

US Petrochemicals

The growing importance of export markets

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Addressing strategic challenges with interconnected capabilities



The comprehensive single source for global data & information, key market insights, analysis & forecasts



Core Segments within Energy & Natural Resources

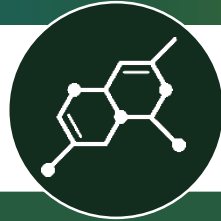
Our core capabilities serve our energy and chemical customers across the value chain through focused data and insight subscriptions as well as consulting.



The Chemical Industry Enables Modern Living

Chemical industry value chain

Customers



Natural resources

Base chemicals

Chemical intermediates

Formulated products / performance materials

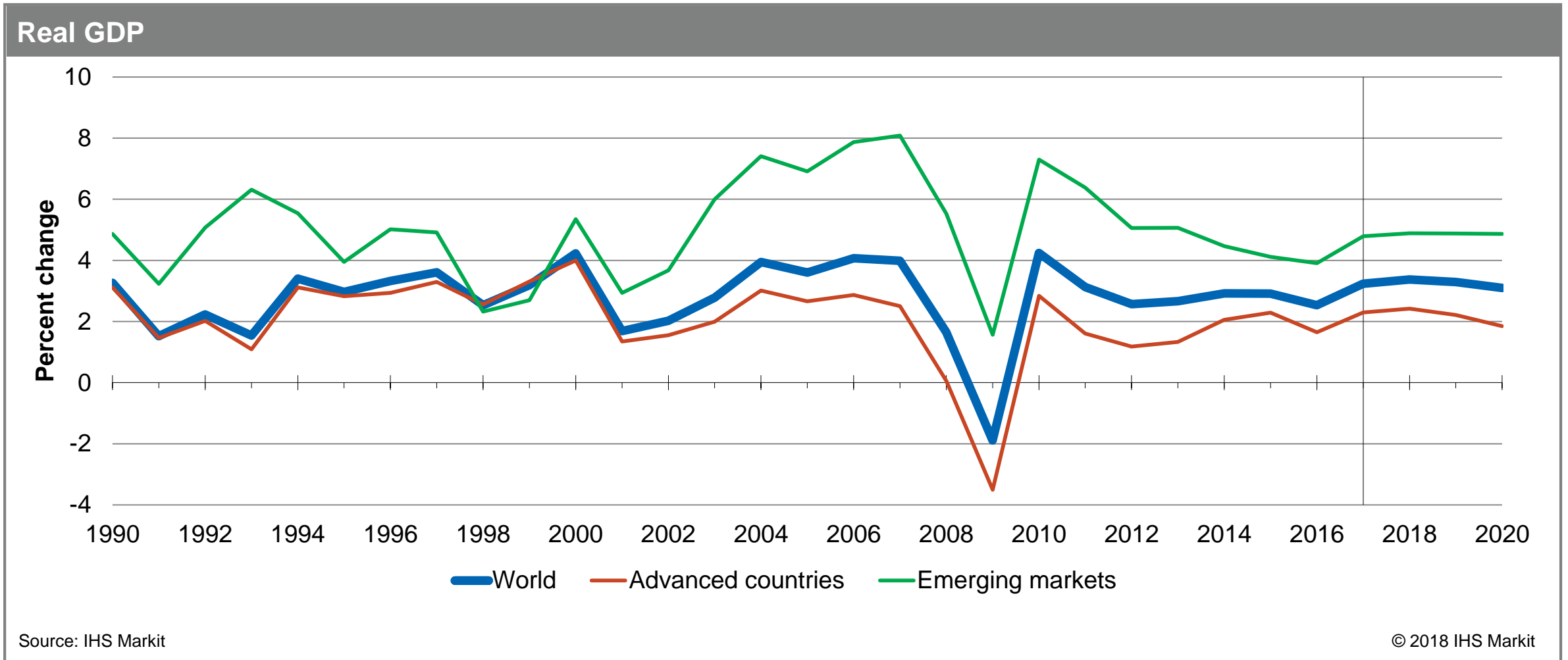
Oil
Gas
Coal
Minerals
Renewables

Olefins
Aromatics
Chlor-alkali
Others

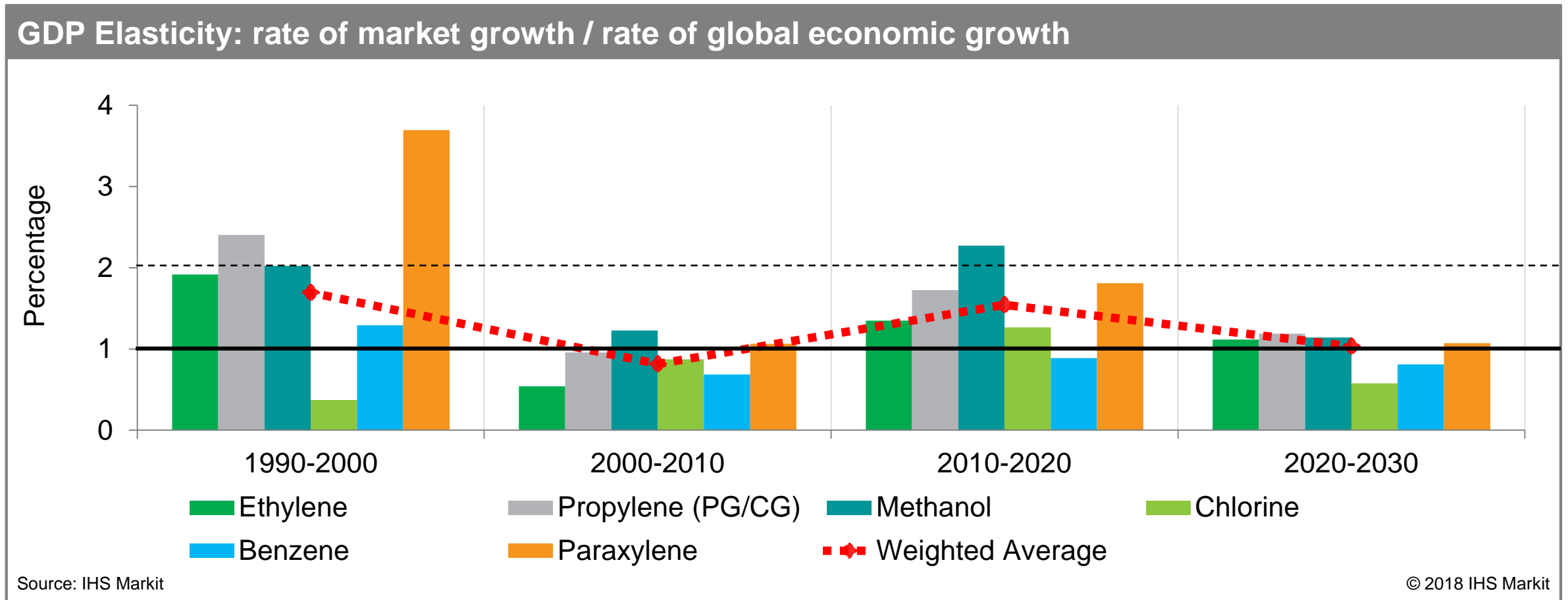
Commodities
Differentiated commodities
Technical specialties

- Transportation
- Consumer products
- Packaging
- Construction
- Recreation
- Industrial
- Medical
- Pharmaceutical
- Personal care
- Textiles
- Electronics
- Aerospace
- Business equipment

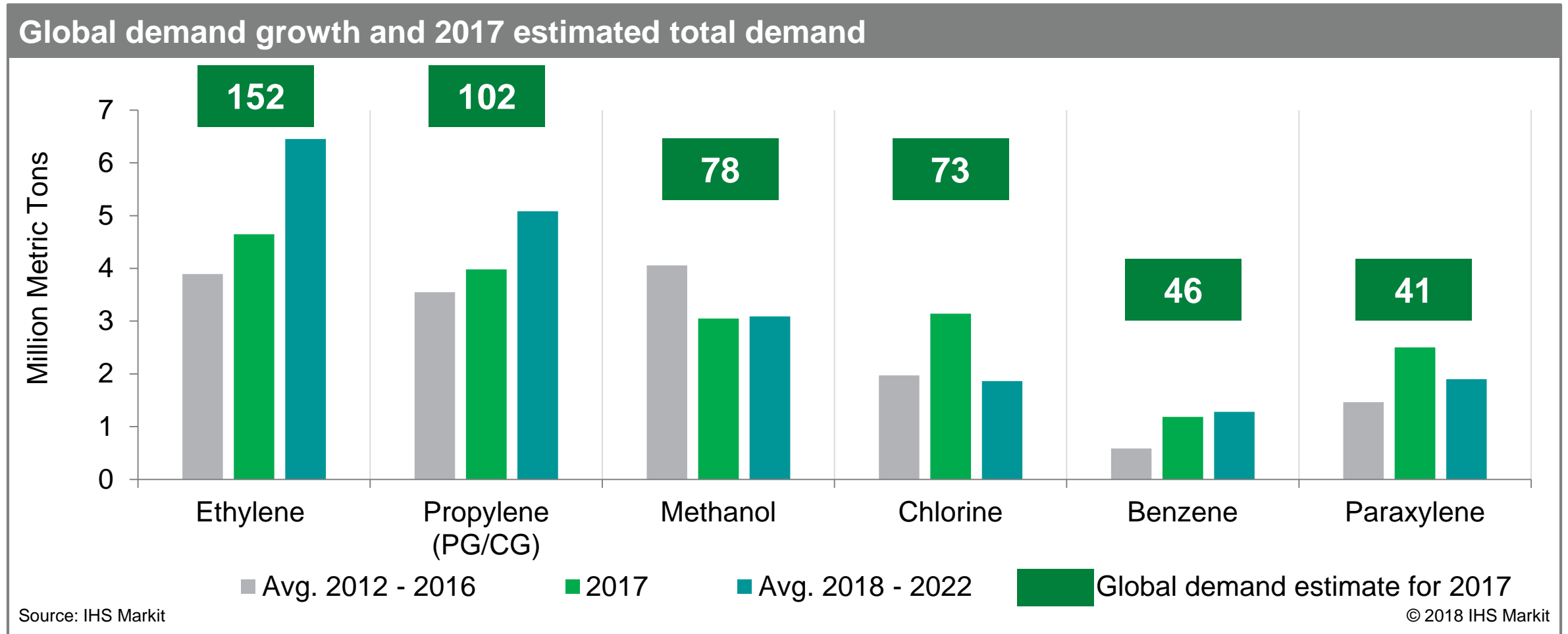
Global economic growth remains strong and steady, if serious mistakes on trade, monetary policy, and international relations can be avoided



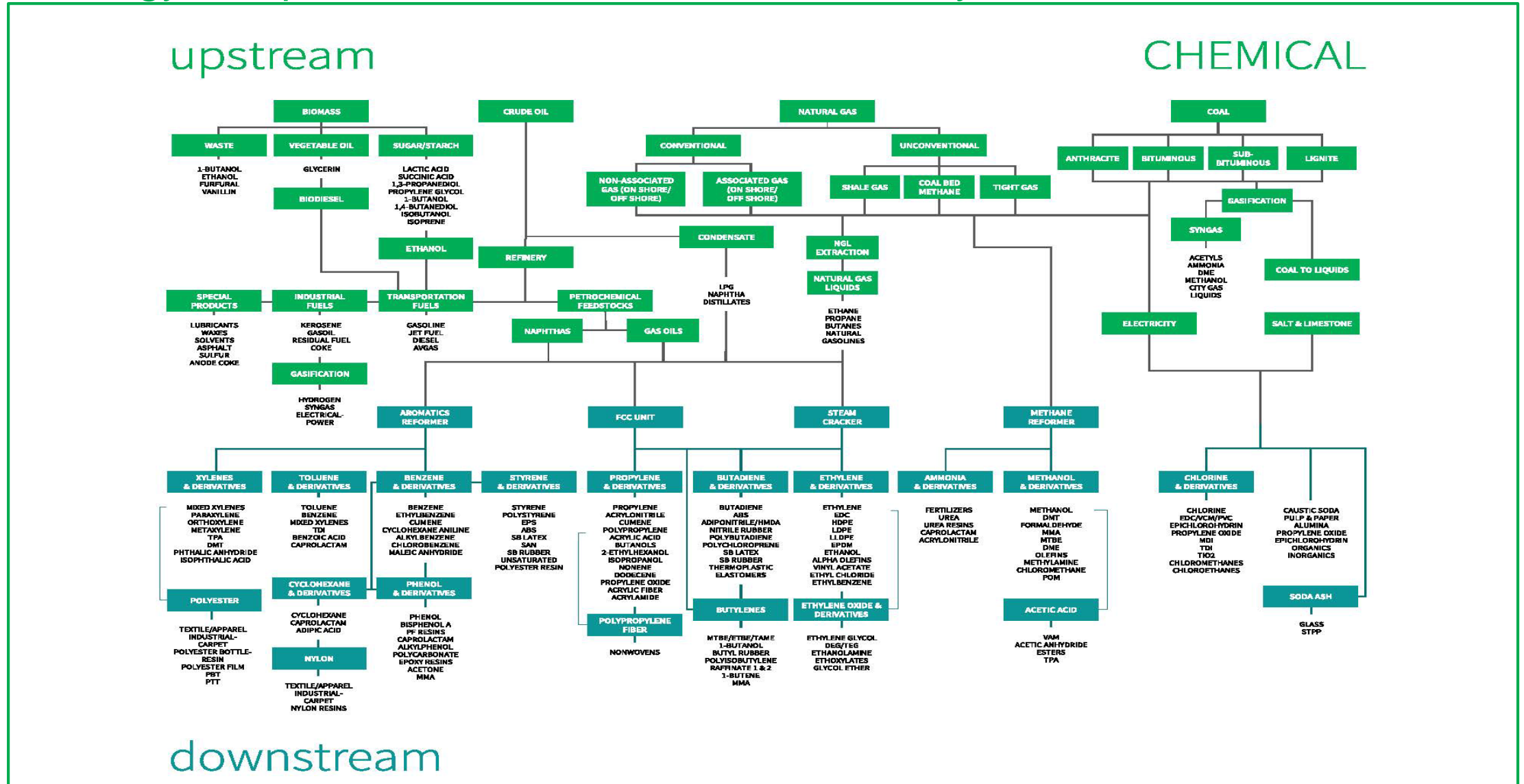
Economic growth in advanced countries and emerging markets are key drivers to petrochemical demand growth



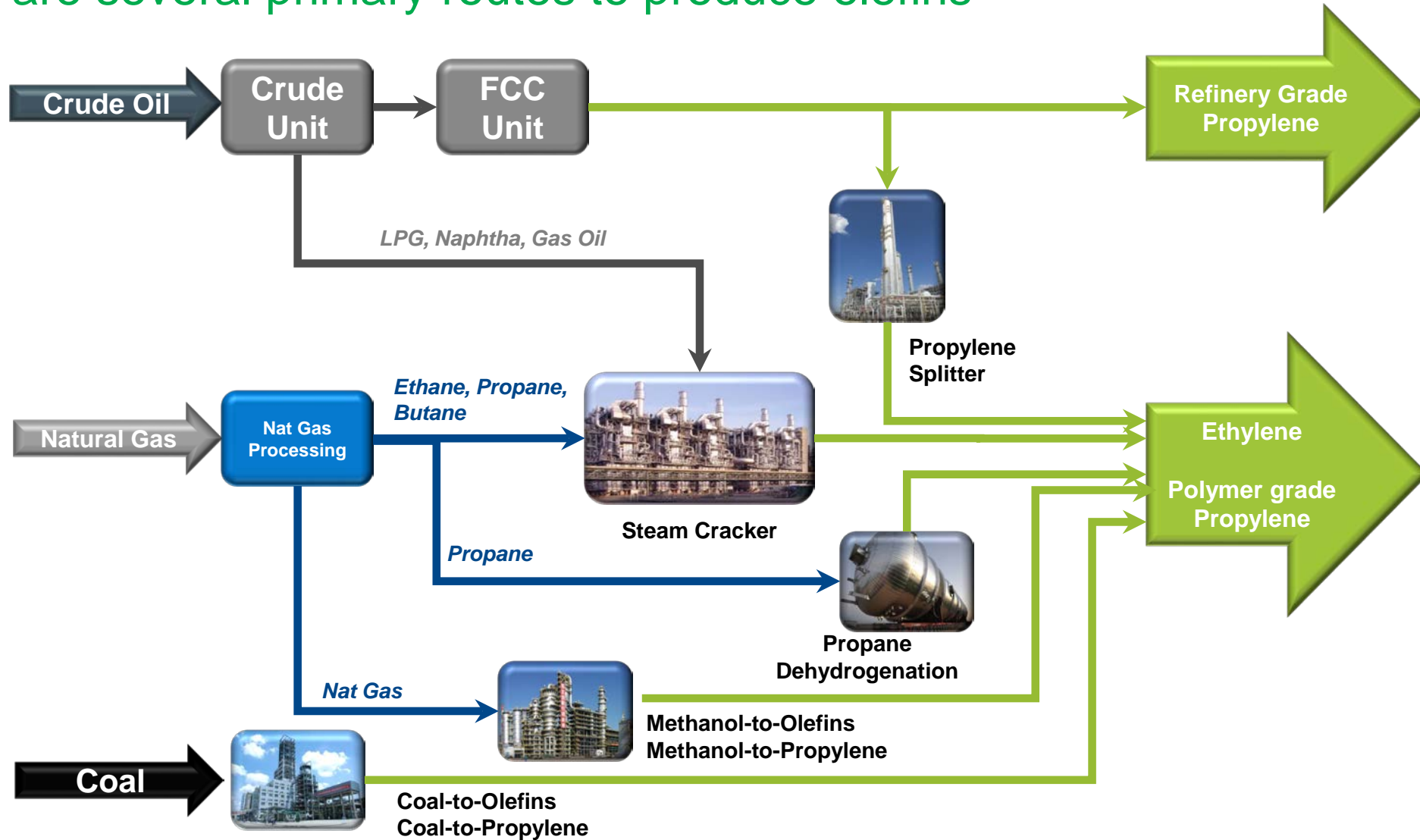
Ethylene and propylene remain in high growth mode; methanol growth stabilizes



The energy and petrochemical industries are closely related

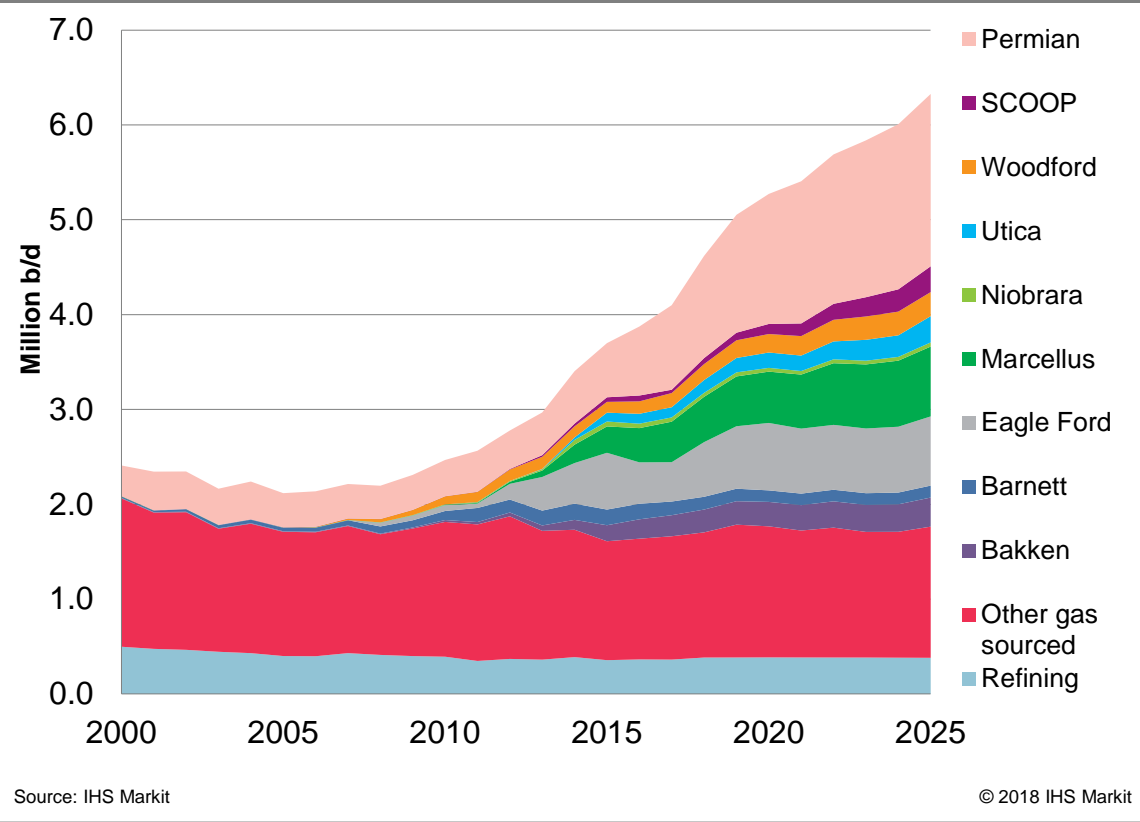


There are several primary routes to produce olefins

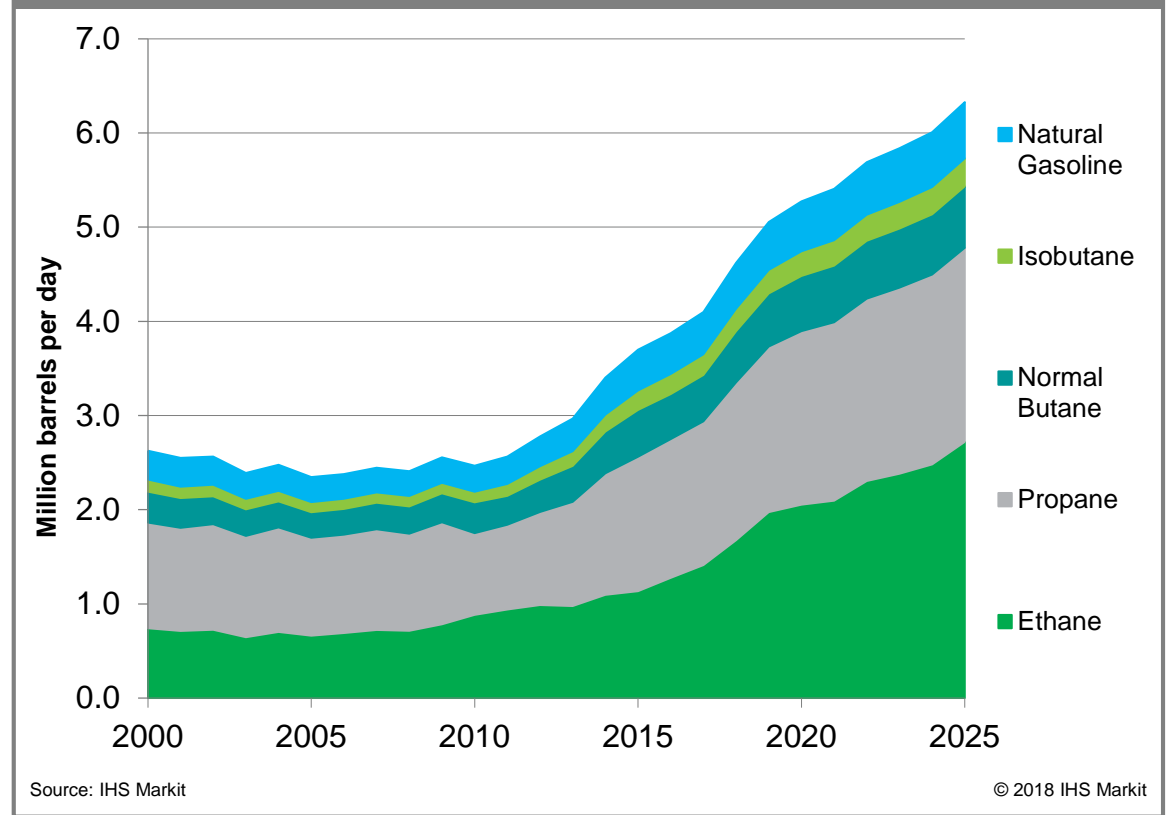


US NGL production is growing with shale gas and tight oil plays

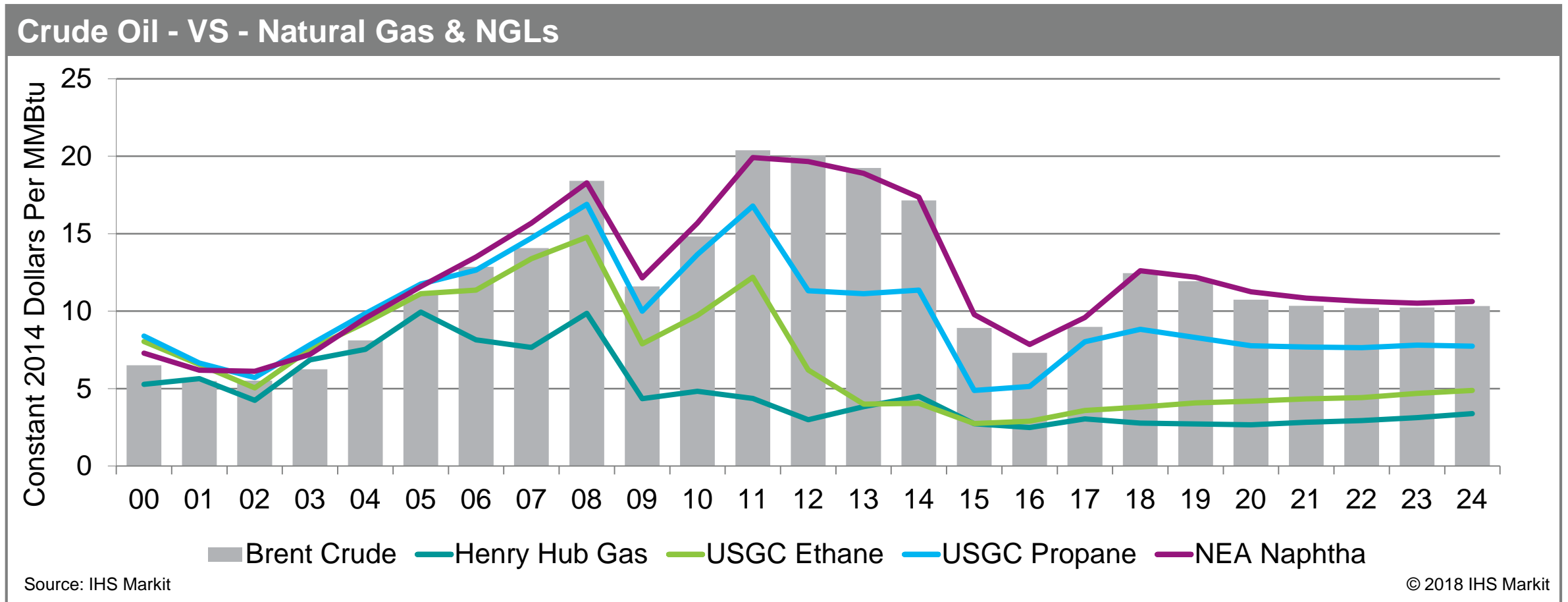
NGL production from key shale gas and tight oil plays



US lower 48 NGL production by product

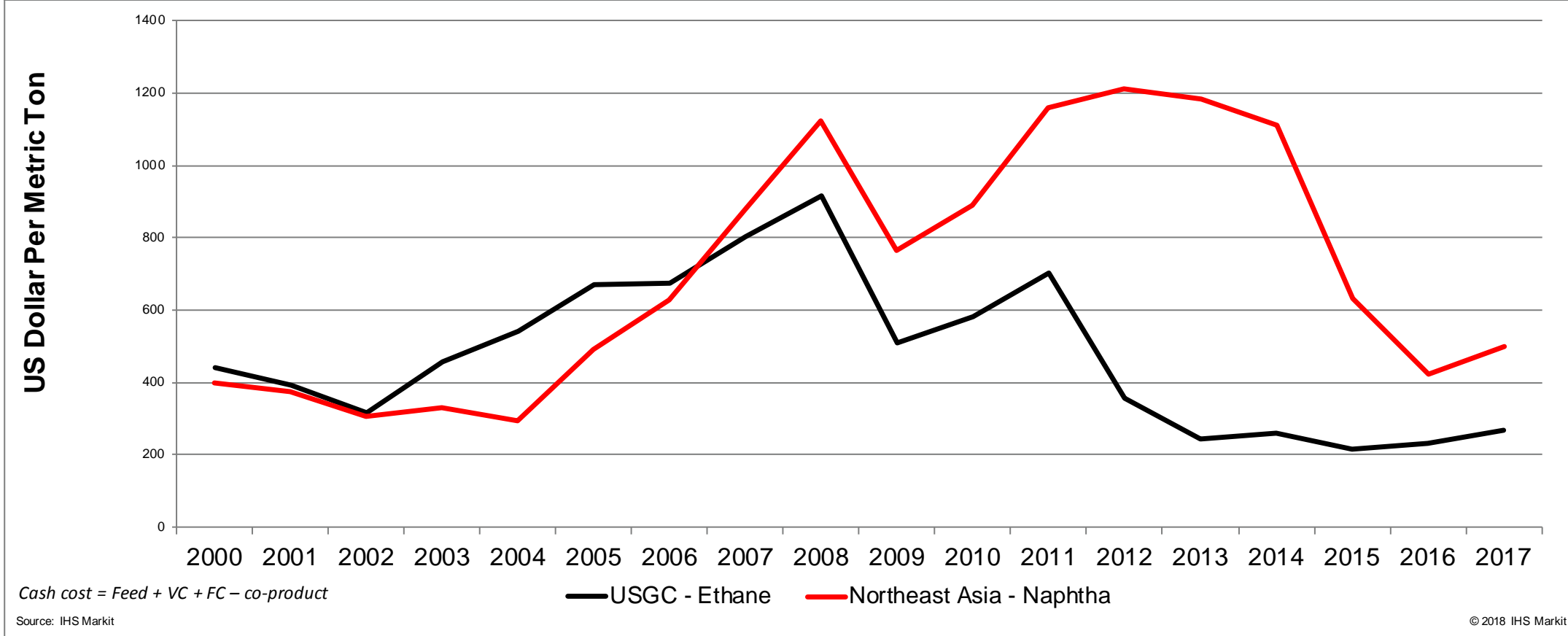


Combination of high crude prices and stable natural gas is attractive for North America gas-based chemical investments



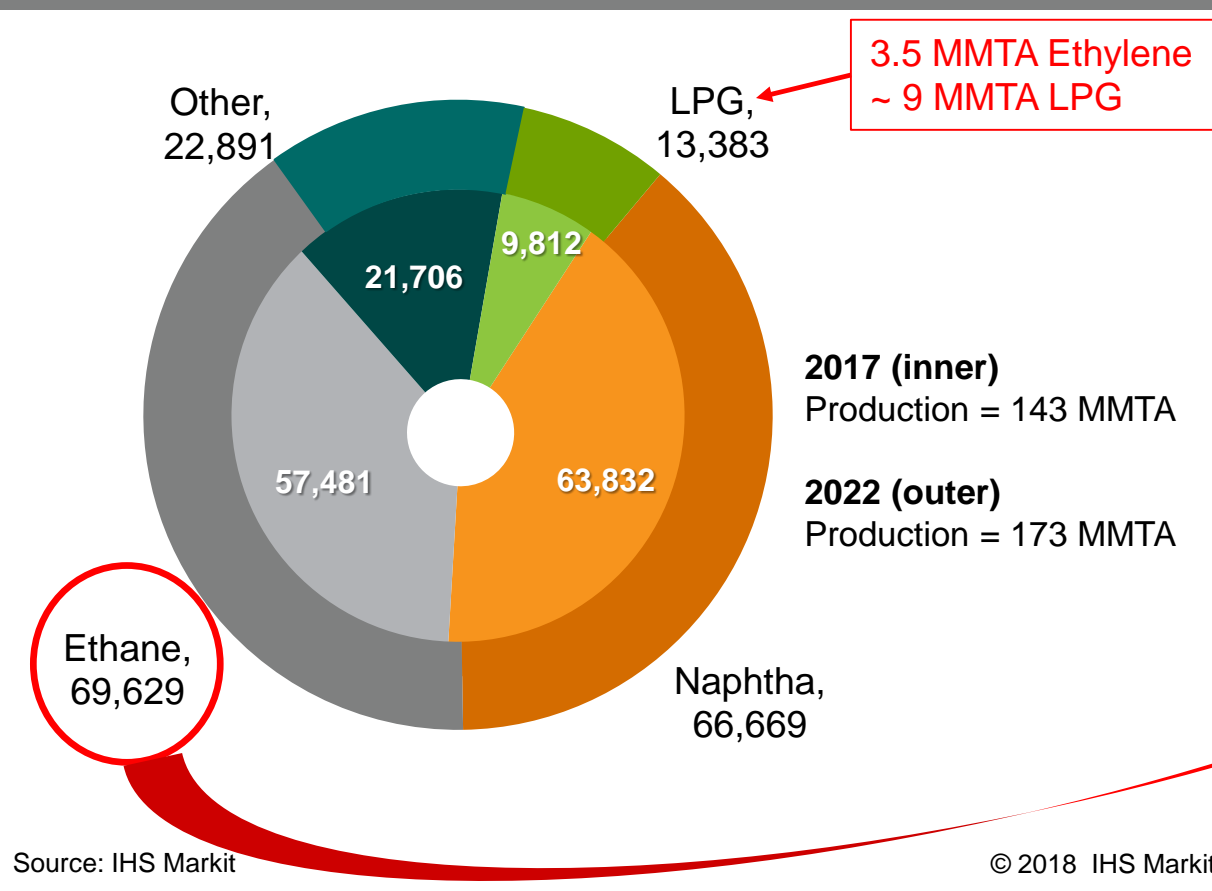
Ethane cracking is expected to maintain a large cash cost advantage

Ethylene Cast Cost Comparison

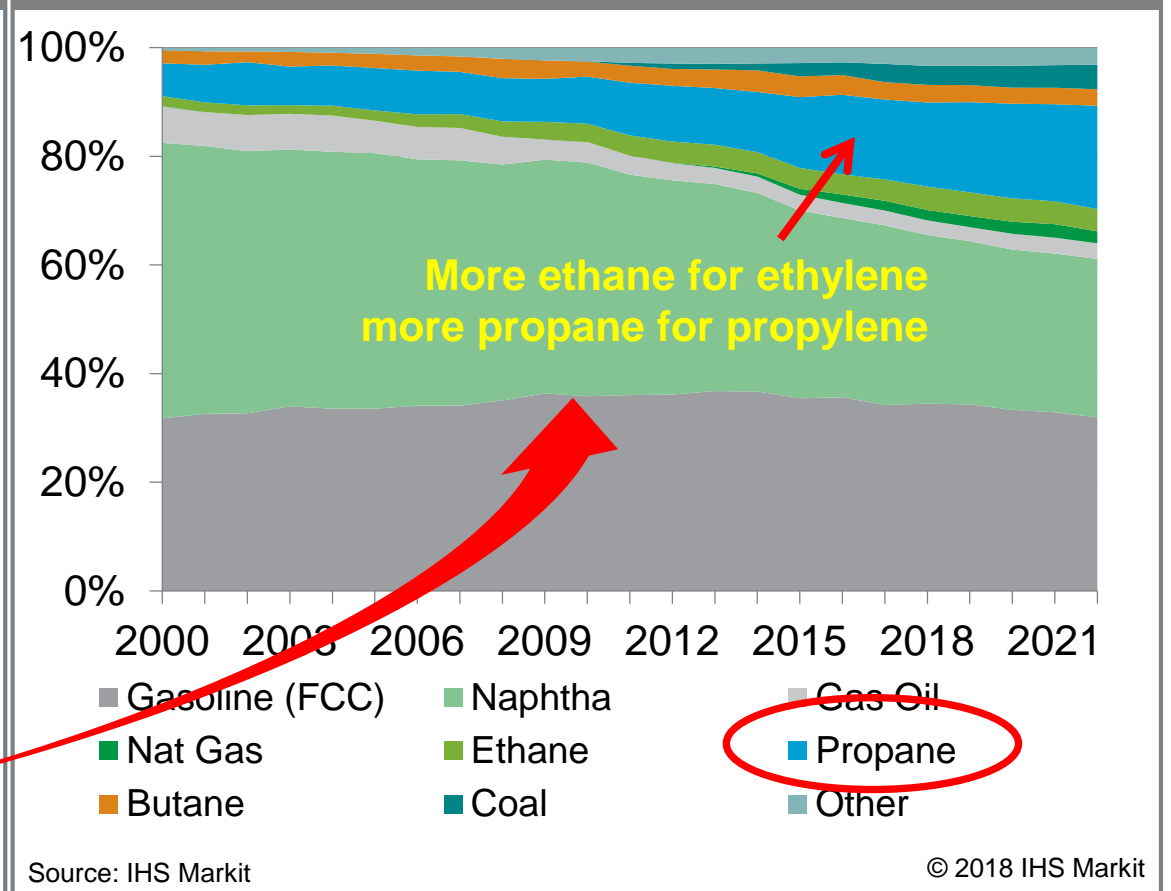


NGLs increasingly important to olefins as crackers shift to ethane

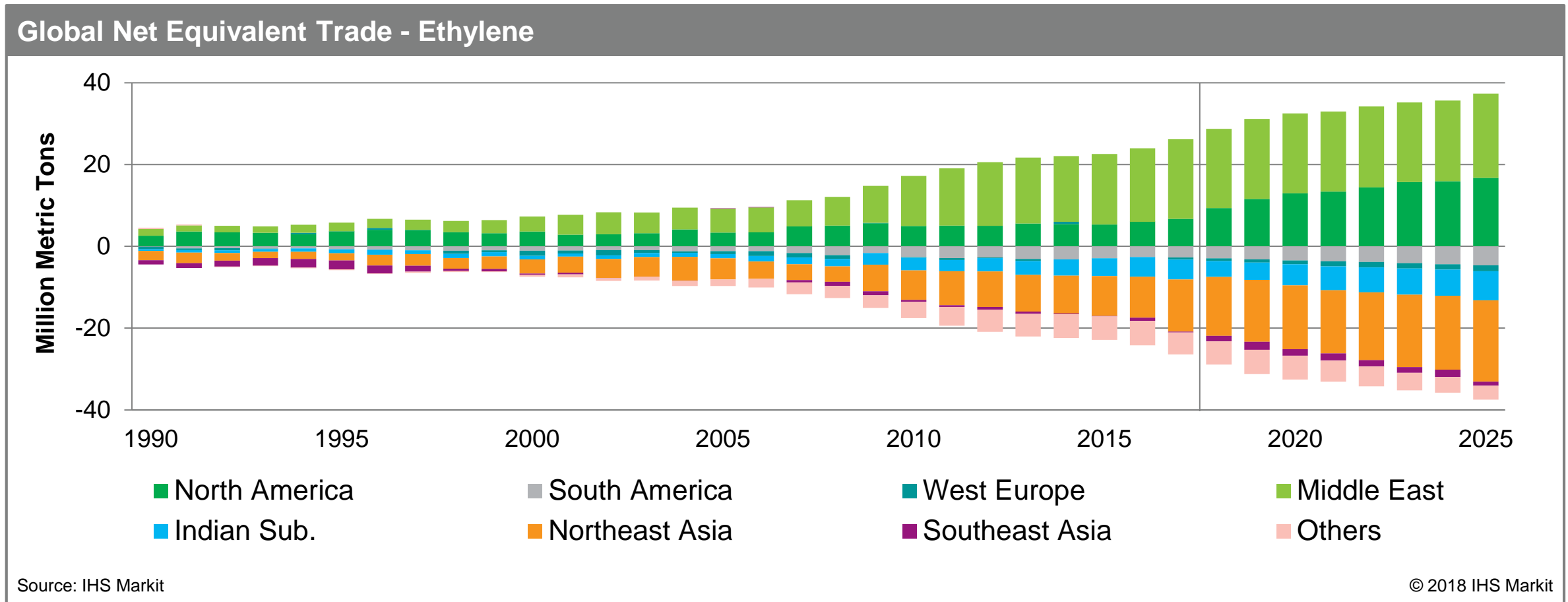
Global Ethylene production by feed type (KTA ethylene by feed)



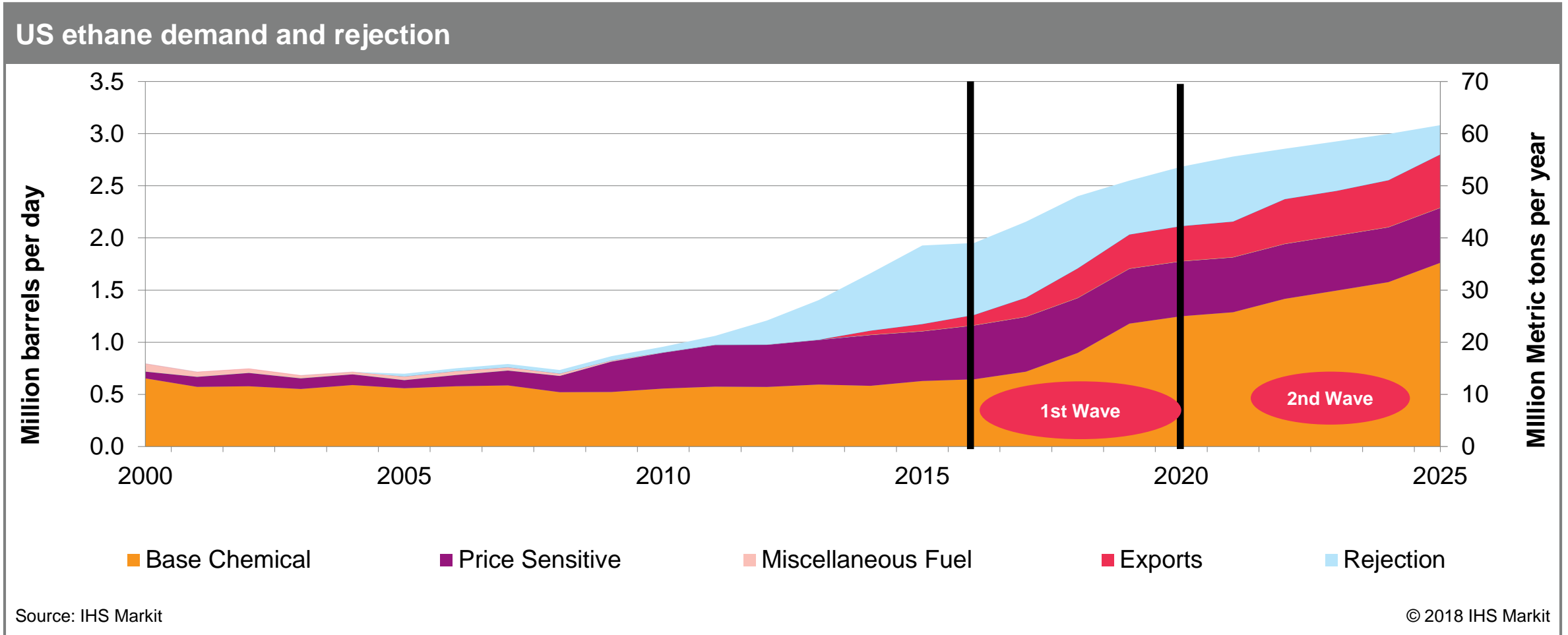
Propylene production by feedstock



Ethylene equivalent trade will continue to expand as the industry builds in low-cost regions and exports to high demand growth regions



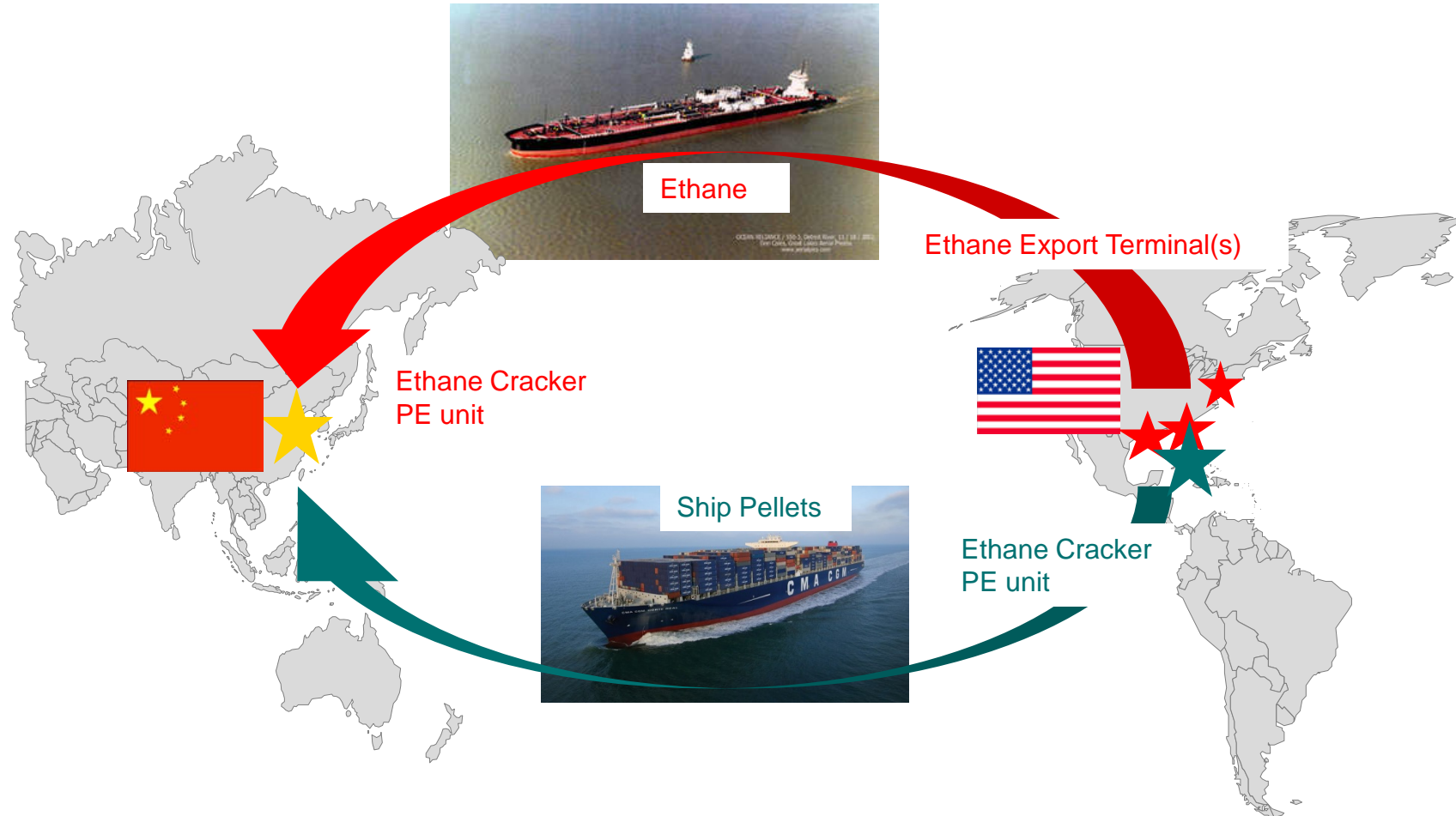
The first wave of US ethane crackers and exports is proceeding but the second wave is uncertain



Improvements in ethane shipping and capital cost differentials are changing olefins investment patterns

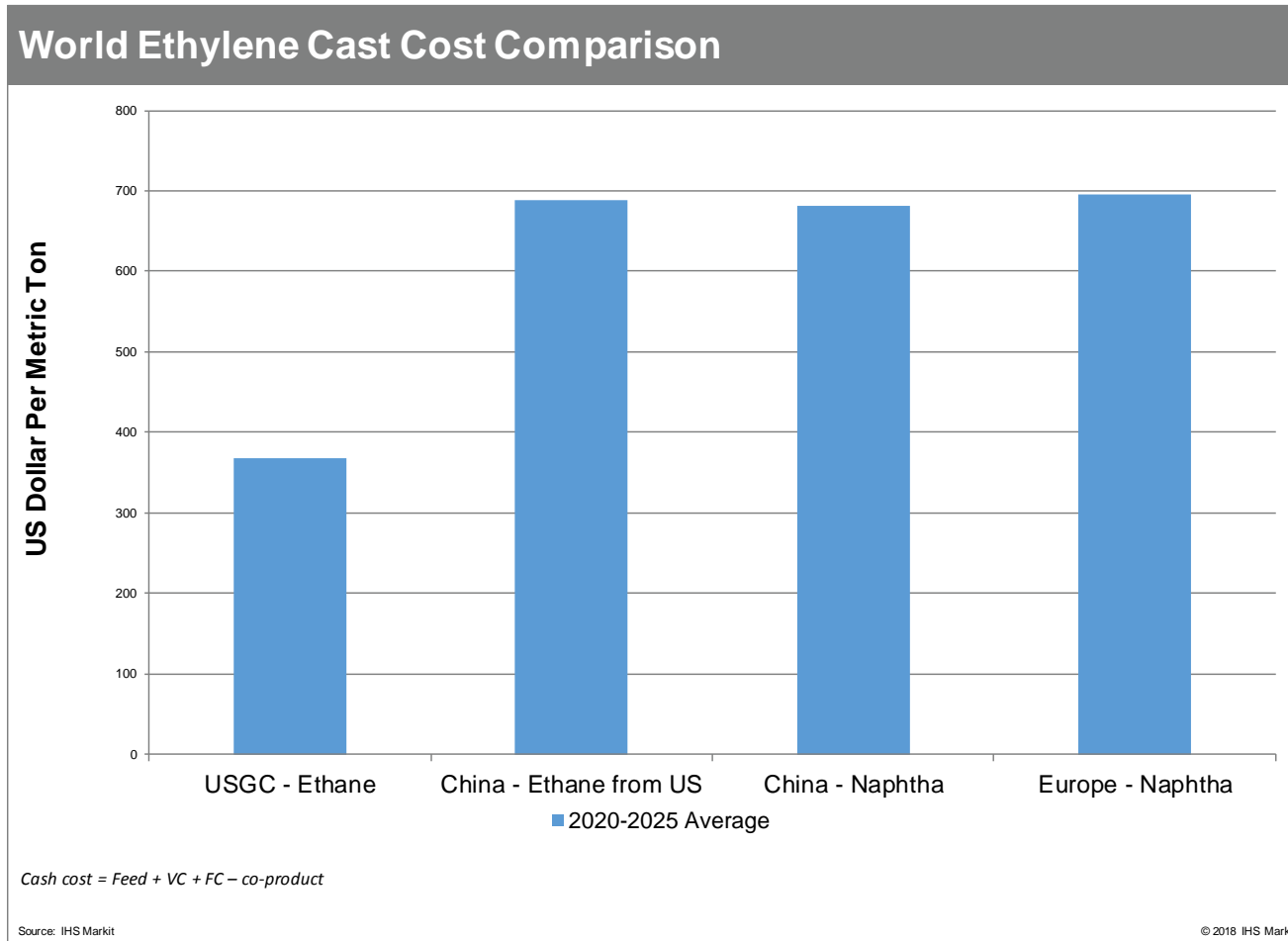
Capital costs in China are currently 50 to 70% of USGC

Can the advantage be sustained?



Similar pattern seen for propylene, but China incentive is stronger

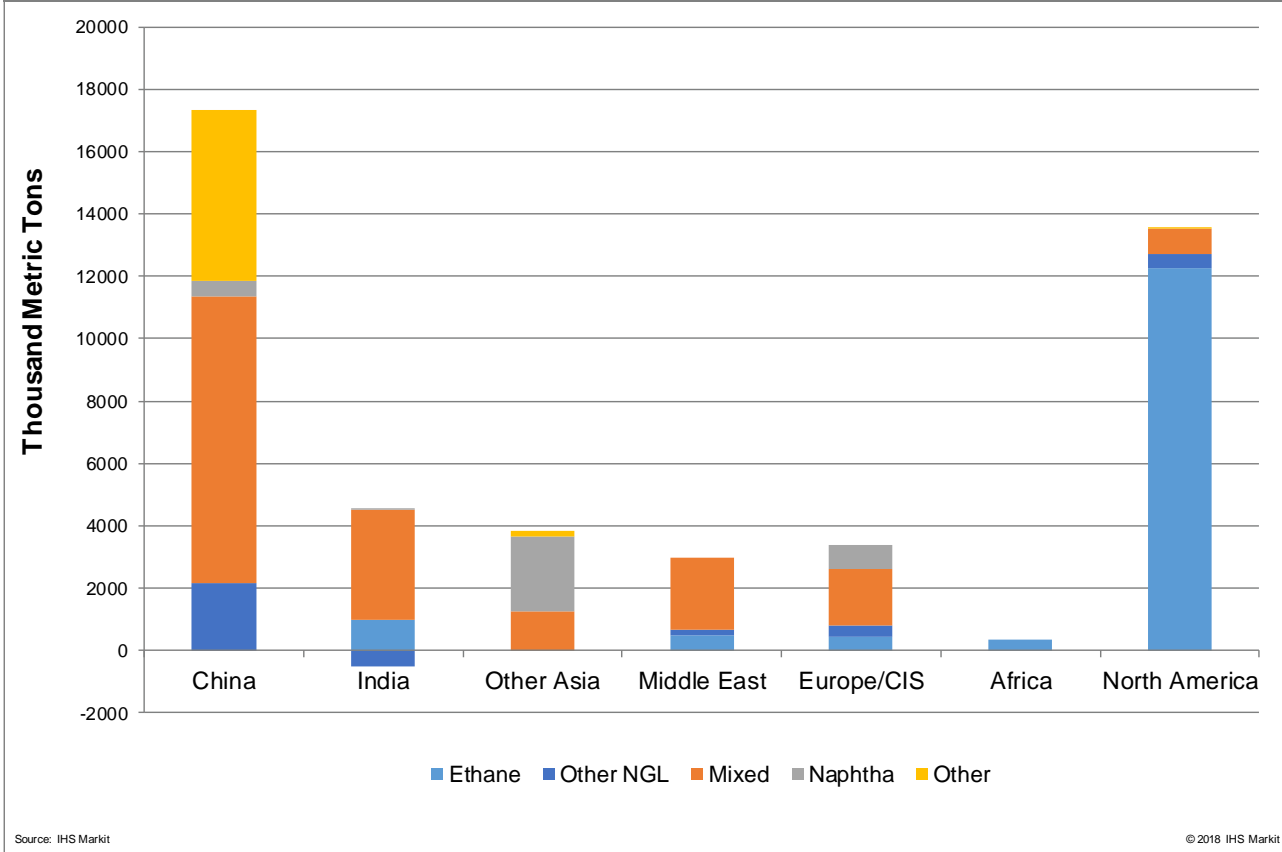
Ethylene cash costs and capital cost advantages make Chinese ethane-based capacity competitive



- Cash costs for ethane cracking in China are higher than in the US due to ethane transport costs
- But - finished product shipping is reduced or eliminated
- In addition, capital cost savings may outweigh the higher operating and feedstock costs
- Ethane cracking capital cost in China is roughly half of naphtha cracking – economics depend on need for co-products

NGL and mixed feed crackers dominate near-term capacity additions

World Ethylene Capacity Changes: 2017-2022



- In addition, over 9 million tons of additional ethane-based units have been announced for China but are still in the planning stages
- In the US, almost 15 million tons of additional ethane-based capacity is under discussion
- With annual demand growth of 6 million tons, the capacity will be needed
- But – is there enough ethane? And where will it be built?

Energy and chemical exports from North America will continue to rise

- Natural gas in North America remains advantaged versus crude
- North America will remain an attractive region for capital investments in base chemicals, derivatives, and feedstocks
- Ethane to China can work - capital versus operating cost dynamics and supply risk tolerance will determine how much is built
- Second wave of ethane crackers will come – but in US or China?



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