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2018 Downstream Challenges and Opportunities

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2018 Downstream Challenges and Opportunities

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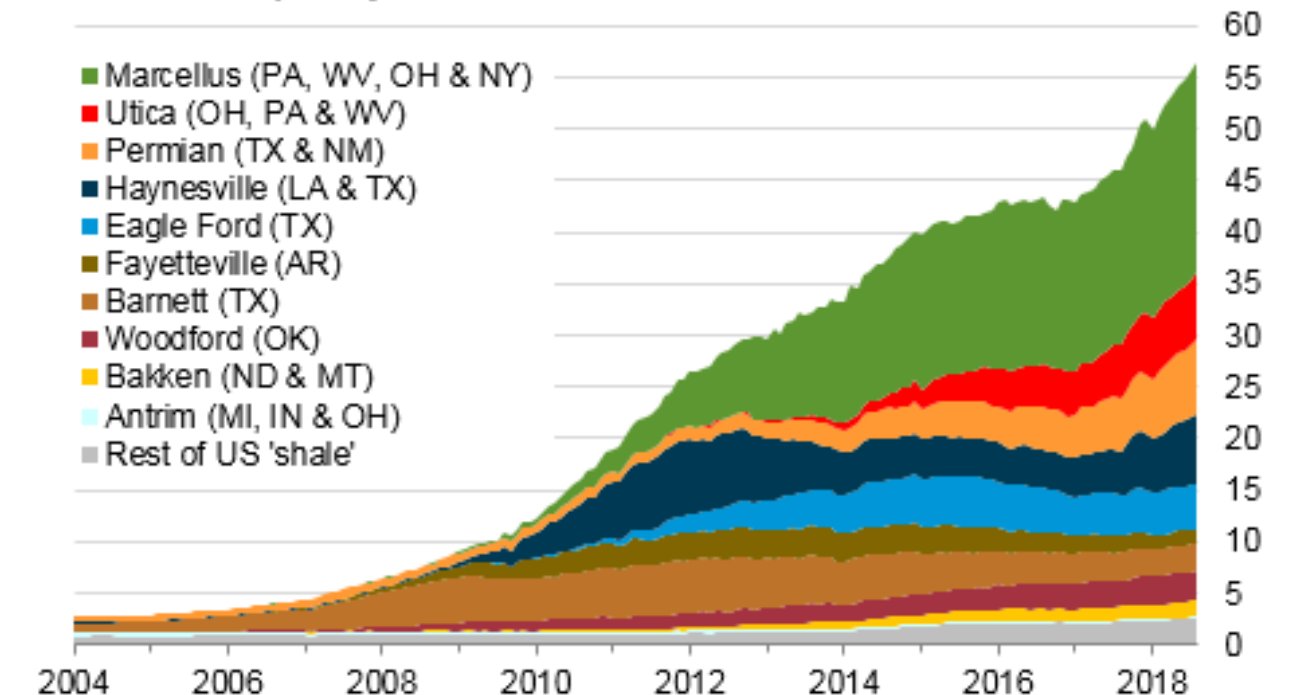
Utica Summit VI
October 10, 2018

Production by Play

- Dry shale gas production in U.S. **up 10 billion** cf per day since last August
- Distribution of plays hasn't changed
- Top Four (EIA estimates)

Marcellus	36.3%
Permian	12.7%
Haynesville	12.0%
Utica	11.3%

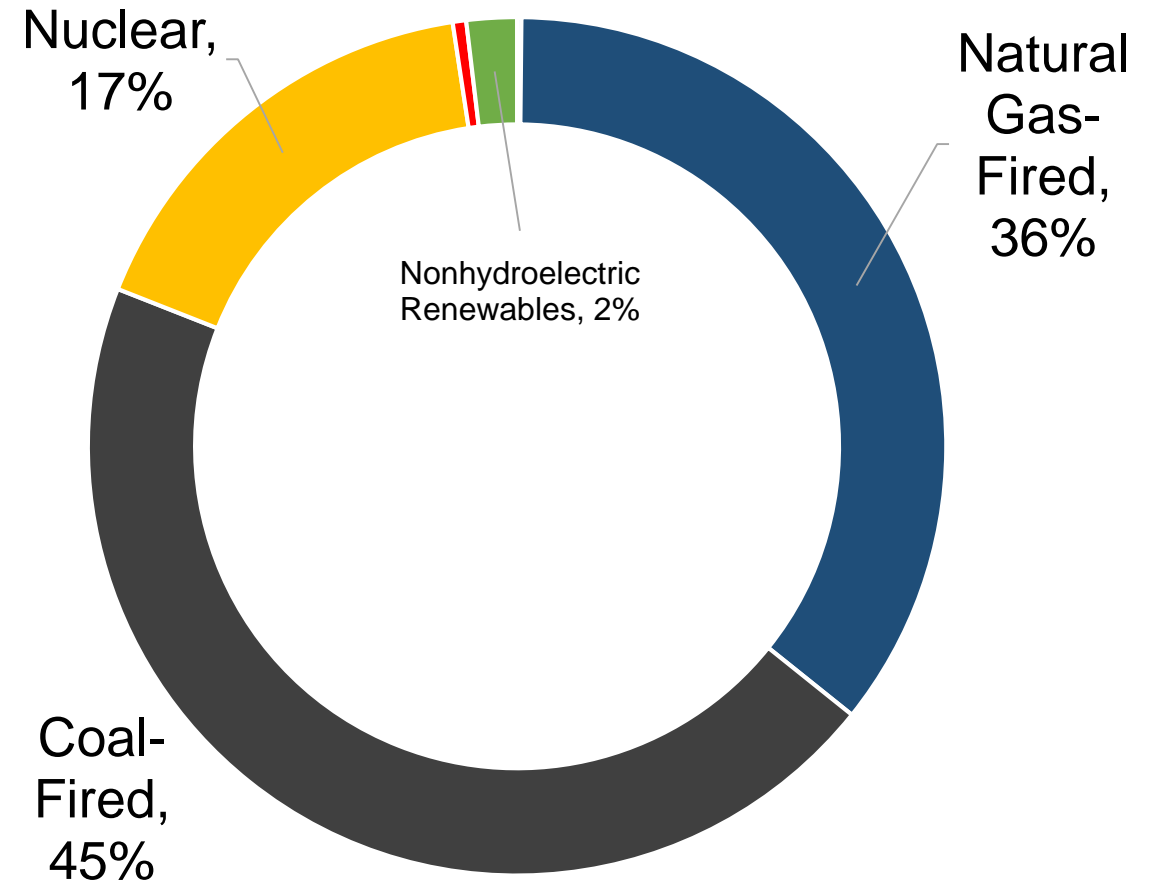
Monthly dry shale gas production
billion cubic feet per day



Sources: EIA derived from state administrative data collected by DrillingInfo Inc. Data are through August 2018 and represent EIA's official tight gas estimates, but are not survey data. State abbreviations indicate primary state(s).

Downstream: Gas-Fired Power Plants

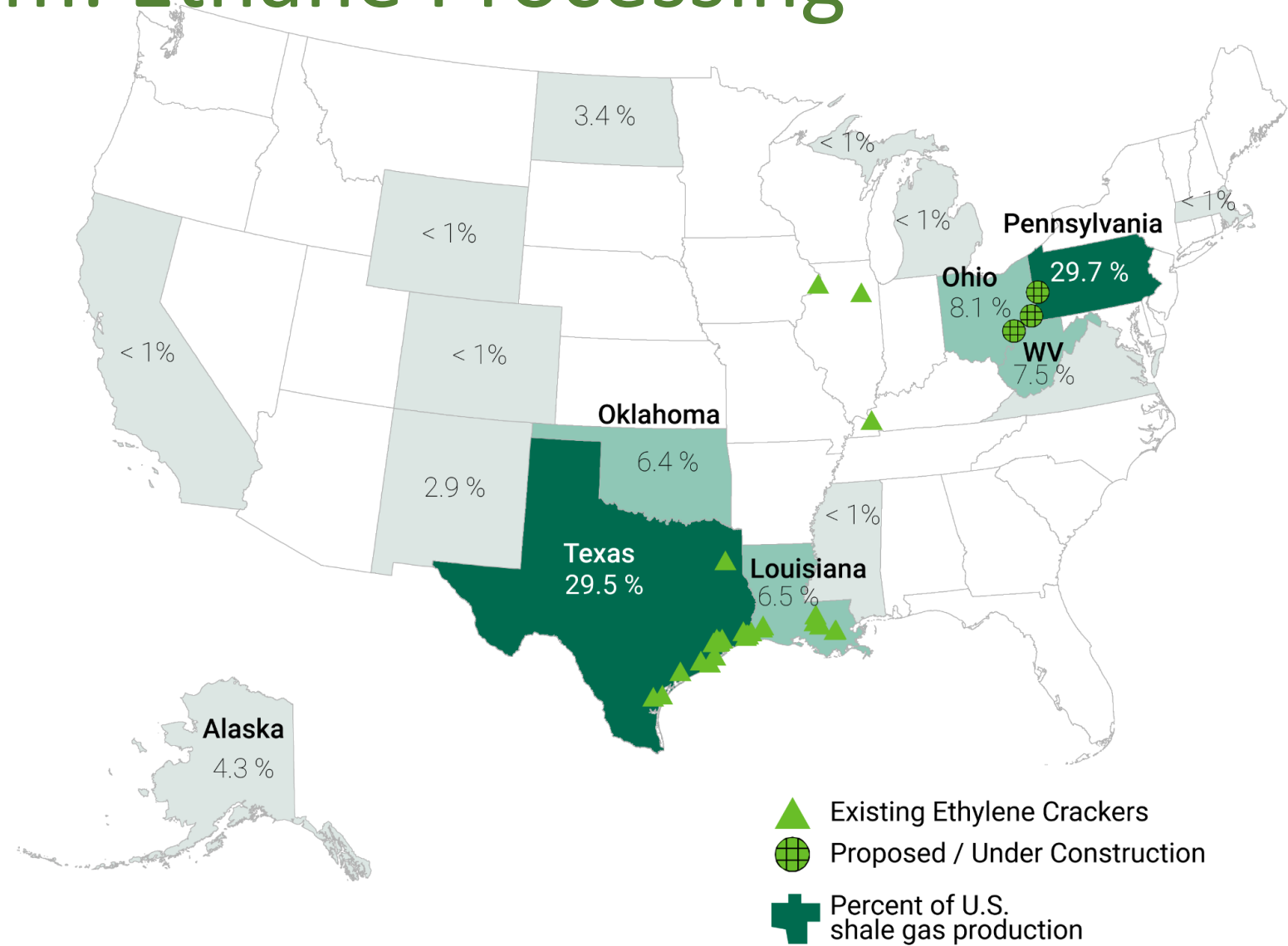
- Ohio's natural gas consumption for electricity generation increased 37% (EIA) from last year
- In June 2018, majority of electricity generation is still by coal (45%), but gap is closing
- **11 gas-fired plants** either under construction, planned, or newly built



Generation of Electricity by Source, Ohio

Downstream: Ethane Processing

- Expansion of ethane cracker plants into Appalachian region beginning
- Shell U.S. ethane cracker in PA currently on schedule for early 2020s
- Planning, approval and construction typically takes 7-10 years



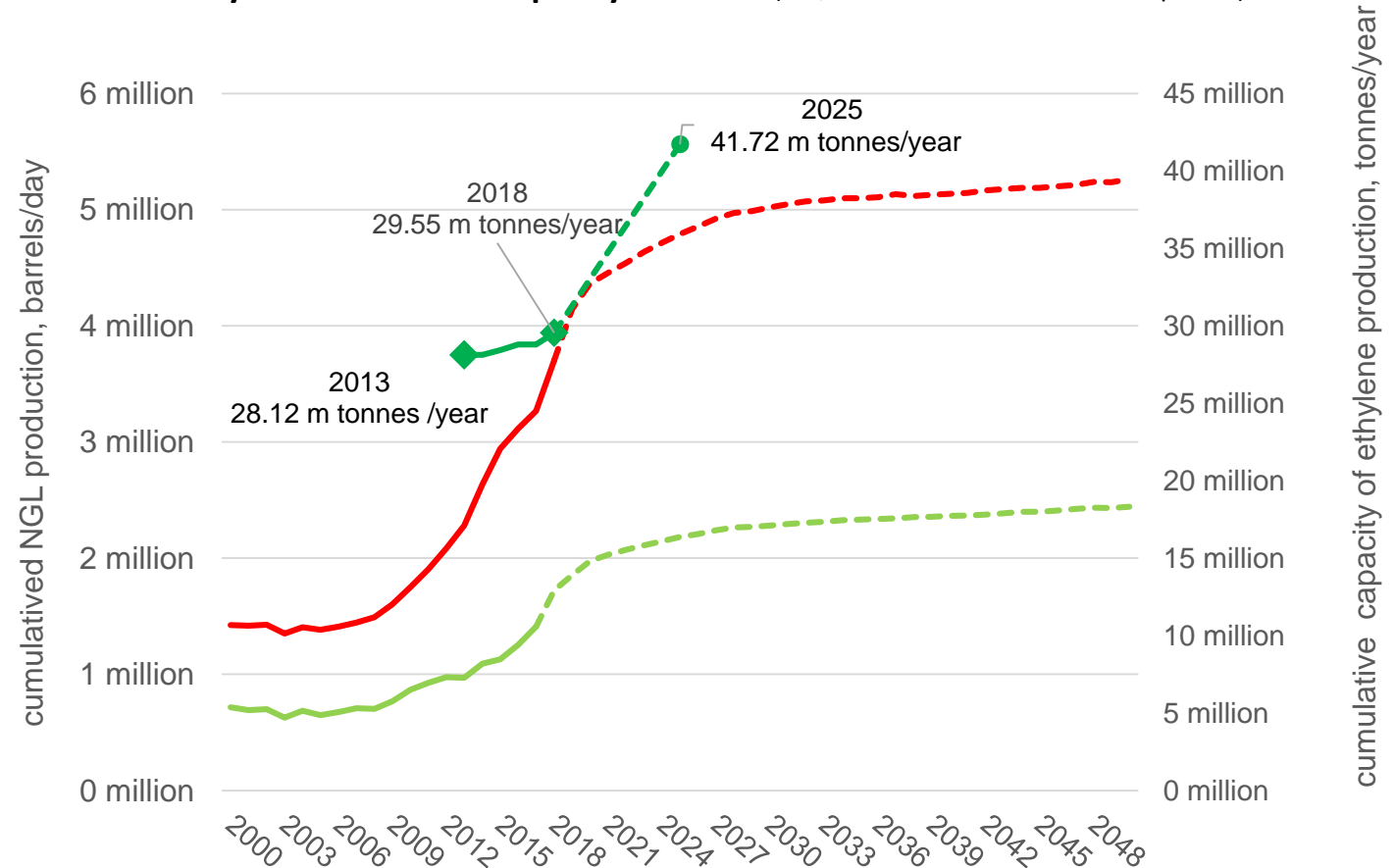
Downstream: Ethane Processing



- Total Onshore NGLs
- Ethane Production
- ◆ Ethylene Nameplate Capacity
- - - Projected Total Onshore NGLs
- - - Projected Ethane Production
- - - ● Planned Ethylene Capacity (verified projects)

- National and global ethane processing capacity going up
- Connected to increasing NGLs and ethane
- US expecting about 48% increase in ethylene

US Ethylene Production Capacity Estimate (EIA, Center for Economic Development)



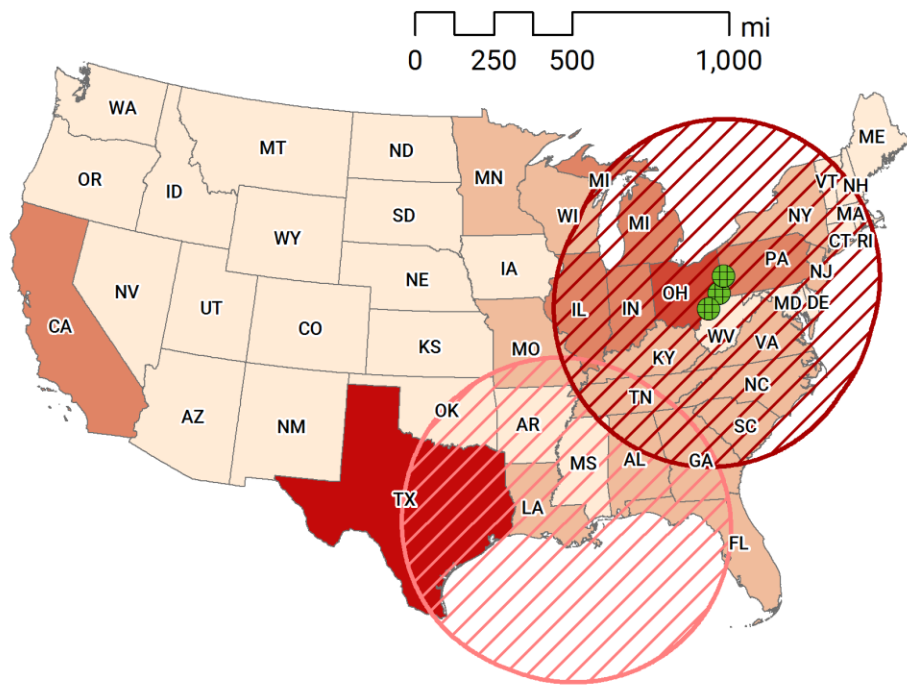


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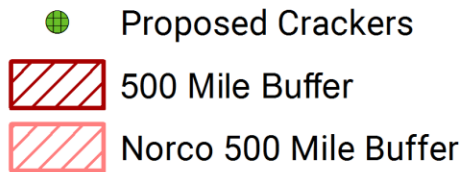
Developing a Petrochemical Hub

Are We Building a HUB?

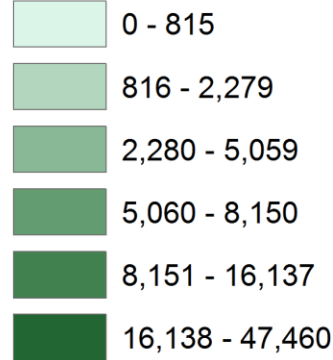
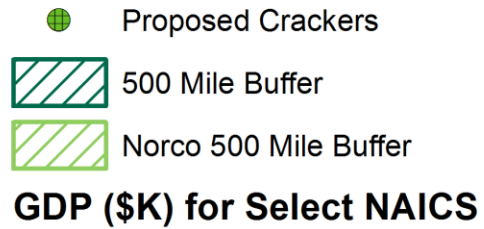
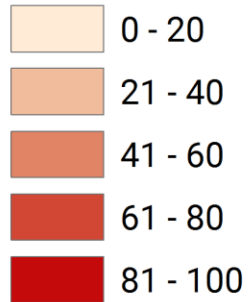
- **Industry hubs** are cities or regions where specific types of businesses are clustered
- “Being faster than your competitors. Developing products more flexibly. Being the first to put complex innovations on the market.” (HighTechCampus)
- “regions are the place to work on technology-based development and that regions need to be anchored by hubs of collaborative R&D where industry can work with academia and government to solve tough problems and foment technology gains.” (Brookings)



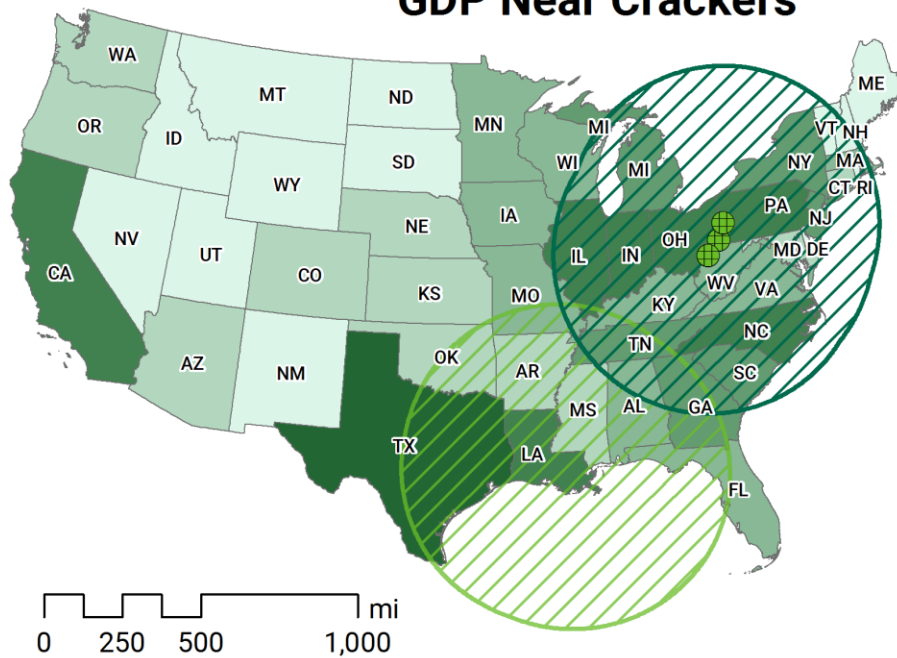
Commodity Chemicals Employment Near Crackers



Employment (thousands) for Select NAICS



Commodity Chemicals GDP Near Crackers

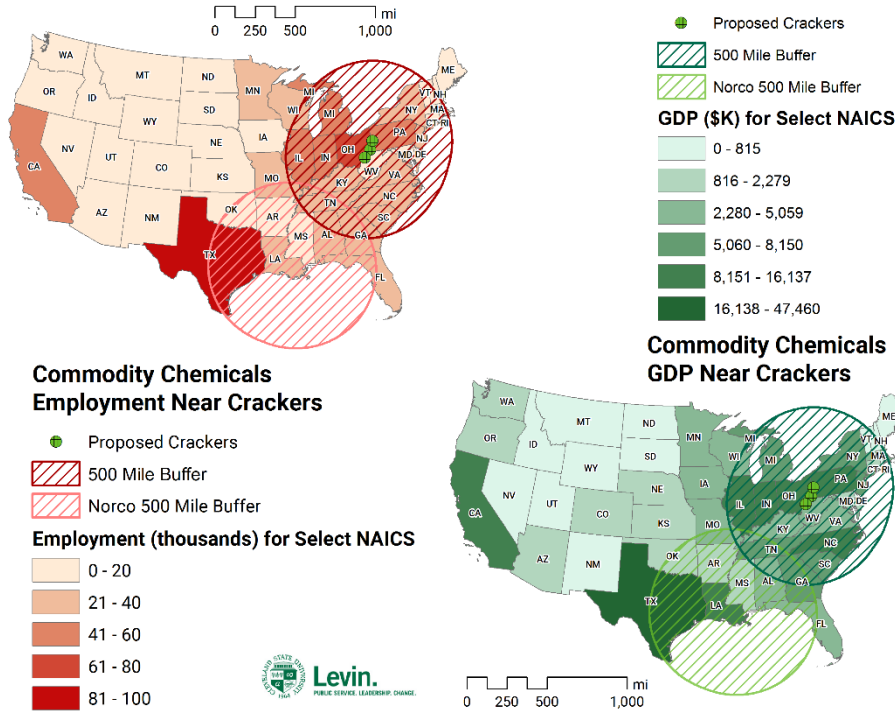


- 68.3% of the national downstream industries employment within 500 miles of Appalachian crackers

- 58.0% of national total of downstream industries GDP within 500 miles of Appalachian crackers

Downstream Industries

- NAICS **3251** Basic Chemical Manufacturing
- NAICS **3252** Resin, Synthetic Rubber, and Artificial and Synthetic Fibers and Filaments Manufacturing
- NAICS **3255** Paint, Coating, and Adhesive Manufacturing
- NAICS **3261** Plastics Product Manufacturing
- NAICS **3259** Other Chemical Product and Preparation Manufacturing
- NAICS **3253** Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing



	2017 Employment (thousands)	GDP (\$K)
Within 500 miles of Appalachian crackers	698 68.3% of national total	\$141,049 58.0% of national total
Within 500 miles of Norco Louisiana	418 40.9% of national total	\$122,080 50.2% of national total

Is Ohio Beefing up Downstream Supply Chain?

- Defined downstream sector by industries

NAICS	Industry Name
3251	Basic Chemical Manufacturing
3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing
3255	Paint, Coating, and Adhesive Manufacturing
3261	Plastics Product Manufacturing
3259	Other Chemical Product and Preparation Manufacturing
3253	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing

- Looked at “backward” and “forward” linkages along the supply chain:
 - The backward linkages describe the process of how a company purchases its goods, products, or supplies from a company in a different sector; these are called inputs (suppliers)
 - Forward linkages describe the process of how a company sells its goods, products, or supplies to a company in a different sector; these are called outputs (customers)
 - Crackers are looking for both suppliers and customers

Supply Chain Gaps



IMPLAN Sector	NAICS	Description
161	32511	Petrochemical manufacturing
156	32411	Petroleum refineries
166	325211	Plastics material and resin manufacturing
165	32519	Other basic organic chemical manufacturing
395	42	Wholesale trade
461	55	Management of companies and enterprises
49	22112	Electric power transmission and distribution
164	32518	Other basic inorganic chemical manufacturing
50	2212	Natural gas distribution
409	482	Rail transportation
411	484	Truck transportation
20	211111	Extraction of natural gas and crude petroleum
188	32611	Plastics packaging materials and unlaminated film and sheet manufacturing
163	32513	Synthetic dye and pigment manufacturing
149	32221	Paperboard container manufacturing

2015 Largest Gaps

- Petroleum Refineries
- Plastic Material and Resin Manufacturing
- Other Basic Organic Chemical Manufacturing
- Plastic Packaging Materials and Unlaminated Film and Sheet Manufacturing

Source: IMPLAN data

27 Petrochemical/Downstream-Related Industries



- Petrochemical manufacturing
- Industrial gas manufacturing
- Synthetic dye and pigment manufacturing
- Other basic inorganic chemical manufacturing
- Other basic organic chemical manufacturing
- Plastics material and resin manufacturing
- Synthetic rubber manufacturing
- Artificial and synthetic fibers and filaments manufacturing
- Nitrogenous fertilizer manufacturing
- Phosphatic fertilizer manufacturing
- Fertilizer mixing
- Pesticide and other agricultural chemical manufacturing
- Paint and coating manufacturing
- Adhesive manufacturing
- Printing ink manufacturing
- Explosives manufacturing
- Custom compounding of purchased resins
- Photographic film and chemical manufacturing
- Other miscellaneous chemical product manufacturing
- Plastics packaging materials and unlaminated film and sheet manufacturing
- Unlaminated plastics profile shape manufacturing
- Plastics pipe and pipe fitting manufacturing
- Laminated plastics plate, sheet (except packaging), and shape manufacturing
- Polystyrene foam product manufacturing
- Urethane and other foam product (except polystyrene) manufacturing
- Plastics bottle manufacturing
- Other plastics product manufacturing



2018 Supply Chain of the Petrochemical Industry (Downstream) in Ohio

- On average, 27 petrochemical industries buy 29% of their supplies in Ohio, equivalent of \$12.6 Bill
- Top industries selling supplies to the downstream:
 - Wholesale trade – 14%
 - Management of companies and enterprises – 14%
 - Petroleum refineries – 6%
 - Electric power transmission and distribution – 5%
 - Natural gas distribution – 5%
 - Truck transportation – 4%
 - Plastics material and resin manufacturing – 4%

**70% of
downstream
supplies are still
bought outside
Ohio**

From What Industries the Downstream Buys in Ohio



IMPLAN Sector	Total Supplies Purchased in Ohio	% of Supplies purchased in Ohio
Wholesale trade	\$1,820,210,475	14%
Management of companies and enterprises	\$1,787,094,582	14%
Petroleum refineries	\$703,071,371	6%
Electric power transmission and distribution	\$591,267,168	5%
Natural gas distribution	\$573,461,846	5%
Truck transportation	\$543,388,696	4%
Plastics material and resin manufacturing	\$442,199,585	4%
Rail transportation	\$350,239,412	3%
Lessors of nonfinancial intangible assets	\$260,330,697	2%
Nitrogenous fertilizer manufacturing	\$254,917,801	2%
Synthetic dye and pigment manufacturing	\$251,554,292	2%
Paperboard container manufacturing	\$232,590,785	2%
Waste management and remediation services	\$200,105,884	2%
Other basic organic chemical manufacturing	\$192,811,440	2%
Maintenance and repair - nonresidential	\$192,772,568	2%

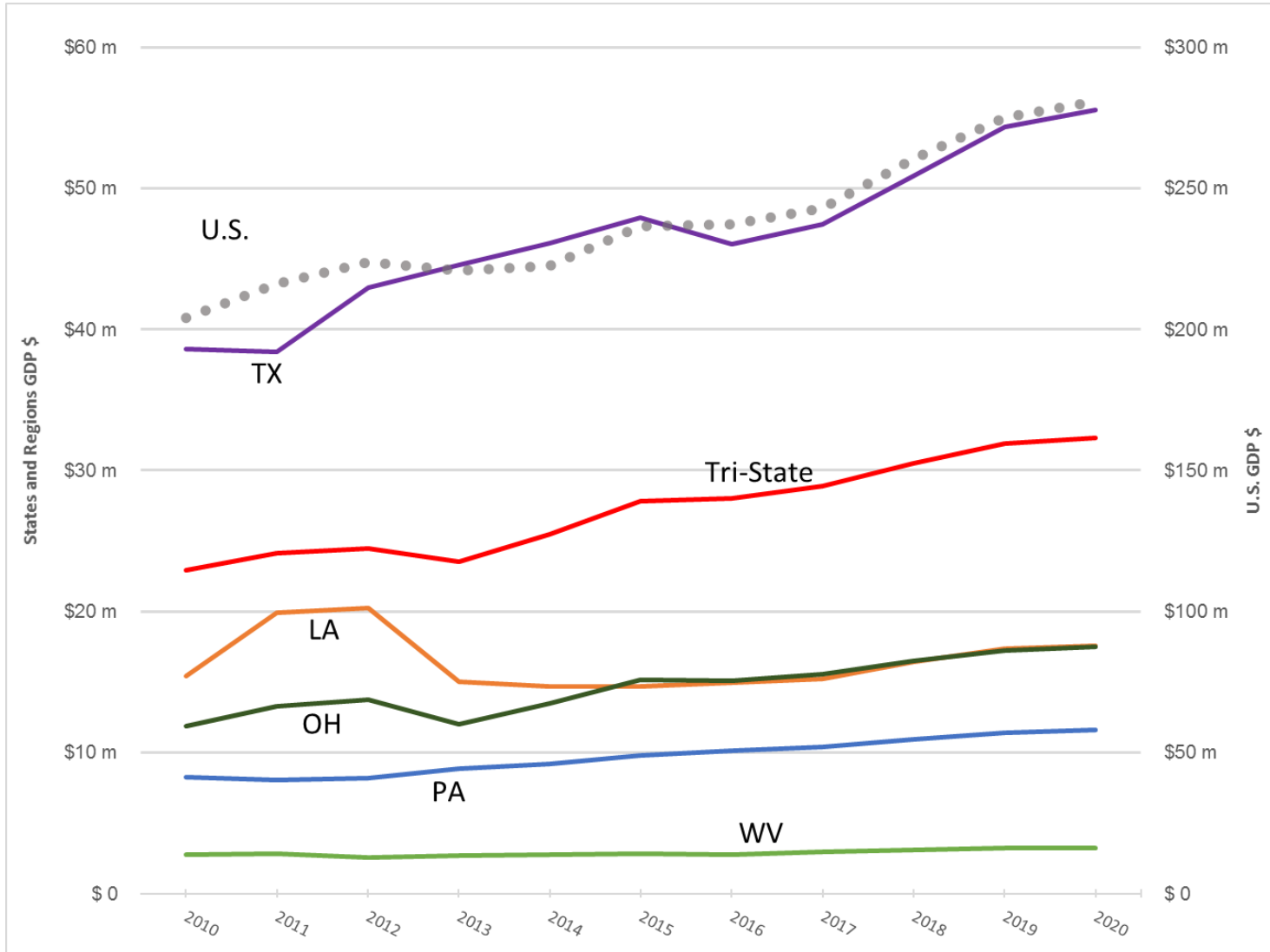
Top 30 Industries Supplying 79% of All Purchases Made in Ohio



IMPLAN Sector	Total Supplies Purchased in Ohio	% of Supplies purchased in Ohio
Industrial gas manufacturing	\$176,951,137	1%
Architectural, engineering, and related services	\$160,219,322	1%
Other local government enterprises	\$160,105,001	1%
Monetary authorities and credit intermediation	\$154,024,283	1%
Plastics packaging materials	\$142,229,094	1%
Marketing research and other technical services	\$113,211,465	1%
Other basic inorganic chemical manufacturing	\$97,101,783	1%
Grain farming	\$88,871,882	1%
Custom compounding of purchased resins	\$84,814,731	1%
Services to buildings	\$84,157,850	1%
Commercial and industrial machinery	\$79,543,559	1%
Air transportation	\$76,750,377	1%
Petrochemical manufacturing	\$72,102,998	1%
Limited-service restaurants	\$71,894,068	1%
Other plastics product manufacturing	\$67,419,129	1%

Checking the Dynamics of the Downstream

GDP/GRP of Downstream Sector



2010-2017

- US grew 19%*:
 - LA declined 1%
 - TX grew 23%
- Tri-State grew 26%
 - OH – 31%
 - PA – 26%
 - WV – 5%

2017-2020

- US is projected to grow 16%:
 - LA – 15%; TX – 17%
- Tri-state is projected to grow 12%:
 - OH – 12%
 - PA & WV – 11%

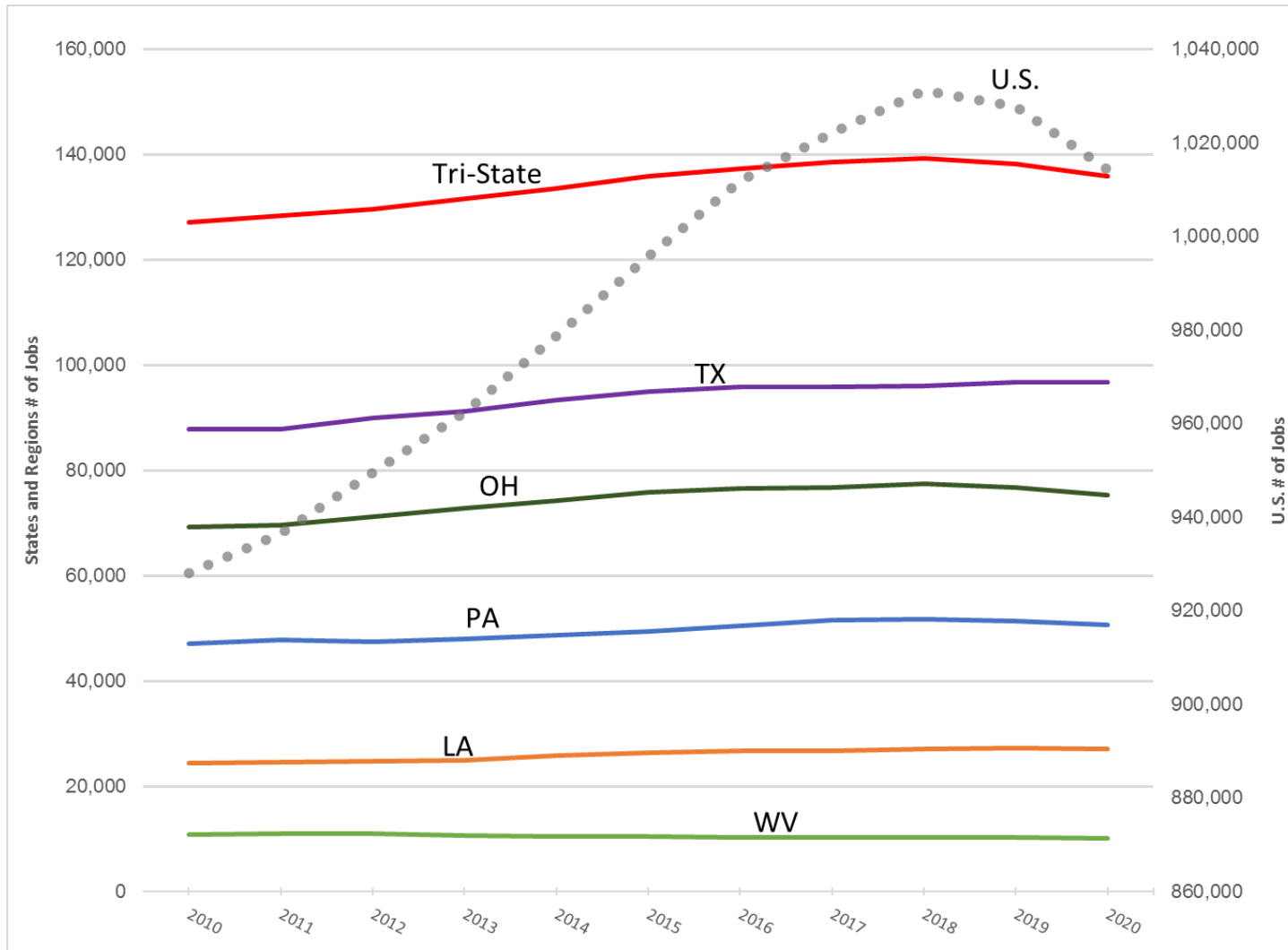
*numbers are not adjusted for inflation

Source: Moody's Economy.com

Checking the Dynamics of the Downstream



Employment of Downstream Sector



2010-2017

- US grew 10%:
 - LA -- 10%
 - TX -- 9%
- Tri-State grew 9%
 - OH – 11%
 - PA – 10%
 - WV declined 6%

2017-2020

- US is projected to decline 1%:
 - LA to grow 1%; TX – 1%
- Tri-state is projected to decline 2%:
 - OH decline 2%
 - PA -- 2%
 - WV – 1%

Source: Moody's Economy.com



Remaining Challenges of the Petrochemical and Downstream Industries

- Tri-state region is competing with global petrochemical producers – vertically integrated, capital-intensive, high-barrier-to-entry
- Moving towards the completion of Pennsylvania Shell ethylene cracker plant may attract other global companies and JVs
- Research, business services, and workforce may provide a competitive advantage for a region in addition to the feedstock and energy
 - Can this become a competitive advantage for the tri-state region?



For More Information

See Our Reports on Utica Shale in Ohio:

- 1) [Economics of Utica Shale in Ohio: Workforce Analysis](#)
- 2) [Economics of Utica Shale in Ohio: Supply Chain Analysis](#)



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