Petrochemical Industry Overview

A KEY VALUE CREATOR FOR THE HYDROCARBON CHAIN

SANJEEV KAPUR
PRINCIPAL CONSULTANT & PRESIDENT

Biography

Sanjeev Kapur is an independent consultant in the field of olefins based petrochemical businesses. He brings the value of strategic thinking, specific industry insights, knowledge and depth of experience for olefins based petrochemical businesses to develop, build and operate best-in-class facilities. Sanjeev has 35 years of industry experience and had been associated with Fluor, Shaw Stone & Webster (now part of Technip), ABB Lummus Global (now CB&I Lummus), and The Kinetics Technology International (now part of Technip). He has extensive experience working in the licensing and engineering / construction industry. Most of this work has been in ethylene/propylene-based petrochemical projects and integration of these with refineries, aromatic production, natural gas processing, polymers, derivatives and specialty chemical units. Sanjeev provides independent expert advice and impartial analysis to deliver value to the businesses to realize their full potential.

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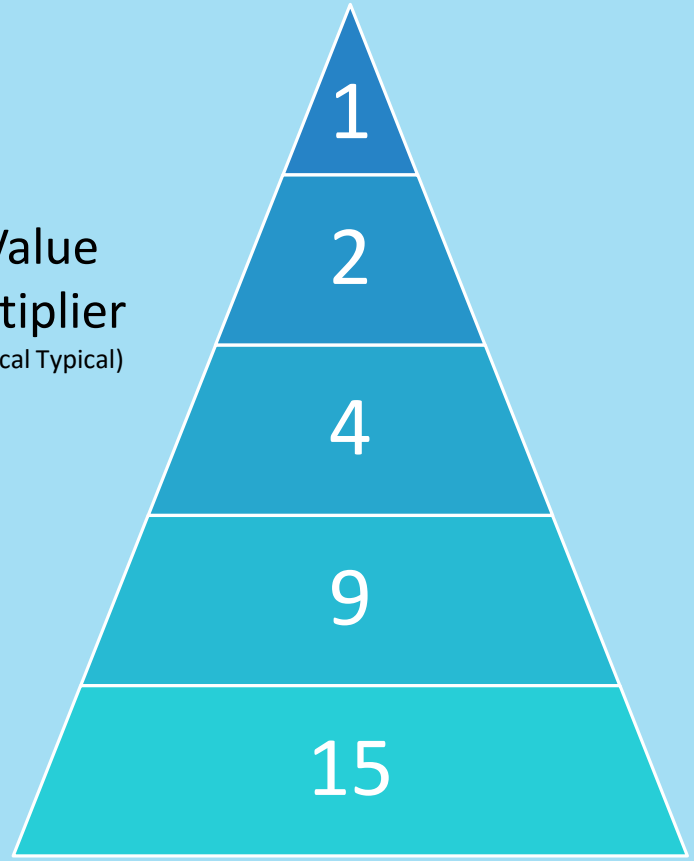
Agenda

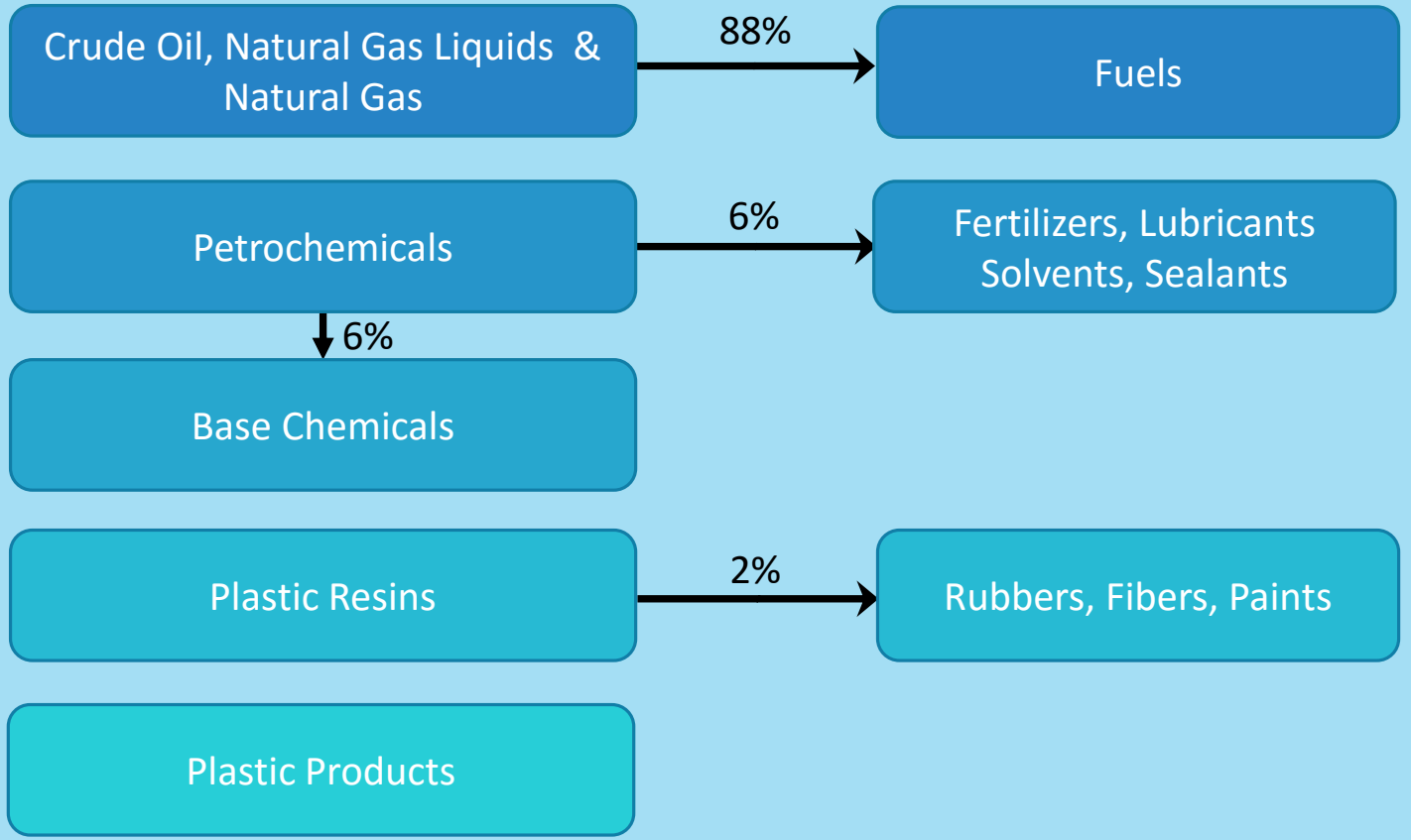
- Understanding the value chain
- Industry fundamentals
- Trends
- Success factors & challenges

Understanding the value chain

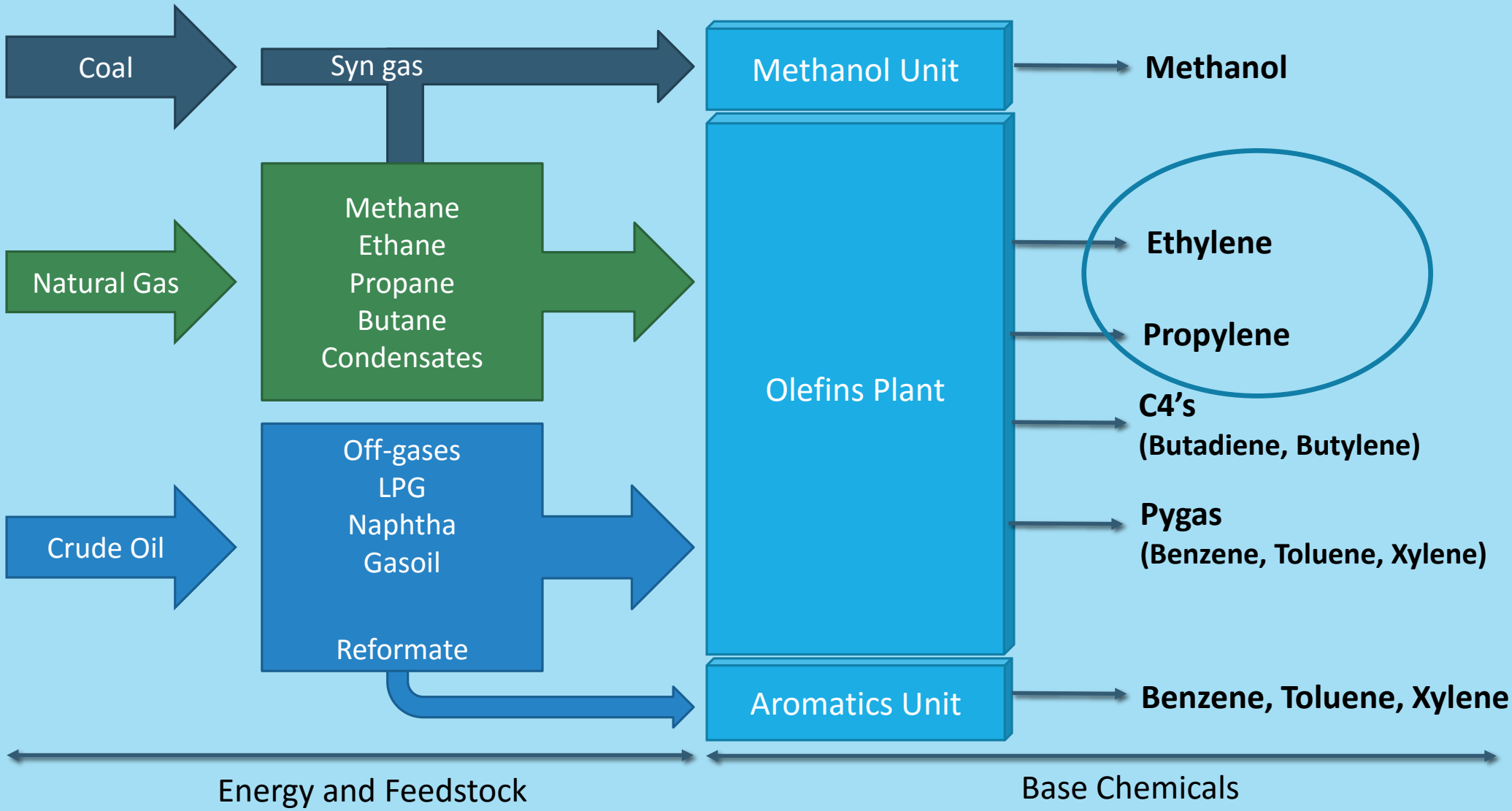
Approximately 12% of crude oil and natural gas ends up in petrochemicals, the *multiplier effect* makes it an important avenue for value creation

~ Value Multiplier
(Historical Typical)

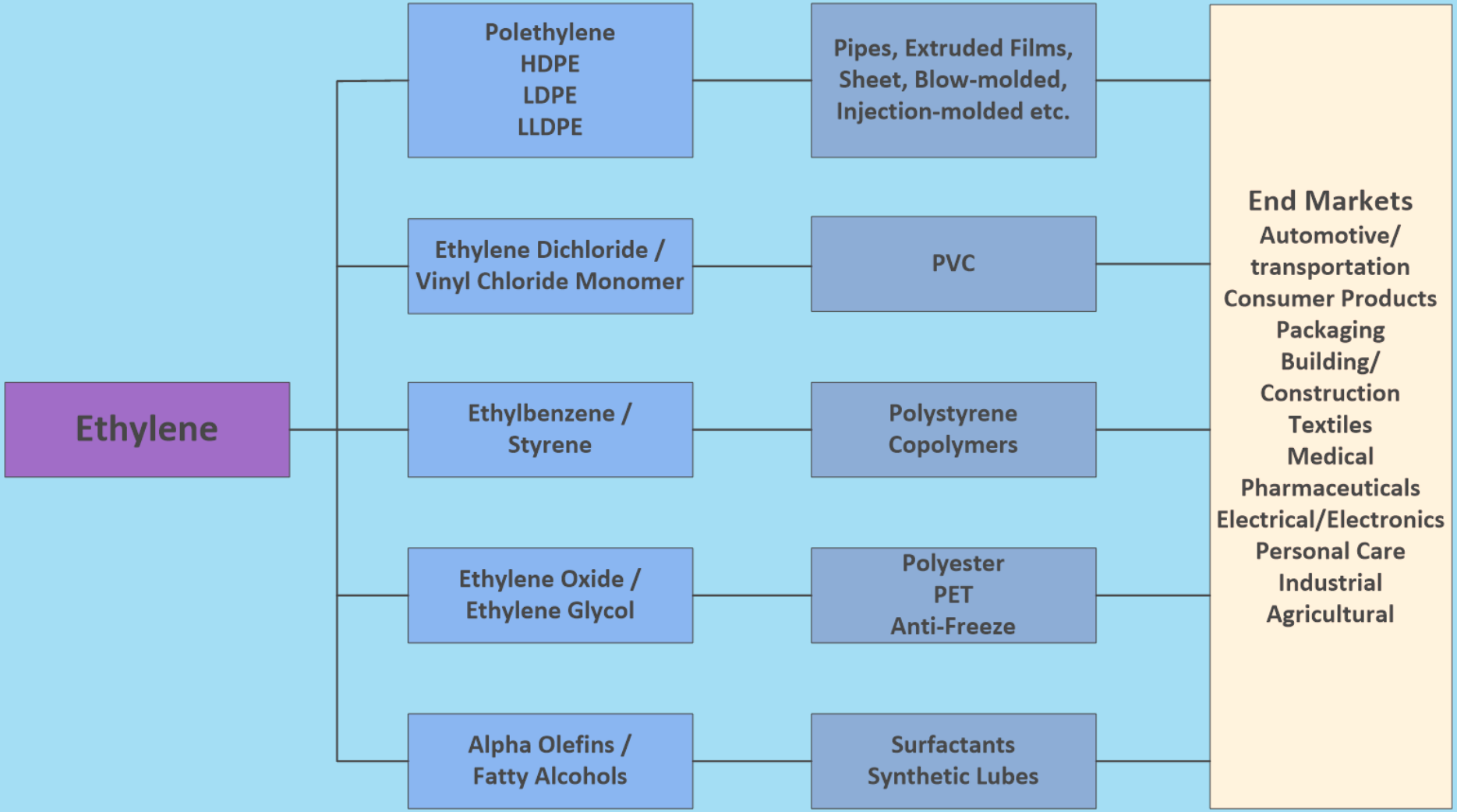




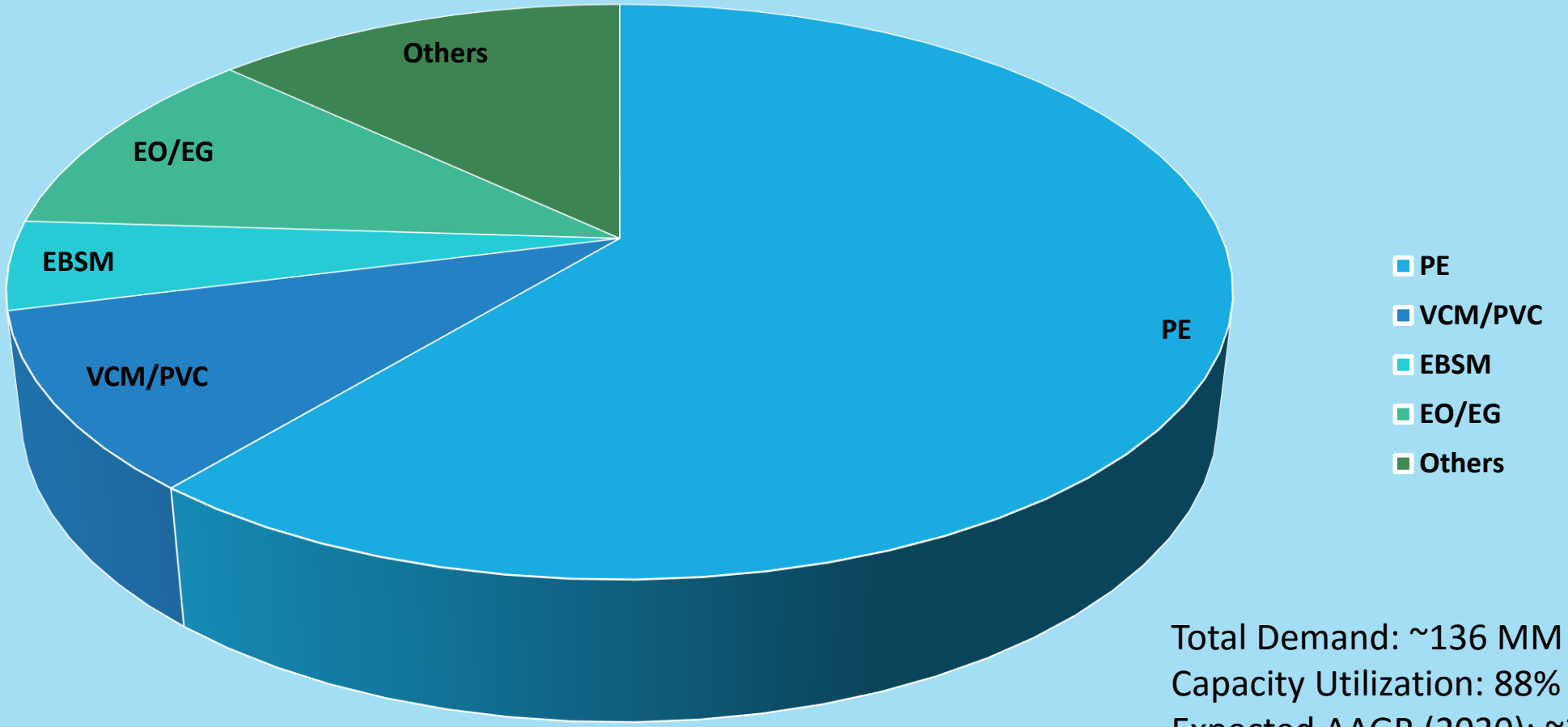
Energy to Base Chemicals



Ethylene Value Chain

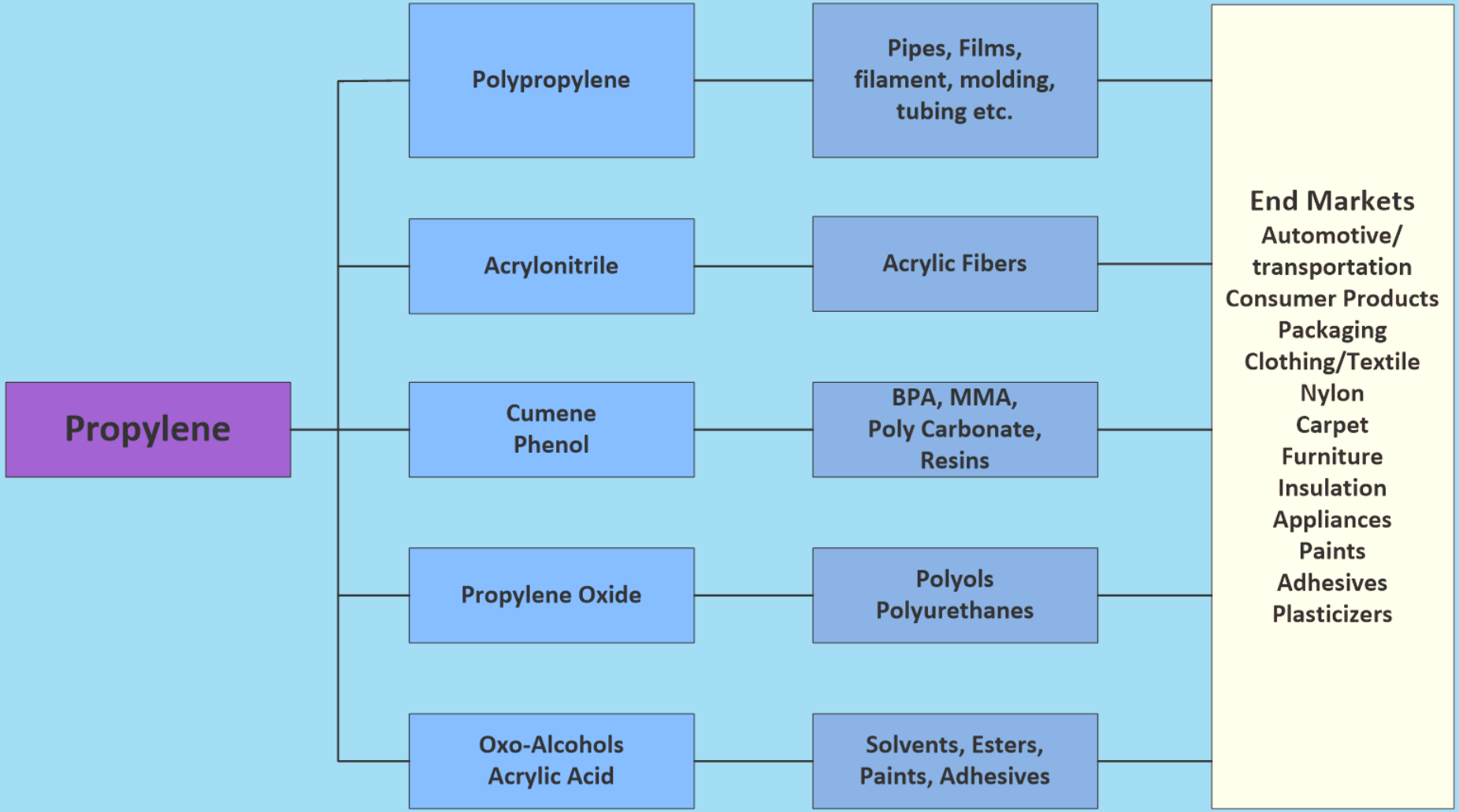


Global Ethylene Demand - 2014

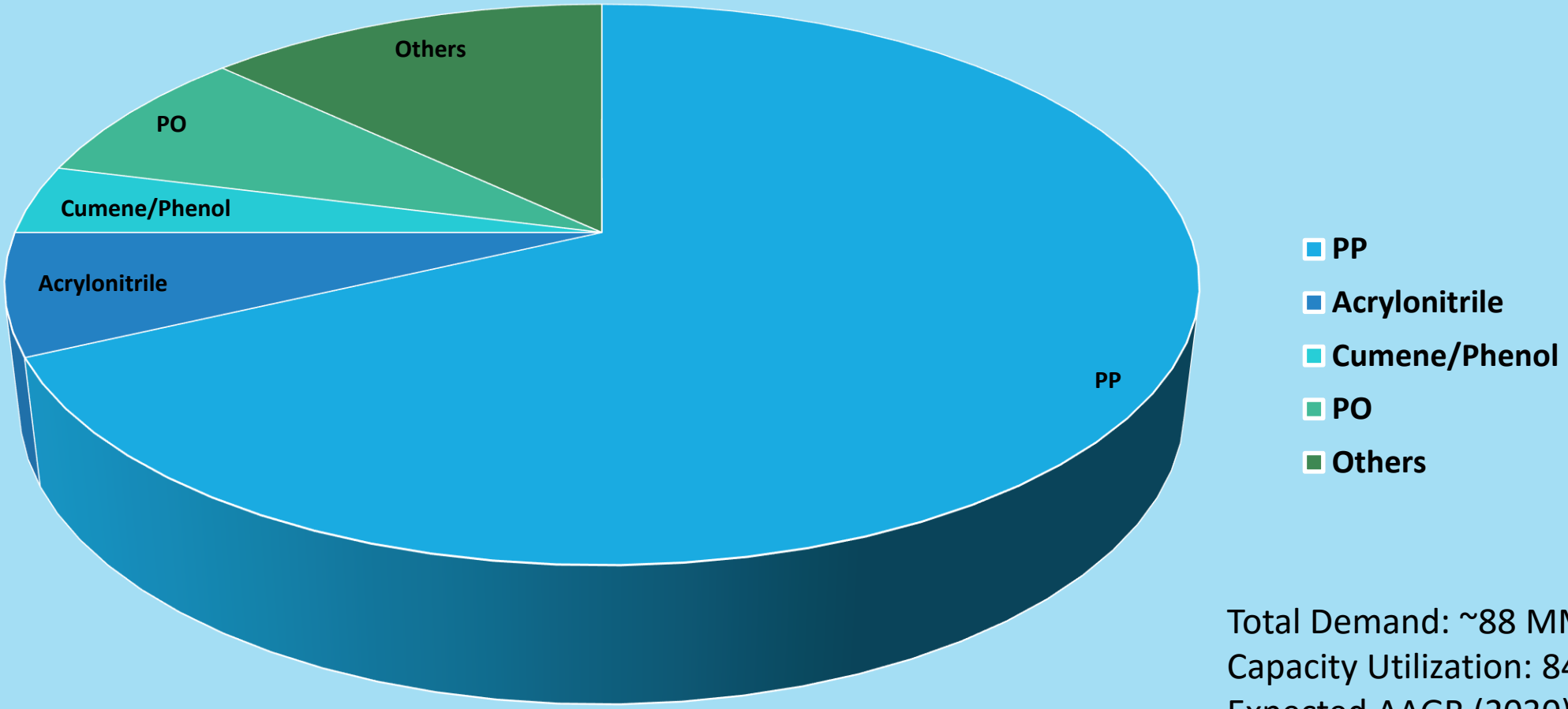


Total Demand: ~136 MM MTA
Capacity Utilization: 88%
Expected AAGR (2030): ~3.3%

Propylene Value Chain

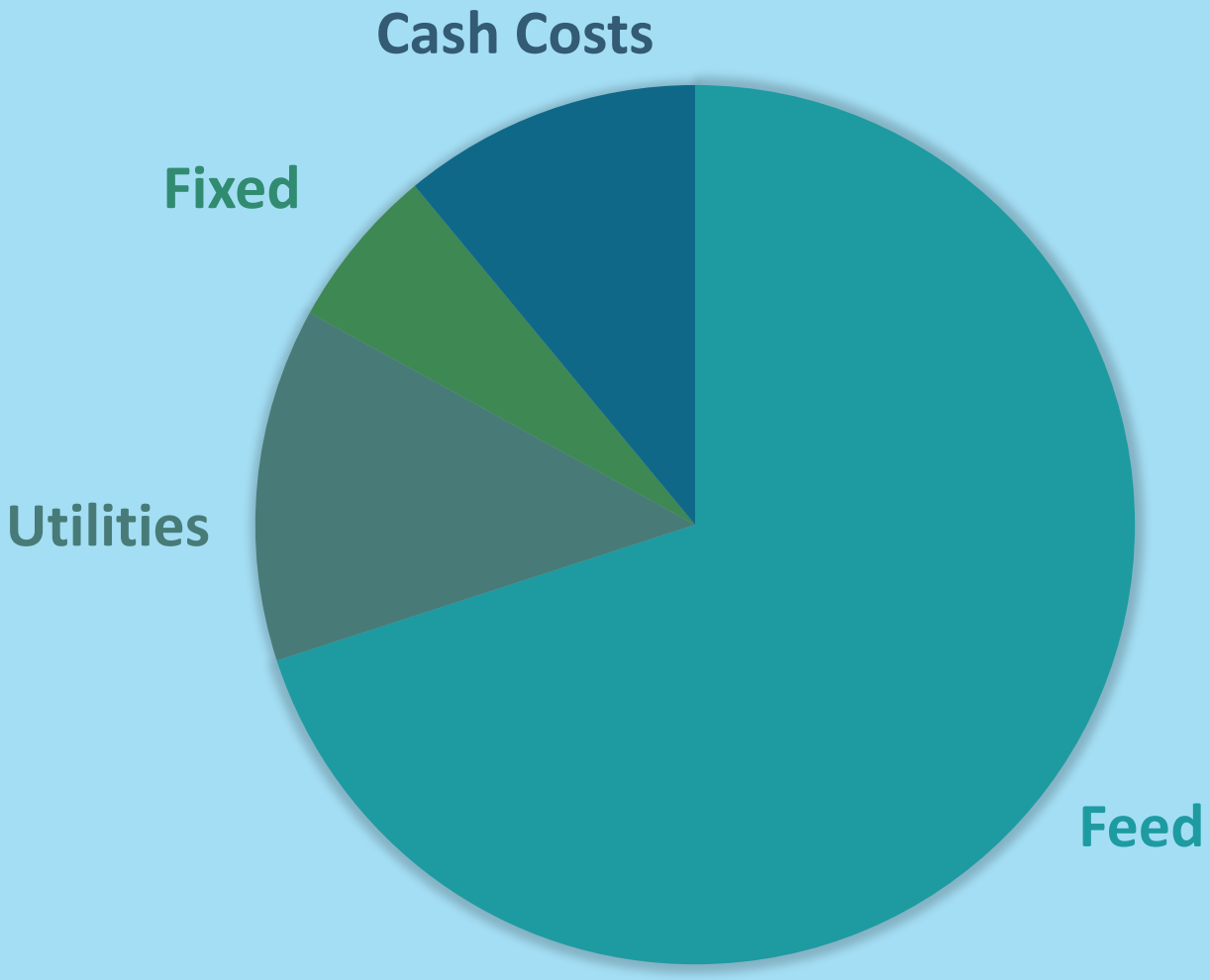


Global Propylene Demand - 2014



Total Demand: ~88 MM MTA
Capacity Utilization: 84%
Expected AAGR (2030): 4.5%

Typical Cost of Production - Chemicals



EIA Outlook – Crude and NG Prices

Figure ES1. North Sea Brent crude oil spot prices in four cases, 2005-40 (2013 dollars per barrel)

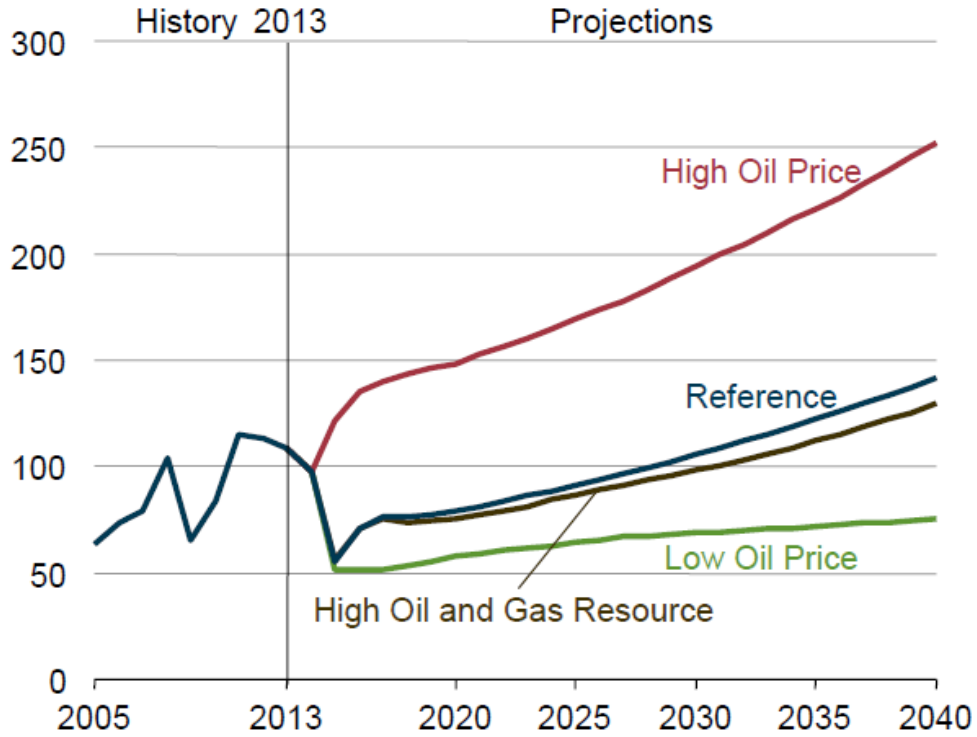
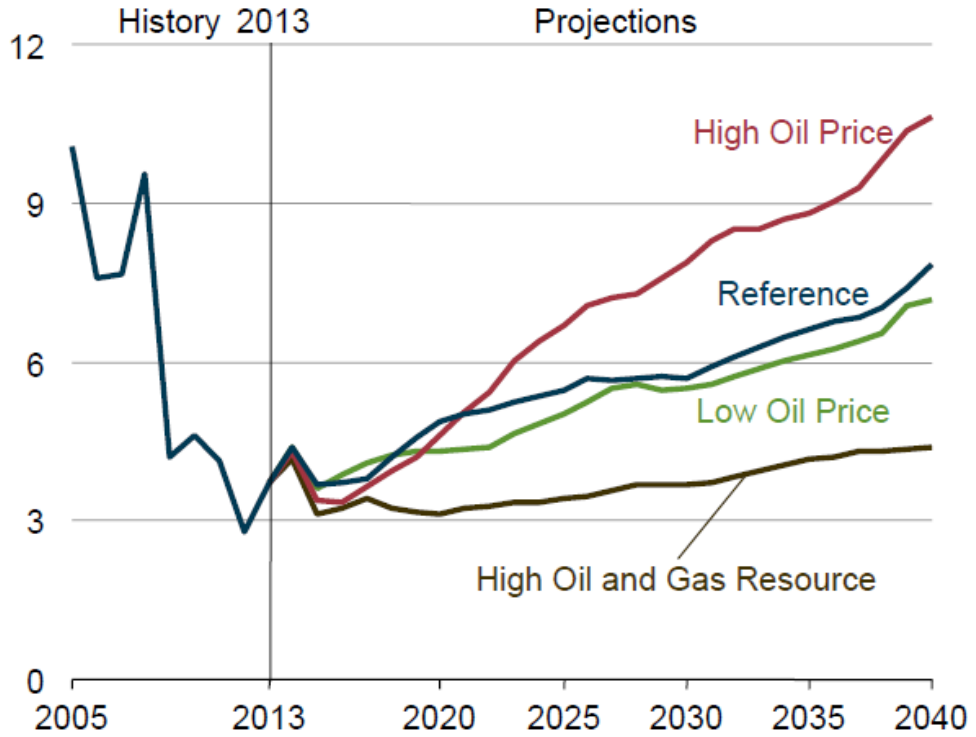


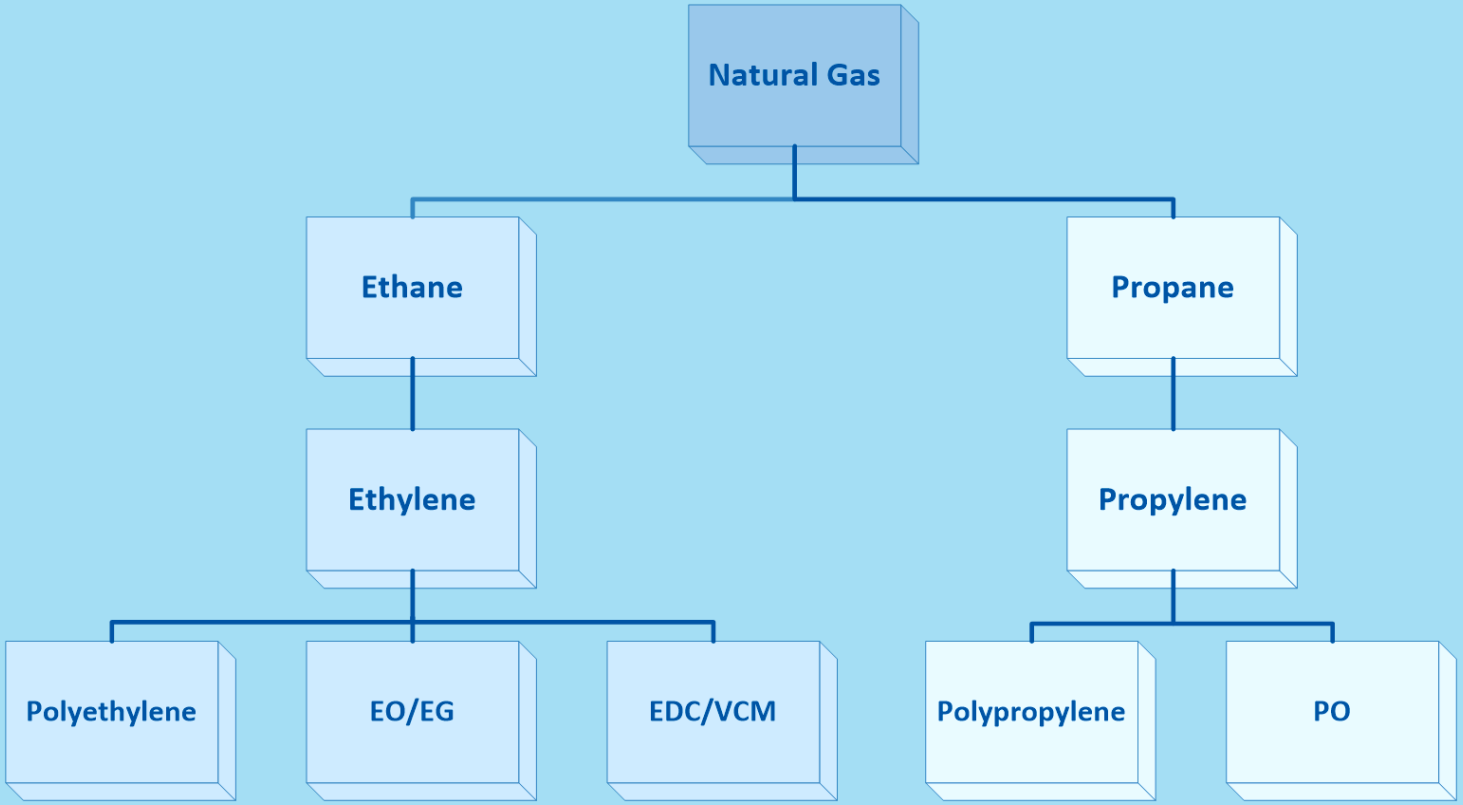
Figure ES2. Average Henry Hub spot prices for natural gas in four cases, 2005-40 (2013 dollars per million Btu)

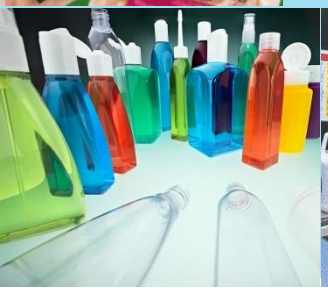


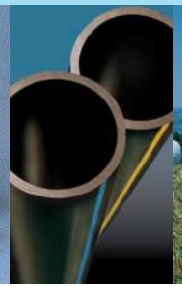
ES-2 U.S. Energy Information Administration | Annual Energy Outlook 2015

Source: www.eia.gov

Shale Driven Growth – Petrochemical Industry

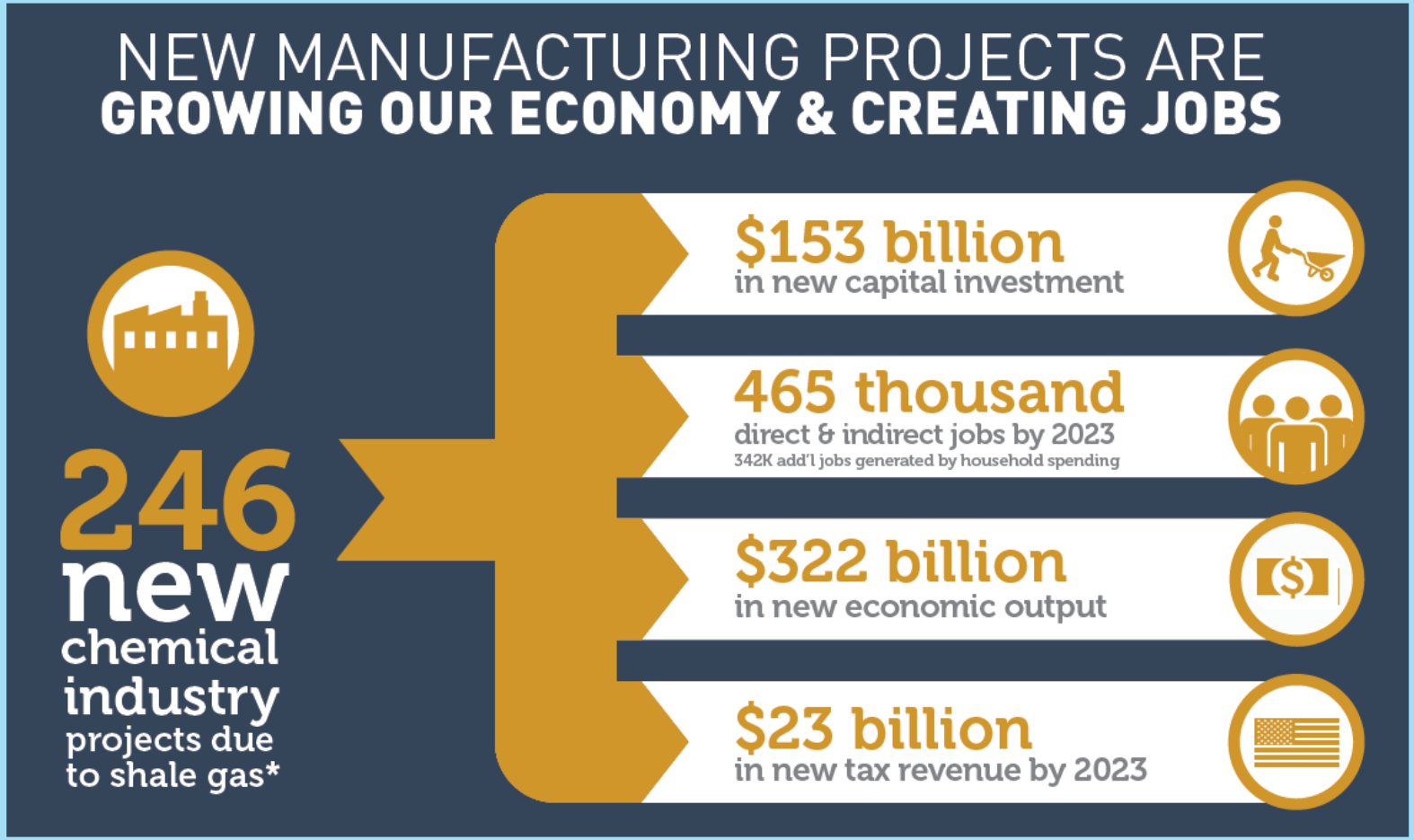






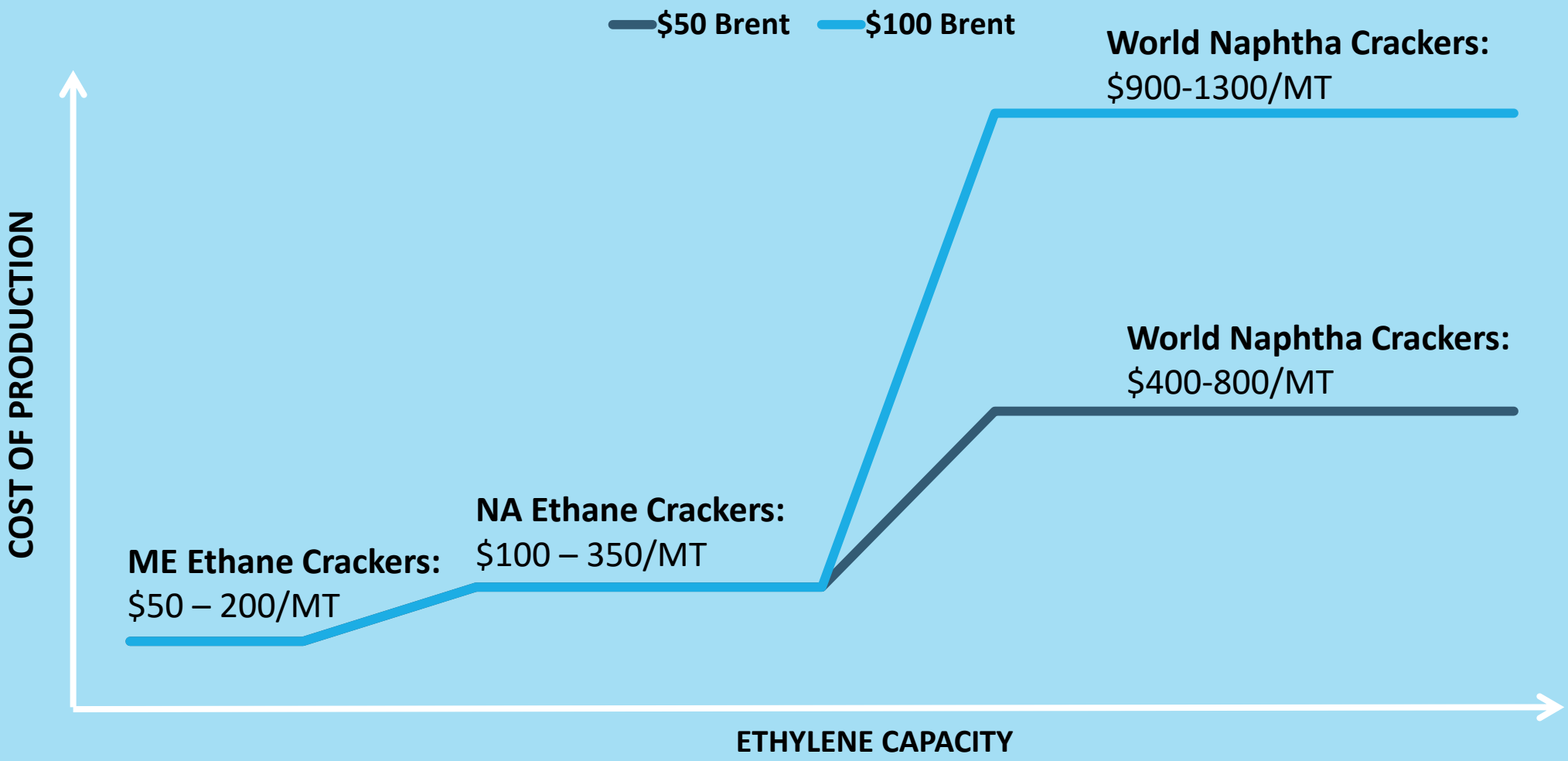
Shale related investments in US chemical industry

Driven by Base Chemicals: Ethylene, Propylene (PDH), Methanol



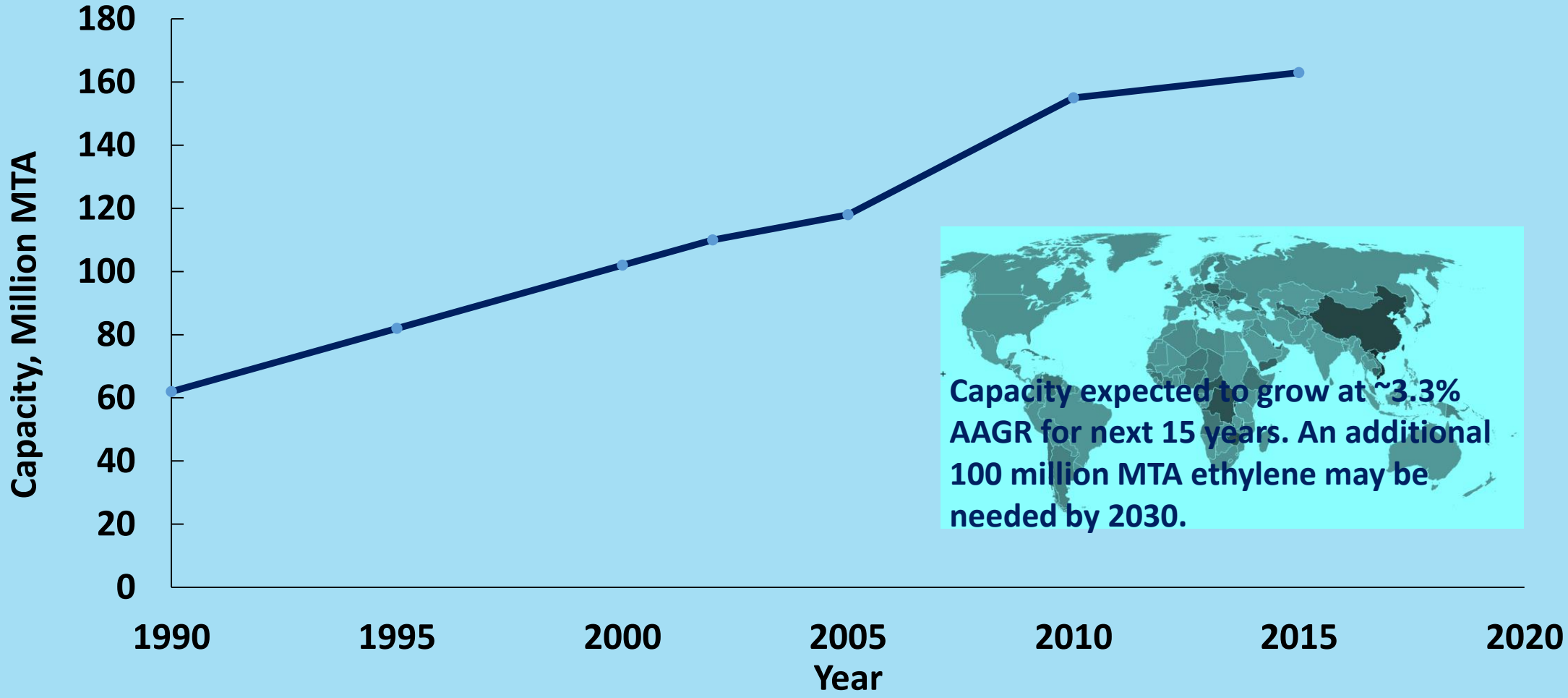
Source: http://www.americanchemistry.com/Policy/Energy/Shale-Gas/Shale-Investment-Infographic.pdf

Energy Market Dynamics



Source: based on publically available data/costs

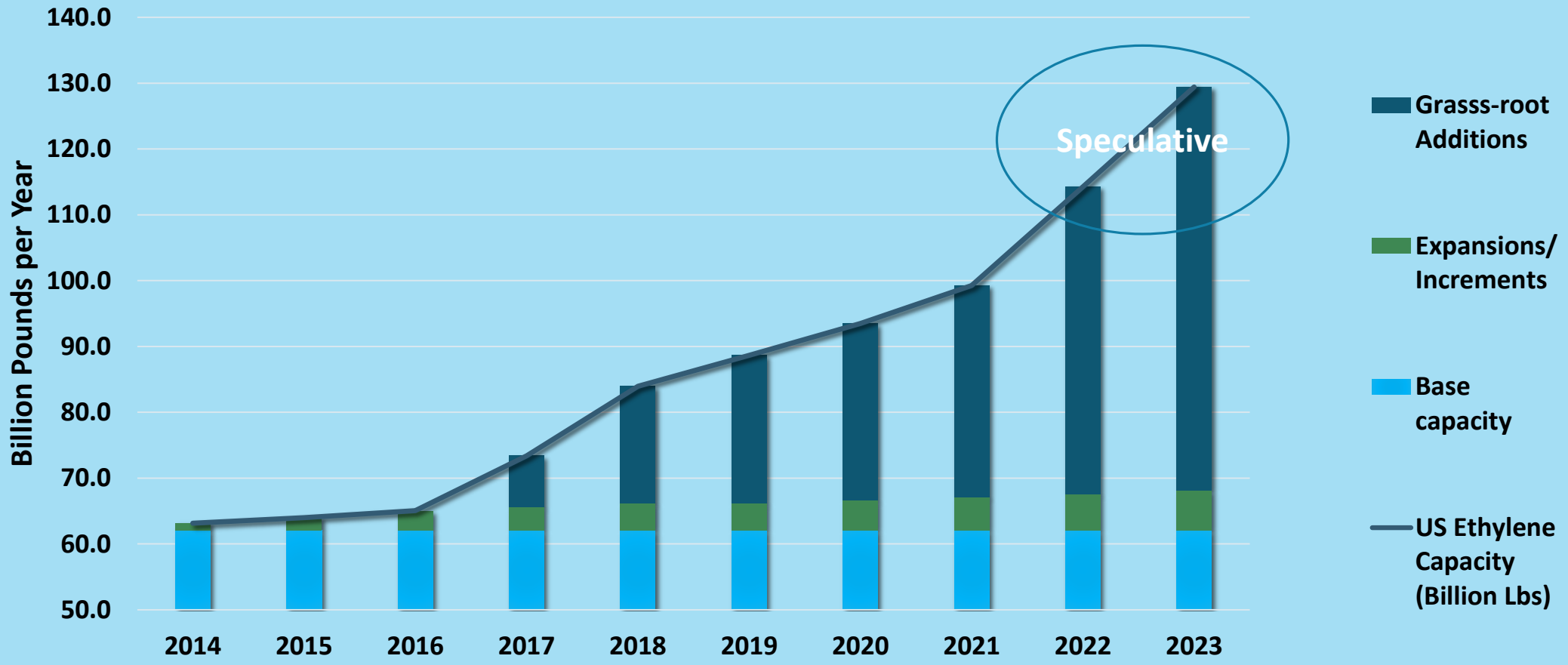
World Ethylene Capacity



Source: based on publically available data

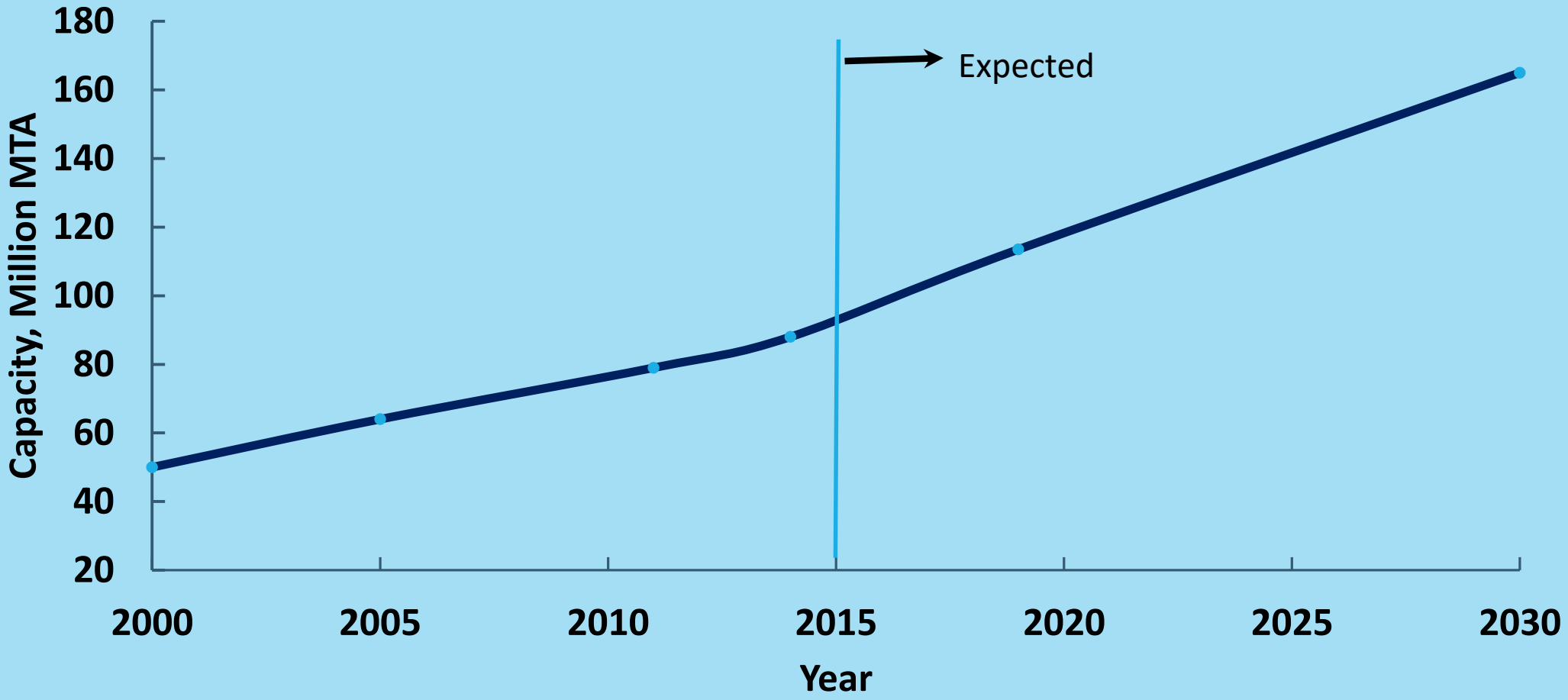
US Ethylene Capacity

Based on announced additions, US will add more than 50% capacity over 5 years



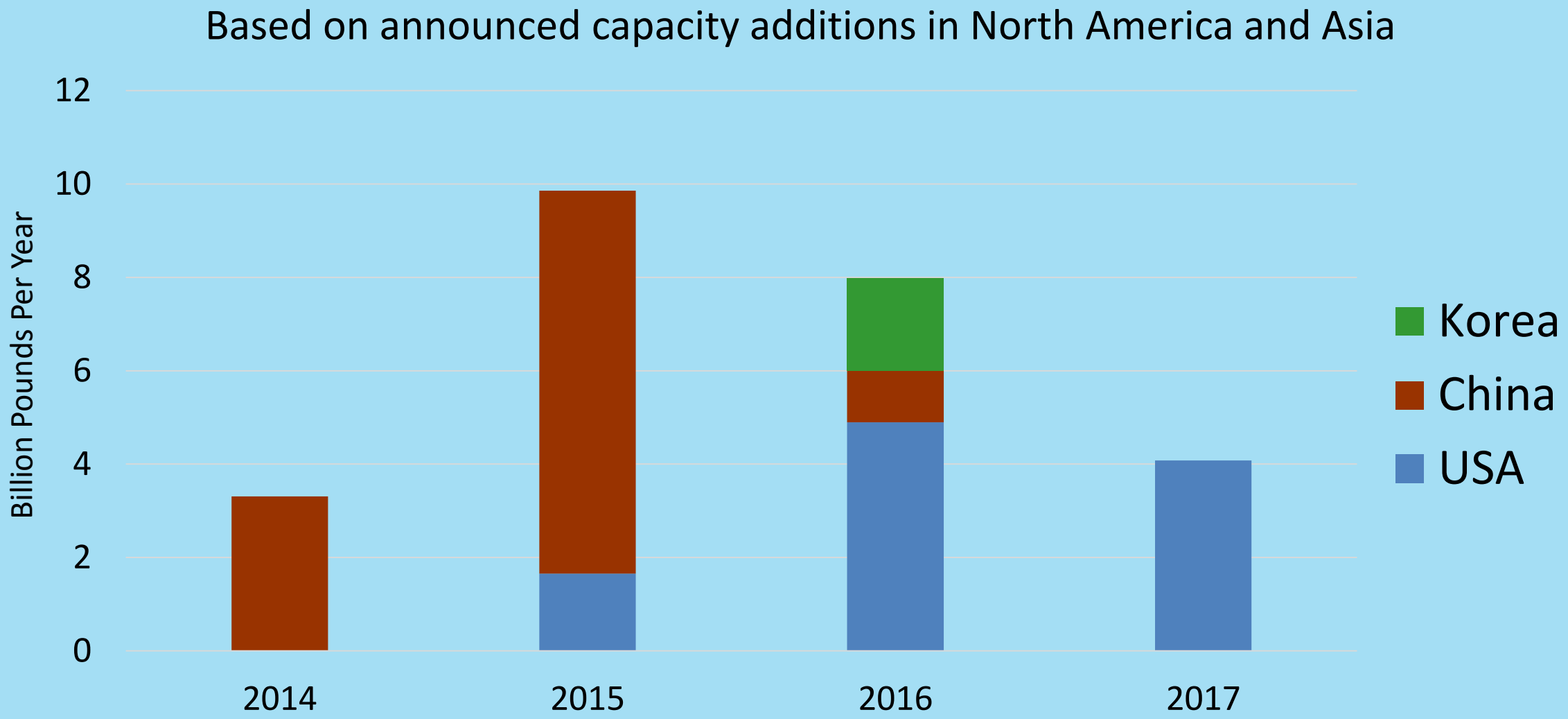
Source: GHS, Apex PetroConsultants, industry news sources

World Propylene Demand



Source: based on publically available data

PDH (Propane Dehydrogenation) Capacity Additions



Source: GHS, Apex PetroConsultants

Petrochemical Industry – Top Trends

- Shale driven growth
- Alternate feedstock - Coal to a large extent, potentially bio/renewables
- Middle East feed diversification, breadth of product coverage
- Demand growth – led by China, India, Brazil, Turkey, Mexico etc.; growing middle class and urbanization; growth of construction sectors/ automobile and packaging industry
- Energy market dynamics – crude oil prices relative to natural gas and coal
- Technology & Innovation - On-purpose technologies for C3s, C4s and aromatics; material advances (lightweight, nanomaterials, functional textiles etc.)
- Environmental - Greenhouse gas emissions regulations, water management, recycling/waste treatment

Petrochemical Business Success Factors

Success Factors

Access to feed, markets, and resources

World scale, integrated, and competitive

Global coverage

Technology, product range coverage

World Scale Ethylene Plant Capacity Trend

Ethylene Cracker Complexes – Mega Projects

Planning is vital

- Mature technology, access to cheap feed-stock cost and the market is critical
- Robust business case development - master planning is crucial
- Integration is the key - hydrocarbon management, energy integration, synergies
- Successful delivery of mega capital projects
  - Capital efficiency, project costs, timely start-up and quick ramp-up to full capacity
- Economics of large scale projects are based on long-term outlook (20 to 30 years is typical) – feed security is important
- Regulatory uncertainty – permitting, taxation, trade barriers, environmental regulations
- Technical and skilled resources
- Access to financing, financing structure

Propane Dehydrogenation (PDH) Plants

- Technology is not as mature and as widely used as ethylene crackers
- Propylene is transitioning from by-product/co-product production to more on-purpose & will be subjected to cyclical nature of the industry
- On-purpose propylene capacity will more than double in next 5 years
- PDH plants, and other on-purpose technologies for propylene, will become swing producers and price setters
- Propane-propylene spread is the major driver of economics (propane price is subjected to seasonal variations)
- Propylene margins diverge on regional basis
  - North America: positive PDH economics due to excess propane supplies
  - Overcapacity in Asian plants

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