world scale NGL conversion plants, while also providing ample NGLs for export to other regions via the network of pipelines that are being developed or are already in place. Of course not all proposed regional petrochemical projects and export pipelines are likely to be built, and a “sorting out” process will take place, including perhaps a race to secure available NGLs over the coming months and years.

According to the numbers provided in the above references, projected potential NGL pipeline exports along existing pipelines (ATEX and Mariner East/West) alone total 850,000 bpd. The Shell plant will use an estimated additional 100,000 bpd of ethane. According to the Platts information, in 2018, ethane production is to only be 443,000 bpd before “rejection”, which refers to ethane that instead of being recovered is “rejected,” and blended in with the methane to be burned as fuel. However, the pipelines being built may also be carrying away propane, butane, and a mixture of NGLs, so without more knowledge of the “mix” of NGLs that will make up the 850,000 bpd it is not readily clear what the exact shortage of ethane will be if all projected pipeline projects come on line.

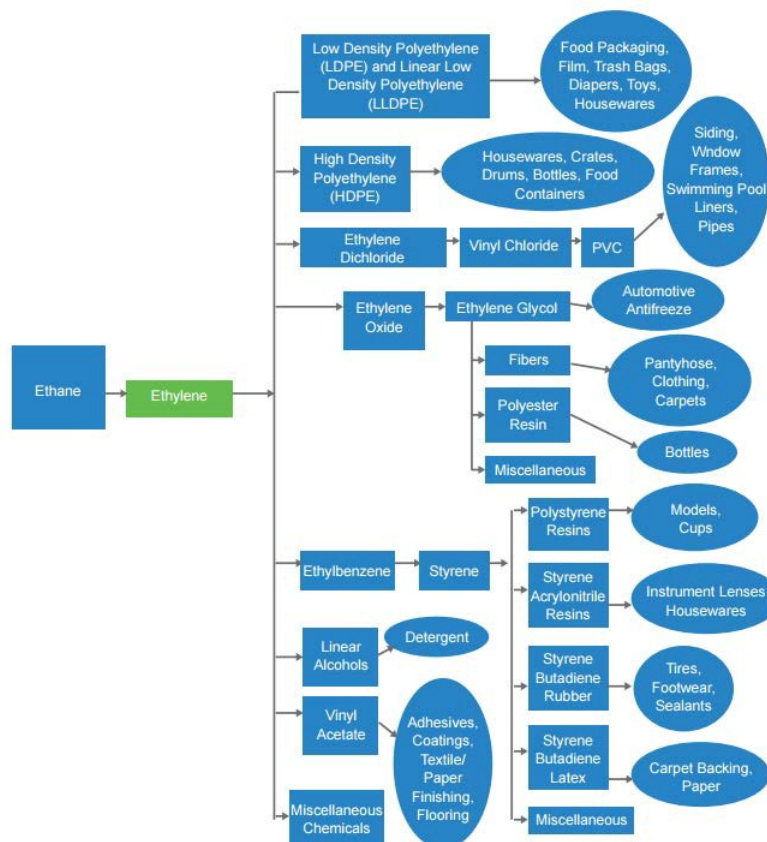
The above discussion points to the fact that the amount of NGLs available from the Marcellus and Utica that can be extracted and recovered from the play at an economically viable price point is not readily available. But based on the geographic scale of the wet gas play, it does seem likely that a ramp up of production can be undertaken to produce significantly larger volumes of NGLs than are currently being produced. This demonstrates the need for a better in-depth analysis of the “NGL picture” going forward. At this point, all signs indicate that the E&P companies are prepared to ramp up to meet the production demands to fulfill announced projects, and there have been no signs that an over-commitment of NGLs is being approached. Thus, this reinforces the earlier assertion that the region needs to prepare strategically for the impending buildout of the

petrochemical industry in the region to maximize the value provided to new and existing small through large companies, and the accompanying job creation opportunities that will result.

Downstream Opportunities:

The Mid-Ohio Valley Regional Council (MOVRC) commissioned a report that provided a detailed analysis of the potential downstream opportunities for growth of the manufacturing sector based on the proposed Odebrecht cracker that is on hold, proposed to be built in Parkersburg, West Virginia.⁹ It also summarizes some of the opportunities for business growth that will occur during the building of a cracker plant. Although the report was commissioned based on the proposed West Virginia project, the results of the study are very pertinent to the Shell Cracker because it is essentially a mirror image of the Odebrecht proposed project. The report notes that the “...*Analysis focused on two key areas: 1) Identifying regional companies that would benefit from the proposed ethane cracker; and 2) Identifying potential companies that may look to expand to the region in order to take advantage of proximity to the cracker.*”

The graphic below shows the entire downstream potential products matrix that can come from an ethane cracker.



Source: American Chemistry Council. Shale Gas and New Petrochemicals Investment: Benefits for the Economy, Jobs, and US Manufacturing (March 2011), p.5.

Ethane – Ethylene Supply Chain Graphic from Page 4 of the “*Ethane Cracker Supply Chain Market Study*” commissioned by the Mid-Ohio Valley Regional Council (MOVRC)⁹

The top two “product lines” shown on the graphic and the associated downstream manufacturing opportunities that utilize high and linear low density polyethylene (as will be produced at the Shell Cracker) should be expected to benefit in our region. If additional cracker plants are announced, or the Shell plant’s design is modified (or additional plants are built separate from the Shell facility to take ethylene from the plant) other product lines shown on the graph may also be produced locally.

The report also notes the following regarding the polyethylene (also referred to as “polymer resins”):

“Polymer resins are usually produced in the form of plastic pellets. Pellets are shipped to fabrication sites where plastics materials and products are manufactured. Plastics products are made using various methods, including: extrusion (film), injection molding (containers), blow molding (bottles) or rotation molding (hollow plastic products). Pellets are typically shipped via rail or truck to plastics fabricators. Due to high shipping costs, fabricators tend to locate near final product assembly. Thus, fabricators will be located near automotive, aerospace, packaging, medical device, and related industry clusters.” But it also notes, “Alternatively, producers of plastic resins may choose to locate close to raw material extraction and feedstock – this is why much of the industry is located along the gulf coast in Texas and Louisiana. However, the possibility of extracting natural gas from shale is likely to change this arrangement. **In fact, there is a strong possibility that a second petrochemicals hub will develop in the Marcellus basin.**”⁹

(Note: Bolding & underlining added for emphasis by this paper’s author)

The report also emphasizes specific “Target Industries” that would be expected to locate in the area as a result of the buildout of the cracker. It zeros in on four key areas - Plastics and Rubber Manufacturing, Chemical Manufacturing, Transportation and Warehousing/Wholesalers, and Oil and Gas Extraction, prioritizing the opportunities into the following three groups:

- Primary targets are the most promising industries for expansion. Targets here show high growth potential alongside a new ethane cracker, positive macroeconomic trends, and strong nationwide/global market forces. Additionally, these industries can be recruited.
- Secondary targets share similar characteristics to primary targets, but show slightly less strong indicators for progress.
- Tertiary targets may or may not improve with the presence of a cracker, but accompany industries which show promise or could grow with favorable macroeconomic trends. Additionally, some tertiary industries show promise for growth but face large barriers to entry. A listing by NAICS codes for 35 different manufacturing opportunities follows. As an example, under Primary Targets, under Chemicals NAICS 32511 – Petrochemical Manufacturing is listed with a paragraph regarding the opportunity. ⁹

Based on the above descriptions, the table below highlights the target industries for the ethylene supply chain. Some are likely to be developed in relation to the cracker plants that are developed within the Marcellus and Utica basins.

All Target Industries for Ethylene Supply Chain			
Primary Targets	Secondary Targets	Tertiary Targets	Short-Term Targets
Petrochemical Manufacturing	Polystyrene Foam Manufacturing	Pharmaceutical Manufacturing	Support Activities for Oil and Gas Operations
Organic Chemical Manufacturing	Urethane Foam Manufacturing	Cosmetic and Beauty Products Manufacturing	Natural Gas Distribution
Plastic and Resin Manufacturing	Tire Manufacturing	Gasoline and Petroleum Bulk Stations	Electrical Contractors and Other Wiring Installation Contractors
Adhesive Manufacturing	Hose and Belt Manufacturing	Gasoline and Petroleum Wholesaling	Plumbing, Heating, and Air-Conditioning Contractors
Chemical Wholesaling	Rubber Product Manufacturing	Refined Petroleum Pipeline Transportation	Oil and Gas Field Machinery and Equipment Manufacturing
Plastic, Film, Sheet and Bag Manufacturing	Oxygen and Hydrogen Gas Manufacturing	Oil Drilling and Gas Extraction	Pipeline Transportation of Natural Gas
Plastic Pipe and Parts Manufacturing	Dye and Pigment Manufacturing	Oil and Gas Field Services	Construction, Mining, and Forestry Machinery and Equipment Rental and Leasing
Laminated Plastics Manufacturing	Inorganic Chemical Manufacturing		Other Commercial and Industrial Machinery Equipment Rental and Leasing
Plastics Bottle Manufacturing	Synthetic Fiber Manufacturing		Engineering Services
Miscellaneous Plastics Products	Fertilizer Manufacturing		
Plastics Wholesaling	Pesticide Manufacturing		
	Paint Manufacturing		
	Soap and Cleaning Compound Manufacturing		
	Ink Manufacturing		
	Explosives Manufacturing		
	Chemical Product Manufacturing		

“All Target Industries for Ethylene Supply Chain” Graphic from Page 14 of the “*Ethane Cracker Supply Chain Market Study*” commissioned by the Mid-Ohio Valley Regional Council (MOVRC).⁹

Based on an informational brochure prepared by Dow, other specific products that can be manufactured from polyethylene include:

1. Durables, Goods, and Flooring
2. Flexible Food and Specialty Packaging
3. Health and Hygiene

4. Industrial and Consumer Packaging
5. Pipes and Fittings
6. Rigid Packaging.¹⁰

There is clearly an extensive list of products that are made from polyethylene, indicating that having multiple crackers producing polyethylene right here in the Appalachian region will likely be a “game changer” to our plastics manufacturing industry going forward.

As an example of what is likely to become regular announcements across the region, on August 30, 2016 it was made public that international plastics packaging manufacturer Retal is opening a regional headquarters and production plant in Donora, PA planning to create 88 jobs. The article in the Mon Valley Observer – Reporter notes, “*Retal PA LLC is a subsidiary of Retal Industries LTD, a Cyprus-based international manufacturer of polyethylene terephthalate (PET) plastic preforms and containers and high density polyethylene lids and closures for the food and beverage industries used in the production of plastic bottles for water, carbonated and still drinks and liquor and beer.*”¹¹

Summary:

Though the actual production of polyethylene from the Shell Cracker won’t be occurring for a few more years, now is the time for regional businesses to begin positioning themselves to benefit from the opportunities that will be presented during the construction of the first regional petrochemical facility. Also this is the time for both small and large companies to begin gaining an understanding of all of the various opportunities that are likely to be presented as both cracker facilities, midstream pipeline buildouts and NGL processing facilities, and additional downstream petrochemical projects are announced to utilize the abundant NGLs.

Now is the time for regional planners to be identifying their prime locations for prospective companies to build facilities, to be determining necessary infrastructure upgrades, and to develop appropriate incentives to attract investors and prospects.

Uday Turaga, President of ADI Analytics, a boutique consulting and advisory firm that focuses on the oil and gas, energy, and chemicals sectors, advising companies, start-ups, investors, and governments in this space, provided the following comments regarding the exciting opportunities the Shell Cracker brings to the state:

- *“Polyethylene (PE) production spawns a wide range of large (PE derivatives manufacturing) and small businesses (PE processing, e.g., blow mold processing) that will drive employment in a more sustainable manner. This is why Saudi and the Middle East have been developing downstream chemical businesses to create jobs for their population. It is important to emphasize that it will create both small and large businesses driving a big economic resurgence.”*
- *“Several other industries will expand or come in the vicinity, e.g., fabrication shops, equipment (pump/compressor) service centers, industrial cleaning and waste management facilities, etc.”*

- *“It will lay the basis for the development of a new industrial logistics and transportation system on the East Coast, and make further cracker or petrochemical plant additions / expansions much cheaper and easier.”*
- *“Finally, the plant will train a new generation of workers, create opportunities for entrepreneurs, and drive research dollars in the neighborhood.”*

These are truly exciting times in the state! A manufacturing renaissance has been launched as a result of this opportunity.

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About the SGICC



The Ben Franklin Shale Gas Innovation and Commercialization Center (www.sgicc.org) is designed to harness innovation and new technologies as a means to maximize the economic return to Pennsylvania's citizens from the Marcellus and Utica shale formations. The Center's goal is to increase sustainable employment while supporting the commercialization of technologies that enhance responsible stewardship of the environment while properly utilizing this transformative energy asset.