POTENTIAL ECONOMIC IMPACTS OF CHEMICAL AND PLASTICS MANUFACTURING IN APPALACHIA

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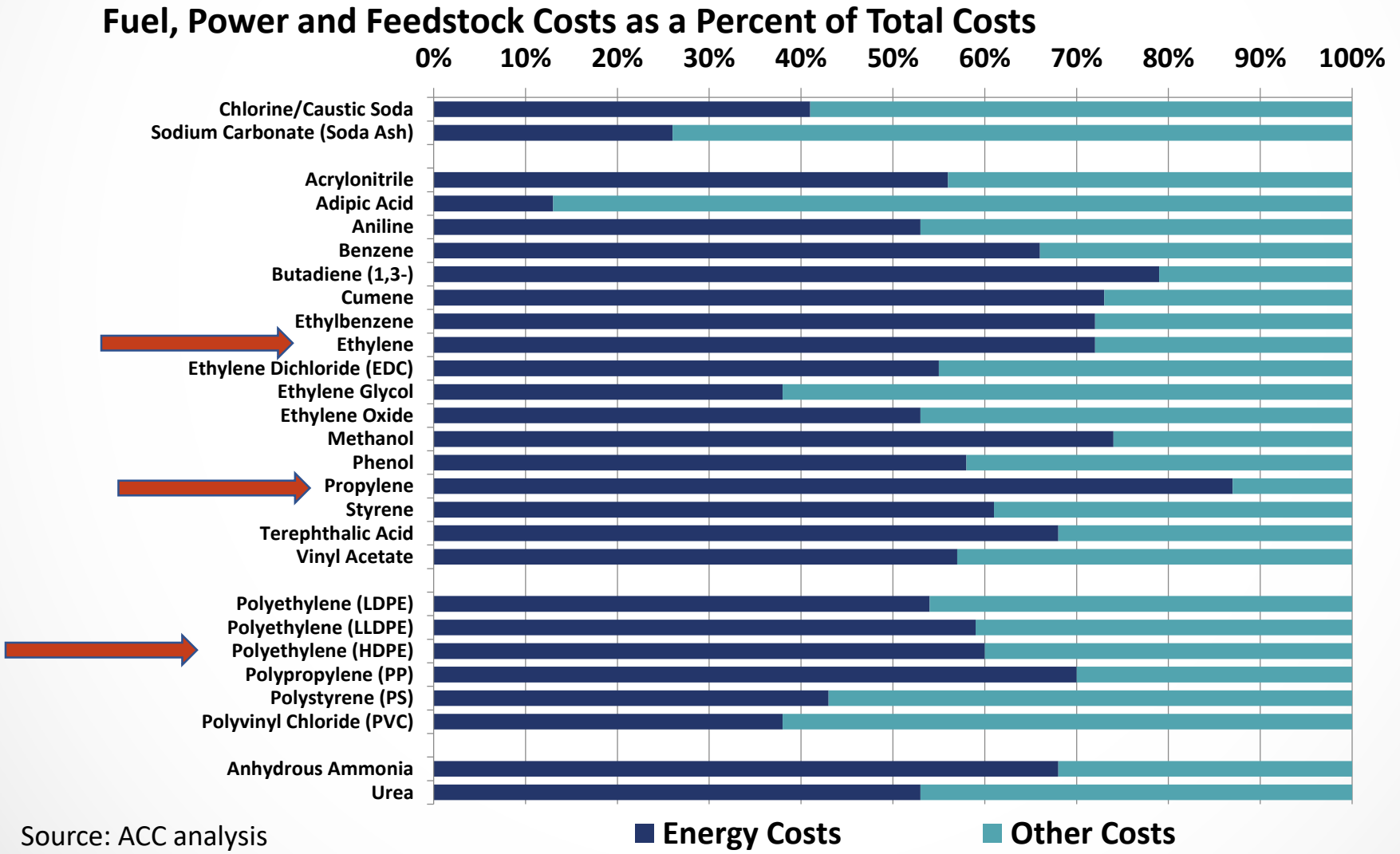
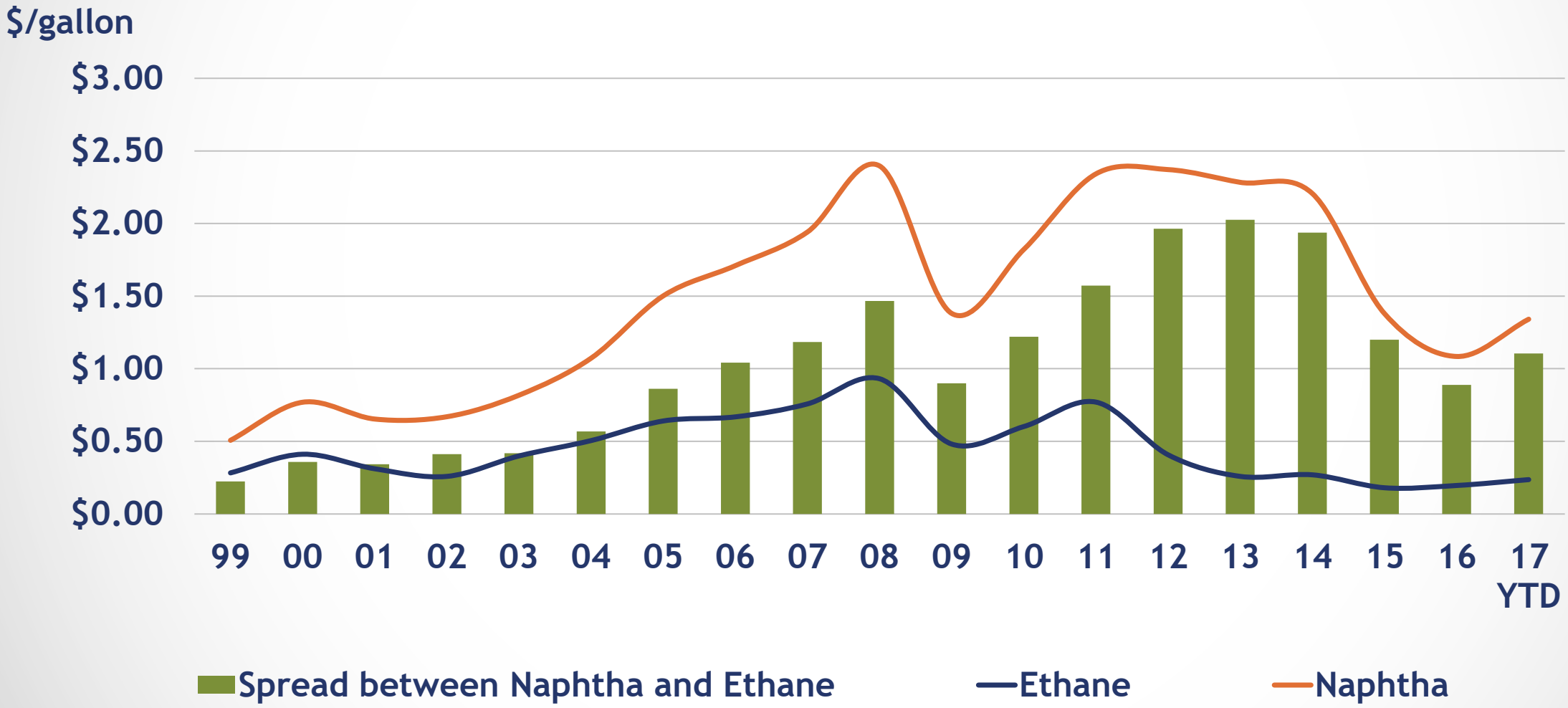
American® Chemistry Council

Chemical Manufacturing is Energy-Intensive



Source: ACC analysis

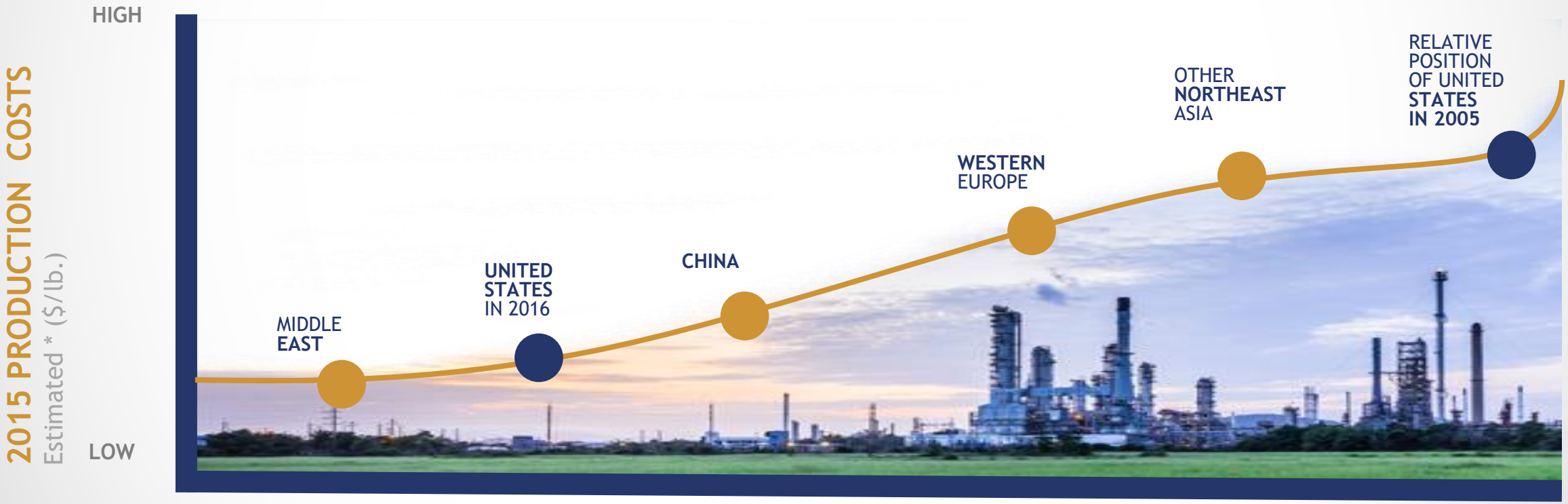
Feedstock Spread Drives Petrochemical Competitiveness



Sources: US Energy Information Administration, ACC analysis

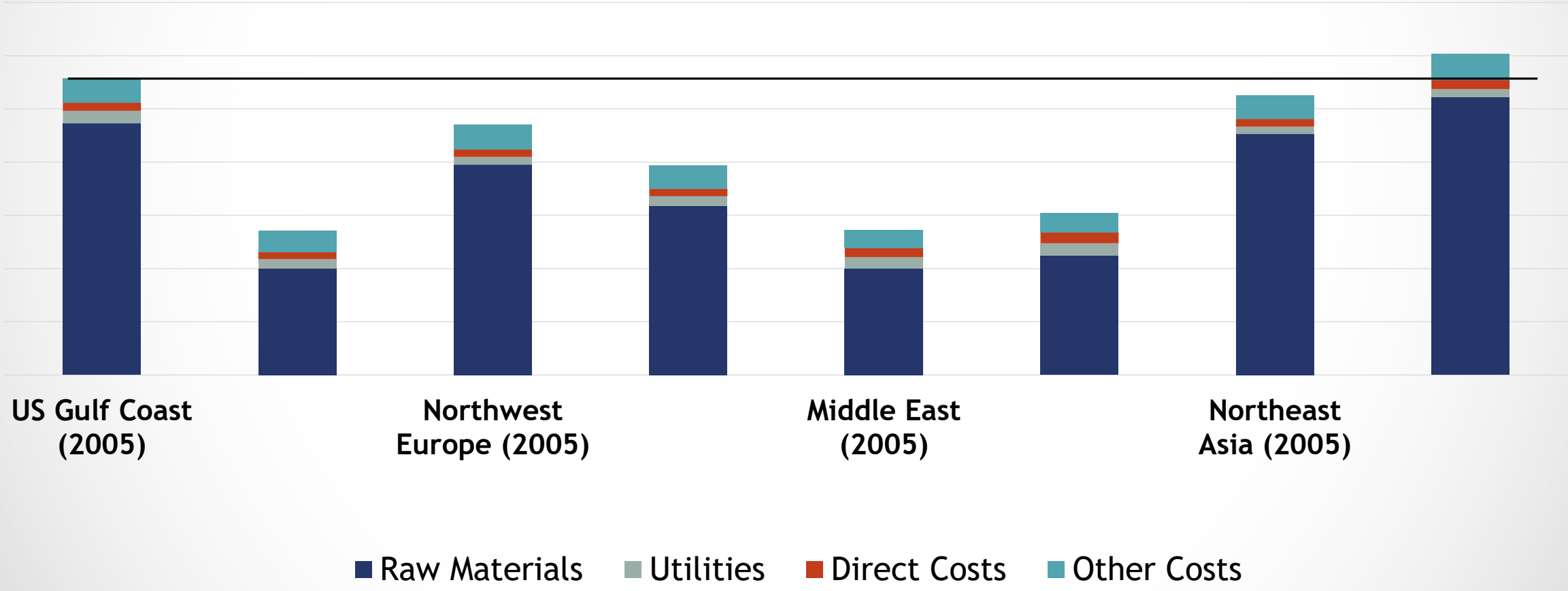
Global Cost Advantage for U.S. Producers

Relative Position of U.S. (2005-2016)
(Petrochemical Production Costs)



*Based on estimates from best available data

Lower US Manufacturing Costs: Case of High Density Polyethylene (HDPE)



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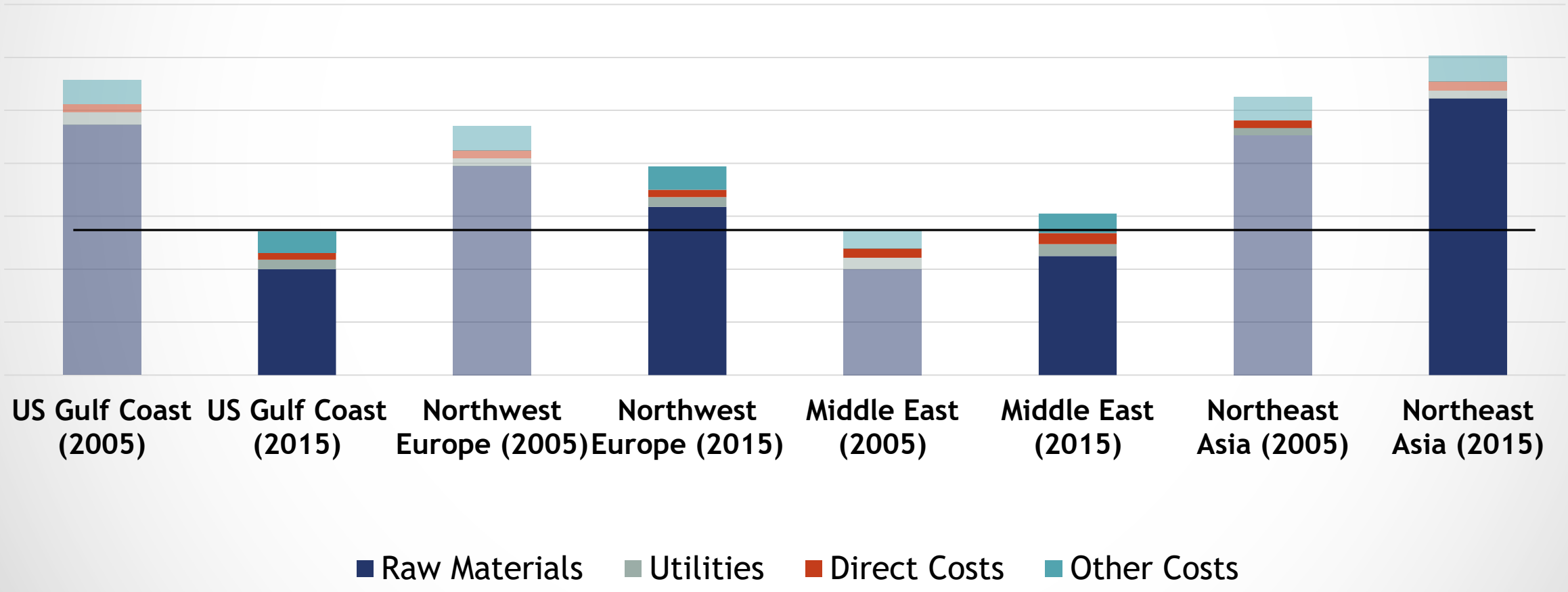
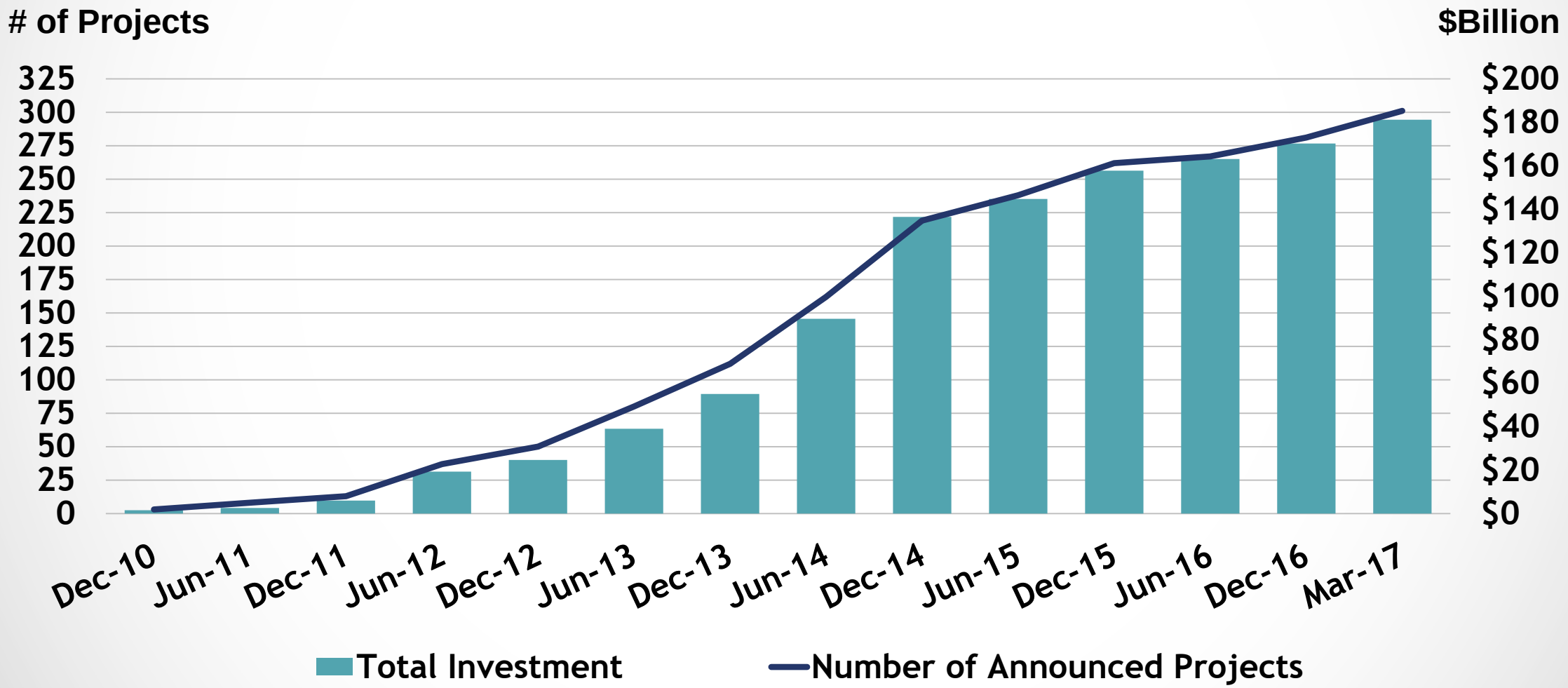


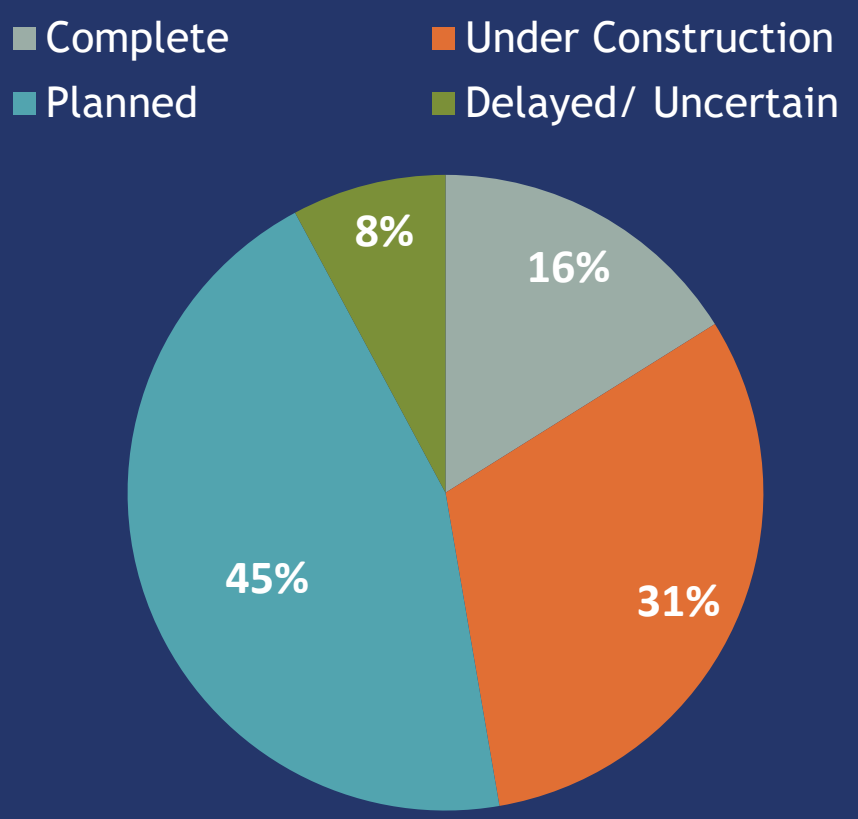
Cumulative Announced Chemical Industry Investments Motivated by Shale Gas



Source: ACC analysis, December 2010 – March 2017

New Chemical Industry Investment in the U.S.

- Building began in 2010 with small projects to increase ethane utilization
- As of April 2017, ACC is tracking 301 projects valued at $181B
- 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



Expansion of Plastic Processing Capacity

Plastics Processing

- The largest domestic customer of plastic resins
- Products go into every sector of the economy - automotive, building and construction, medical, electrical, etc.
- As these industries expand, so does demand for plastic products

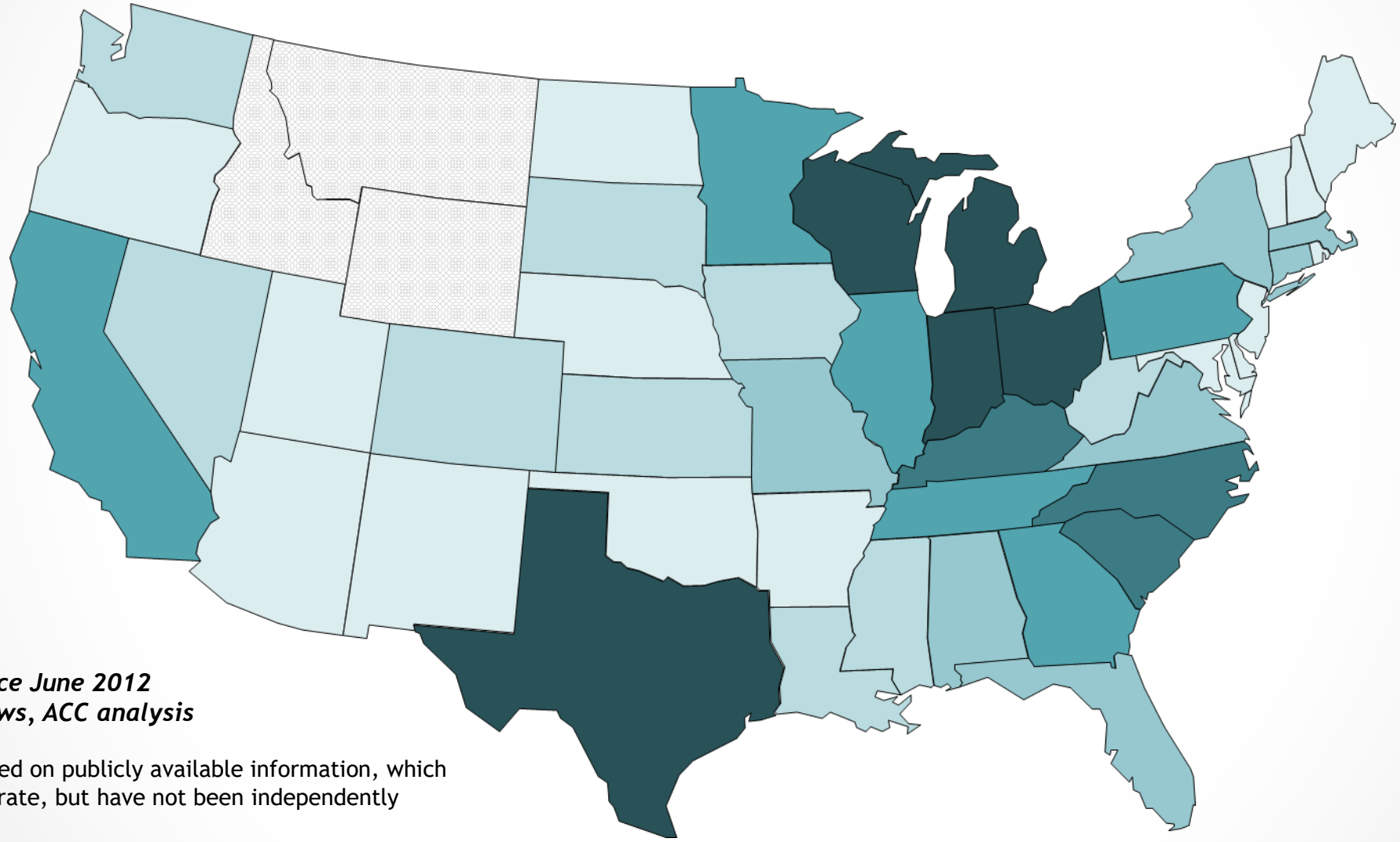
Shale-Motivated Expansion

- Two-thirds of announced chemical industry investment is bulk petrochemicals and plastic resins.
- While more than half of new resin is expected to be exported, much will remain in U.S. → expanded capacity

Other Drivers of U.S. Manufacturing

- Increased consumer desire for “Made in the USA” products
- Rising costs (wages) in China
- Reduction of transportation/logistics costs
- Proximity to customers, supply chain

Announced Plastics Processor Projects by State



Announced Projects

40+
30-39
20-29
10-19
5-9
1-4
0

Note: 1 project has been announced in AK; none in HI (not shown)

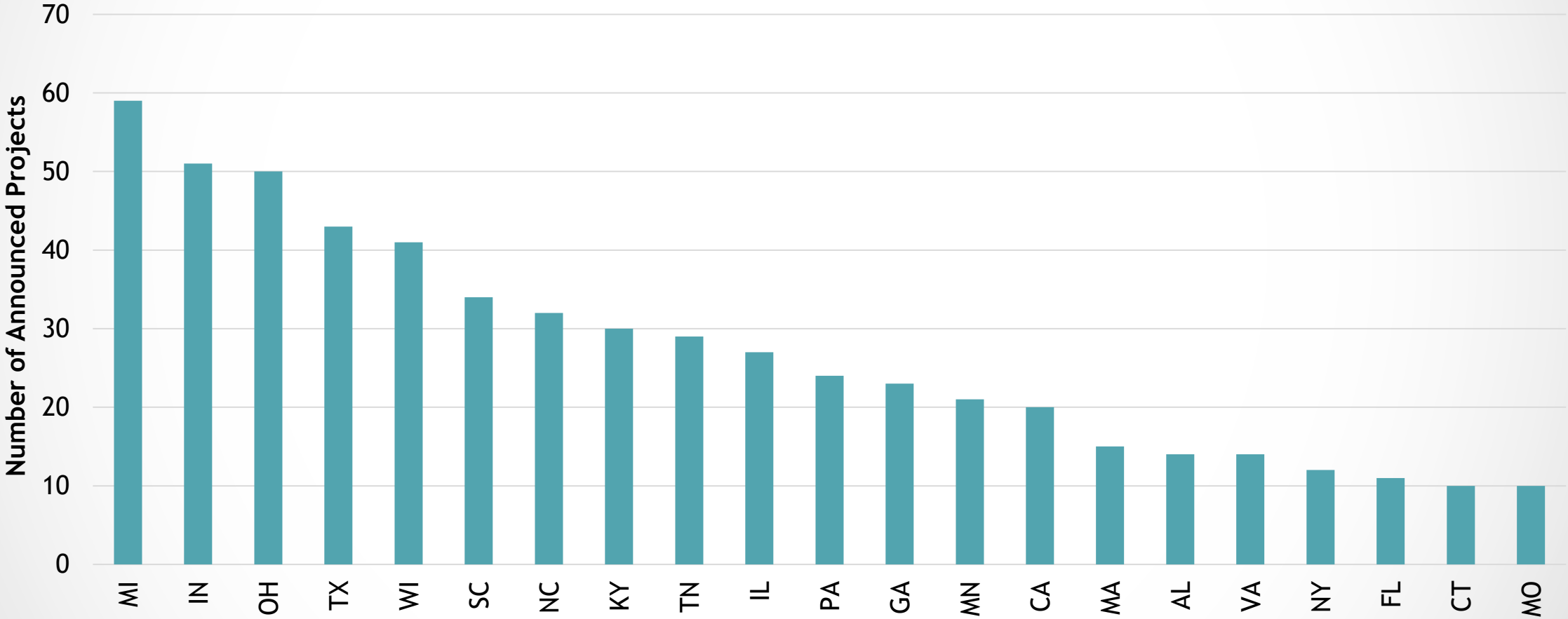
Announcements since June 2012
Source: Plastics News, ACC analysis

NOTE: The data is based on publicly available information, which is believed to be accurate, but have not been independently verified by ACC.

Updated –4/6/17

Announced Plastics Processor Projects by State

States where ten or more projects have been announced since June 2012



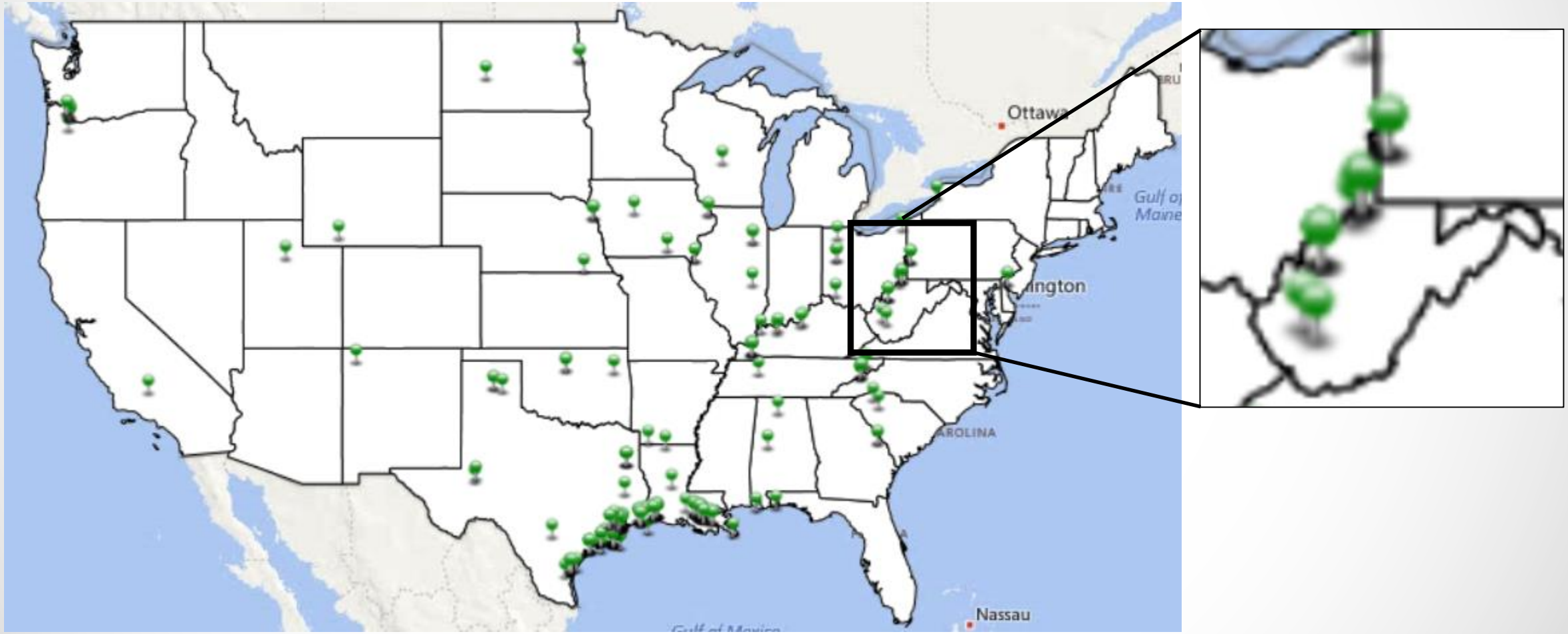
Source: Plastics News, ACC analysis

NOTE: The data is based on publicly available information, which is believed to be accurate, but have not been independently verified by ACC.

Advantages for Appalachian Chemicals and Plastics

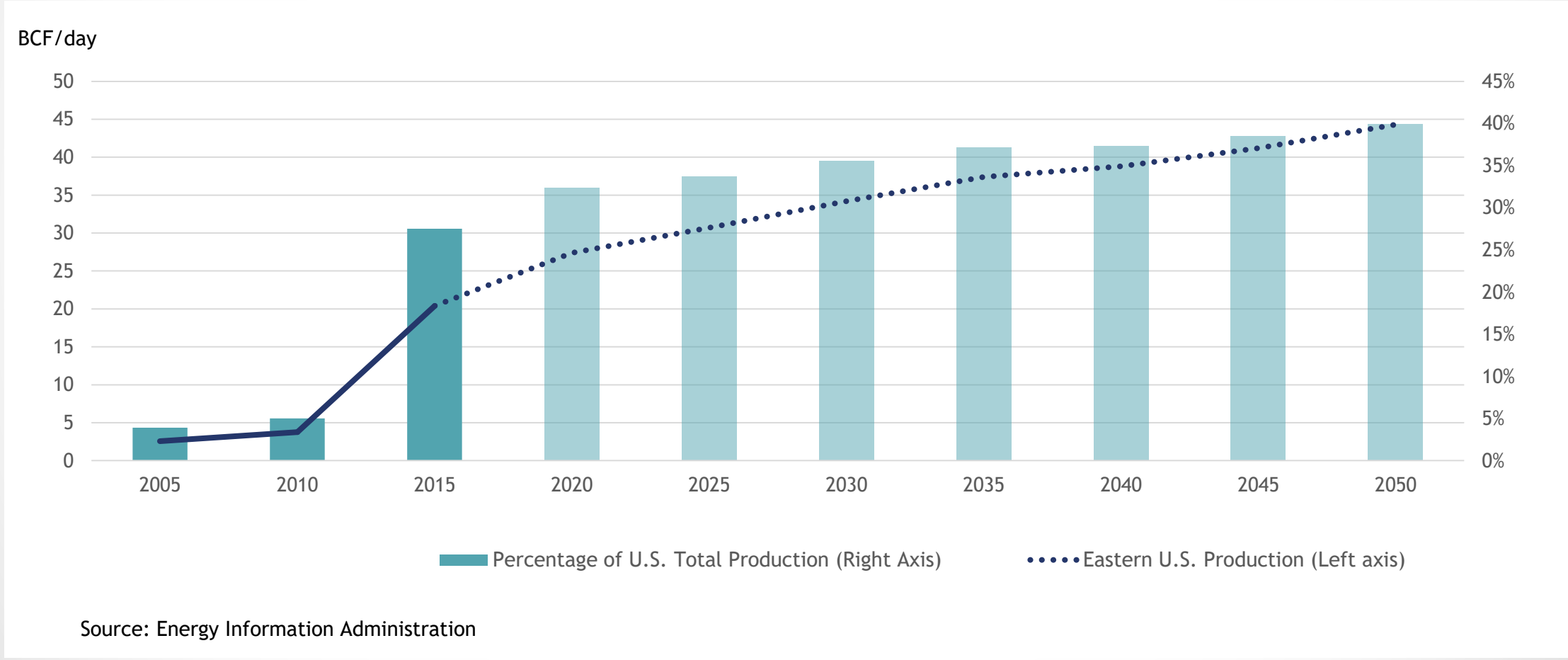
- Proximity to abundant NGL resources in Marcellus/Utica and Rogersville shales
- Proximity to manufacturing markets in Midwest, East Coast, and Canada
- Opportunity to strengthen the U.S. economy by providing employment and supply diversity
- Avoids ethane rejection

Geography of Shale-Advantaged Chemical Investment



* Each green pin represents one or more announced chemical industry investments

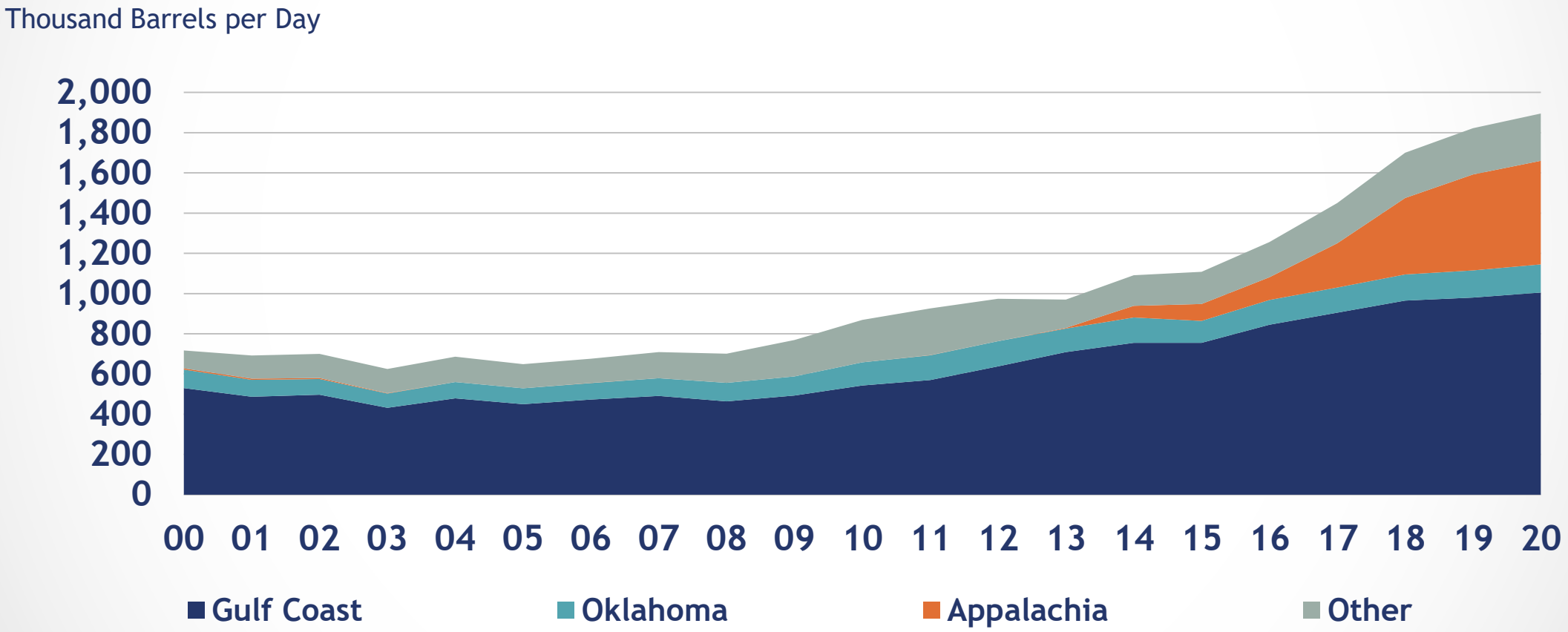
Natural Gas Production Outlook in the Eastern U.S.



Source: Energy Information Administration

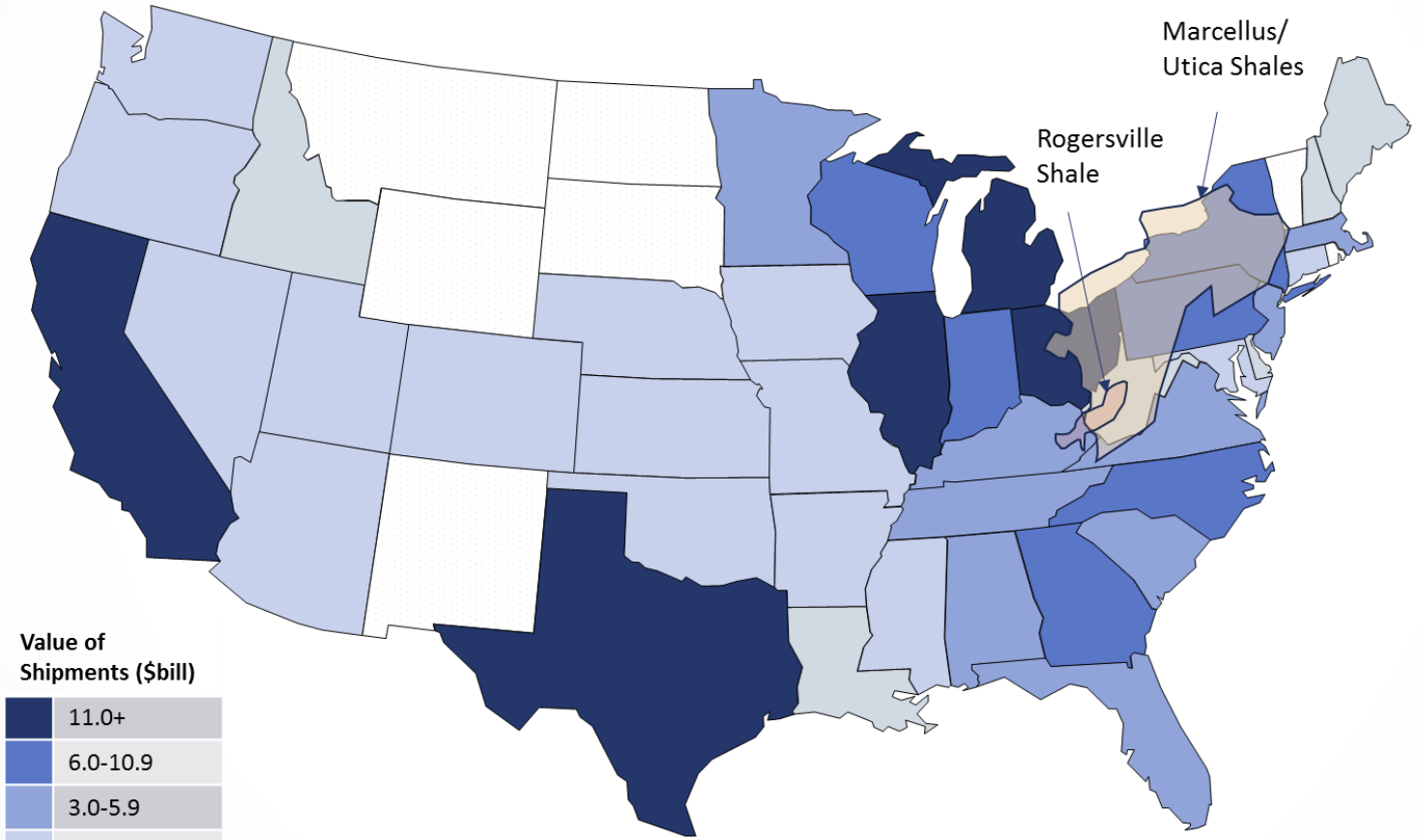
Sources: US Energy Information Administration

Surging Ethane Supply from Marcellus and Utica Shales



Sources: US Energy Information Administration, ACC analysis

Plastic Products Manufacturing in the U.S.



Value of Shipments ($bill)

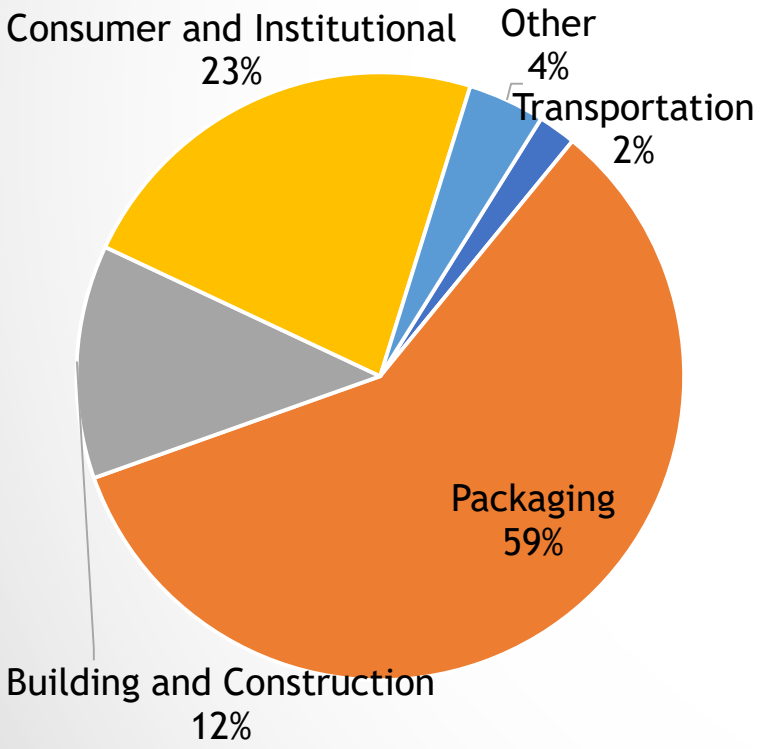
	11.0+
	6.0-10.9
	3.0-5.9
	1.0-2.9
	<1.0
	n/a

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

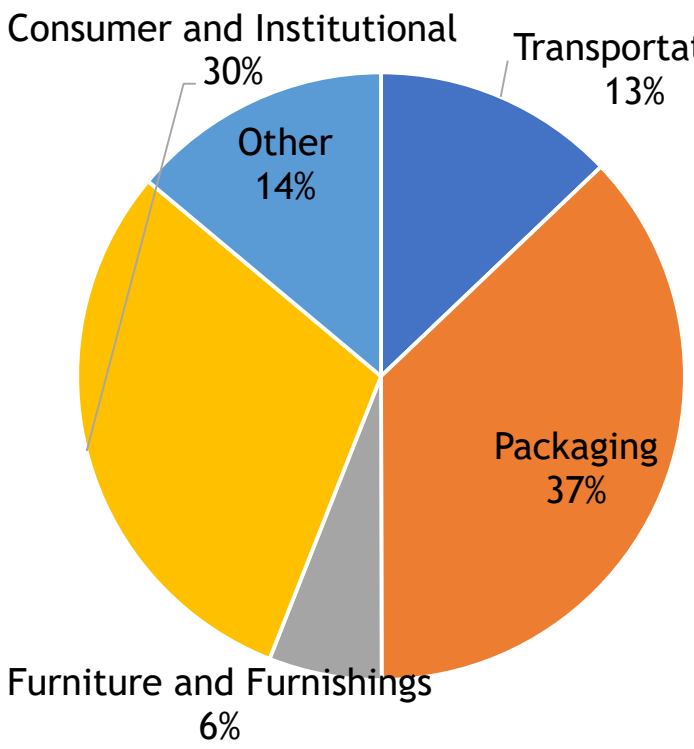
Note: Shaded areas for shale formations are approximate.

Major Markets for Selected Plastic Resins

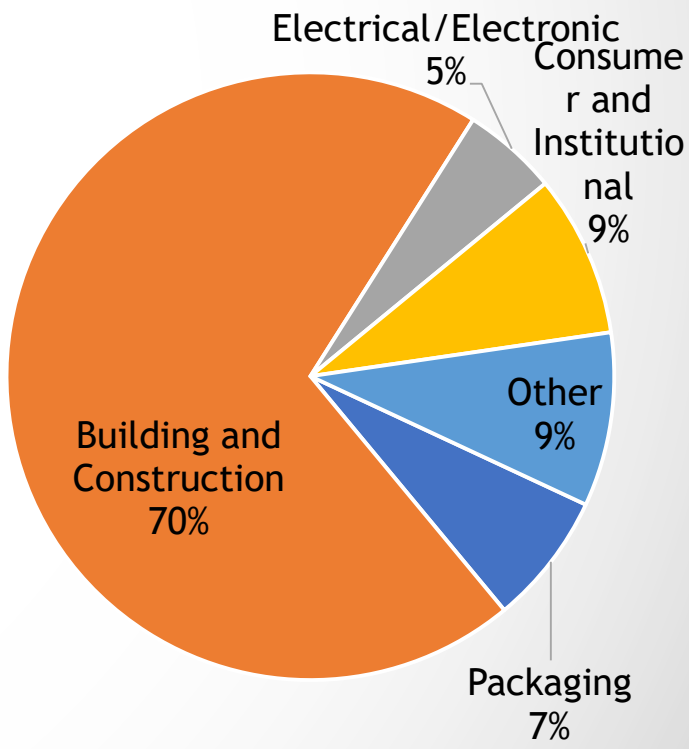
Polyethylene



Polypropylene



Polyvinyl Chloride (PVC)



Scenario Analysis

- *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)

	Employment	Payroll ($ bill)	Output ($ bill)	Federal Tax Revenues ($ bill)	State & Local Tax Revenues ($ bill)
Direct	25,664	1.7	28.5	0.6	0.5
Indirect (Supply Chain)	43,042	3.0	10.0	0.7	0.5
Payroll-Induced	32,112	1.5	4.5	0.4	0.2
Total	**100,818**	**$6.2**	**$43.0**	**$1.7**	**$1.2**

Analysis of upstream economic impacts was done with the IMPLAN model, using industry spending patterns and output-to-labor ratios.

- Direct – Jobs, wages, and output generated from the manufacturing of insulation.
- Indirect (Supply Chain) – Jobs, wages, and output created by the businesses in the supply chain that sell goods and services to insulation manufacturers (and their suppliers)
- Payroll-Induced – Jobs, wages, and output supported by the household spending of wages and salaries of direct and indirect employees.

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