POTENTIAL BENEFITS OF EXPANDED CHEMICAL AND PLASTICS MANUFACTURING IN APPALACHIA

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West Virginia chemistry...

At $8.7B, the largest manufacturing industry in the state

Generates $790M in payroll across 73 establishments

Provides 9,132 direct jobs and another 11,341 related jobs

Generates $81M in state & local taxes, and $169M in federal taxes

Has an average wage of $86,490, 53% higher than the average manufacturing wage

Invests $279M to build & update equipment and facilities

Ships $1.5B in products to customers around the world

Generates an additional 3,346 jobs in plastics & rubber products

($81M in state & local taxes, and $169M in federal taxes)
Chemical Manufacturing is Energy-Intensive

Source: ACC analysis

### Fuel, Power and Feedstock Costs as a Percent of Total Costs

- **Chlorine/Caustic Soda**
- **Sodium Carbonate (Soda Ash)**
- **Acrylonitrile**
- **Adipic Acid**
- **Aniline**
- **Benzene**
- **Butadiene (1,3-)**
- **Cumene**
- **Ethybenzene**
- **Ethylene**
- **Ethylene Dichloride (EDC)**
- **Ethylene Glycol**
- **Ethylene Oxide**
- **Methanol**
- **Phenol**
- **Propylene**
- **Styrene**
- **Terephthalic Acid**
- **Vinyl Acetate**
- **Polyethylene (LDPE)**
- **Polyethylene (LLDPE)**
- **Polyethylene (HDPE)**
- **Polypropylene (PP)**
- **Polystyrene (PS)**
- **Polyvinyl Chloride (PVC)**
- **Anhydrous Ammonia**
- **Urea**

**Legend:**
- **Energy Costs**
- **Other Costs**
Feedstock Spread Drives Petrochemical Competitiveness

Sources: US Energy Information Administration, ACC analysis
Global Cost Advantage for U.S. Producers

(Petrochemical Production Costs)

2015 PRODUCTION COSTS
Estimated * ($/lb.)

GLOBAL SUPPLY
(billion lbs.)

*Based on estimates from best available data
Oil-to-Gas Ratio: A Proxy for US Petrochemical Competitiveness

Divide Brent oil price ($ per barrel) by Henry Hub natural gas price ($ per million BTUs). When the ratio is above 7, US competitiveness is favorable vis-à-vis other major producing regions. Above 10 and competitiveness is further enhanced. The current ratio is very favorable for US competitiveness and exports of petrochemicals, plastics and other derivatives.

Sources: EIA, ICE, NYMEX
Net Ethylene Capacity Additions by Region

Source: ICIS
New Chemical Industry Investment in the U.S.

- Building began in 2010 with small projects to increase ethane utilization
- As of September 2017, ACC is tracking 318 projects valued at $185B
- 62% of projects are foreign-owned or include a foreign partner
- Additional projects in Canada and Mexico
- In addition, ACC is tracking more than 600 plastic processor projects
Cumulative Announced Chemical Industry Investments from Shale Gas

Number of Projects

0 25 50 75 100 125 150 175 200 225 250 275 300 325 350

Total Investment

Number of Announced Projects


Billions

$0 $20 $40 $60 $80 $100 $120 $140 $160 $180 $200

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Geography of Shale-Advantaged Chemical Investment

* Each green pin represents one or more announced chemical industry investments
Advantages for Appalachian Chemicals and Plastics

- Proximity to abundant NGL resources in Marcellus/Utica and Rogersville shales
- Proximity to manufacturing markets in Midwest, East Coast, and Canada
- Opportunity to generate jobs and economic activity in Appalachia
- Avoids ethane rejection
Plastic Products Manufacturing in the U.S.

Value of Shipments ($bill)
- 11.0+
- 6.0-10.9
- 3.0-5.9
- 1.0-2.9
- <1.0
- n/a

Sources: Census Bureau, Marcellus Coalition, and the University of Kentucky

Note: Shaded areas for shale formations are approximate.
Potential Benefits to Appalachian Economy from New Chemical and Plastics Products Manufacturing

- ACC analyzed a hypothetical scenario based on ~350,000-400,000 barrels per day of ethane expected to be available by 2025
- Assumes storage and pipeline infrastructure is built
- $35.8 billion in new chemicals and plastics industry investment
  - 5 ethane crackers
  - 2 propane dehydrogenation (PDH)
  - Polyethylene, polypropylene and other derivatives
  - Plastics compounding
  - Plastic products manufacturing
- $28.4 billion in new output by 2025
Economic Impact of New Chemical and Plastic Products Manufacturing ($2016)

- **$36** billion in capital investment
  - $32.4 billion in petrochemicals, resins, and derivatives
  - $3.4 billion in plastics products

- **101 thousand** jobs created & supported
  - 68,706 direct + indirect jobs
  - 32,112 payroll-induced jobs in local communities

- **$28** billion economic expansion
  - $23.0 billion in chemicals + plastic resins
  - $5.4 billion in plastics compounding + plastics products

- **$2.9** billion in tax revenues annually
  - $1.7 billion in federal tax revenues
  - $1.2 billion in state & local tax revenues