

Ethane Cracker Supply Chain Market Study



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¹ <http://pabook.libraries.psu.edu/palitmap/Marcellus.html>

² <http://allianceblog.org/category/ethane-cracker/>

³ <http://www.igs.com/solutions/industries/general-manufacturing/>

Executive Summary

The Ethane Cracker Supply Chain Opportunities market research study explores the potential impact on regional and future businesses of the proposed Appalachian Shale Cracker Enterprise, or ASCENT. ASCENT is a proposed ethane cracker site including the cracker, three polyethylene plants, water treatment facilities, and a gas-fired co-generation power plant to be carried out by Odebrecht, a Brazilian company, with construction slated to begin sometime in 2015.

The Mid-Ohio Valley Regional Council engaged Thomas P. Miller and Associates (TPMA), along with Camoin Associates (CA), to study the potential impacts of ASCENT. 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

Key Findings

- **Opportunities through the ASCENT cracker lie primarily in the ethylene supply chain.** As the key product of the cracking process, ethylene provides the greatest tangible opportunity for businesses retention, attraction, and expansion that the cracker has to offer.
- While many types of companies within the region will likely benefit from the construction and development of the ethane cracker, **regional companies within the ethylene supply chain are most likely to benefit over the long-term.**
- **The possibility of low cost feedstock in the region presents significant opportunities for business attraction.** The region's close proximity to several manufacturing markets in the Upper Midwest and Northeast represent opportunities for downstream plastics manufacturers to locate near the feedstock, while being close to final customers.
- The polyethylene/plastic materials and resins supply chain within the region compares similarly to other areas with existing ethane crackers. **No significant supply chain gaps were identified.** This is likely due to the existing presence of the oil and gas industry within the region, as well as the fact that plastics resins are currently being manufactured in the region.
- **The ethane value chain can be broken down into five primary groups:** Oil and Gas Extraction; Chemical Manufacturing; Plastics and Rubber Products Manufacturing; Wholesalers; and Transportation and Warehousing. The best opportunities for the region will be within the Chemical Manufacturing and Plastics and Rubber Products Manufacturing sectors.

Target Industries

Target industries are areas ripe for business attraction, retention, and expansion and were chosen for a combination of their position in the ethylene supply chain, rising demand in downstream industries, current presence in the region, and overall macroeconomic trends.

Target Industries	
Industry	Rationale
Petrochemical Manufacturing	Ethane is a key product, polyethylene resin supply chain, downstream industry purchases will stoke growth
Organic Chemical Manufacturing	Polyethylene resin supply chain, growth in key downstream markets, exports expected to rise, Midwestern strength
Plastic and Resin Manufacturing	Primary industry for polyethylene, growth in construction
Adhesive Manufacturing	Closely tied to plastic and resin manufacturing, automotive and aerospace industries are key drivers, Midwestern strength
Chemical Wholesaling	Key to polyethylene supply chain, supports manufacturing
Plastic Film, Sheet, and Bag Manufacturing	Polyethylene reliant industry, regional strength, heavily referenced in interviews
Plastic Pipe and Parts Manufacturing	Growth in construction industry will aid growth, regional strength, plastic resins are a key industry input
Laminated Plastic Manufacturing	Key to construction and automotive industries, ethylene reliant industry
Plastic Bottle Manufacturing	Plastic resin input, growth in downstream industries including household and automotive products
Miscellaneous Plastics Products	Largest sector within the plastics industry
Plastics Wholesaling	Key part of polyethylene supply chain, supports manufacturing

Business Attraction Recommendations

Interviews with local companies, regional economic development organizations, site selectors and industry experts revealed a number of opportunities for business attraction to the region. These steps are the **initial recommendations** that the region can follow up on to promote business attraction:

- **Inventory and market available sites.** The availability of shovel-ready, permit-ready sites with a minimum of 20 available acres of flat land is one of the most critical location requirements for business expansion and attraction. The region should actively promote existing sites to prospective companies and location advisors within the ethylene supply-chain.
- **Market other key assets.** Other key assets, including market proximity, skilled workforce, transportation (rail, highway, and river), energy, existing supply-chain, incentives and support programs, and educational resources should be actively documented and promoted.
- **Continue to develop transportation infrastructure.** Roads, river and rail are all very important for future development. Thus, maintaining and expanding the transportation infrastructure will be critical for future growth within the ethylene supply chain.
- **Document labor and workforce skills.** Another critical location requirement is the availability of skilled labor. Begin and continue to prepare the workforce – including for early opportunities around site development, construction, hospitality as well as for opportunities that will result from the cracker itself and the related supply chain –gas, plastics, resins, chemicals, and logistics. Bring together economic and workforce development as well as education and training partners for this effort and develop specific projects to prepare the workforce.

- **Collaboration between MOVRC, BHHVRDD, member counties,** and other stakeholders. Many partners and stakeholder exist that are already doing this work for economic, workforce, and community development in general and also specifically within these targeted sectors related to the ethane cracker opportunity. It is paramount that the entities work together, leverage resources, and don't duplicate work. Establish a coalition or alliance specifically around this opportunity that cuts across counties and both states (West VA an Ohio) and:
 - Develop protocols for business attraction and expansion specifically as to how this will be done
 - Develop shared information and marketing resources that can be utilized by the partners/stakeholders to support business and workforce expansion and attraction. Focus on digital resources including web site/pages; newsletters/blogs, and social media
 - Kick-off the coalition/alliance at a convening event brining attention to the effort and opportunities
 - Continue to work with companies within the region to strengthen existing networks, such as the Polymer Alliance Zone

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Introduction

In the fall of 2013, Odebrecht informed officials that Wood County had been chosen as the site of a proposed ethane cracker project. If completed, the project would be an economic boon to the area; analyses suggest short term economic impacts of over two billion dollars⁴ and area business owners predict a jobs multiplier effect as high as 20 to 1.⁵ This study focuses on the supply chain needs generated by an ethane cracker, primarily focusing on the supply chain of ethylene, the end product of the cracking process.

Methodology

The market research component of the project includes the following components:

- An analysis of the industries and supply chain that relate to the cracking of natural gas
- The identification of three existing ethane crackers, including an analysis of the types of companies within the supply chain that are located within the comparison regions
- In-depth market research on industries within the supply chain
- Interviews with companies, regional economic development organizations, site selectors and industry experts
- A supply leakage analysis of the supply chain within Wood County and the MOVRC & BHHVRDD regions to better understand existing companies that may benefit, as well as those not yet present in the region that could potentially be targets for business attraction
- Recommendations

The region included in the study is defined as the 16 counties in West Virginia and Ohio located along the Ohio River within the Mid-Ohio Valley Regional Council (MOVRC)⁶ and the Buckeye Hills-Hocking Valley Regional Development District (BHHVRDD).⁷

A Note on Data Sources

All data and statistics used in this report were sourced from Economic Modeling Specialists Intl. (EMSI) 2014 data, unless otherwise noted. EMSI compiles data from a variety of federal, state, and private data sources. Projections are backwards-looking, which means that future projections are partially based upon 15-year trends and may not accurately predict real-time demand. Therefore, it will be critical to update projections, confirm employer demand, and assess workforce requirement on a regular basis. For more information about EMSI, see Appendix A.

⁴ Witt Economics LLC study

⁵ Interview Citation needed

⁶ Includes West Virginia counties: Calhoun County, Jackson County, Pleasants County, Ritchie County, Roane County, Tyler County, Wirt County, and Wood County.

⁷ Includes Ohio counties: Athens County, Hocking County, Meigs County, Monroe County, Morgan County, Noble County, Perry County, and Washington County.

Part 1 – Identifying the Supply Chain

MOVRC and BHHVRDD Economic Base

The MOVRC and BHHVRDD counties in southeast Ohio and northwest West Virginia are home to over 430,000 people. The combined MOVRC/BHHVRDD region has approximately 146,500 jobs and an unemployment rate around 7.3 percent. Overall, the workforce is aging, with declines in every age group under the age of 50 in the past 10 years.

The table below shows the economic base of the MOVRC and BHHVRDD regions. Highlighted cells indicate sectors with a national location quotient greater than 1.2 (i.e. the share of jobs represented by a certain sector is at least 1.2 times the share at the national level). In both regions, the national LQ for Mining, Quarrying, and Oil and Gas Extraction was 3.68, the highest of all sectors.

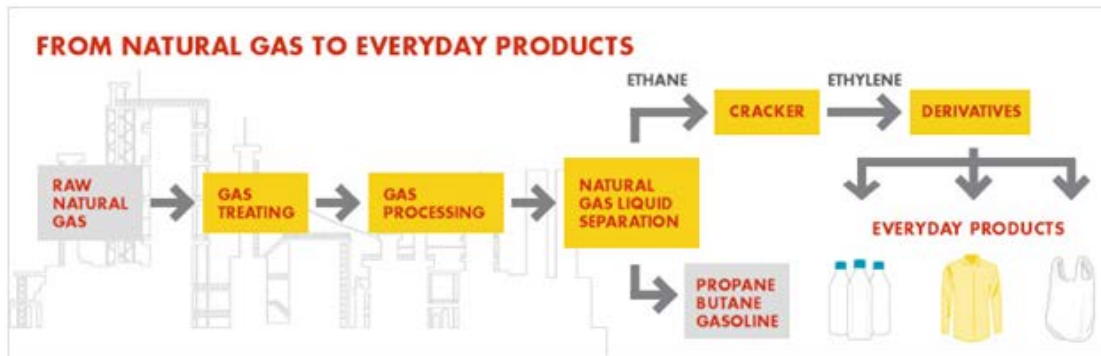
Utilities was the second most concentrated sector in both regions, with an LQ of 1.83 in the MOVRC region and 1.68 in the BHHVRDD region. Retail; Health Care and Social Assistance; and Manufacturing were the other MOVRC industries with high location quotients. For Ohio, Government and Construction were highly concentrated.

Economic Base, 2014							
NAICS	Description	Jobs		% of Total Jobs		National LQ	
		MOVRC	BHHVRDD	MOVRC	BHHVRDD	MOVRC	BHHVRDD
11	Agriculture, Forestry, Fishing, and Hunting	128	654	0.2%	0.8%	0.16	0.66
21	Mining, Quarrying, and Oil and Gas Extraction	1,382	1,691	2.1%	2.1%	3.68	3.68
22	Utilities	432	485	0.7%	0.6%	1.83	1.68
23	Construction	3,305	5,393	5.0%	6.7%	0.98	1.30
31	Manufacturing	6,476	7,213	9.8%	8.9%	1.22	1.11
42	Wholesale Trade	1,280	1,715	1.9%	2.1%	0.49	0.54
44	Retail Trade	9,166	9,244	13.9%	11.5%	1.33	1.09
48	Transportation and Warehousing	1,928	1,936	2.9%	2.4%	0.90	0.74
51	Information	1,039	566	1.6%	0.7%	0.86	0.38
52	Finance and Insurance	2,521	2,172	3.8%	2.7%	0.95	0.67
53	Real Estate and Rental and Leasing	632	843	1.0%	1.0%	0.58	0.63
54	Professional, Scientific, and Technical Services	1,631	1,968	2.5%	2.4%	0.39	0.39
55	Management of Companies and Enterprises	279	549	0.4%	0.7%	0.30	0.49
56	Administrative and Support	3,069	2,348	4.7%	2.9%	0.74	0.46
61	Educational Services	786	1,551	1.2%	1.9%	0.47	0.77
62	Health Care and Social Assistance	10,511	11,079	15.9%	13.7%	1.29	1.11
71	Arts, Entertainment, and Recreation	708	372	1.1%	0.5%	0.65	0.28
72	Accommodation and Food Services	5,678	7,282	8.6%	9.0%	1.04	1.09
81	Other Services (except Public Administration)	3,082	3,568	4.7%	4.4%	0.98	0.93
90	Government	11,865	19,962	18.0%	24.8%	1.14	1.57
99	Unclassified Industry	27	15	0.0%	0.0%	0.36	0.17
		65,921	80,607	100.0%	100.0%		

Source: EMSI Complete Employment Data 2014.3 Class of Worker

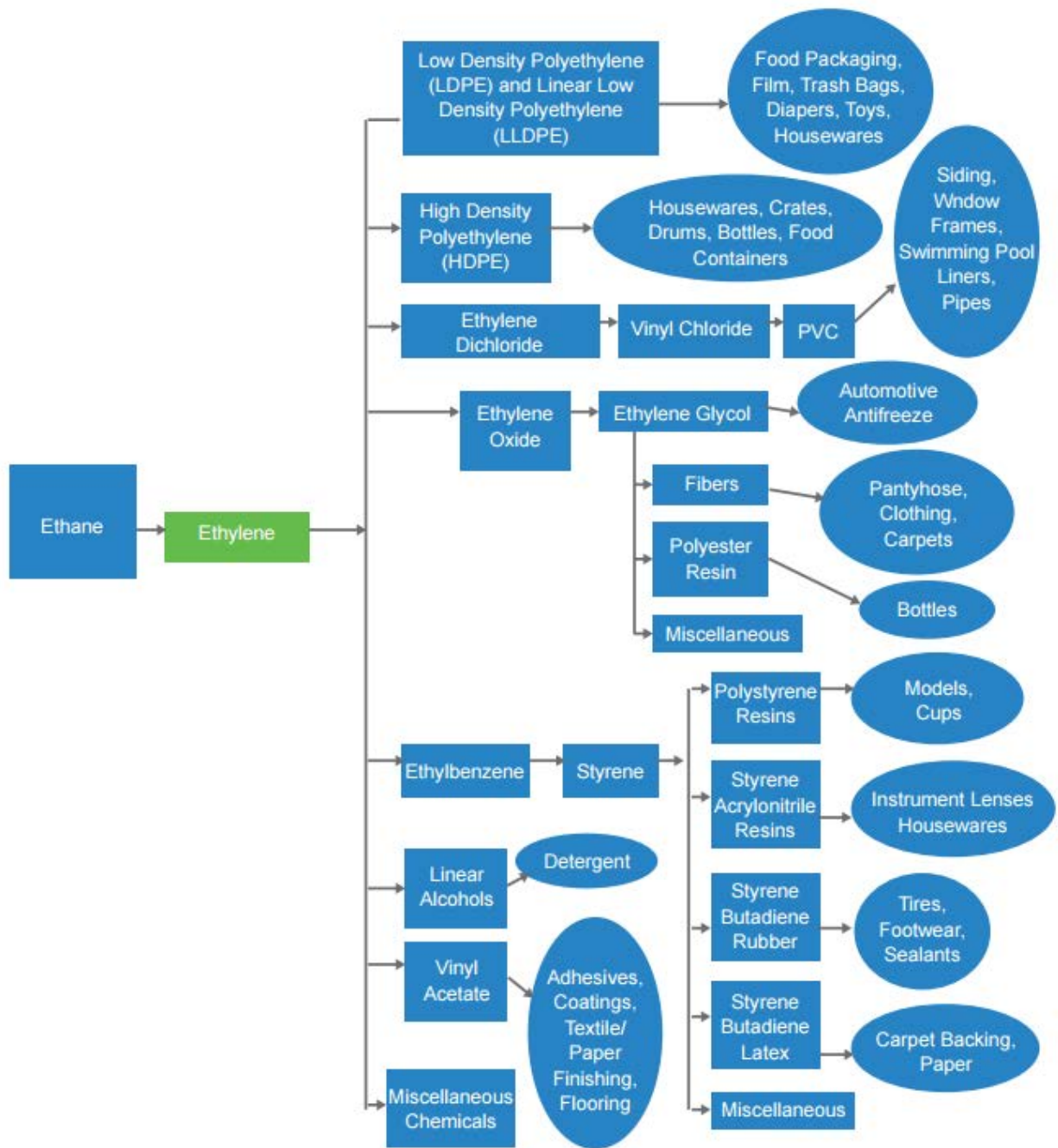
Ethane Cracking

The proposed ASCENT cracker will extract natural gas from the Marcellus Shale, and then process ethane, a natural gas liquid, into ethylene. This process is accomplished through cracking where ethane is heated to a point where it “cracks” into ethylene. Natural gas extracted from the Marcellus Shale can also be processed into propane, butane, and gasoline; however, with the proposed polyethylene plants, it is likely that the main purpose for the ASCENT cracker will be to crack ethane into ethylene. The chart below outlines the process of extracting raw natural gas and processing it into ethylene:⁸



Ethylene is a major building block for numerous consumer and industrial products including everyday items such as plastics bags, plastic bottles, and diapers. End products also include antifreeze, detergent, clothing, and housing materials with a more comprehensive diagram on the following page.

⁸ Alaska Natural Gas Transportation Products



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

Polyethylene

An important intermediate product that is produced from ethylene is polyethylene – the main product that will be produced by the cracker. Polyethylene or polymer resins are used in the production of downstream plastics products, particularly packaging and film materials. **Downstream plastics industries represent a significant opportunity for the region.**

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.

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. If this were to occur, it is likely the distance between suppliers and end customers will shorten as suppliers **locate near raw material production in the West Virginia region.**⁹

Ethylene Supply Chain Industries

As ethylene is the primary product that will be produced by the cracker, we focused our research on the ethylene supply chain. Using the research gathered surrounding the ethylene supply chain, we identified the 6-digit NAICS codes that relate to the various industries that make up the supply chain. These industries can be divided into five primary groups:

- **Oil and Gas Extraction** – Industries in the supply chain are upstream of cracking and extract natural gas and natural gas liquids and execute well drilling and support activities for oil and gas operations.
- **Chemical Manufacturing** – Industries within this group manufacture a variety of chemical products using ethylene and its derivatives. These products include polyethylene, ethylbenzene, styrene, ethyl alcohol, vinyl chloride, PVC, fibers, adhesives, detergents, and others. Ethane cracking itself falls within this category.
- **Plastics and Rubber Products Manufacturing** – This grouping includes industries that manufacture plastics and rubber products such as bags, film, pipes, bottles, tires, and more using ethylene-derived inputs.
- **Wholesalers** – This group includes wholesalers that buy and sell chemicals and plastics derived from ethylene.
- **Transportation and Warehousing** – This group includes firms involved in the transport and storage of products at all stages in the supply chain, including natural gas, ethane, chemicals, and plastics. Pipeline transportation as well as traditional freight transportation are included.

⁹A Renaissance for the Plastics Industry, www.expansionsolutionsmagazine.com, K. John Gutshaw and David S. Laszlo, Wadley Donovan Gutshaw Consulting.

Within the ethylene supply chain, certain industries already have a strong presence in the region. The table below shows the top 10 industries by total number of jobs in the ethylene supply chain:

NAICS	Industry	MOVRC 2014 Jobs	BHHVRDD 2014 jobs	Combined jobs
325211	Plastics Material and Resin Manufacturing	1,885	779	2,664
326199	All Other Plastics Product Manufacturing	1,182	150	1,332
213112	Support Activities for Oil and Gas Operations	746	382	1,128
484121	General Freight Trucking, Long Distance, Truckload	256	554	810
211111	Crude Petroleum and Natural Gas Extraction	400	272	672
493110	General Warehousing and Storage	440	136	576
213111	Drilling Oil and Gas Wells	158	351	509
484110	General Freight Trucking, Local	175	270	445
484220	Specialized Freight (except Used Goods) Trucking, Local	197	228	425
484230	Specialized Freight (except Used Goods) Trucking, Long Distance	43	260	303

For additional information on industries in the ethylene supply chain, please see Appendix B.

Comparison Regions

The analysis team selected three regions with ethane cracker facilities to use as models for how the MOVRC region might approach attracting the various industries that are part of the ethylene supply chain. As shown in the map below, the majority of ethane crackers are clustered in the U.S. Gulf Coast region. Only three ethane crackers in the U.S. are outside of this region. Of those, analysis focused on the two using the same feedstock (ethane) as what is proposed for the ASCENT project, along with a third facility from the Gulf Coast, based on similarities in production capacity. Chosen comparison sites include:

1. Grundy County, Illinois
2. Clinton County, Iowa
3. Orange County, Texas

Each is described in greater detail on the following pages.



Grundey County, Illinois

Grundey County, Illinois, is home to an ethane cracker facility owned by Equistar Chemicals, a wholly owned subsidiary of LyondellBasell Industries. Equistar is one of the largest producers of ethylene and polyethylene in North America. The ethane cracker is part of a larger complex located just outside the city of Morris, on the outskirts of the Chicago metropolitan area.

Covering nearly 670 acres, the Morris Complex is one of the largest in the Midwest. The ethane cracker has a capacity of about 606,000 tons per year and uses a feedstock of 80% ethane and 20% propane. In addition to the ethane cracker, there are facilities onsite for the conversion of ethylene into polyethylene plastic resins.

The plant opened in 1969 and has over 300 employees and contractors. Several other facilities related to the ethylene supply chain have clustered around the Morris Complex since its establishment:¹⁰

- A&R Logistics opened across the street from Equistar in the same year to truck specialty plastics products to and from the cracker.
- In 1973, Dutch company AkzoNobel opened a plant to make chemicals for paints, fabric softeners, and agriculture, and purchases steam and other products from Equistar.
- Morris Cogeneration was built in the area in 1998 to turn natural gas and waste gas from the cracker into steam and electric power for Equistar and other customers.
- Canadian companies Enbridge Inc. and Veresen Inc. and Oklahoma-based The Williams Companies Inc. spent several hundred million dollars to build a gas processing plant next door, in part taking ethane from gas and sending it to Equistar. The joint-venture company is called Aux Sable Liquid Products, Inc.

Clinton County, Iowa

Clinton County, Iowa, is home to another ethane cracker facility owned and operated by Equistar Chemicals. The cracker is part of the company's Clinton Complex in the city of Clinton. The city is located on the Mississippi River about 40 miles northeast of Davenport.

The Clinton Complex is about 239 acres. Similar to the company's Morris Complex in Illinois, the plant manufactures ethylene, which is then converted into polyethylene plastic resins. The facility has a capacity of 525,000 tons per year and uses a feedstock of 80% ethane and 20% propane. There are more than 400 employees and contractors on-site.

Orange County, Texas

The third ethane cracker facility being studied is located in Orange County, Texas, and is operated by DuPont. The cracker is part of DuPont's Sabine River Works plant and has a capacity of about 520,000 tons per year and uses a 100% ethane feedstock.

Orange County is located in southeastern Texas on the Louisiana border, and together with Beaumont and Port Arthur is part of the Golden Triangle area, a region that has been historically linked with oil, natural gas, and petrochemical industries. The ethane cracker is one of several dozen located on the Gulf Coast, the U.S. hub for activities related to oil and gas production.

¹⁰ http://triblive.com/x/pittsburghtrib/news/regional/s_782369.html#axzz3KIRGATCm

Regional Employment Comparison

Generally, the three comparison counties were similar in employment for the broadest industry categories, with subtle differences shown in the table below.

County Economic Base Comparison, 2014									
NAICS	Description	Wood County, West Virginia		Grundy County, Illinois		Clinton County, Iowa		Orange County, Texas	
		Number of Jobs	Percent of Total	Number of Jobs	Percent of Total	Number of Jobs	Percent of Total	Number of Jobs	Percent of Total
11	Crop and Animal Production	25	0%	148	1%	290	1%	56	0%
21	Mining, Quarrying, and Oil and Gas Extraction	100	0%	20	0%	132	0%	422	2%
22	Utilities	109	0%	1,597	9%	110	0%	122	0%
23	Construction	1,899	5%	1,784	10%	1,003	3%	2,477	10%
31	Manufacturing	2,983	7%	1,286	7%	4,850	16%	5,191	20%
42	Wholesale Trade	791	2%	743	4%	526	2%	823	3%
44	Retail Trade	6,436	15%	2,260	12%	2,626	8%	3,299	13%
48	Transportation and Warehousing	1,225	3%	1,094	6%	1,088	3%	649	2%
51	Information	850	2%	109	1%	278	1%	100	0%
52	Finance and Insurance	1,784	4%	423	2%	725	2%	885	3%
53	Real Estate and Rental and Leasing	453	1%	186	1%	178	1%	284	1%
54	Professional, Scientific, and Technical Services	1,014	2%	532	3%	352	1%	707	3%
55	Management of Companies and Enterprises	264	1%	<10	-	92	0%	65	0%
56	Admin/Support and Waste Mgmt/Remediation Svcs	2,332	6%	661	4%	1,814	6%	908	3%
61	Educational Services	733	2%	252	1%	7,353	24%	156	1%
62	Health Care and Social Assistance	6,919	17%	2,147	12%	3,559	11%	1,612	6%
71	Arts, Entertainment, and Recreation	549	1%	238	1%	498	2%	245	1%
72	Accommodation and Food Services	4,126	10%	1,496	8%	1,798	6%	2,146	8%
81	Other Services (except Public Administration)	2,146	5%	734	4%	1,191	4%	1,453	6%
90	Government	6,825	16%	2,718	15%	2,807	9%	4,435	17%
99	Unclassified Industry	22	0%	43	0%	-	0%	<10	-
	Total	41,585	100%	18,482	100%	31,273	100%	26,037	100%

Source: EMSI

= share is more than 5 percentage points higher than Wood County share
 = share is more than 5 percentage points lower than Wood County share

The project team also compared and contrasted the current employment within the Ethane supply chain for MOVRC, BHHVRDD, Clinton County, Grundy County and Orange County. For the most part, the various industries within the comparison regions differed, but points of similarity are noted in key ethane supply chain industries.

Presence of Jobs in the Ethane Supply Chain by County					
Industry	MOVRC	BHHVRDD	Grundy	Clinton	Orange
Oil and Gas Extraction	✓	✓			✓
All Other Basic Organic Chemical Manufacturing	✓	✓		✓	✓
Plastics Material and Resin Manufacturing	✓	✓	✓	✓	✓
Custom Compounding of Purchased Resins	✓		✓	✓	
All Other Misc. Chemical Product and Preparation Manufacturing			✓		✓
Unlaminated Plastics Film and Sheet Manufacturing				✓	✓
All Other Plastics Product Manufacturing	✓	✓		✓	
Freight Transportation Arrangement		✓	✓		
Petroleum and Petroleum Products Merchant Wholesalers	✓	✓	✓	✓	✓
Rail Transportation	✓	✓	✓	✓	✓
All Trucking Sectors	✓	✓	✓	✓	✓
Pipeline Transportation of Natural Gas	✓	✓	✓	✓	✓
Support Activities for Rail Transportation	✓	✓	✓	✓	✓

Supply Leakage Analysis

A supply leakage analysis shows the amount of money an industry spends on its top resource requirements, as well as the proportion spent inside the region as compared to outside of the region. Due to the planned construction of the three polyethylene facilities and a high prevalence of plastics in each of the comparison counties, the Plastics Material and Resin Manufacturing industry (NAICS 325211) was analyzed to identify any areas of weakness in the ethylene supply chain. For comparison, the analysis was run for both the MOVRC & BHHVRDD regions, as well as the three comparison regions of Grundy County, Clinton County, and Orange County. Ultimately, the supply leakage analysis provided guiding information for the types of industry targets to pursue.

The results of the input-output analysis can be seen on the next page.

	Grundy County, IL		Clinton County, IA		Orange County, TX		Wood County, WV		MOVRC/BHVRDD Counties	
Industry	Amount (M)	Out of Region	Amount (M)	Out of Region	Amount (M)	Out of Region	Amount (M)	Out of Region	Amount (M)	Out of Region
All Other Basic Organic Chemical Manufacturing	\$118.5	100.0%	\$93.2	80.0%	\$64.4	13.1%	\$358.7	94.3%	\$625.9	86.7%
Petrochemical Manufacturing	\$109.7	100.0%	\$86.3	100.0%	\$59.6	100.0%	\$318.4	100.0%	\$579.5	97.9%
Plastics Material and Resin Manufacturing	\$46.0	40.8%	\$36.2	44.9%	\$25.0	51.9%	\$136.2	18.5%	\$242.8	19.1%
Petroleum Refineries	\$34.0	92.3%	\$26.8	58.2%	\$18.5	100.0%	\$102.0	100.0%	\$179.8	99.0%
Corporate, Subsidiary, and Regional Managing Offices	\$26.3	99.2%	\$20.7	98.7%	\$14.3	99.0%	\$84.2	95.0%	\$138.9	97.6%
Ethyl Alcohol Manufacturing	\$26.1	100.0%	\$20.5	100.0%	\$14.2	100.0%	\$79.2	100.0%	\$137.9	99.8%
Other Basic Inorganic Chemical Manufacturing	\$12.3	100.0%	\$9.7	97.0%	\$6.7	86.6%	\$37.4	96.5%	\$64.8	87.7%
Rail transportation	\$10.8	84.8%	\$8.5	81.7%	\$5.9	81.4%	\$32.7	73.8%	\$56.9	82.4%
Cyclic Crude, Intermediate, and Gum and Wood Chemical Manufacturing	\$7.4	100.0%	\$5.8	100.0%	\$4.0	100.0%	\$22.6	100.0%	\$39.2	100.0%
Wholesale Trade Agents and Brokers	\$6.1	95.0%	\$4.8	92.1%	\$3.3	95.2%	\$17.9	85.9%	\$32.2	87.4%
Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	\$5.6	100.0%	\$4.4	82.1%	\$3.0	99.2%	\$17.8	24.3%	\$29.4	54.8%
Wet Corn Milling	\$5.3	100.0%	\$4.2	0.1%	\$2.9	100.0%	\$16.1	100.0%	\$27.9	100.0%
Natural Gas Distribution	\$4.0	48.4%	\$3.1	96.1%	\$2.2	98.6%	\$11.6	24.4%	\$20.9	21.0%
All Other Plastics Product Manufacturing	\$3.1	99.4%	\$2.5	80.0%	\$1.7	99.6%	\$9.5	91.6%	\$16.6	88.5%
General Freight Trucking, Long-Distance, Truckload	\$2.9	86.2%	\$2.3	80.2%	\$1.6	82.5%	\$8.7	64.2%	\$15.5	60.5%
Electric Power Distribution	\$2.6	100.0%	\$2.0	78.4%	\$1.4	94.2%	\$8.1	60.5%	\$13.6	45.2%
Computer and Computer Peripheral Equipment and Software Merchant Wholesalers	\$2.1	99.7%	\$1.6	100.0%	\$1.1	99.8%	\$6.1	99.7%	\$10.9	99.7%
Crude Petroleum and Natural Gas Extraction	\$2.0	100.0%	\$1.6	99.5%	\$1.1	98.4%	\$5.1	96.4%	\$10.8	93.8%
Corrugated and Solid Fiber Box Manufacturing	\$1.9	100.0%	\$1.5	85.1%	\$1.0	100.0%	\$5.8	100.0%	\$9.9	100.0%
Industrial Machinery and Equipment Merchant Wholesalers	\$1.7	97.2%	\$1.3	88.4%	\$0.9	40.1%	\$4.9	47.6%	\$8.8	33.0%
Scheduled Passenger Air Transportation	\$1.6	99.6%	\$1.3	100.0%	\$0.9	99.9%	\$5.0	98.4% ¹¹	\$8.8	99.0%
Machine Shops	\$1.6	97.1%	\$1.3	96.6%	\$0.9	91.6%	\$4.7	97.8%	\$8.5	96.8%
Drugs and Druggists' Sundries Merchant Wholesalers	\$1.5	100.0%	\$1.2	99.6%	\$0.8	99.2%	\$4.5	98.7%	\$8.1	99.0%
Fossil Fuel Electric Power Generation	\$1.4	100.0%	\$1.1	39.2%	\$0.7	100.0%	\$4.3	100.0%	\$7.3	15.2%
General Freight Trucking, Local	\$1.4	79.4%	\$1.1	75.8%	\$0.7	90.7%	\$4.0	71.2% ¹²	\$7.2	67.4%

¹¹ These four industries presented out of order to match other datasets

¹² Preceded by 325120 Industrial Gas Manufacturing (\$4.3M) and 551112 Offices of Other Holding Companies (\$4.2M)

At its root, the supply chain for plastics manufacturing is the same in the targeted regions as it is in the comparison counties. The top twenty-five supply industries for plastics manufacturing in the area were the same as those in each of the three comparison counties. The percentage supplied from within the region as compared to the percentage brought in from outside of the region was also very similar across the board, with one or two outliers in which one county spent a markedly larger amount within the county (i.e. “All Other Basic Organic Chemical Manufacturing” for Orange County and “Petroleum Refineries” for Clinton County). Thus, **no significant supply chain gaps were identified.**

Plastics manufacturing currently provides hundreds of jobs to each of the counties. The table below provides the number of jobs in the Plastics and Material Resin Manufacturing industry in each of the comparison counties as well as the target region.

Jobs in Plastics Material and Resin Manufacturing 325211, 2004-2014							
County Name	2004 Jobs	2014 Jobs	'04 – '14 Change	'04 – '14 % Change	2014 Location Quotient	Competitive Effect (CE)	Current Total Earnings
MOVRC/BHHVRDD Counties	3,418	2,665	-753	-22%	--	-628	\$125,071
Wood County, WV	2,335	1,351	-984	-42%	88.74	-898	\$127,151
Grundy County, IL	584	421	-163	-28%	62.24	(141)	\$149,323
Clinton County, IA	349	342	-7	-2%	29.84	5	\$151,028
Orange County, TX	644	253	-391	-61%	26.52	(368)	\$133,328

Each county has its own strength within the plastics production industry in terms of share of the workforce. The top plastics industry for each county can be seen in the table below:

Largest Polyethylene Related Industry in each County by Number of Jobs (2014)						
County	Description	2014 Jobs	'04 -'14 Change	'04 -'14 % Change	CE	2014 Location Quotient
MOVRC/BHHVRDD Counties	Plastics Material and Resin Manufacturing (325211)	2,665	-753	-22%	-628	49.67
Wood County, WV	Plastics Material and Resin Manufacturing (325211)90	2,335	-984	-42%	-898	88.74
Orange County, TX	All Other Basic Organic Chemical Manufacturing (325199)	1,204	319	36%	240	196.25
Clinton County, IA	All Other Plastics Product Manufacturing (326199)	846	278	49%	394	15.01
Grundy County, IL	Plastics Material and Resin Manufacturing (325211)	421	-163	-28%	-141	62.24

Part 2 – Target Industry Recommendations

Summary

Based on market research, the best opportunities for business attraction for the region are found in chemical and plastics manufacturing. Below are the specific industry sectors by five-digit NAICS code. Additional information, including detailed industry description and rationale are included in this section.

Primary Industry Targets for Attraction	
Chemical Manufacturing	Plastics Manufacturing
32511 – Petrochemical Manufacturing	32611 – Plastic Film, Sheet & Bag Manufacturing
32519 – Organic Chemical Manufacturing	32612 – Plastic Pipe & Parts Manufacturing
32521 – Plastics & Resin Manufacturing	32613 – Laminated Plastic Manufacturing
32552 – Adhesive Manufacturing	32616 – Plastic Bottle Manufacturing
42469 – Chemical Wholesaling	32619 – Miscellaneous Plastics Products
	42461 – Plastics Wholesaling

Several companies within the ethylene supply chain currently exist in the region. The project team recommends developing a business and retention list for existing companies within the industries defined throughout this section.

In addition, **short-term impacts to the region will occur during construction of the cracker.** The following industries are within the supply chain for natural gas extraction, and regional companies within these sectors represent additional opportunities for business retention and expansion.

- 213112 – Support Activities for Oil and Gas Operations
- 221210 – Natural Gas Distribution
- 238210 – Electrical Contractors and Other Wiring Installation Contractors
- 238220 – Plumbing, Heating, and Air-Conditioning Contractors
- 333132 – Oil and Gas Field Machinery and Equipment Manufacturing
- 486210 – Pipeline Transportation of Natural Gas
- 532412 – Construction, Mining, and Forestry Machinery and Equipment Rental and Leasing
- 532490 – Other Commercial and Industrial Machinery Equipment Rental and Leasing
- 541330 – Engineering Services

A summary of all of these industries can be found in the table on the next page.

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		

Market Research

Market research was conducted on five industry areas: Plastics and Rubber Manufacturing, Chemical Manufacturing, Transportation and Warehousing, Wholesalers, and Oil and Gas Extraction. For the sake of presentation, the Transportation and Warehousing cluster and the Wholesalers cluster were combined into one group. Analysis included 35 NAICS codes using IBIS World research with results separated out by grouping.

Industries with these four areas are prioritized below into three groups: primary targets, secondary targets, and tertiary targets.

- *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.

For complete business data and market analysis see Appendix C.

Primary Targets

Chemicals

32511 – Petrochemical Manufacturing

This industry manufactures petrochemicals, which are chemicals derived from refined petroleum or liquid hydrocarbons. Key products include ethylene, propylene, butylene, benzene, toluene, styrene, xylene, ethyl benzene and cumene. These products are used in the production of consumer products, automotive components and various durable and non-durable goods. This industry was included because:

- Ethane is a key product
- Part of polyethylene resin supply chain
- Basic chemicals manufactured from liquid hydrocarbons are included in this category. While ethane is the primary emphasis, other chemicals such as butane, propane and pentane can be produced from natural gas
- Will experience rise in demand as key downstream industries increase purchases
- Retention and business attraction target

32519 – Organic Chemical Manufacturing including 325193 – Ethyl Alcohol; 325194 – Cyclic Crude, Intermediate, and Gum and Wood Chemical Manufacturing; and 325199 – All Other Basic Organic Chemical Manufacturing

This industry manufactures basic organic chemicals (other than petrochemicals), industrial gases and synthetic dyes and pigments. Key product /groups include gum and wood products, cyclic crudes and intermediates, ethyl alcohol and other basic organic chemicals. These products are predominantly

intermediates that are used as raw material inputs by other manufacturing industries in the production of downstream products. This industry was included because:

- Part of polyethylene resin supply chain
- Industry is expected to experience an increase in demand as key buy markets such as cosmetic and beauty products, plastics and rubber manufacturing increase purchases
- Exports are expected to rise
- The region is within close proximity to Ohio and Illinois, which have a large number of companies within this industry
- Retention and business attraction target

32521 – Plastic & Resin Manufacturing including 325211 – Plastics Material and Resin Manufacturing and 325212 – Synthetic Rubber Manufacturing

This industry is composed of establishments that primarily manufacture resins, plastic materials (i.e. polymers) and synthetic rubber. Key product groups include thermosetting resins, thermoplastic resins and synthetic rubber. Raw material inputs are sourced from other components within the chemical industry and industries involved in the production of petroleum-based feedstock. This industry was included because:

- Major product is polyethylene, which is the key product that will be produced by the proposed cracker
- Part of polyethylene resin supply chain
- Products are used in construction and several downstream manufacturing industries. Continued recovery in these industries should increase demand
- Retention and business attraction target

32552 – Adhesive Manufacturing

This industry manufactures adhesives, glues and caulking compounds. Adhesives are materials that are initially fluid or semifluid, but when placed between two opposing solid materials, they become solids. They bond to the surfaces they are applied to and prevent joint movement. This industry excludes asphalt, dental and gypsum-based adhesives. This industry was included because:

- Plastic & resin manufacturing is a key input for this industry sector
- The automotive and aerospace industries are key purchasers of adhesives. The region is within close proximity to the automotive industry in Michigan and Ohio.
- Ohio and Illinois both have a higher percentage of companies within this industry
- Retention and business attraction target

42469 – Chemical Wholesaling

This industry wholesales chemicals and related products, including compressed gas, chemical additives and synthetic rubber, to the manufacturing, construction and mining industries. This industry does not wholesale agricultural or medicinal chemicals, paints or varnishes, fireworks or plastics materials. This industry was included because:

- Part of polyethylene supply chain
- Supports manufacturing
- Demand from end users will lead to industry growth

Plastics

32611 – Plastic Film, Sheet, & Bag Manufacturing including 326111 – Plastics Bag and Pouch Manufacturing; 326112 – Plastics Packaging Film and Sheet (including Laminated) Manufacturing; and 326113 – Unlaminated Plastics Film and Sheet (except Packaging) Manufacturing

This industry converts plastic resins into various films, sheets and bags. Industry products are used by manufacturers for packing and storing products, by retailers for transporting merchandise, and by consumers for household purposes. Industry operators also form, coat or laminate plastic film and sheets into single-wall or multiwall plastic bags. This industry was included because:

- Organic chemical manufacturing and plastic resins are both key inputs for this industry so a manufacturer who locates in the region could potentially benefit from lower input costs
- This industry was identified multiple times through the interviews that companies would benefit from close proximity to a polyethylene supplier
- There is a strong cluster of companies within this industry in Ohio, Wisconsin and Illinois. Many of the downstream manufacturers who purchase these products are within the Upper Midwest as well.
- Retention and business attraction target

32612 – Plastic Pipe & Parts Manufacturing including 326121 – Unlaminated Plastics Profile Shape Manufacturing and 326122 – Plastics Pipe and Pipe Fitting Manufacturing

This industry manufactures a range of plastic pipes, plastic fittings for plastic pipes and unlaminated plastic profile shapes, such as rods, tubes, plates and car parts. This industry does not include plastic hose fixtures, plastic plumbing fixtures or plastic packaging. This industry was included because:

- Plastic resins are a key manufacturing input
- The construction industry, which is a key buyer of plastic pipe and parts, is expected to grow. Thus, demand for plastic pipes is expected to increase for construction and water supply and irrigation systems, as well as overall infrastructure construction
- The region is within close proximity to Pennsylvania, Ohio and Illinois which have high concentrations of companies within the industry, as well as to companies that are end users
- Retention and business attraction target

32613 – Laminated Plastic Manufacturing

Companies within this industry manufacture a range of laminated plastic shapes, plates and sheets. The lamination process generally involves bonding or impregnating profiles with plastics resins and compressing them under heat. Laminated plastic products are used for interior and exterior motor vehicle parts, consumer appliances and construction projects. This industry was included because:

- Plastic resins are a key manufacturing input
- The construction and automotive sectors are key buyers of laminated plastics
- The region is within close proximity to several companies within this industry, as well as to the automotive industry cluster in Michigan and Ohio

32616 – Plastic Bottle Manufacturing

Operators in this industry manufactures a range of bottles from various plastic compounds based on their end use. These bottles are then sold to beverage, food and chemical manufactures to use as packaging for soft drinks, milk, condiments and household and automotive chemicals. This industry does not manufacture reusable plastic bottles or other plastic containers. This industry was included because:

- Plastic resins are a key manufacturing input
- Multiple industries, including food, drink, household products, automotive and various industrial segments are key buyers
- The region is within close proximity to several companies within this industry, as well as to companies that are end users

32619 – Miscellaneous Plastics Products including 326191 – Plastics Plumbing Fixture Manufacturing and 326199 – All Other Plastics Manufacturing

This industry comprises companies that manufacture a range of plastic products; including housewares, building materials, motor vehicle parts, resilient floor coverings and appliance parts. This industry excludes plastic film, sheet, bags, profile shapes, pipes, pipe fittings, laminates, foam products and bottles. This industry was included because:

- Plastic resins are a key manufacturing input
- This is the largest segment within the plastics industry, so it is a key sector for targeting
- Products classified here are used in multiple downstream industries, including automotive, electrical equipment, construction, etc.
- The region is within close proximity to Ohio, Michigan and Illinois, all of which have several companies within this industry. The region is also home to several companies that are end users of these products

42461 – Plastics Wholesaling

This industry wholesales plastics materials and resins, and unsupported plastic film, sheet, sheeting, rod, tube and other basic forms and shapes. Products sold within the Plastics Wholesaling industry are sold to industrial manufacturers. Manufacturers use plastic products to manufacture durable goods. This industry was included because:

- Part of polyethylene supply chain
- Supports manufacturing
- Demand from end users will lead to industry growth

Secondary Targets

Secondary targets share similar characteristics to primary targets, but show slightly less strong indicators for progress.

32614 – Polystyrene Foam Manufacturing – Recent growth may be counteracted by stabilization in construction industries, slowing purchases and causing revenue to fall.

32615 – Urethane Foam Manufacturing – Industry is recovering and should be bolstered by increased housing starts, car manufacturing, residential construction, and overall consumer confidence.

32621 – Tire Manufacturing – New car sales and increased usage expected to boost industry.

32622 – Hose and Belt Manufacturing – Increases in manufacturing and consumer spending expected.

32629 – Rubber Product Manufacturing – U.S. auto industry expected to create increased demand.

32512 – Oxygen and Hydrogen Gas Manufacturing – Expected increases in US manufacturing and industrial output should boost industry.

32513 – Dye and Pigment Manufacturing – Housing and automotive sector demand will bolster this group.

32518 – Inorganic Chemical Manufacturing – Recovery in economy and downstream industries should coincide with growth in this industry, particularly due to housing, construction, paint, and glass manufacturing.

32532 – Synthetic Fiber Manufacturing – Industry expected to stabilize as industrial products and consumer goods recover.

32531 – Fertilizer Manufacturing – While short term growth is expected to be hindered by lower demand, long term growth is expected.

32532 – Pesticide Manufacturing – Growth expected to accelerate alongside of genetic modified plantings and use of other biotech seeds.

32551 – Paint Manufacturing – Demand will rise alongside construction activity.

32561 – Soap and Cleaning Compound Manufacturing – Consumer demand for brand-name soap and cleaning products will bolster industry.

32591 – Ink Manufacturing – Rising input costs and declining print circulation present difficulties for this industry.

32592 – Explosives Manufacturing – Lower input prices and increased demand from metal mining will help to grow industry.

32599 – Chemical Product Manufacturing – Industry will continue to expand slowly.

Tertiary Targets

Tertiary targets may or may not improve with the presence of a cracker, but accompany industries which do show promise or could grow with favorable macroeconomic trends. Additionally, some of these industries show promise for growth but face large barriers to entry.

32541A – Pharmaceutical Manufacturing – Industry demand expected to grow due to increased consumer demand for biological drugs.

32562 – Cosmetic and Beauty Products Manufacturing – No significant change in demand is projected for the next five years.

42471 – Gasoline and Petroleum Bulk Stations – Growth will continue but rate expected to slow.

42472 – Gasoline and Petroleum Wholesaling – Projected revenue increases.

48691 – Refined Petroleum Pipeline Transportation – Continued growth projection alongside growth of natural gas liquid production.

21111 – Oil Drilling and Gas Extraction – Projected growth.

21311 – Oil and Gas Field Services – Projected to perform strongly.

Targeting Recommendations for Business Retention and Expansion

In addition to the industries identified above, any regional company that is in the ethylene supply chain could potentially benefit from the presence of the ethane cracker. It is our recommendation to go beyond the industries identified above and develop a list of companies within the MOVRC and BHHVRDD regions that fall within the supply chain for the forthcoming business retention and expansion opportunities list.

Short-Term Impact/Recommendations

While not a primary focus of the study, there will be short-term impacts across the region related to the construction of the ethane cracker and associated polyethylene plants. A recent study done by Witt Economics LLC explored the potential economic impact of the construction of an ethane cracker. The construction impacts are as follows:

Projected Impacts of Ethane Cracker Construction			
Impact Type	Employment (job-years)	Employee Compensation (million)	Output (million)
Direct Effect	18,156	\$893	\$1,346
Indirect Effect	976	\$46	\$134
Induced Effect	5,087	\$178	\$563
Total Effect	24,118	\$1,116	\$2,043

Source: IMPLAN Group LLC, implan.com; (\$2012)¹³

¹³ Note: These numbers are not specifically tied to the planned ASCENT investment. Rather, they represent a generic project, with an estimated cost of \$3.8 billion, \$150 million in pipeline infrastructure, \$20 million in on-site

The short term impacts of the development and construction of the ethane cracker are significant, with the possibility of 25,000 full and part-time jobs over the estimated four-year period.

Several existing companies are likely to benefit short-term from the potential development and construction. Broadly, these companies are within the Construction, Engineering, Equipment Rental, Manufacturing, and Infrastructure industries.

In order to better understand regional companies that may benefit in the short-term from construction, we analyzed the existing supply chain for natural gas liquid extraction (NAICS 211112). **MOVRC and BHVRDD may want to consider identifying regional companies within these NAICS codes for the forthcoming business retention and expansion opportunities list.** Specific industries with a regional presence to consider include:

- 213112 – Support Activities for Oil and Gas Operations
- 221210 – Natural Gas Distribution
- 238210 – Electrical Contractors and Other Wiring Installation Contractors
- 238220 – Plumbing, Heating, and Air-Conditioning Contractors
- 333132 – Oil and Gas Field Machinery and Equipment Manufacturing
- 486210 – Pipeline Transportation of Natural Gas
- 532412 – Construction, Mining, and Forestry Machinery and Equipment Rental and Leasing
- 532490 – Other Commercial and Industrial Machinery Equipment Rental and Leasing
- 541330 – Engineering Services

Further analysis of the supply leakage within these industries can be found in appendix D.

ethane storage, and \$20 million in rail and truck terminals. These are also one-time impacts spread over an estimated four-year construction period.

Part 3 – Business Attraction and Expansion Recommendations

The proposed ethane cracker for Wood County will create numerous opportunities for the county and region within the ethylene supply chain. As a key product of the cracking process, ethylene provides the greatest tangible opportunity for business retention, attraction, and expansion that the proposed cracker has to offer. The production of ethylene will provide upstream and downstream opportunities in these sectors:

- Plastics/Polymers/Resins/Rubber and Related Manufacturing
- Chemical Manufacturing
- Transportation, Warehousing and Wholesalers

The following is an assessment of the **opportunities and constraints** for the MOVRC and BHVRDD region in attracting business investment through expansion and attraction related to the development of the ethane cracker and polyethylene manufacturing facilities. These opportunities and constraints were identified based on interviews with businesses, site selectors, economic development organizations, and other partners.

Based on this assessment, **initial recommendations** include the following:

- **Inventory and market available sites.** The availability of, shovel-ready, permit-ready sites with a minimum of 20 available acres of flat land is one of the most critical location requirements for business expansion and attraction. The region should actively promote existing sites to prospective companies and location advisors within the ethylene supply-chain.
- **Market other key assets.** Other key assets, including market proximity, skilled workforce, transportation (rail, highway, and river), energy, existing supply-chain, incentives and support programs, and educational resources should be actively documented and promoted.
- **Continue to develop transportation infrastructure.** Roads, river and rail are all very important for future development. Thus, maintaining and expanding the transportation infrastructure will be critical for future growth within the ethylene supply chain.
- **Document labor and workforce skills.** Another critical location requirement is the availability of skilled labor. Begin and continue to prepare the workforce – including for early opportunities around site development, construction, hospitality as well as for opportunities that will result from the cracker itself and the related supply chain –gas, plastics, resins, chemicals, and logistics. Bring together economic and workforce development as well as education and training partners for this effort and develop specific projects to prepare the workforce.
- **Collaboration between MOVRC, BHVRDD, member counties, and other stakeholders.** Many partners and stakeholder exist that are already doing this work for economic, workforce, and community development in general and also specifically within these targeted sectors related to the ethane cracker opportunity. It is paramount that the entities work together, leverage resources, and don't duplicate work. Establish a coalition or alliance specifically around this opportunity that cuts across counties and both states (West Virginia and Ohio) and:
 - Develop protocols for business attraction and expansion specifically as to how this will be done.
 - Develop shared information and marketing resources that can be utilized by the partners/stakeholders to support business and workforce expansion and attraction.

Focus on digital resources including web site/pages; newsletters/blogs, and social media.

- Kick-off the coalition/alliance at a convening event bringing attention to the effort and opportunities.
- Continue to work with companies within the region to strengthen existing networks, such as the Polymer Alliance Zone.

Considerations for Market Opportunities – Interview Results

Our research included multiple interviews with companies in the region, economic development organizations, trade associations, site selectors, and industry experts.¹⁴

The results of the interviews were used throughout to guide us to final recommendations regarding industry targets, as well as to develop the marketing positioning material. Below are aggregated highlights and findings from the interviews:

Perceived Strengths

- Due to the region’s Midwestern location, companies that locate in the region can easily reach large segments of the US population within one day.
- The labor force was described multiple times as hardworking and loyal.
- A secondary benefit of the proposed cracker will be significant improvements to existing infrastructure, primarily rail and road upgrades. This will help all businesses within the region
- Many ethylene plants are located on the gulf coast and in the hurricane zone. An ethane cracker within the West Virginia/Ohio region represents an opportunity to expand outside of the hurricane zone.
- The proposed cracker would stabilize and lower prices for polyethylene. Current transportation costs represent roughly 30% of polyethylene costs. With a local supplier, these costs would be much lower.
- All downstream manufacturing within the ethylene supply chain will benefit as the region will be more competitive.
- One interviewee mentioned that in addition to the 300 expected jobs, there could be a 20 to 1 multiplier effect throughout the region. In other words, the 300 initial jobs could turn into as many as 6,000 jobs within downstream manufacturing and support industries throughout the region.
- Small manufacturers may choose to locate near the cracker in order to get lower-cost access to ethylene.

Perceived Weaknesses

- Labor availability may be an issue. The number of available workers has been in decline, due to retirements, and not enough young workers are available to replace those jobs. Thus, the cracker may put a strain on workforce availability.
- The region’s mountainous geography limits the number of good manufacturing sites.
- The current proposed legislative activity around the regulation of above ground storage tanks in West Virginia may hinder location expansion.

¹⁴ Questions included, but were not limited to: How would the presence of an ethane cracker impact your business? What industries and companies are part of your supply chain? What gaps, if any, exist in the supply chain? What factors drive your location decisions? What are the strengths and challenges of operating a business within the region? What is the growth potential for companies within the ethylene supply chain? What will companies in the ethylene supply chain require in order to be competitive?

Key Investment Factors

Through interviews and discussions with local businesses, site selectors, and other important stakeholders, a list of **key factors** that drive investment and location decisions emerged, including:

- Proximity to Key Market and Suppliers
- Availability of Sites and Buildings for Development
- Workforce and Education
- Transportation and Logistics
- Energy and Utilities
- Taxes and Incentives
- Regulatory and Business Environment/Climate
- R&D/Innovation
- Resources

Proximity to Key Markets and Suppliers

Both West Virginia and Ohio are home to many existing polymer and chemical related manufacturing companies. Both are among the top ten states in the U.S. by number of these establishments. The region is **near major metropolitan areas** with existing manufacturing sectors that utilize plastics, polymers, resins, rubber, and chemicals. These include Cleveland, Columbus, and Cincinnati, Ohio, and Pittsburg, Pennsylvania. The region is **near both feedstock** (Natural Gas/Ethylene) as well as **customers** (other manufacturers). This creates a significant advantage for these manufacturing sectors **as it reduces shipping costs**. Key manufacturing sectors that would benefit include **automotive, aerospace, packaging and various consumer products**. If the proposed cracker comes on line, the price for feedstock in the region is likely to be more competitive, further making the region an attractive location for manufacturers.

Sites and Buildings

The availability of sites and buildings is a critical factor influencing investment. Companies and developers are constantly pushing for reduced development windows as additional time creates cost and lost opportunities. There are two types of sites required by manufacturers within the ethylene supply chain: 1) large sites for upstream operations and chemical manufacturers and 2) smaller sites for downstream, plastics manufacturers. Large sites for upstream operations and chemical manufacturers must be over 100 acres, have river access and not be in a flood plain. For downstream, plastics manufacturers sites that are a minimum of 20 acres are preferred. However, depending on the operation, some could require a site with a minimum of 10 acres. Other important factors include:

- **Speed to development** – sites must be readily available for development, shovel ready, with key infrastructure; pre-permitting is also ideal
- **Access to rail**
- Close proximity to **major highways**

The most promising large sites within the region are along both sides of the Ohio River. West Virginia has 6 sites over 100 acres and Ohio has 5 sites over 100 acres. West Virginia is limited in sites, due mainly to the geography of the region. Overall the river counties provide the best – and probably only viable – sites. With the exception of one county, each county on both sides along the river has at least

one site with river access. Moving away from the river, sites are quite sparse in the inland counties. The counties with the best available sites by size and river access are:

- Jackson, WV (Hoffman Farms, 118 acres; Jackson County Maritime and Industrial Centre, 64 acres; Jackson Crossing, 276 acres, no river; Fairhavens IV, 245 acres, no river; Casto Site, 508 acres, no river)
- Tyler, WV (Dominion Resources, 75 acres)
- Wood, WV (Erickson Site, 105 acres; Parkersburg Business Park Phase 2, 150 acres, no water)
- Monroe, OH (Center Port Terminal, 400 acres; Powhatan #4, 200 acres)
- Washington, OH (Orion-Industrial, 500 acres; Marietta River Site, 159 acres; Price Island Terminal, 160 acres)¹⁵

Both areas have smaller sites (20 acres or more) that would be suitable for downstream plastics manufacturing opportunities. However, most of these exist within the counties adjacent to the river.

Workforce and Education

The region offers several advantages to manufacturers including **labor quality, cost of labor, skills** that are a fit with the **targeted industries**, and the **availability of training and education programs** to support workforce talent and skills. The region is part of the strong polymer mega-region (Ohio, West Virginia, Pennsylvania) with strengths in bachelor and advanced degrees in engineering, chemistry, advanced materials as well as machinists and related trades. Other advantages within the immediate region include, **affordability of housing, low cost of living**, and a **strong presence of career and technical education**, along with other technical training, including union training centers and apprenticeships. The rural, low population density of the region around the site creates a potential challenge for workforce, with perceived limited workforce availability. The focus on workforce education, training, and availability will need to be increased and maintained in order to support expansion and attraction. Education resources include:

- West Virginia University at Parkersburg – which includes Certificate Program in Chemical & Operator Technology¹⁶
- Case Western Reserve Department of Macromolecular Science and Engineering¹⁷
- University of Akron – Maurice Morton Institute of Polymer Science and Polymer Engineering¹⁸
- Edison Polymer Innovation Corporation at Case Western and University of Akron¹⁹
- Institute for Materials Science at The Ohio State University²⁰
- Center for Macromolecular Engineering at Carnegie Mellon University²¹
- Marietta College in Marietta, Ohio – offers a four year degree in Petroleum Engineering²²

¹⁵ Source: www.wvcommerce.org and jobs-ohio.com/site-selection

¹⁶ www.wvup.edu/academics/programs-of-study/programs/

¹⁷ <http://engineering.case.edu/emac/>

¹⁸ <http://www.uakron.edu/ipspe/>

¹⁹ <http://engineering.case.edu/emac/facilities/epic.htm>

²⁰ <http://imr.osu.edu/>

²¹ www.chem.cmu.edu/groups/maty/center/

²² www.marietta.edu

Transportation and Logistics

The region is well positioned to a number of transportation opportunities including:

- **Road** – The region is well positioned with close proximity to major interstates including I-64, I-77, and I-79. This allows for quick and easy access to several large metropolitan areas, including Pittsburgh, PA and Columbus and Cleveland, OH.
- **Rail** – The region is served by both CSX and Norfolk Southern
- **Rivers** – access to Ohio River including sites with direct access
- **Ports** – the region is near several East Coast and Great Lake ports, but is at a comparative disadvantage to Gulf Coast competition in process chemicals. Chemical manufacturers along the gulf coast are within very close proximity to deep water ports that allow the exporting of large volumes of oil and gas products.

Energy and Utilities

The **availability** and **low price** of natural gas, particularly shale gas is an advantage. Natural gas can be used as both an energy source, as well as feedstock for various chemical products. Additionally, **electricity rates** in the area are competitive. According to the U.S. Energy Information Administration, November industrial electrical rates for WV were \$0.0588 per KWH. OH was \$0.062 – **one interviewee stated that off-peak demand was very inexpensive.**

Taxes and Incentives

Overall, West Virginia has a **fairly competitive tax environment**, especially regarding corporate tax rates. Ohio is very competitive when it comes to unemployment insurance. Ohio does not tax manufacturing equipment as part of property tax, which is a benefit.

	Overall Rank	Corporate Tax Rate	Individual Income Tax Rate	Sales Tax Rate	Unemployment Insurance Tax Rate	Property Tax Rate
Ohio	44	26	47	32	5	20
West Virginia	21	17	26	25	23	25

Source: Tax Foundation

Regulatory and Business Environment/Climate

The topic of regulatory and business environment brought out **mixed reviews** from interviewees. Some interviewees expressed concern that neither West Virginia nor Ohio are “right to work” states. Other interviewees mentioned that they perceive West Virginia as a strong labor union state. In terms of recruiting businesses and standing out to site selectors, both of these are perception issues that the region will need to address.

R&D/Innovation

This region is part of the strong polymer innovation region (Ohio, West Virginia, Pennsylvania) with strengths in polymer and related research and development. Specific resources for connections include: Case Western Reserve Department of Macromolecular Science and Engineering, University of Akron Maurice Morton Institute of Polymer Science and Polymer Engineering, Edison Polymer Innovation

Corporation at Case Western and University of Akron, Institute for Materials Science at Ohio State University, and the Center for Macromolecular Engineering at Carnegie Mellon University.

Other Resources

Many additional industry support resources exist in the region, including the Mid-Ohio Valley Regional Council²³, Buckeye Hills-Hocking Valley Regional Development District²⁴, Jobs Ohio²⁵, Appalachian Partnership for Economic Growth²⁶, West Virginia Development Office²⁷, West Virginia Advantages Related to Chemicals and Polymers from West Virginia Development Office²⁸, Ohio Development Services Agency²⁹, Polymer Alliance Zone³⁰, Chemical Alliance Zone³¹, and Polymer Ohio³².

²³ www.movrc.org

²⁴ www.buckeyehills.org

²⁵ jobs-ohio.com

²⁶ <http://apeg.com>

²⁷ www.wvcommerce.org/info/aboutcommerce/developmentoffice/default.aspx

²⁸ <http://www.wvcommerce.org/business/industries/chempoly/default.aspx>

²⁹ <http://development.ohio.gov/businessservices.htm>

³⁰ www.pazwv.org

³¹ www.cazwv.com

³² <http://polymerohio.org/>

Appendix A – About EMSI Analyst

EMSI Analyst provides in-depth and current local employment data, updated four times per year. To extrapolate data to the county and ZIP code level where it is otherwise unavailable, EMSI 2014.3 relies on more than 90 data sources, including the following: Bureau of Economic Analysis and U.S. Census Bureau from the U.S. Department of Commerce; Bureau of Labor Statistics and Employment and Training Administration (ETA) from the U.S. Department of Labor; and Integrated Postsecondary Education Data System (IPEDS), Common Core of Data (CCD), and Characteristics of Private Schools in the United States from the U.S. Department of Education, National Center for Education Statistics.

Typical labor market data ignores much of the economy. On average, about 35% of all county-level data is suppressed to hide firm-specific numbers. These datasets also generally exclude proprietors, understating the total number of workers by an average of 17%. In contrast, EMSI data removes suppressions and includes proprietors, creating a more complete picture of the regional workforce.

EMSI data provides the following advantages:

- **Detailed: Includes info on industries, occupations, demographics, wages, skills, education, training, companies, and more.**
- **Comprehensive: Over 90 federal, state, and private data sources brought together for quick analysis.**
- **Current: Updated four times per year by our team of full-time data analysts.**
- **Regional: Available for any county or individual ZIP code in the U.S.**
- **Accessible: Built into simple web-based tools so you can tap into the data quickly and efficiently.**

For more information visit www.economicmodeling.com.

Appendix B – Full Analysis of Supply Chain Industries

The table below lists each of the 6-digit NAICS codes that make up each of the 5 primary groups listed above. Current and projected employment for each 6-digit NAICS code have been provided for the MOVRC & BHHVRDD regions. The most significant growth within the region is expected in the following industries:

- 213112 – Support Activities for Oil and Gas Operations
- 325199 – All Other Basic Organic Chemical Manufacturing
- 325413 – In-Vitro Diagnostic Substance Manufacturing
- 325991 – Custom Compounding of Purchased Resins
- 326150 – Urethane and Other Foam Product (except Polystyrene) Manufacturing
- 326291 – All Other Rubber Product Manufacturing
- 424690 – Other Chemical and Allied Products Merchant Wholesalers
- 424710 – Petroleum Bulk Stations and Terminals
- 424720 – Petroleum and Petroleum Products Merchant Wholesalers (except Bulk Stations and Terminals)
- 483211 – Inland Water Freight Transportation
- 484110 – General Freight Trucking, Local
- 484121 – General Freight Trucking, Long-Distance, Truckload
- 484122 – General Freight Trucking, Long-Distance, Less Than Truckload
- 484220 – Specialized Freight Trucking, Local
- 484230 – Specialized Freight Trucking, Long-Distance
- 488510 – Freight Transportation Arrangement
- 488991 – Packing and Crating
- 493110 – General Warehousing and Storage

Ethane Supply Chain Industries, Projected Job Growth

NAICS	Description	MOVRC Region				BHHVRDD Region				U.S.	Important Products
		2014 Jobs	2024 Jobs	2014 - 2024 Change	2014 - 2024 % Change	2014 Jobs	2024 Jobs	2014 - 2024 Change	2014 - 2024 % Change	2014 - 2024 % Change	
Oil and Gas Extraction											
211111	Crude Petroleum and Natural Gas Extraction	400	284	(116)	(29%)	272	218	(54)	(20%)	24%	"wet" natural gas
211112	Natural Gas Liquid Extraction	0	0	0	0%	35	97	62	177%	28%	ethane produced through fractionation / de-ethanization
213111	Drilling Oil and Gas Wells	158	162	4	3%	351	355	4	1%	14%	
213112	Support Activities for Oil and Gas Operations	746	817	71	10%	382	407	25	7%	30%	
Chemical Manufacturing											
325110	Petrochemical Manufacturing	0	0	0	0%	<10	0	--	--	(10%)	ethylene (produced through cracking), ethylbenzene, styrene
325120	Industrial Gas Manufacturing	0	0	0	0%	38	39	1	3%	(2%)	
325130	Synthetic Dye and Pigment Manufacturing	0	0	0	0%	0	0	0	0%	(28%)	
325180	Other Basic Inorganic Chemical Manufacturing	163	26	(137)	(84%)	51	19	(32)	(63%)	(5%)	
325193	Ethyl Alcohol Manufacturing	0	0	0	0%	<10	<10	--	--	31%	ethyl alcohol (a.k.a. ethanol) can be produced from ethylene
325194	Cyclic Crude, Intermediate, and Gum and Wood Chemical Manufacturing	0	0	0	0%	0	0	0	0%	(16%)	
325199	All Other Basic Organic Chemical Manufacturing	65	32	(33)	(51%)	83	123	40	48%	9%	ethylene oxide, ethylene glycol
325211	Plastics Material and Resin Manufacturing	1,885	1,661	(224)	(12%)	779	813	34	4%	6%	polyethylene, vinyl chloride, PVC, vinyl acetate
325212	Synthetic Rubber Manufacturing	0	0	0	0%	0	0	0	0%	(12%)	synthetic rubbers made using various ethylene-derived inputs
325220	Artificial and Synthetic Fibers and Filaments Manufacturing	0	0	0	0%	<10	0	--	--	(22%)	fibers made from ethylene glycol
325311	Nitrogenous Fertilizer Manufacturing	0	0	0	0%	0	0	0	0%	(8%)	
325312	Phosphatic Fertilizer Manufacturing	0	0	0	0%	0	0	0	0%	(9%)	
325314	Fertilizer (Mixing Only) Manufacturing	0	0	0	0%	0	0	0	0%	3%	
325320	Pesticide and Other Agricultural Chemical Manufacturing	0	0	0	0%	0	0	0	0%	(11%)	
325411	Medicinal and Botanical Manufacturing	86	55	(31)	(36%)	0	0	0	0%	3%	
325412	Pharmaceutical Preparation Manufacturing	0	0	0	0%	0	0	0	0%	6%	
325413	In-Vitro Diagnostic Substance Manufacturing	0	0	0	0%	116	153	37	32%	39%	
325414	Biological Product (except Diagnostic) Manufacturing	0	0	0	0%	0	0	0	0%	23%	
325510	Paint and Coating Manufacturing	0	0	0	0%	11	<10	--	--	(4%)	paint/coatings made with vinyl acetate
325520	Adhesive Manufacturing	0	0	0	0%	0	0	0	0%	(4%)	adhesives made with vinyl acetate
325611	Soap and Other Detergent Manufacturing	0	0	0	0%	<10	<10	--	--	(6%)	detergents made with ethylene oxide
325612	Polish and Other Sanitation Good Manufacturing	0	0	0	0%	0	0	0	0%	(11%)	
325613	Surface Active Agent Manufacturing	0	0	0	0%	0	0	0	0%	(7%)	
325620	Toilet Preparation Manufacturing	0	0	0	0%	0	0	0	0%	1%	
325910	Printing Ink Manufacturing	0	0	0	0%	0	0	0	0%	(19%)	
325920	Explosives Manufacturing	0	0	0	0%	0	0	0	0%	19%	
325991	Custom Compounding of Purchased Resins	105	164	59	56%	0	0	0	0%	(8%)	
325992	Photographic Film, Paper, Plate, and Chemical Manufacturing	<10	0	--	--	0	0	0	0%	(74%)	
325998	All Other Miscellaneous Chemical Product and Preparation Manufacturing	<10	<10	--	--	<10	<10	--	--	15%	antifreeze (uses ethylene glycol)

Ethane Supply Chain Industries, Projected Job Growth

NAICS	Description	MOVRC Region				BHHVRDD Region				U.S.	Important Products
		2014 Jobs	2024 Jobs	2014 - 2024 Change	2014 - 2024 % Change	2014 Jobs	2024 Jobs	2014 - 2024 Change	2014 - 2024 % Change	2014 - 2024 % Change	
Plastics and Rubber Products Manufacturing											
326111	Plastics Bag and Pouch Manufacturing	0	0	0	0%	0	0	0	0%	31%	made from polyethylene
326112	Plastics Packaging Film and Sheet (including Laminated) Manufacturing	0	0	0	0%	0	0	0	0%	65%	made from polyethylene
326113	Unlaminated Plastics Film and Sheet (except Packaging) Manufacturing	0	0	0	0%	0	0	0	0%	(8%)	made from polyethylene
326121	Unlaminated Plastics Profile Shape Manufacturing	0	0	0	0%	0	0	0	0%	1%	made from polyethylene
326122	Plastics Pipe and Pipe Fitting Manufacturing	0	0	0	0%	0	0	0	0%	8%	made from PVC
326130	Laminated Plastics Plate, Sheet (except Packaging), and Shape Manufacturing	0	0	0	0%	0	0	0	0%	2%	
326140	Polystyrene Foam Product Manufacturing	0	0	0	0%	0	0	0	0%	13%	made from ethylbenzene/styrene
326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing	52	109	57	110%	0	0	0	0%	19%	ethylene oxide sometimes used to produce
326160	Plastics Bottle Manufacturing	0	0	0	0%	0	0	0	0%	8%	made from polyethylene, PVC, others
326191	Plastics Plumbing Fixture Manufacturing	0	0	0	0%	0	0	0	0%	(54%)	made from PVC, others
326199	All Other Plastics Product Manufacturing	1,182	1,042	(140)	(12%)	150	33	(117)	(78%)	(5%)	
326211	Tire Manufacturing (except Retreading)	0	0	0	0%	<10	<10	--	--	(2%)	made from ethylbenzene/styrene
326212	Tire Retreading	0	0	0	0%	0	0	0	0%	6%	uses ethylbenzene/styrene
326220	Rubber and Plastics Hoses and Belting Manufacturing	0	0	0	0%	0	0	0	0%	12%	
326291	Rubber Product Manufacturing for Mechanical Use	0	0	0	0%	179	319	140	78%	(15%)	
326299	All Other Rubber Product Manufacturing	0	0	0	0%	0	0	0	0%	1%	
Wholesalers											
424610	Plastics Materials and Basic Forms and Shapes Merchant Wholesalers	0	0	0	0%	18	<10	--	--	(0%)	
424690	Other Chemical and Allied Products Merchant Wholesalers	54	68	14	26%	<10	<10	--	--	12%	
424710	Petroleum Bulk Stations and Terminals	25	27	2	8%	50	61	11	22%	4%	
424720	Petroleum and Petroleum Products Merchant Wholesalers (except Bulk Stations and Terminals)	24	38	14	58%	59	86	27	46%	7%	
424950	Paint, Varnish, and Supplies Merchant Wholesalers	<10	<10	--	--	<10	0	--	--	(21%)	

Ethane Supply Chain Industries, Projected Job Growth

NAICS	Description	MOVRC Region				BHHVRDD Region				U.S.	Important Products
		2014 Jobs	2024 Jobs	2014 - 2024 Change	2014 - 2024 % Change	2014 Jobs	2024 Jobs	2014 - 2024 Change	2014 - 2024 % Change	2014 - 2024 % Change	
Transportation and Warehousing											
482110	Rail transportation	145	145	0	0%	91	85	(6)	(7%)	2%	
483111	Deep Sea Freight Transportation	0	0	0	0%	0	0	0	0%	(2%)	
483113	Coastal and Great Lakes Freight Transportation	0	0	0	0%	0	0	0	0%	31%	
483211	Inland Water Freight Transportation	70	107	37	53%	<10	<10	--	--	18%	
484110	General Freight Trucking, Local	175	191	16	9%	270	242	(28)	(10%)	4%	
484121	General Freight Trucking, Long-Distance, Truckload	256	283	27	11%	554	609	55	10%	7%	
484122	General Freight Trucking, Long-Distance, Less Than Truckload	22	27	5	23%	63	70	7	11%	14%	
484220	Specialized Freight (except Used Goods) Trucking, Local	197	244	47	24%	228	206	(22)	(10%)	20%	
484230	Specialized Freight (except Used Goods) Trucking, Long-Distance	43	47	4	9%	260	425	165	63%	23%	
486210	Pipeline Transportation of Natural Gas	69	60	(9)	(13%)	19	14	(5)	(26%)	5%	
486910	Pipeline Transportation of Refined Petroleum Products	0	0	0	0%	0	0	0	0%	(1%)	natural gas liquids transportation
486990	All Other Pipeline Transportation	0	0	0	0%	0	0	0	0%	(47%)	
488210	Support Activities for Rail Transportation	14	<10	--	--	0	0	0	0%	16%	
488310	Port and Harbor Operations	0	0	0	0%	0	0	0	0%	9%	
488320	Marine Cargo Handling	0	0	0	0%	34	33	(1)	(3%)	8%	
488330	Navigational Services to Shipping	<10	0	--	--	0	0	0	0%	(8%)	
488390	Other Support Activities for Water Transportation	56	48	(8)	(14%)	0	0	0	0%	(9%)	
488490	Other Support Activities for Road Transportation	<10	<10	--	--	<10	<10	--	--	27%	
488510	Freight Transportation Arrangement	<10	<10	--	--	23	31	8	35%	13%	
488991	Packing and Crating	53	72	19	36%	0	0	0	0%	7%	
488999	All Other Support Activities for Transportation	<10	<10	--	--	0	0	0	0%	23%	
493110	General Warehousing and Storage	440	392	(48)	(11%)	136	177	41	30%	18%	
493190	Other Warehousing and Storage	62	66	4	6%	<10	<10	--	--	13%	
Total, Ethylene Supply Chain Industries		6,550	6,166	(366)	(6%)	4,253	4,617	392	9%	10%	
Total, Economy-wide		65,921	68,591	2,670	4%	80,607	90,087	9,480	12%	11%	

Appendix C – Full Industry Analysis Data

Plastics and Rubber Products Manufacturing

Overview

There are currently 10,293 establishments with a total of 673,639 employees within Plastics and Rubber Products Manufacturing industries in the U.S. with the largest subsectors being: Plastic Products Miscellaneous Manufacturing; Rubber Product Manufacturing; Plastic Film, Sheet, & Bag Manufacturing; and Plastic Pipe & Parts Manufacturing. The states with the most establishments in Plastics and Rubber Products Manufacturing industries include: CA, GA, FL, IL, MI, NC, OH, PA, TX, WI.

Revenues in the Plastics and Rubber Manufacturing industries totaled \$215.6 billion in the U.S. Between 2009 and 2014 revenue growth within subsectors within Plastics and Rubber Products Manufacturing averaged 4.0% and from 2014 through 2019 is projected to grow 1.5% with the highest growth projected in the subsectors of: Plastic Film, Sheet, & Bag Manufacturing; Plastic Pipe & Parts Manufacturing; Laminated Plastic Manufacturing; Urethane Foam Manufacturing; Plastic Bottle Manufacturing; and Hose & Belt Manufacturing.

Exports in Plastics and Rubber Products Manufacturing totaled \$29.33 billion with the largest exporting subsectors including: Plastic Film, Sheet, & Bag Manufacturing; Plastic Products Miscellaneous Manufacturing; Hose & Belt Manufacturing, Tire Manufacturing; and Rubber Product Manufacturing. Key countries exported to include: Canada, Mexico, China, Belgium, Australia, the Dominican Republic, Japan, Kuwait, Brazil, and the United Kingdom

Key external drivers in Plastics and Rubber Products Manufacturing include:

- Consumer spending, demand for consumer goods, per capita disposable income
- Demand from: Food manufacturing; Construction and value of construction; Furniture and related product manufacturing; Agriculture, forestry, fishing and hunting; water supply and irrigation system; Car and automobile manufacturing and new car sales; Electrical equipment manufacturing; Tool and hardware wholesaling
- Trade-weighted index and industrial production index
- Price of plastic materials and resin
- World price of crude oil
- World price of rubber
- Total vehicles miles

Key success factors in Plastics and Rubber Products Manufacturing related to site location and expansion include:

- Supply contracts in place for key inputs and managing raw material costs
- Research and development and development of new products
- Proximity to key markets and supplier

Leading companies in Plastics and Rubber Products Manufacturing include: Bemis Company Inc.; Sigma Plastics Group; Printpack Inc.; AEP Industries Inc.; Sealed Air Corporation; J-M Manufacturing Company Inc.; Saudi Basic Industries Corporation; Advanced Drainage Systems Inc.; Westlake Chemical Corp.; Ply Gem Industries Inc.; PolyOne Corporation; Illinois Tool Works Inc.; Rochling Glastic Corporation; Reynolds Group Holdings Ltd.; Dart Container Corporation; The Dow Chemical Company; Carpenter Co.; Huntsman Corporation; FXI Foamex Innovations; Johnson Controls Inc.; Rogers Corporation; Graham Packaging Company Inc.; Plastipak Holdings Inc.; Consolidated Container Company LLC; Pretium Packaging LLC; SABIC Innovative Plastics; Polyone Corporation; Armstrong World Industries Inc; Compagnie Generale des Etablissements Michelin; The Goodyear Tire & Rubber Company; Bridgestone Corporation; Copper Tire & Rubber Company; Carlisle Tire & Wheel Company, General/Toyo/Yokohama (GTY); Denman Tire Corporation; Pirelli Tire North America, Specialty Tires of North America, Titan Tire Corporation, Toyo Tire North America, Trelleborg Wheel Systems, Yokohama Tire Corporation; Gates Corporation; Eaton Corporation; Veyance Technologies Inc.; Carlisle Companies Incorporated; Ansell Limited; and Continental AG

Targeted Industry Outlook

The following industries were assessed and analyzed within the chemical and rubber product group

Primary Targets

Plastic Film, Sheet, & Bag Manufacturing (32611) – This industry converts plastic resins into various films, sheets and bags. Industry products are used by manufacturers for packing and storing products, by retailers for transporting merchandise, and by consumers for household purposes. Industry operators also form, coat or laminate plastic film and sheets into single-wall or multiwall plastic bags.

Industry revenue will grow at annualized rate of 2.6% over 5 years to 2019. Increases in consumer spending, industrial production, construction and exports will drive demand for plastic film, sheets and bags during the period. Stronger growth expected later in period due to advances in the use of polyethylene. Foreign Competition will increase.

Plastic Pipe & Parts Manufacturing (32612) – This industry manufactures a range of plastic pipes, plastic fittings for plastic pipes and unlaminated plastic profile shapes, such as rods, tubes, plates and car parts. This industry does not include plastic hose fixtures, plastic plumbing fixtures or plastic packaging.

Industry Outlook: Demand for plastic pipes is expected to increase for construction and water supply and irrigation systems industry. Infrastructure construction will experience consistent growth increasing demand for plastic piping.

Laminated Plastic Manufacturing (32613) – Companies within this industry manufacture a range of laminated plastic shapes, plates and sheets. The lamination process generally involves bonding or impregnating profiles with plastics resins and compressing them under heat. Laminated plastic products are used for interior and exterior motor vehicle parts, consumer appliances and construction projects.

Industry Outlook: Demand from downstream customers will continue to strengthen. Increase in demand of laminated plastic sheets and shapes from construction. Demand will be slightly volatile.

Plastic Bottle Manufacturing (32616) - Operators in this industry manufactures a range of bottles from various plastic compounds based on their end use. These bottles are then sold to beverage, food and chemical manufactures to use as packaging for soft drinks, milk, condiments and household and

automotive chemicals. This industry does not manufacture reusable plastic bottles or other plastic containers.

Industry Outlook: Growth will stabilize. Increased demand from downstream customers. Demand from large beverage manufacturers will remain low. Increased demand from new types of drink products, household products, automotive and industrial product segments.

Plastic Products Miscellaneous Manufacturing (32619) - This industry comprises companies that manufacture a range of plastic products; including housewares, building materials, motor vehicle parts, resilient floor coverings and appliance parts. This industry excludes plastic film, sheet, bags, profile shapes, pipes, pipe fittings, laminates, foam products and bottles.

Industry Outlook: Demand will increase from downstream industries using plastic products. Demand linked to construction and housing market recovery.

Secondary Targets

Polystyrene Foam Manufacturing (32614) - This industry produces a wide range of polystyrene foam products including expanded polystyrene (EPS) for food containers and cups, foam ice chests and other packaging and insulation goods. The industry's products are used by a wide range of downstream industries in the construction, manufacturing and hospitality sectors.

Industry Outlook: Contraction may be on the horizon. Stabilization in construction industries will slow purchases. Increased regulation will pose an additional threat. Industry revenue will fall.

Urethane Foam Manufacturing (32615) - This industry manufactures plastic foam products (except polystyrene). These products are used to insulate objects or reduce shock. Plastic foam products are used in bedding, packaging, seat cushioning, carpet cushioning, car interiors, fluid filtration systems, antinoise and vibration systems in aircraft, medical devices, and a number of consumer applications such as sponges, mops, paint brushes and cosmetic applicators. Industry

Outlook: Industry has begun to recover. Housing starts and consumer confidence are picking up. Demand for cars increasing and residential construction activity reviving.

Tire Manufacturing (32621) - This industry manufactures aircraft and motor vehicle tires, inner tubes and tire repair materials. The finished products are then sold to aircraft and motor vehicle manufacturers and tire wholesalers. Operators within this industry do not retread tires.

Industry Outlook: Demand will increase as more consumers return to commuting and are better able to afford new tires. New car sales are also forecast to rise, resulting in expanding demand for tires.

Hose & Belt Manufacturing (32622) - Companies in this industry manufacture a range of plastic and rubber hoses and belts, including garden hoses. These products are then sold to manufacturers; coal, oil and gas industries; and the automotive market. The industry includes manufacturing of plastic tubing, rubber tubing and fluid power hose assemblies.

Industry Outlook: High oil prices and tensions in the Middle East will lead to demand due to domestic oil and natural gas exploration and production. Increased demand due to growing manufacturing and consumer spending.

Rubber Product Manufacturing (32629) – Operators in this industry manufacture a range of rubber products, including automotive parts, doormats, rubber bands and rubber gloves. Due to the diversity of goods, this industry sells to a number of downstream industries, including manufacturing, construction and healthcare companies.

Industry Outlook: Demand for industry products will be fueled by a revitalized US auto industry. Demand for rubber inputs for construction materials will also expand due to new residential construction.

Chemical Manufacturing

There are currently 11,258 establishments with a total of 713,378 employees within Chemical Manufacturing industries in the U.S with the largest subsectors being: Plastic & Resin Manufacturing; Pharmaceutical Manufacturing; Soap & Cleaning Compound Manufacturing; and Cosmetic & Beauty Products Manufacturing.

The states with the most establishments in these industries include: CA, FL, GA, IL, IN, LA, MI, MO, NC, NJ, NY, OH, PA, SC, TX, WI,

Revenues in the Chemical Manufacturing industries totaled \$815.0 billion in the U.S. Between 2009 and 2014 revenue growth within subsectors within Chemical Manufacturing averaged 4.5% and from 2014 through 2019 is projected to grow 2.3% with the highest growth projected in the subsectors of: Petrochemical Manufacturing; Inorganic Chemical Manufacturing; Organic Chemical Manufacturing; Pesticide Manufacturing; Cosmetic & Beauty Products Manufacturing; and Explosives Manufacturing

Exports in Chemical Manufacturing totaled \$179.8 billion with the largest exporting subsectors including: Inorganic Chemical Manufacturing; Organic Chemical Manufacturing; Plastic & Resin Manufacturing; Pharmaceutical Manufacturing; Soap & Cleaning Compound Manufacturing; Cosmetic & Beauty Products Manufacturing; and Chemical Product Manufacturing

Key countries exported to include: Canada, Mexico, China, Belgium, Brazil, Colombia, Japan, Korea, Australia, Germany, Netherlands, UK, and Singapore.

Key external drivers in Chemical Manufacturing include:

- Consumer Spending, Per capita disposable income, Consumer confidence index
- Demand from: Construction, Construction Value, Housing starts; Plastic and resin manufacturing; Oil and gas extraction; Carpet mills, apparel knitting mills, textile mills; Crop production; Iron ore and coal mining; Aircraft, engine and parts manufacturing, Car and automobile manufacturing; Accommodation and food services, Janitorial services; Printing, Price of paper; Print advertising; Beauty, cosmetics, and fragrance stores
- Price of natural gas, world price of crude oil, electric power, nonferrous metals, materials and resin
- Trade-weighted index, Industrial production index, Agricultural price index
- Regulation for the petrochemical manufacturing industry; soap and cleaning compound manufacturing industry; Brand Name Pharmaceutical Manufacturing industry
- Research and development expenditure

Key success factors in Chemical Manufacturing related to site location and expansion include:

- Access to highly skilled workforce
- Prompt delivery to market
- Upstream vertical integration
- Access to niche markets
- Ability to accommodate environmental requirements
- Government regulations that accommodate investment and growth
- Guaranteed supply of key inputs and availability of resources
- Research and development

Leading companies in Chemical Manufacturing include: ExxonMobil; LyondellBasell; Royal Dutch Shell; Chevron Phillips; Dow Chemical; Enterprise Products Partners; Praxair; Air Product and Chemicals; Airgas; Air Liquide; The Linde Group; Clariant International; Sun Chemical; BASF SE; DuPont; Occidental; Olin; FMC; Celanese Corporation; Arizona Chemical; Momentiv Specialty Chemicals; Koch Industries; Rayonier Advanced Materials; Eastman Chemical; CF Industries Holdings; The Mosaic Company; Potash Corporation of Saskatchewan; Bayer AG; Monsanto; Pfizer; Merck and Co.; Amgen; Johnson & Johnson; Eli Lilly; AbbVie; GlaxoSmithKline; AstraZeneca; Sanofi-aventis; PPG Industries; Valspar; Sherwin-Williams; Masco; Benjamin Moore & Co.; 3M Company; HB Fuller; Procter & Gamble; SC Johnson & Son; Ecolab; Unilever; Colgate-Palmolive; Clorox; Henkel; L'Oreal USA; Estee Lauder; Unilever; Mary Kay; Revlon; Avon Products; Dainippon Ink and Chemicals; Siegwirk Druckfarben; INX; Flint Group; Incitec Pivot Limited; Orica Limited; Austin Powder Company; Eastman Kodak; Ferro; and Fujifilm.

Targeted Industry Outlook

The following industries were assessed and analyzed within the chemical and rubber product group

Primary Targets

Petrochemical Manufacturing (32511) - This industry manufactures petrochemicals, which are chemicals derived from refined petroleum or liquid hydrocarbons. Key products include ethylene, propylene, butylene, benzene, toluene, styrene, xylene, ethyl benzene and cumene. These products are used in the production of consumer products, automotive components and various durable and non-durable goods. Organic compounds like ethyl alcohol and inorganic chemicals like carbon black are excluded from the industry.

Industry Outlook: Growth will be more subdued compared to previous years. Will experience rise in demand as key downstream industries increase purchases, but threat of raw material volatility will persist.

Organic Chemical Manufacturing (32519) - This industry manufactures basic organic chemicals (other than petrochemicals), industrial gases and synthetic dyes and pigments. Key product groups include gum and wood products, cyclic crudes and intermediates, ethyl alcohol and other basic organic chemicals. These products are predominantly intermediates that are used as raw material inputs by other manufacturing industries in the production of downstream products. Industry Outlook: Expected to experience an increase in demand as key buying markets (e.g. cosmetic and beauty products and rubber manufacturing) increase purchases. Exports will also continue to rise.

Plastic & Resin Manufacturing (32521) - This industry is composed of establishments that primarily manufacture resins, plastic materials (i.e. polymers) and synthetic rubber. Key product groups include thermosetting resins, thermoplastic resins and synthetic rubber. Raw material inputs are sourced from other components within the chemical industry and industries involved in the production of petroleum-based feedstock. Industry Outlook: The importance of plastic and resin products in construction and manufacturing industries is expected to bolster industry revenue in the next five years.

Adhesive Manufacturing (32552) - This industry manufactures adhesives, glues and caulking compounds. Adhesives are materials that are initially fluid or semifluid, but when placed between two opposing solid materials, they become solids. They bond to the surfaces they are applied to and prevent joint movement. This industry excludes asphalt, dental and gypsum-based adhesives.

Industry Outlook: Industry will continue to grow over next five years with demand from aircraft and automobile manufacturers driving growth.

Secondary Targets

Oxygen & Hydrogen Gas Manufacturing (32512) - This industry manufactures organic and inorganic industrial gases in various forms, including compressed, liquid and solid (i.e. dry ice). Examples of industrial gases include oxygen, hydrogen, helium, nitrogen and carbon dioxide. These gases are then supplied to a diverse range of customers, including industrial and medical users. Key inputs for the industry include electricity and natural gas.

Industry Outlook: Revenue will be largely driven by higher US manufacturing and industrial output and greater domestic energy refining, both of which will increase demand for industrial gases like hydrogen and nitrogen.

Dye and Pigment Manufacturing (32513) - This industry manufactures synthetic organic and inorganic dyes and pigments, such as lakes and toners (except electrostatic and photographic). The industry produces various pigments and dyes, including color, lead, chrome, metallic and zinc-based pigments, as well as disperse, vat and direct dyes. As a chemical intermediate product, these pigments and dyes are used to impart color to numerous products.

Industry Outlook: Expected to expand due to robust demand from downstream sectors including housing and automotive. As foreign manufacturers contend with more stringent environmental regulations, this trend will lower the industry's exposure to price-based competition.

Inorganic Chemical Manufacturing (32518) - This industry produces basic inorganic chemicals including titanium dioxide, chlor-alkali products and carbon black. Inorganic chemicals are mineral-based, while organic chemicals are carbon-based (see IBISWorld report 32519, Organic Chemical Manufacturing). Inorganic chemicals are mainly used as inputs in manufacturing and industrial processes. Inorganic chemicals used as pigments and dyes (IBISWorld report 32513) or pesticides (IBISWorld report 32532) are not included in this industry.

Industry Outlook: Projected to steadily expand as the economy and downstream industries recover. As the housing sector improves, demand from construction, paint, and glass manufacturing sectors will also increase. Improved industrial production index will also fuel demand.

Synthetic Fiber Manufacturing (32522) - This industry produces cellulosic and noncellulosic fibers and filaments in the form of monofilament, filament yarn, staple or tow. Key cellulosic organic fibers and filaments include rayon and acetate. Noncellulosic fibers and filaments include acrylic, nylon, polyester and spandex. This industry does not include fiber, yarn or thread mills, thread manufacturers of any other fibers, or manufacturers of hemp yarn.

Industry Outlook: Expected to remain stable over next five years, as industrial products and consumer goods recover from their depressed levels of production during the recession.

Fertilizer Manufacturing (32531) - This industry primarily manufactures fertilizer products. These products contain a different mixture of the three vital nutrients essential for plant growth: nitrogen, phosphorous and potassium. The products are distributed via wholesale arrangements with third parties or, in the case of vertically integrated operations, by the manufacturer.

Industry Outlook: Hindered by low fertilizer demand from farmers and distributors in the near term. Increase in fertilizer imports also expected to dampen revenue growth. Agriculture expected to pick up in long term and will likely boost fertilizer use.

Pesticide Manufacturing (32532) - Operators in this industry manufacture household and agricultural pest control chemicals. Industry products include pesticides and agricultural chemical products such as herbicides, insecticides, fungicides, insect repellents, sheep dips, fly sprays and flea powders. This industry does not manufacture fertilizers.

Industry Outlook: Growth expected to pick up over next five years as trends that favor genetically modified plantings and the use of biotech seeds are expected to continue.

Paint Manufacturing (32551) - This industry manufactures various paints, timber finishes and other surface coating products to decorate and protect surfaces against wear, weather and corrosion. Key products include paints, varnishes, lacquers and stains, as well as fillers, putties, paint thinners and removers. This industry does not manufacture artist's paint (see IBISWorld report 33994, Art and Office Supply Manufacturing).

Industry Outlook: Stronger manufacturing and construction activity will drive demand for paint. Without recessionary lows of 2009 to boost growth rates, industry will grow slightly more slowly.

Soap & Cleaning Compound Manufacturing (32561) - This industry produces substances that loosen and remove soil from a surface for personal hygiene, sanitization or cleaning clothes, linens and furnishings. The industry does not include manufacturers of synthetic glycerin, industrial bleaches or shampoos.

Industry Outlook: Industry will benefit from growing consumer demand for high-quality, brand-name soap and cleaning products. Increased disposable incomes will increase demand from hotels and restaurant.

Ink Manufacturing (32591) - Companies in this industry manufacture inkjet cartridges and printing and inkjet inks, including lithographic, flexographic, gravure and letterpress inks. These products are sold to commercial printers, newspaper and magazine printers, office supplies wholesalers and screen printers. This industry does not include firms that manufacture writing, drawing and stamping ink, nor toner cartridges for photocopiers, fax machines and computer printers.

Industry Outlook: Will continue to face challenges from rising input costs and declining print circulation.

Explosives Manufacturing (32592) - Operators in this industry manufacture explosives, blasting agents and oxidizers. Industry manufacturers may also be involved in the production of blasting accessories, such as blasting and detonating caps, fuses and cords. This industry does not manufacture pyrotechnics, ammunition, ammunition detonators or percussion caps.

Industry Outlook: Stronger demand from metal mining and lower input prices will drive growth and offset volatility in demand from coal mining.

Chemical Product Manufacturing (32599) - This industry manufactures a diverse range of chemical products. Key activities include custom compounding plastic resins and manufacturing toners, toner cartridges, photographic chemicals and sensitized photographic film, paper and plates. Custom compounding of plastic resins includes custom mixing and blending of purchased plastic resins and reformulating plastic resins from recycled plastic products.

Industry Outlook: Continue to expand slowly -- demand for photographic chemicals and materials will continue to decline, but strong demand from downstream manufacturers expected to persist

Tertiary Targets

Pharmaceutical Manufacturing (32541A) - Pharmaceutical manufacturers develop prescription and over-the-counter products that are used to prevent or treat illnesses in humans or animals. Brand name drugs and medication have patent protection. This industry does not include nutritional supplement or cosmetic product manufacturers.

Industry Outlook: Industry will exhibit growth due to strong consumer demand for biological drugs over the next five years.

Cosmetic & Beauty Products Manufacturing (32562) - This industry prepares, blends, compounds and packages beauty products and cosmetics. Products included in this industry are perfumes, makeup items, hair preparations, face creams, lotions and other toiletries. Toothpastes, toothbrushes, soaps and body washes are not included in this industry.

Industry Outlook: No significant change in demand for the next five years.

Transportation, Warehousing, and Wholesaler

There are currently 16,586 establishments with a total of 291,244 employees within in Transportation, Warehousing, and Wholesaler industries in the U.S with the largest subsector being: Chemical Wholesaling, followed by fairly even distribution among Paint, Plastics, and Gasoline & Petroleum Wholesaling,

The states with the most establishments in these industries include: CA, FL, IL, LA, NY, OH, PA, and TX.

Revenues in Transportation, Warehousing, and Wholesaler industries totaled more than \$1.1 trillion in the U.S. Between 2009 and 2014 revenue growth within subsectors within Transportation, Warehousing, and Wholesaler industries averaged 6.1% and from 2014 through 2019 is projected to grow 2.6% with the highest growth projected in the subsectors of: Chemical Wholesaling; Gasoline & Petroleum Bulk Stations; and Refined Petroleum Pipeline Transportation.

Key external drivers in Transportation, Warehousing, and Wholesaler industries include:

- Consumer spending; private spending on home improvements; access to credit; 30-year conventional mortgage rate
- Demand from: Manufacturing; Plastics and rubber products manufacturing; Construction and construction value; Petroleum refining
- Price of plastic materials and resin
- World price of crude oil and world production of oil
- Industrial production index
- US oil and gas production index
- Trade-weighted index
- Regulation for the chemical wholesaling industry
- Total vehicle miles

Key success factors in Transportation, Warehousing, and Wholesaler industries related to site location and expansion include:

- Access to required utility infrastructure
- Development of new products
- Guaranteed supply of key inputs
- Having links with suppliers
- Having an extensive distribution/collection network
- Must comply with government regulations

Leading companies in Transportation, Warehousing, and Wholesaler industries include: Nexeo Solutions Holdings; H. Muehlstein & Co; PolyOne Corporation; Univar; Airgas; ExxonMobil; Marathon; Valero; Chevron; Royal Dutch Shell; Phillips 66; BP; Motiva Enterprises; Global Partners; Gulf Oil; Center Oil; AmeriGas Partners; Uni-Select; GDB International; Kinder Morgan; Magellan Midstream Partners; Enterprise Products Partners; Buckeye Partners; and NuStar Energy.

Targeted Industry Outlook

The following industries were assessed and analyzed within the chemical and rubber product group

Primary Targets

Plastics Wholesaling (42461) - This industry wholesales plastics materials and resins, and unsupported plastic film, sheet, sheeting, rod, tube and other basic forms and shapes. Products sold within the Plastics Wholesaling industry are sold to industrial manufacturers. Manufacturers use plastic products to manufacture durable goods.

Industry Outlook: Higher demand from downstream customers will cause revenue to expand, but rising purchasing costs will slightly offset demand increases.

Chemical Wholesaling (42469) - This industry wholesales chemicals and related products, including compressed gas, chemical additives and synthetic rubber, to the manufacturing, construction and mining industries. This industry does not wholesale agricultural or medicinal chemicals, paints or varnishes, fireworks or plastics materials.

Industry Outlook: Expected to benefit from growing economy. Chemical demand from downstream customers will continue to increase.

Paint Wholesaling (42495) - Establishments in this industry wholesale paints, wallpaper, paintbrushes, rollers and other related products. Industry operators purchase paint and other coatings from manufacturers for resale to downstream customers, and do not generally manufacture paint themselves. Sales divisions of paint manufacturers are not included in this industry.

Industry Outlook: Expected to continue to recover in next five years

Tertiary Targets

Gasoline & Petroleum Bulk Stations (42471) - Companies in this industry operate bulk crude oil, gasoline and other petroleum products storage facilities for the resale of these products to smaller petroleum distributors, gasoline stations, petroleum refiners and other downstream markets.

Industry Outlook: Expected to continue growing, but at a slower rate. Domestic demand for crude oil and petroleum products is forecast to continue to grow at a slow, steady rate as domestic activity expands.

Gasoline & Petroleum Wholesaling (42472) - The US Gasoline and Petroleum Wholesaling industry distributes most of the same products as the Gasoline and Petroleum Bulk Stations industry (IBISWorld report 42471) but on a smaller scale. Operators in this industry purchase petroleum products directly from bulk stations and sell them to retailers, including gas stations, car parts retailers, warehouses, superstores and supermarkets, manufacturers and natural gas retail distributors.

Industry Outlook: Revenue is set to increase, but car manufacturers' continued push for fuel efficiency in response to increasing consumer demand will likely slow the growth of gasoline demand and volume sold.

Refined Petroleum Pipeline Transportation (48691) - Operators in this industry transport refined petroleum products via pipeline systems. The major products transported are gasoline, diesel and aviation fuel. Pipelines that haul natural gas liquids are also included.

Industry Outlook: Continued growth in natural gas production will bolster natural gas liquids production, and more NGL pipelines will be needed over the next five years.

Oil and Gas Extraction

There are currently 17,452 establishments with a total of 417,293 employees within in Oil and Gas Extraction industries in the U.S and for this analysis the subsectors include: Oil Drilling & Gas Extraction and Oil & Gas Field Services.

The states with the most establishments in these industries include: TX, OK, LA, KS, CO, and WY.

Revenues in the Oil and Gas Extraction industries totaled \$522.0 billion in the U.S. Between 2009 and 2014 revenue growth within the two subsectors averaged 12.2% and from 2014 through 2019 is projected to grow 3.2%.

Exports in Oil and Gas Extraction industries totaled \$23.6 billion which is all accounted for by Oil Drilling & Gas Extraction as Oil and Gas Field Services does not have exports. Key countries exported to include Canada and Mexico.

Key external drivers in Oil and Gas Extraction industries include:

- World price of crude oil and natural gas; World production of oil
- Trade-weighted index
- US oil and gas production index
- Regulation for the petrochemical manufacturing industry
- Total vehicle miles

Key success factors in Oil and Gas Extraction industries related to site location and expansion include:

- Downstream ownership links
- Ability to find new resource deposits
- Ability to meet environmental regulations

Leading companies in Oil and Gas Extraction industries include: ConocoPhillips; Chevron Corporation; BP; ExxonMobil; Royal Dutch Shell; Devon Energy; Hess; Halliburton; Schlumberger; Baker Hughes; Weatherford International; Nabors Industries; Helmerich & Payne; and Patterson-UTI Energy.

Industry NAICS Codes and Descriptions within Oil and Gas Extraction industries and assessed for this supply chain analysis along with a summarized industry outlook include:

Targeted Industry Outlook

The following industries were assessed and analyzed within the chemical and rubber product group

Tertiary Industries

Oil Drilling & Gas Extraction (21111) - Companies in this industry operate and develop oil and gas field properties. Activities include the exploration and production of crude petroleum; the mining and extraction of oil from oil shale and oil sands; the exploration and production of natural gas; sulfur recovery from natural gas; and recovery of hydrocarbon liquids. Companies may operate oil and gas wells on their own account or for others on a contract or fee basis.

Industry Outlook: Expected to grow -- along with the rising output of natural gas, increasing oil and natural gas prices will continue to drive the industry's financial performance.

Oil & Gas Field Services (21311) – Operators in this industry provide support services on a fee or contract basis to companies involved in oil and gas extraction, mining and quarrying. Industry operators may also provide services such as drilling, taking core samples and making geological observations at prospective work sites.

Industry Outlook: Project to perform strongly. Continuing development of shale resources and steady offshore drilling activity will drive demand. High value-added nature and lack of substitute services will bolster performance.

Appendix D – Supply Chain for Natural Gas Liquid Extraction

The industries highlighted in yellow represent existing industries within the natural gas liquid extraction supply chain that may benefit short-term from the construction of the ethane cracker. Thus, these are recommended industries for business expansion and retention.

Supply Chain for Natural Gas Liquid Extraction – Industries that will Benefit Short Term from Construction Highlighted				
NAICS	Industry	Amount	In-Region	Out of Region
211111	Crude Petroleum and Natural Gas Extraction	\$1,559,621	5.1%	94.9%
551114	Corporate, Subsidiary, and Regional Managing Offices	\$935,211	1.5%	98.5%
213112	Support Activities for Oil and Gas Operations	\$501,789	50.0%	50.0%
325110	Petrochemical Manufacturing	\$351,299	0.1%	99.9%
541110	Offices of Lawyers	\$289,698	9.7%	90.3%
486210	Pipeline Transportation of Natural Gas	\$259,789	21.8%	78.2%
324110	Petroleum Refineries	\$219,135	18.9%	81.1%
331110	Iron and Steel Mills and Ferroalloy Manufacturing	\$178,328	4.3%	95.7%
533110	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	\$164,439	5.3%	94.7%
333132	Oil and Gas Field Machinery and Equipment Manufacturing	\$156,222	4.5%	95.5%
532412	Construction, Mining, and Forestry Machinery and Equipment Rental and Leasing	\$134,650	21.7%	78.3%
541512	Computer Systems Design Services	\$123,145	5.5%	94.5%
522110	Commercial Banking	\$114,557	42.0%	58.0%
532490	Other Commercial and Industrial Machinery and Equipment Rental and Leasing	\$113,154	29.3%	70.7%
541330	Engineering Services	\$93,476	10.1%	89.9%
333515	Cutting Tool and Machine Tool Accessory Manufacturing	\$86,954	0.2%	99.8%
486110	Pipeline Transportation of Crude Oil	\$84,186	36.9%	63.1%
221210	Natural Gas Distribution	\$82,191	47.7%	52.3%
425120	Wholesale Trade Agents and Brokers	\$61,716	4.7%	95.3%
238220	Plumbing, Heating, and Air-Conditioning Contractors	\$60,403	28.5%	71.5%
332912	Fluid Power Valve and Hose Fitting Manufacturing	\$58,504	0.0%	100.0%
238210	Electrical Contractors and Other Wiring Installation Contractors	\$55,617	26.8%	73.2%
541511	Custom Computer Programming Services	\$54,631	2.6%	97.4%
325120	Industrial Gas Manufacturing	\$51,775	3.6%	96.4%
551112	Offices of Other Holding Companies	\$46,996	0.0%	100.0%
486910	Pipeline Transportation of Refined Petroleum Products	\$46,473	0.0%	100.0%
333519	Rolling Mill and Other Metalworking Machinery Manufacturing	\$46,153	0.0%	100.0%
562111	Solid Waste Collection	\$45,540	39.0%	61.0%