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# CAV: THE ROAD AHEAD

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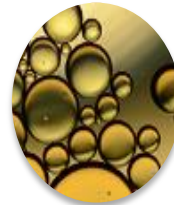
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# Discussion Agenda

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1. Economic outlook
2. Directions for Chlor-alkali
3. The PVC road ahead
4. Key take-aways



# Economic Outlook: What train are we on?

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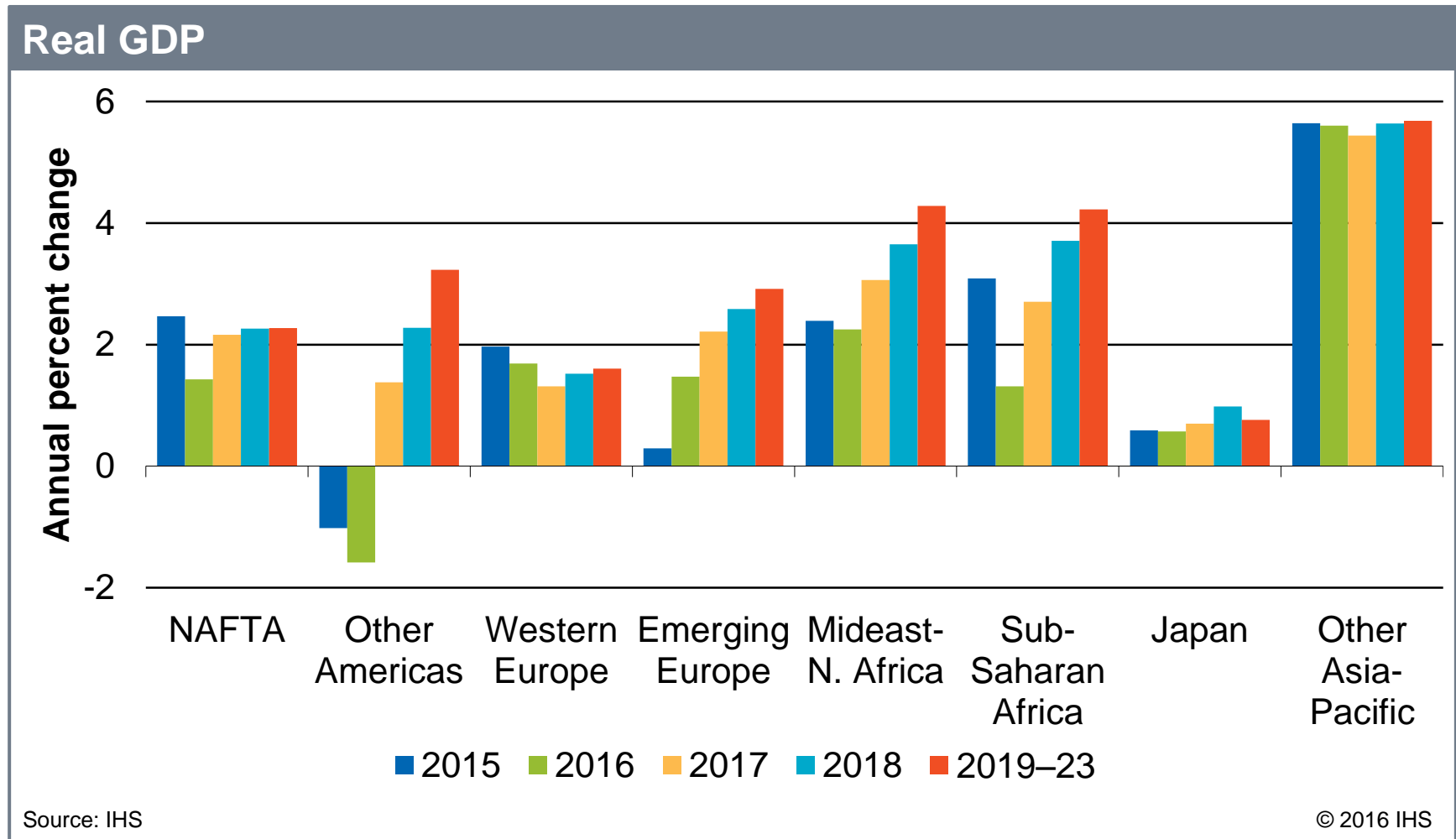


## Global economic growth remains subdued

- Global growth will stay below 3% in 2017 as slowdowns in Europe and China offset accelerations in the United States and emerging markets.
- US economic growth will pick up from 1.4% in 2016 to 2.2% in 2017, led by growth in consumer spending and business fixed investment.
- Economic and political uncertainty will hurt UK investment, consumer spending, and capital inflows in the year ahead.
- Eurozone growth is projected to slow from 1.6% in 2016 to 1.3% in 2017, reflecting increased political instability and banking problems.
- China's economic growth will slow further because of imbalances in credit, housing, and industrial markets.
- Deep recessions in Brazil and Russia are ending.

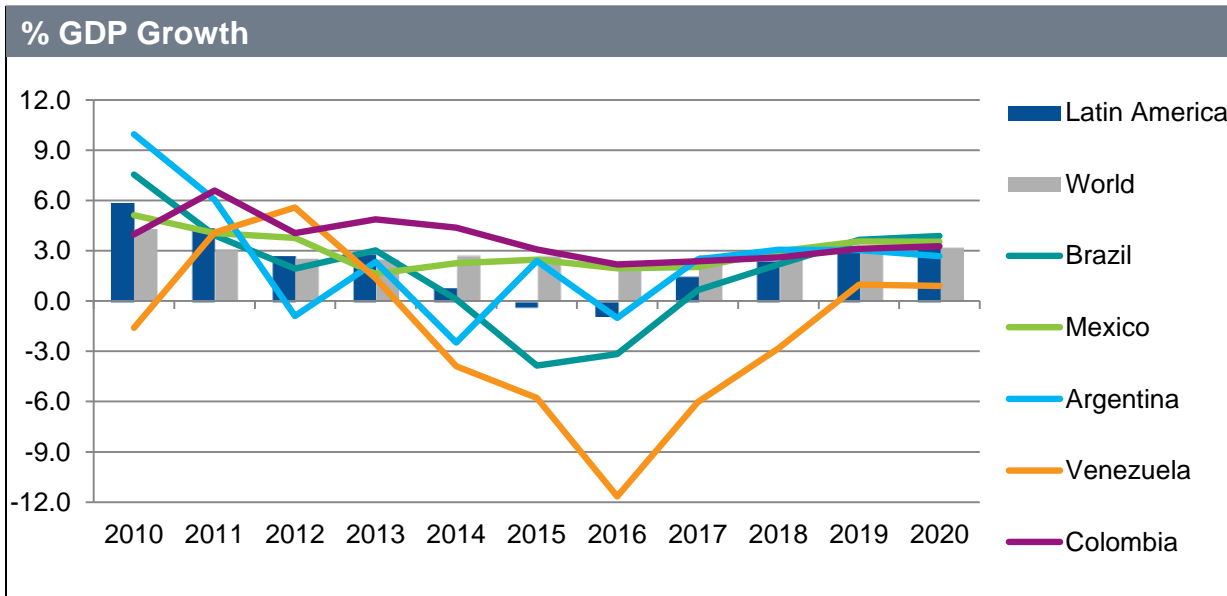


# Asia-Pacific (excluding Japan) will achieve the fastest growth in real GDP

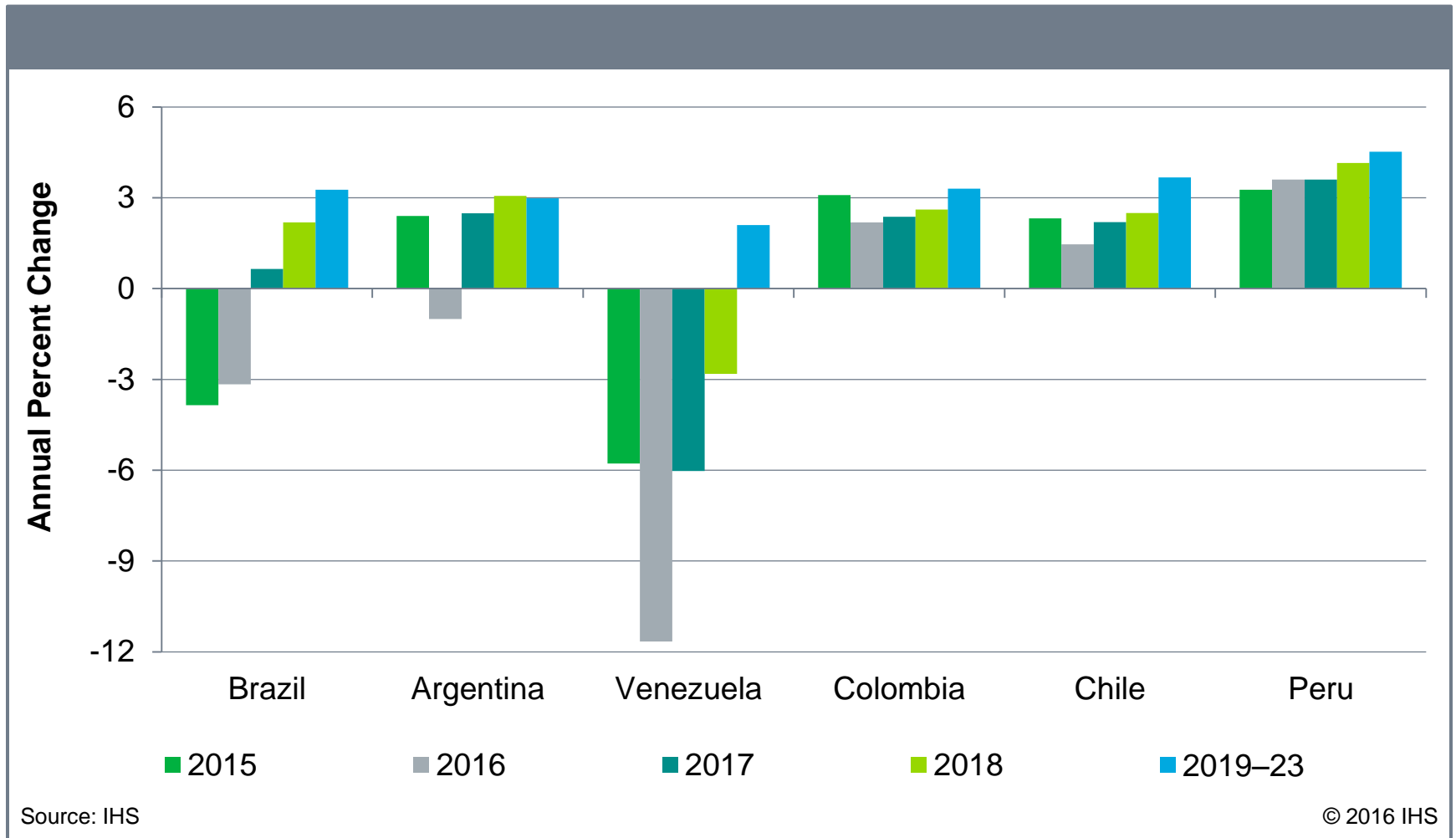


# Latin America – 3 Regions on 2 Continents With Significant Potential

- Large market with **640 Million** of finished goods consumers
- Mid America: **MEX**, **VEN**, **COL**
- East of Andes: **BRA**, **ARG**
- West of Andes: **CHL**, **PER**

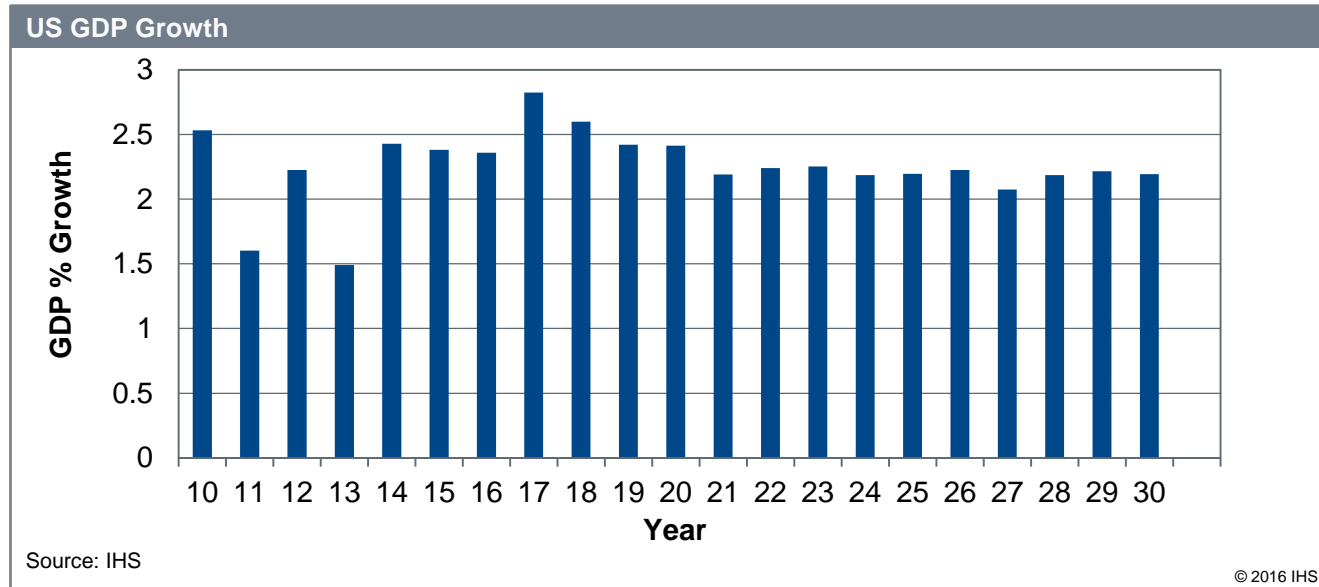


# Real GDP Growth in South America





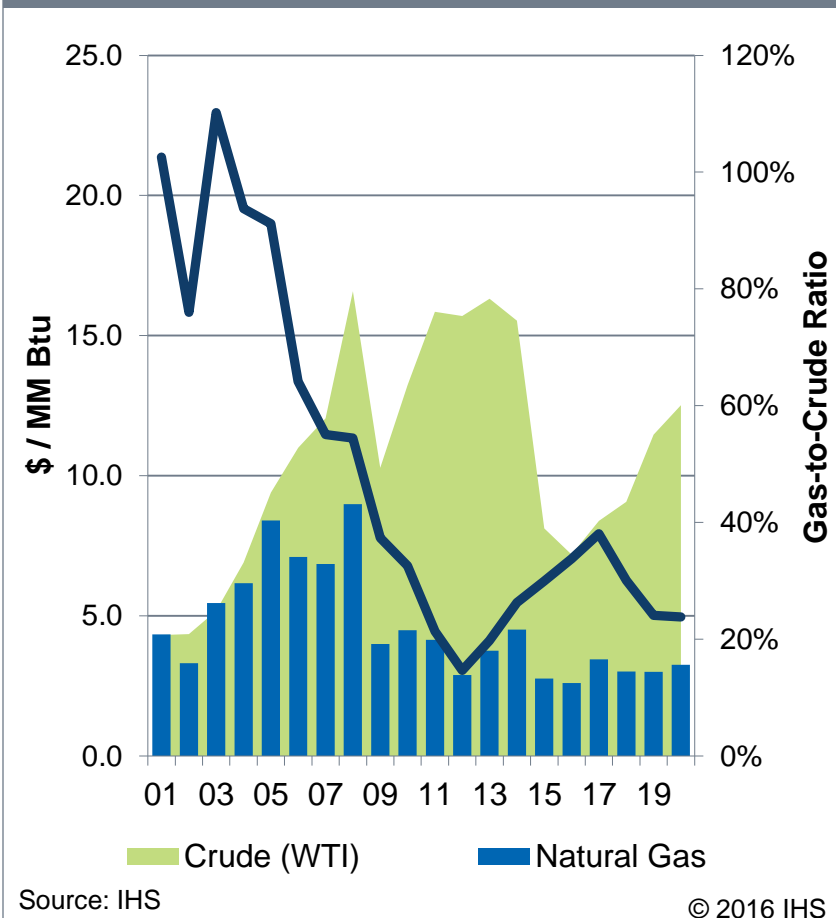
# Average U.S real GDP growth 2.3% for 2016-30



- Bright consumer outlook based on robust employment growth, strong disposable income gains, modest inflation.
- IHS projects real GDP growth average growth rate to be 2.3% for 2016-30.
- Moderate inflation outlook. Average Consumer Price Index inflation forecast = 2.3% per year; Core inflation will average 2.0%
- Labor market improves; unemployment rate settles at around 4.6%.
- Low energy prices improve consumer spending

# The Big Picture on Crude Oil

## Energy Price Trends



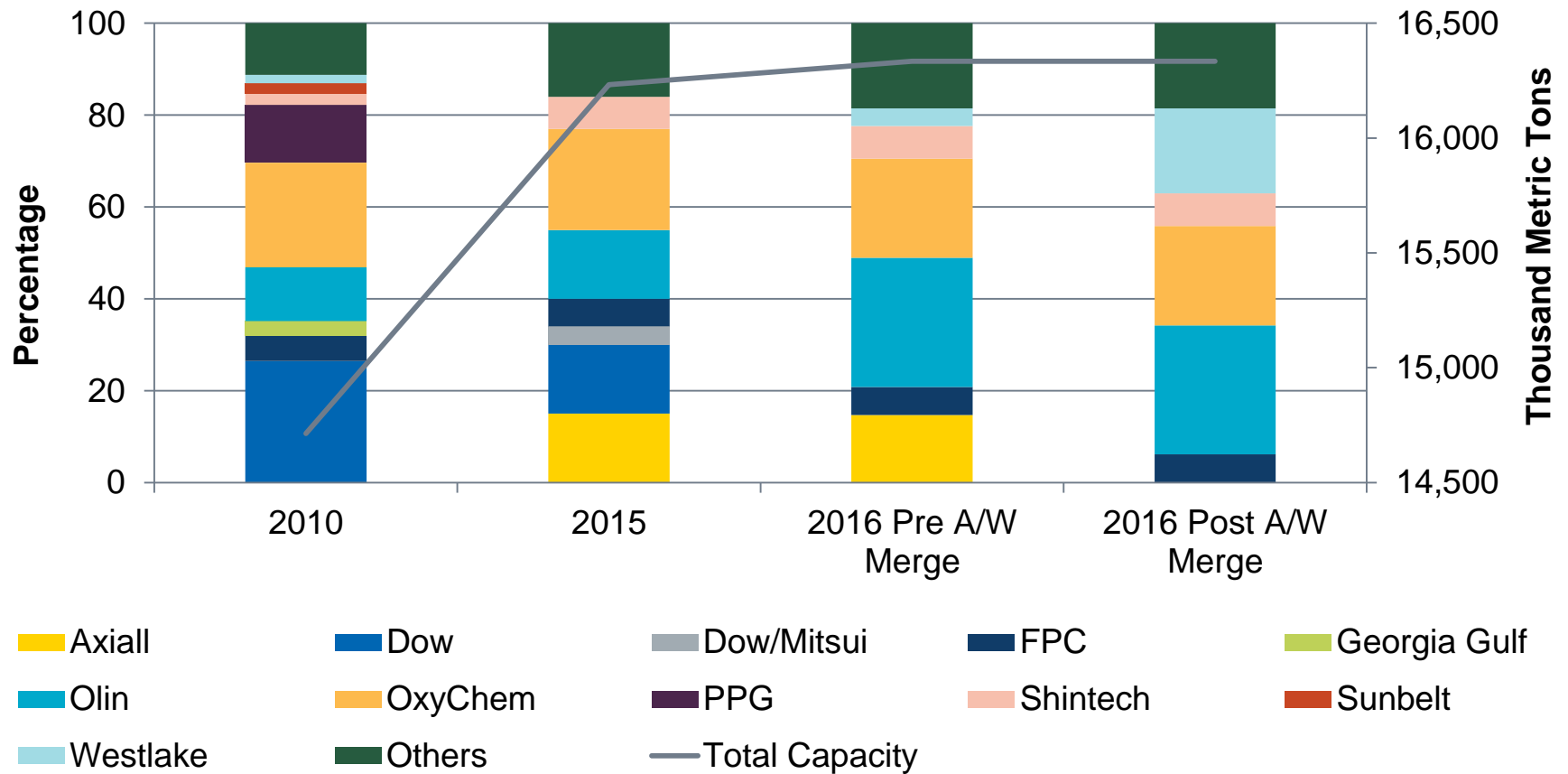
- High product stocks will restrain prices in the near term.
- After significant surpluses in 2015 and H1-2016, the global liquids market will return to balance in late 2016 and in 2017.
- The US, China, and India drive global oil demand growth.
- 2017 will be similar to 2016 for natural gas based petrochemicals as natural gas remains close to parity with crude oil.

# The Chlor-Alkali Market: Picking up the pace



# North America Caustic Supply Consolidation

North America Caustic Capacity

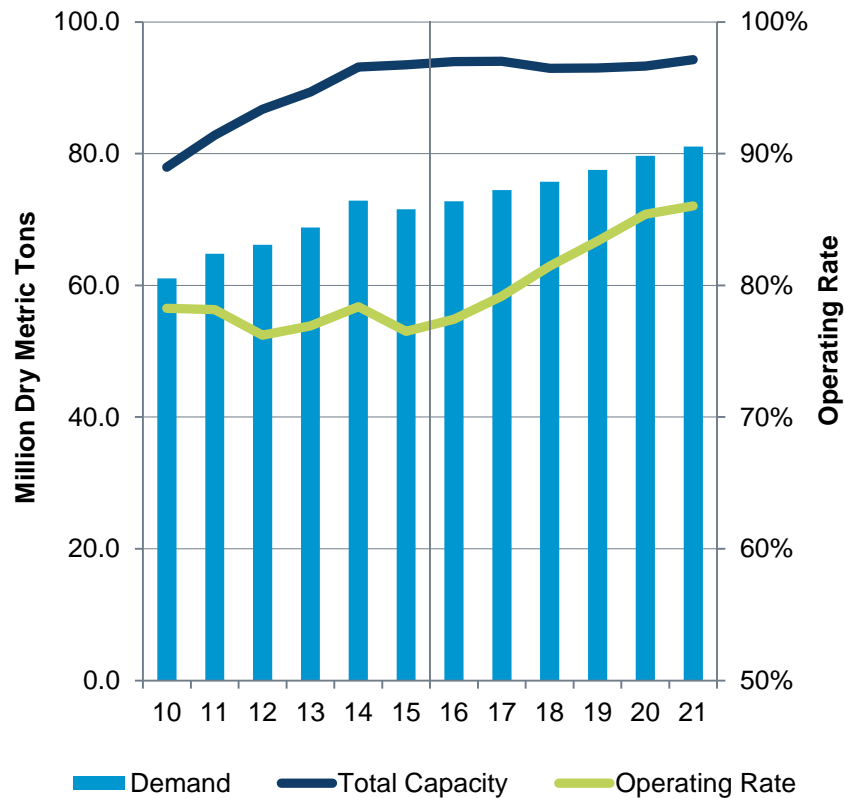


Source: IHS

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# Higher Asset Utilization In Chlor-Alkali Will Drive Improved Profitability By 2020

World: Caustic Soda Supply & Demand



Source: IHS

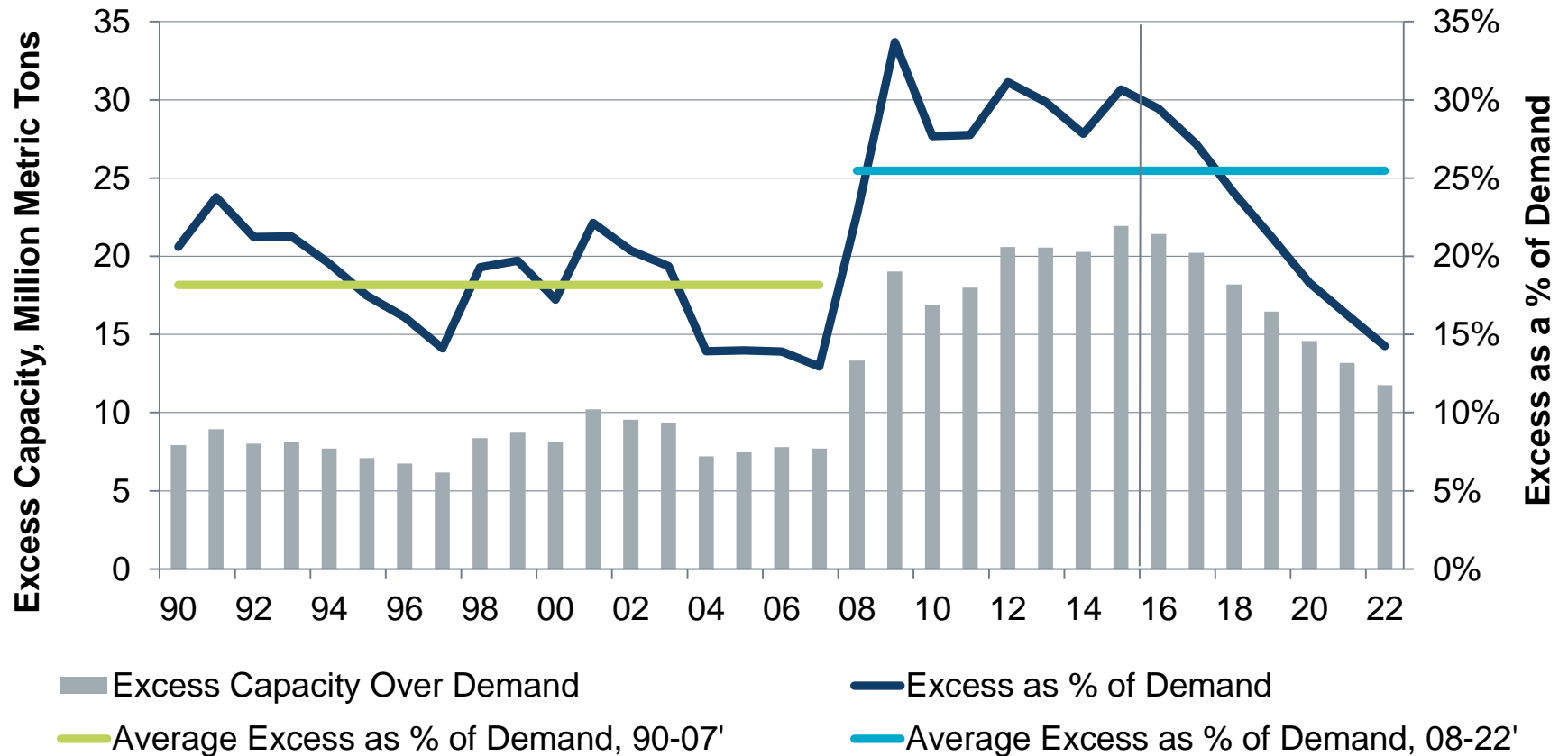
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- Global operating rates currently below 80%; China operating rates below 70%
- No significant capacity increases on the horizon beyond 2017
- EU mandate to close or convert mercury cell plants reduce capacity
- Steady demand growth over the forecast period raises operating rates to upper 80's% in forecast period; some regional operating rates will be > 90%



# Global Surplus Caustic Capacity To Decline Due To Limited Capacity Growth

Global Caustic Soda Excess Capacity



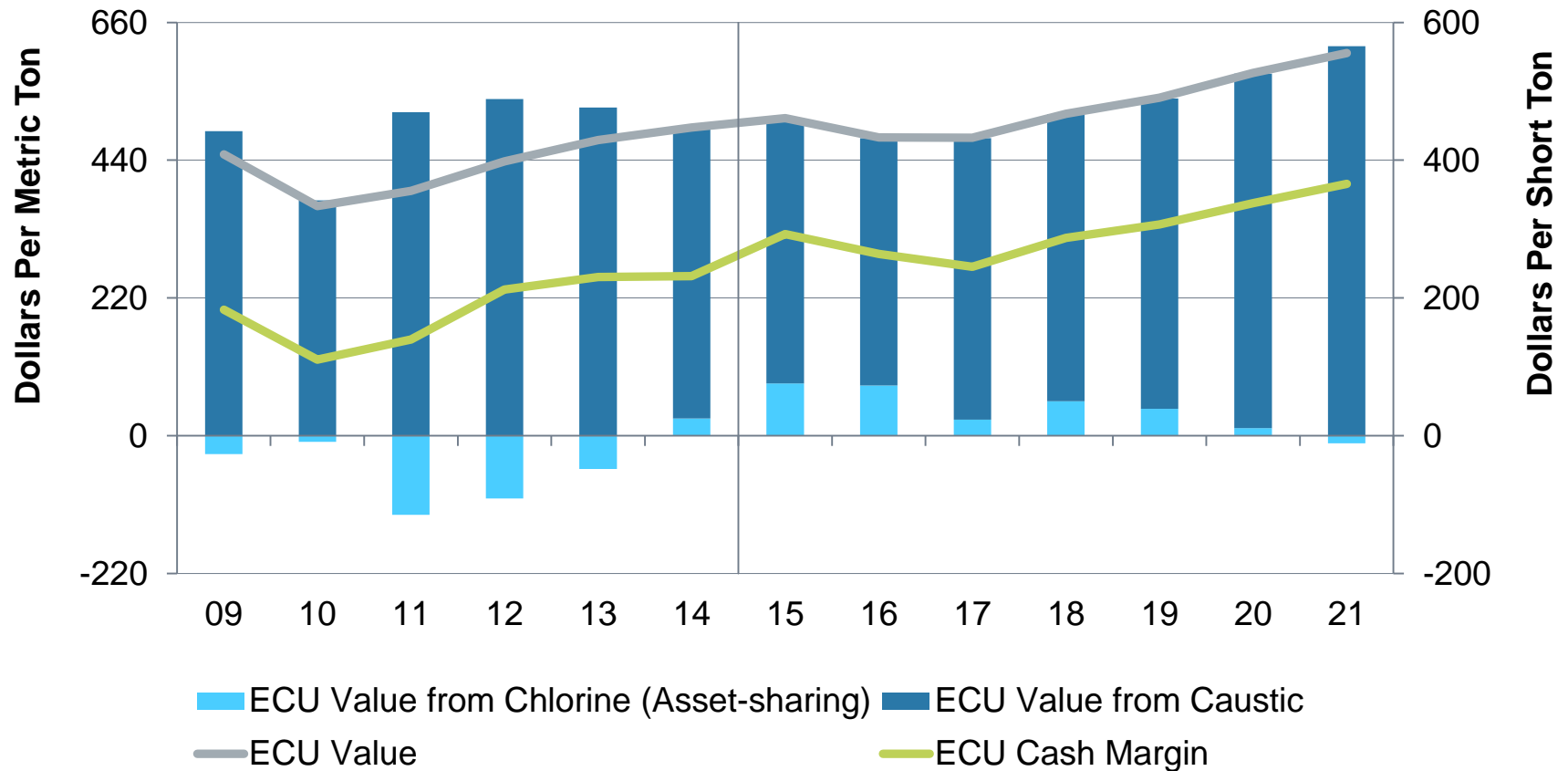
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# USGC ECU Economics Improve with Higher Asset Utilization

*Caustic Prices Provide Majority of Earnings Contribution*

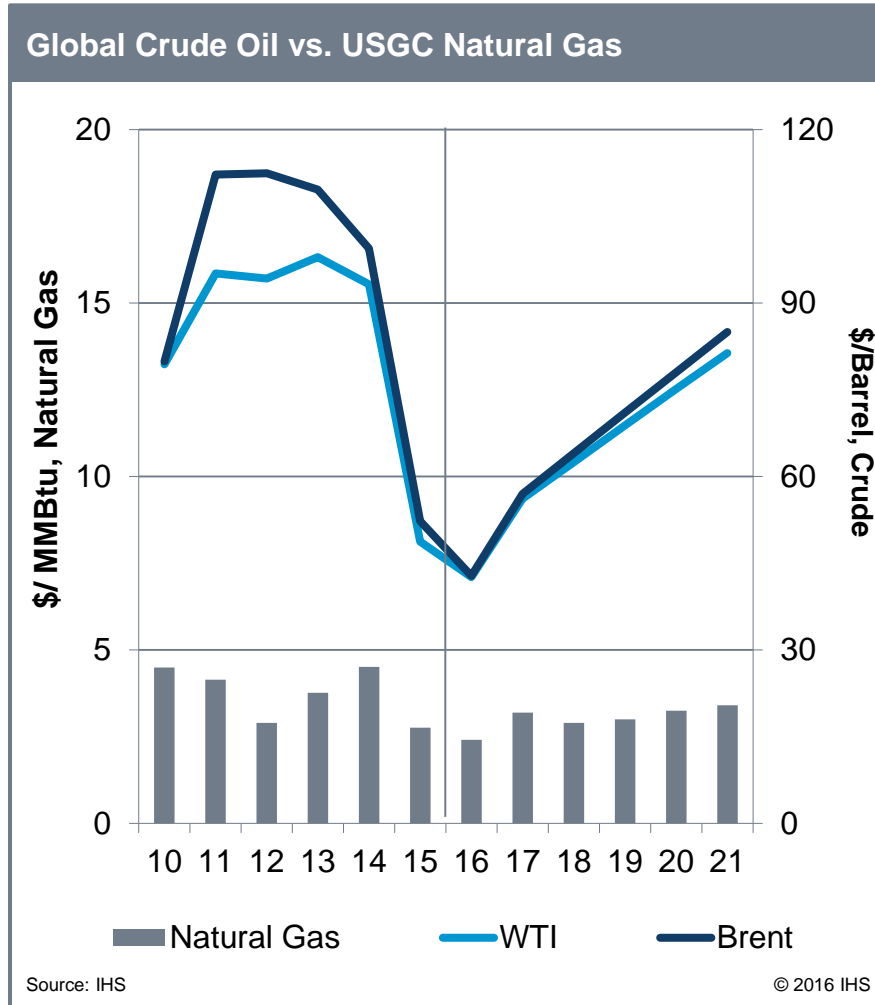
US Gulf Coast Chlor-Alkali Annual ECU Economics



Source: IHS

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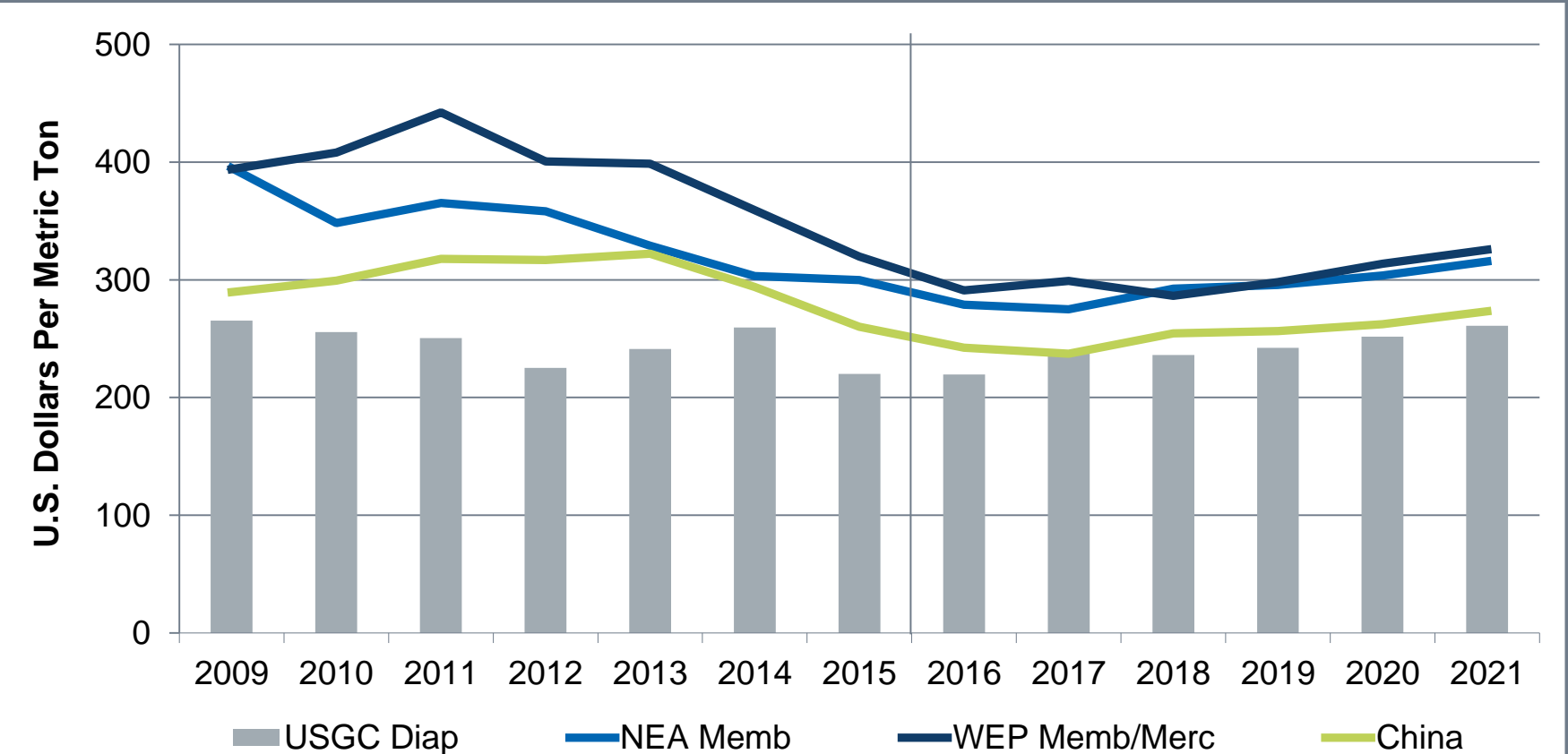
# Global Crude Prices Recover as Oil Supply/Demand Balances Tighten



- Demand growth of 1.1-1.5 MMb/d from 2016-20 underpins oil market outlook.
- Oil prices remain low enough to force US crude production lower.
- OPEC production remains high and surplus capacity available from OPEC falls to extremely low levels.
- Driven by power and LNG exports, North American gas demand reaches 105 Bcf/d by 2020, but....
- N. American gas supply is plentiful and low cost. Rapid demand growth leads to higher natural gas prices, but remain under \$4 per MMBtu

# US Gulf Coast & China ECU Advantage Driven By Low Cost Energy

Global ECU Cash Cost



Notes: \* NEA Excludes China

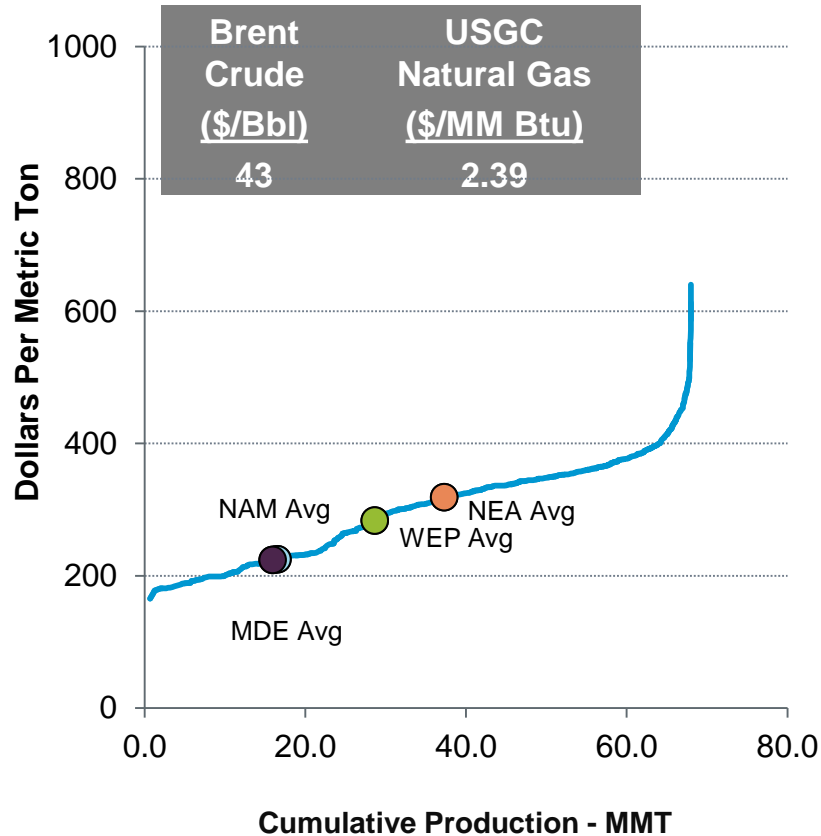
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# ECU Cash Cost Curve

*North America has a sustainable advantage under current energy scenario*

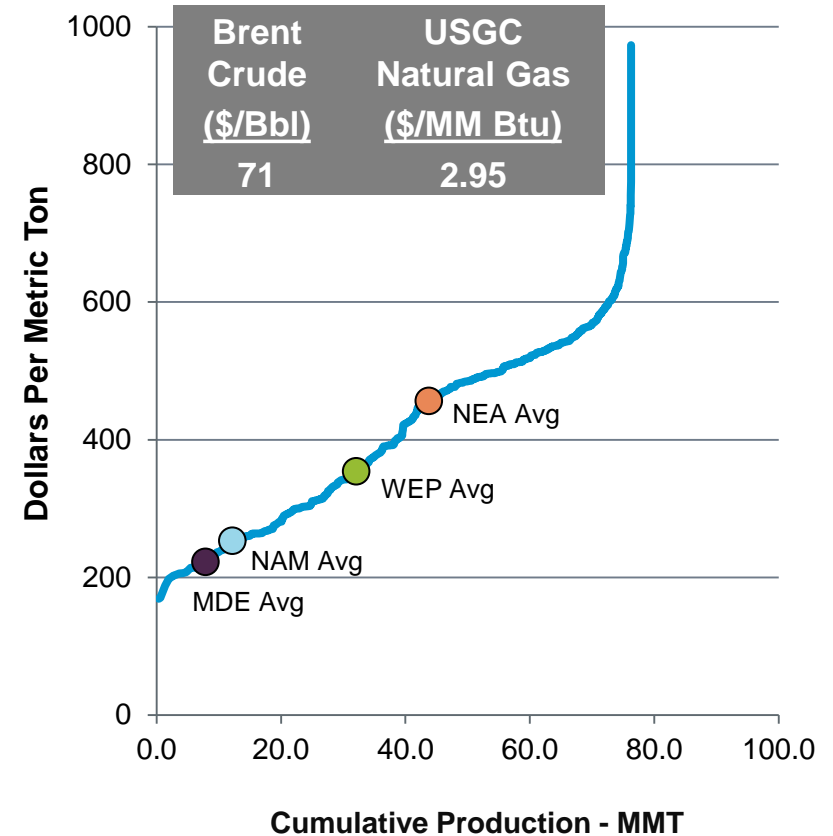
2016 World Cost Curve: ECU



Source: IHS

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2019 World Cost Curve: ECU



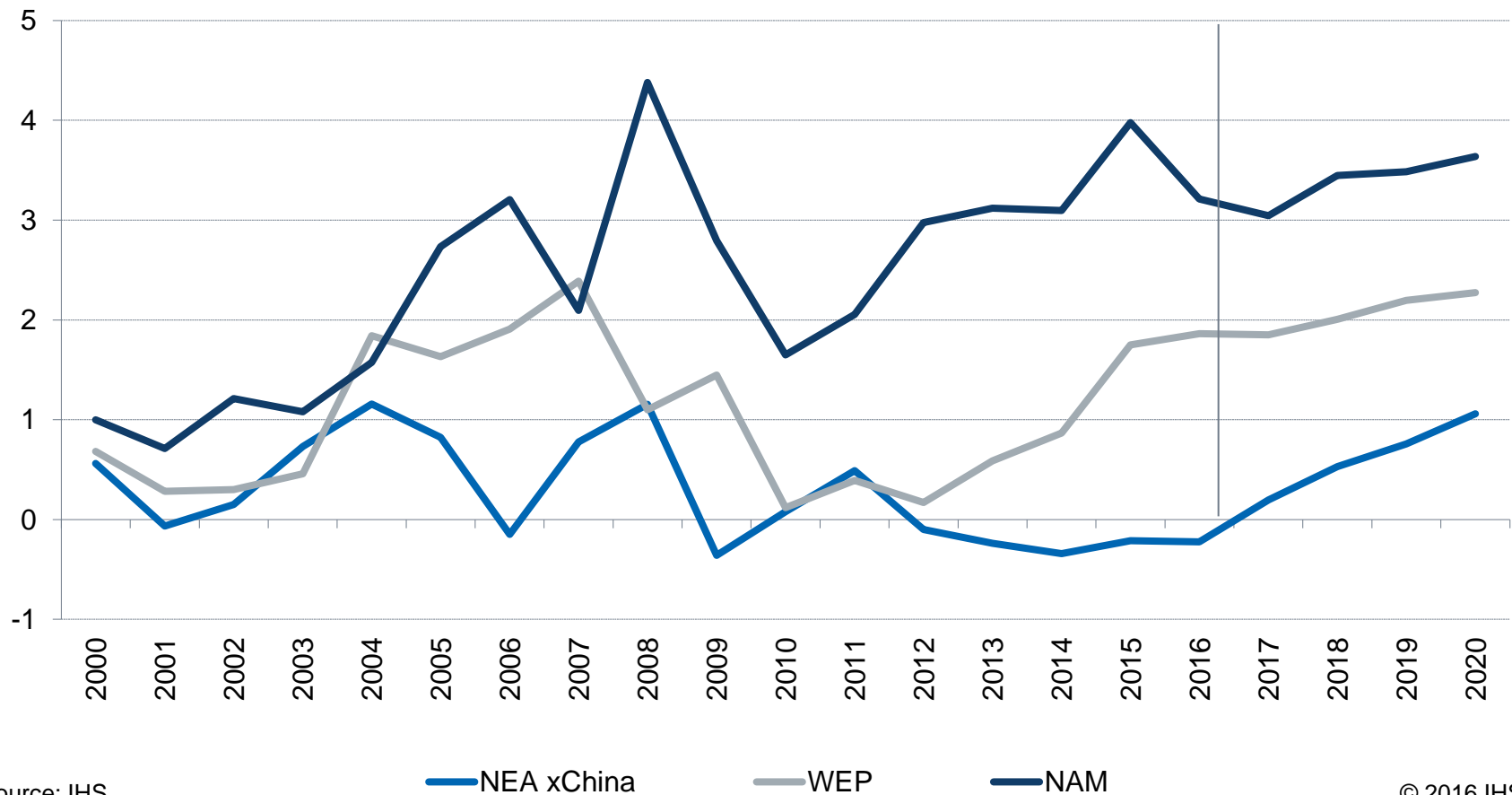
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# Shale Gas Driving ROI Advantage

Indexed CAV ROI trend with time (NAM 2000 as 1)

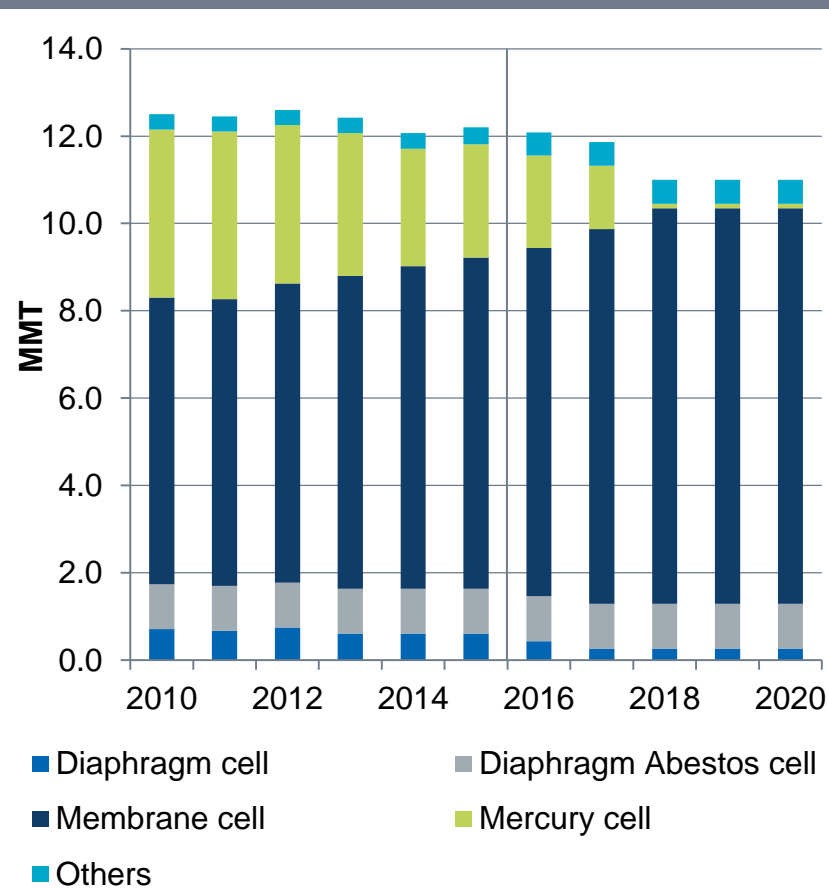


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# Mercury Phase-out Impact on European Capacity Will Help Improve Industry Asset Utilization

European Chlorine Capacity



Source: IHS

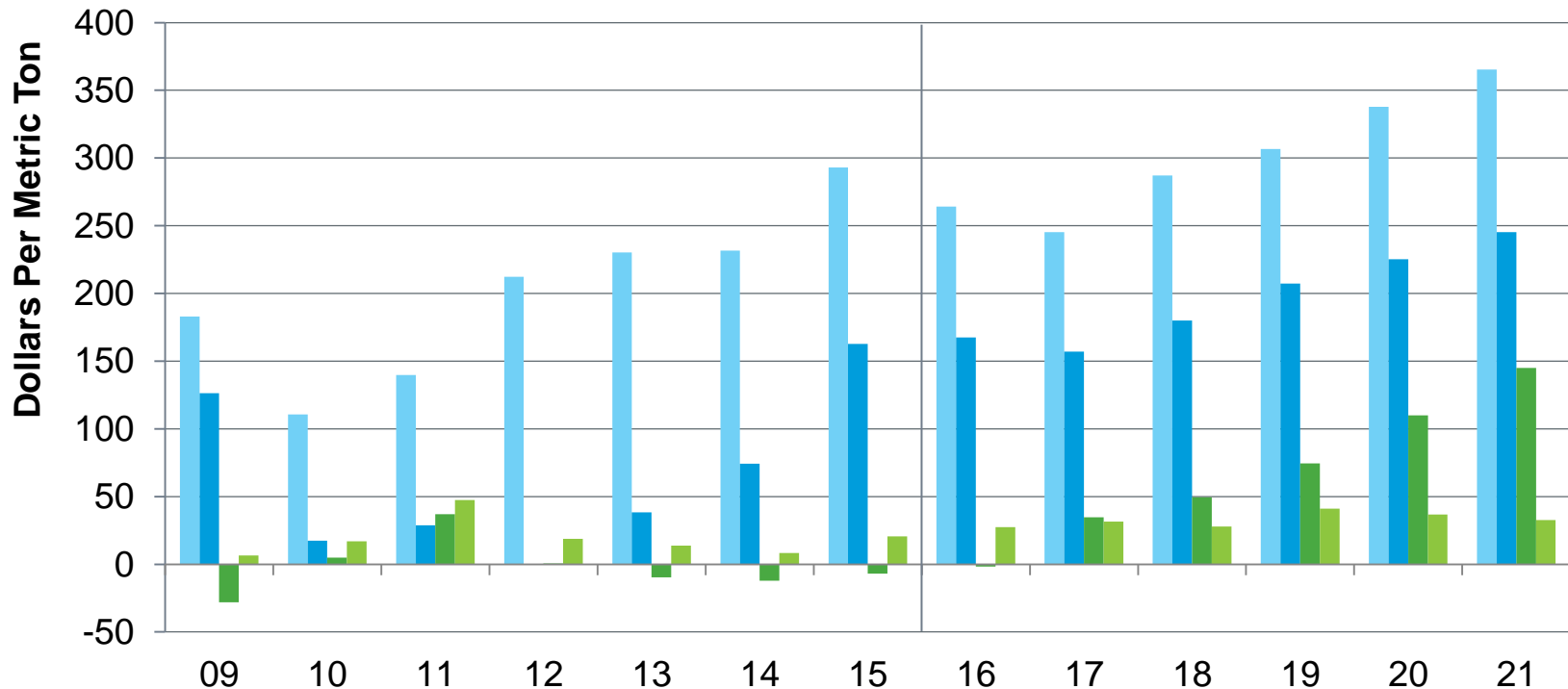
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- Net Capacity loss  $\approx$  1 dmt
- Capacity loss limited by several membrane plants expansion:
  - Akzo (Frankfurt)
  - BASF (Ludwigshafen)
  - Rokita (Brzeg Dolny)
  - Spolchemie, CABB, ICL
- Some conversion delays expected
- Asbestos extension and conversion

# ECU Cash Margin In Europe Improves With Capacity Rationalization

*All Regions Benefit From Higher Asset Utilization*

## Global ECU Margins



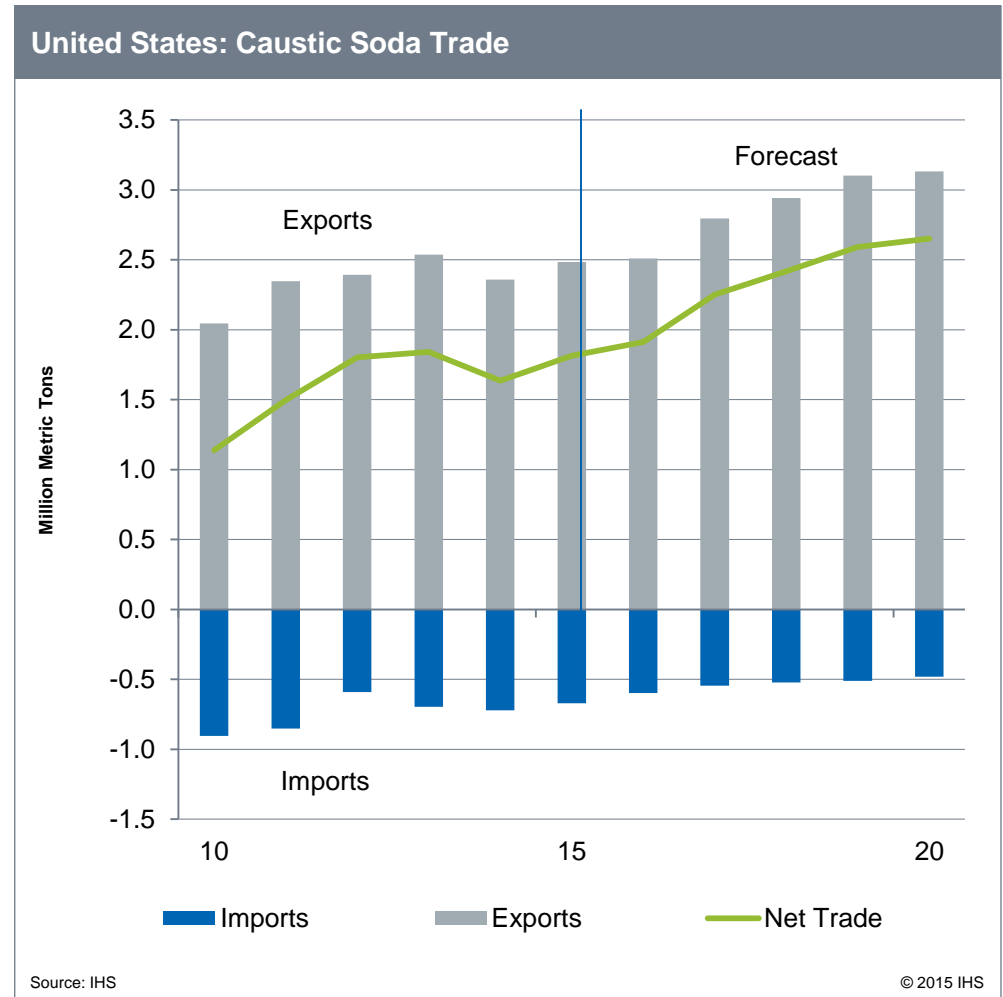
Source: IHS

■ North America ■ West Europe ■ Northeast Asia ■ China

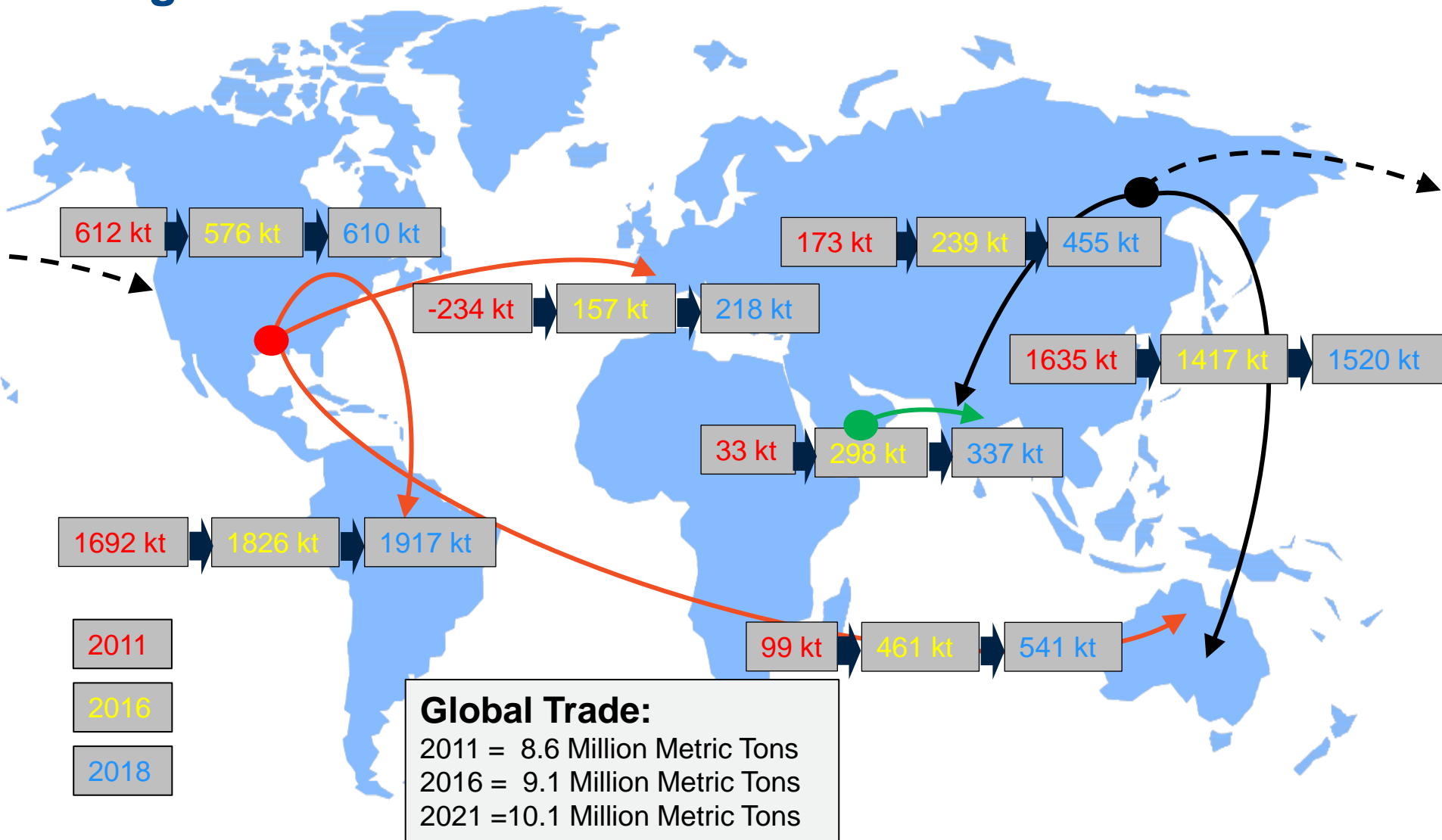
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# US Caustic Trade Reflects Global Cost Advantage

- 2Q 2016: Record USGC exports
- Net exports must increase to handle the additional caustic generated by chlorine chain exports
- Imports on North America's East coast will decline
- Growing exports become a more significant percentage of output



# Caustic Trade Grows: Three Export Powerhouse Regions





## Near-to-Medium Term Chlor-Alkali Take-Aways

- **US cost advantage** (energy and ethylene) declined near term with lower oil; expected to recover with rising oil and steady gas prices, and higher utilization.
- **Trade flow shifts** Europe becomes net importer; US poised to increase caustic and vinyls exports; South America imports increase from the US
- **Merger & acquisition activity** continues as the global market consolidates (Olin/Dow, INOVYN/VYNOVA, Westlake/Axiall, Solvay/Unipar Carbochloro)
- **New US capacity** requires higher vinyls and caustic exports
- **Availability of ethylene** becoming a potential limiting factor for merchant US buyers. Ethylene integration in the US remains key question.
- **Europe is high cost** but with modern C-A industry and higher utilization and margins post 2017; note risk of currency movement on export strategy.
- **Asia has high cash cost** and excess capacity. China is self-sufficient in PVC production – crude to coal ratio will play a role in domestic asset utilization



# PVC: The Road Ahead

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# Global Ethylene Prices

*US moves up: higher cash cost on ethane feed and spot price increases*

## Global Monthly Ethylene Prices

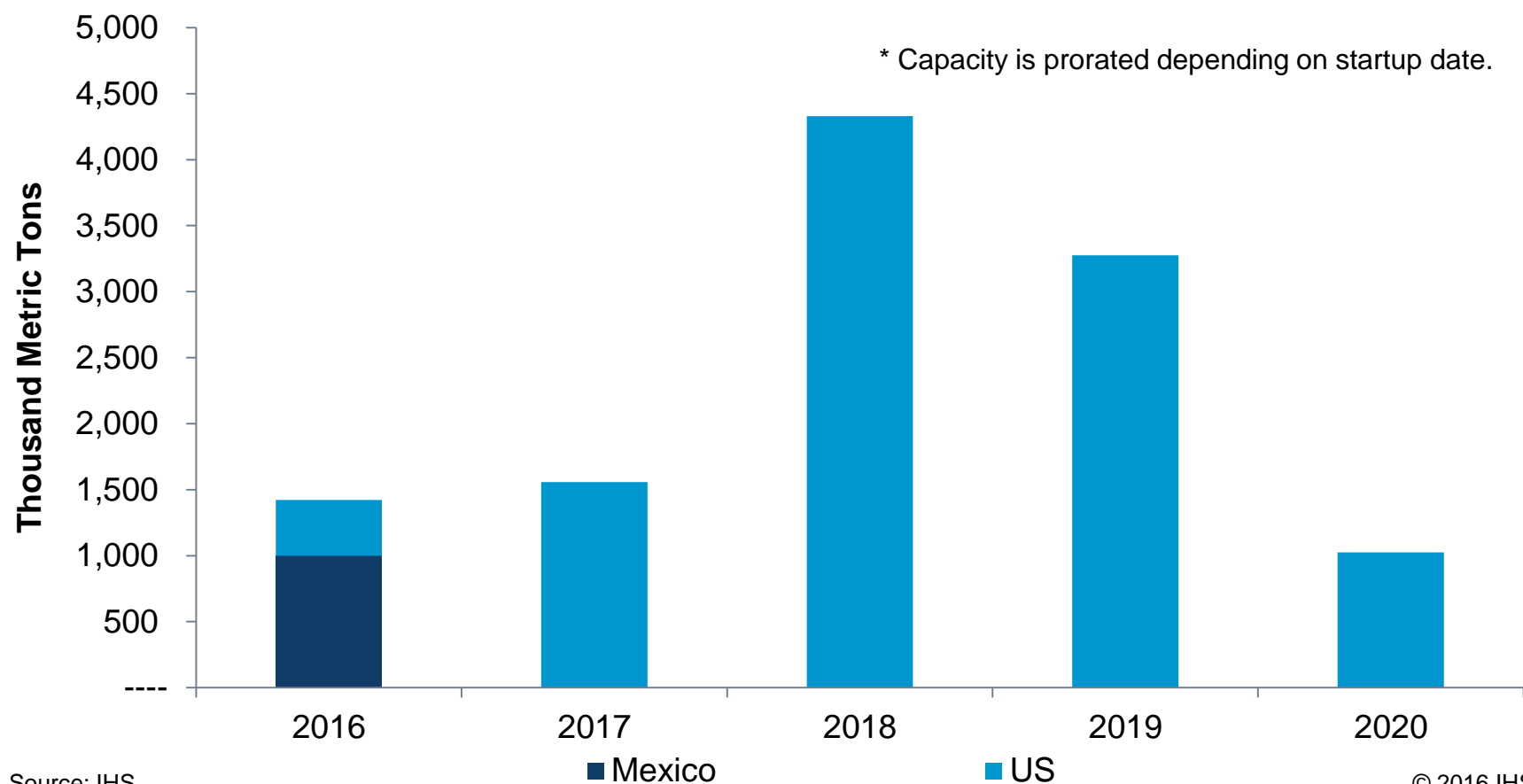


Source: IHS

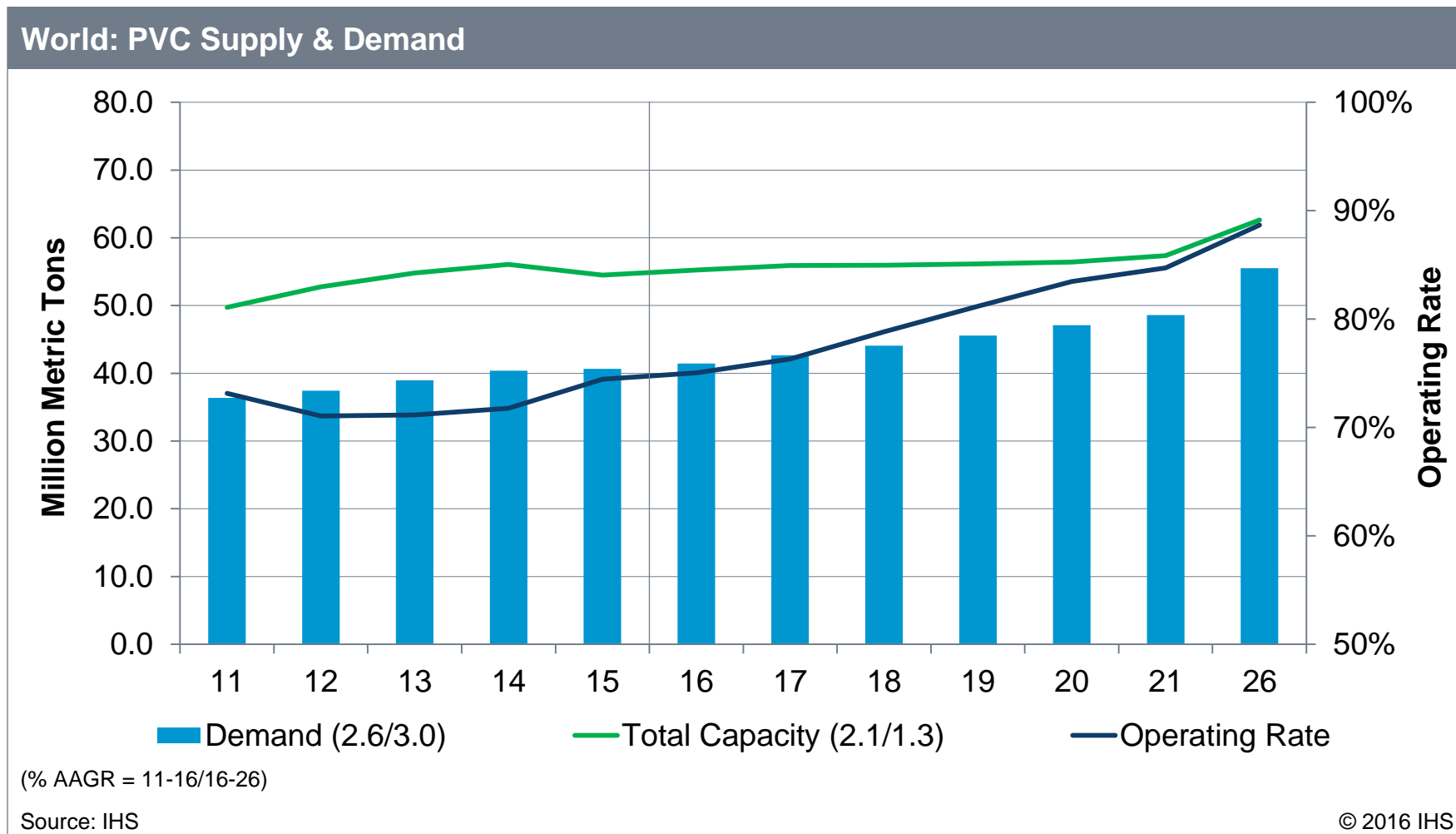
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# Timely Start-up of Ethylene Crackers is Critical

## New Ethylene Capacity in NAM

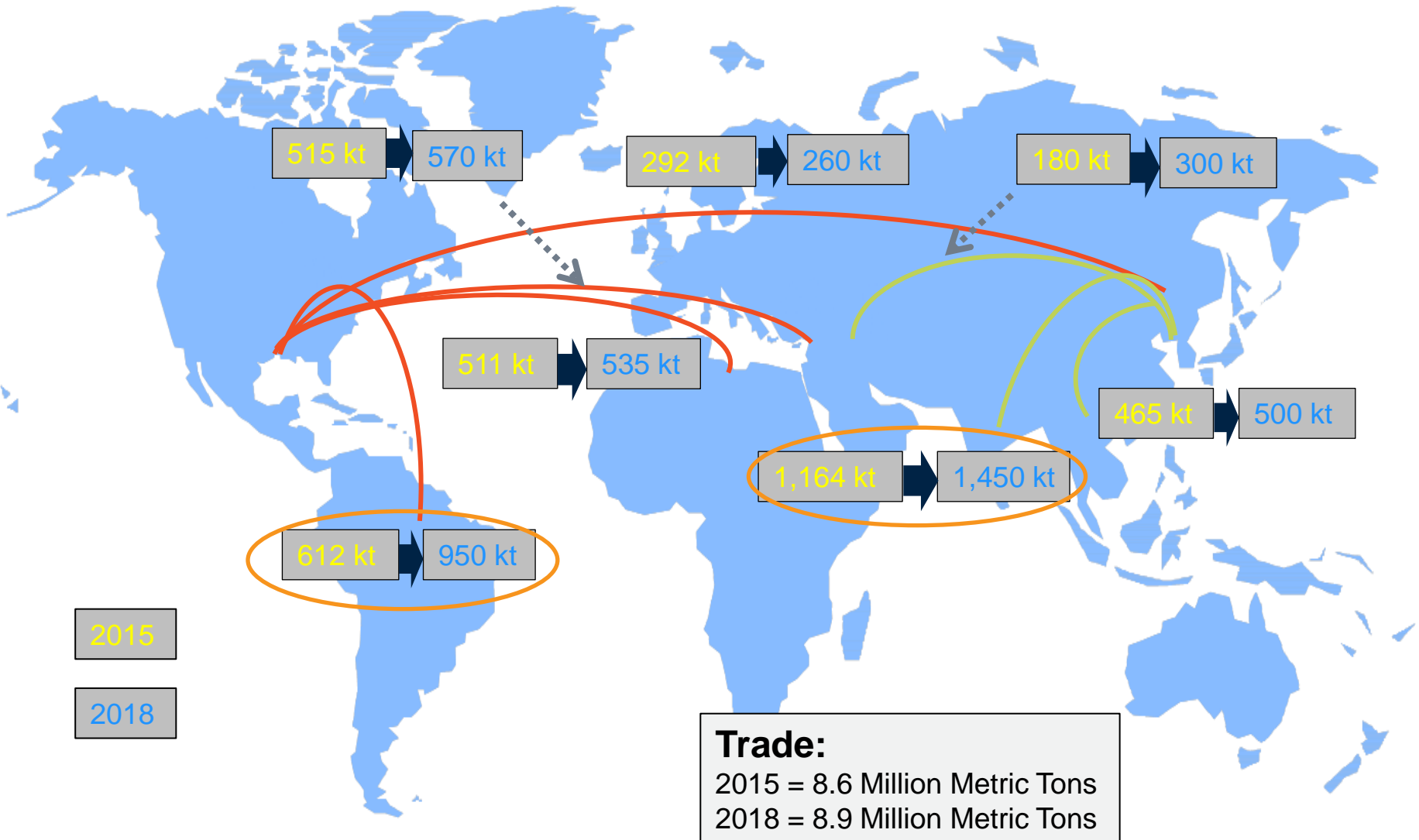


# Higher PVC Operating Rates as Capacity Stabilizes

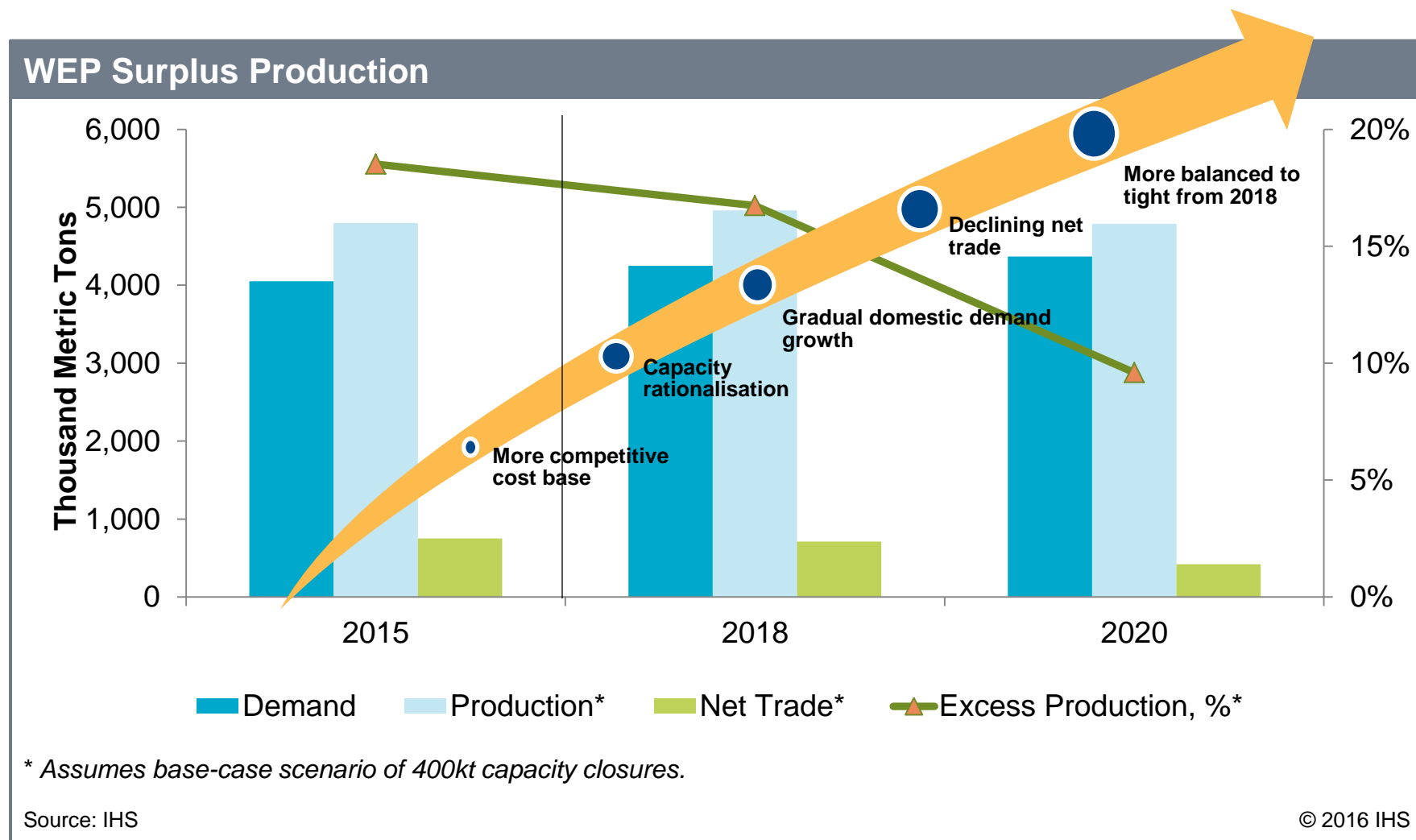




# PVC Trade Grows, More Intra-Region Flow

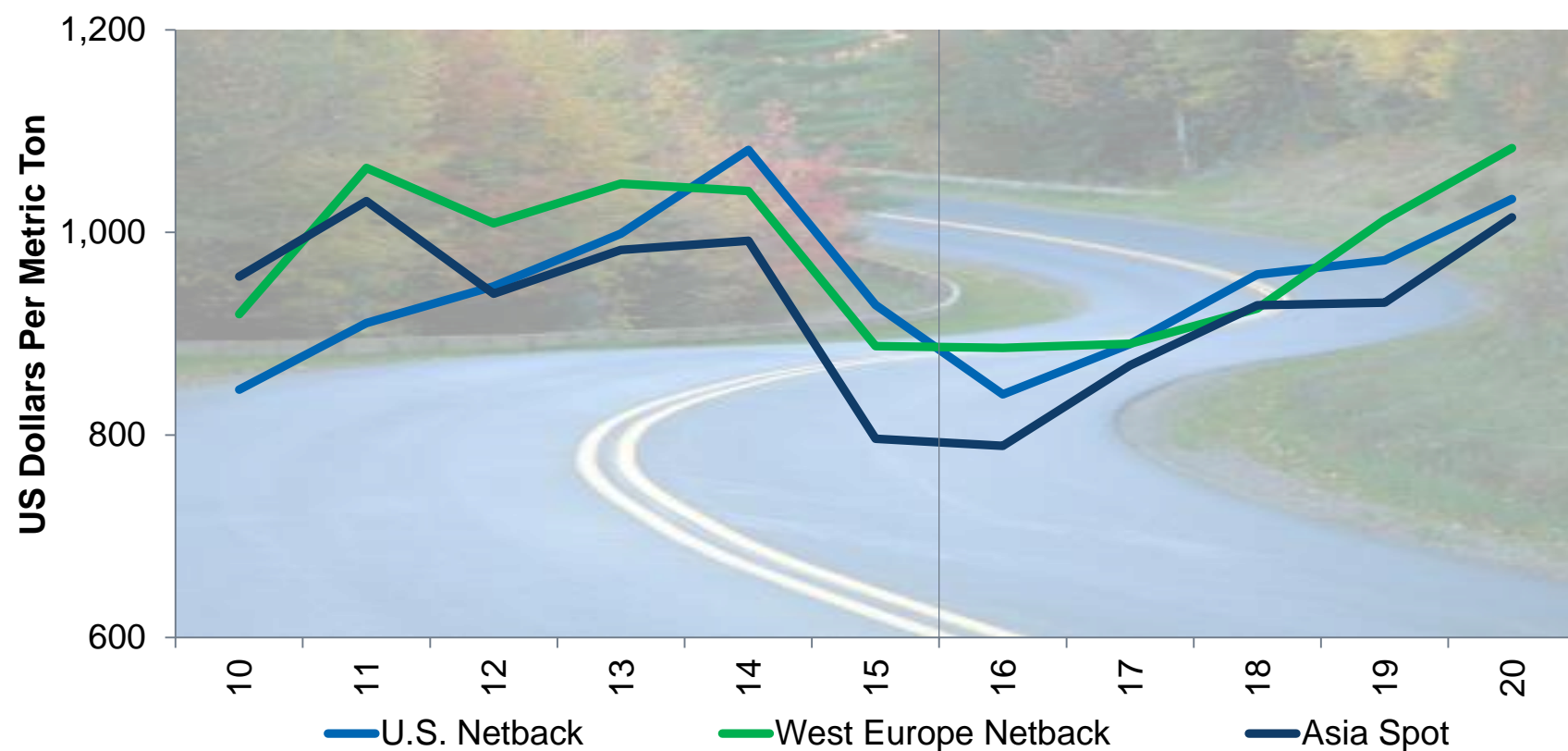


# West Europe: A Much More Balanced Market Come 2018



# PVC Global Prices: From Downhill To Uphill

## Regional PVC Netback Comparison

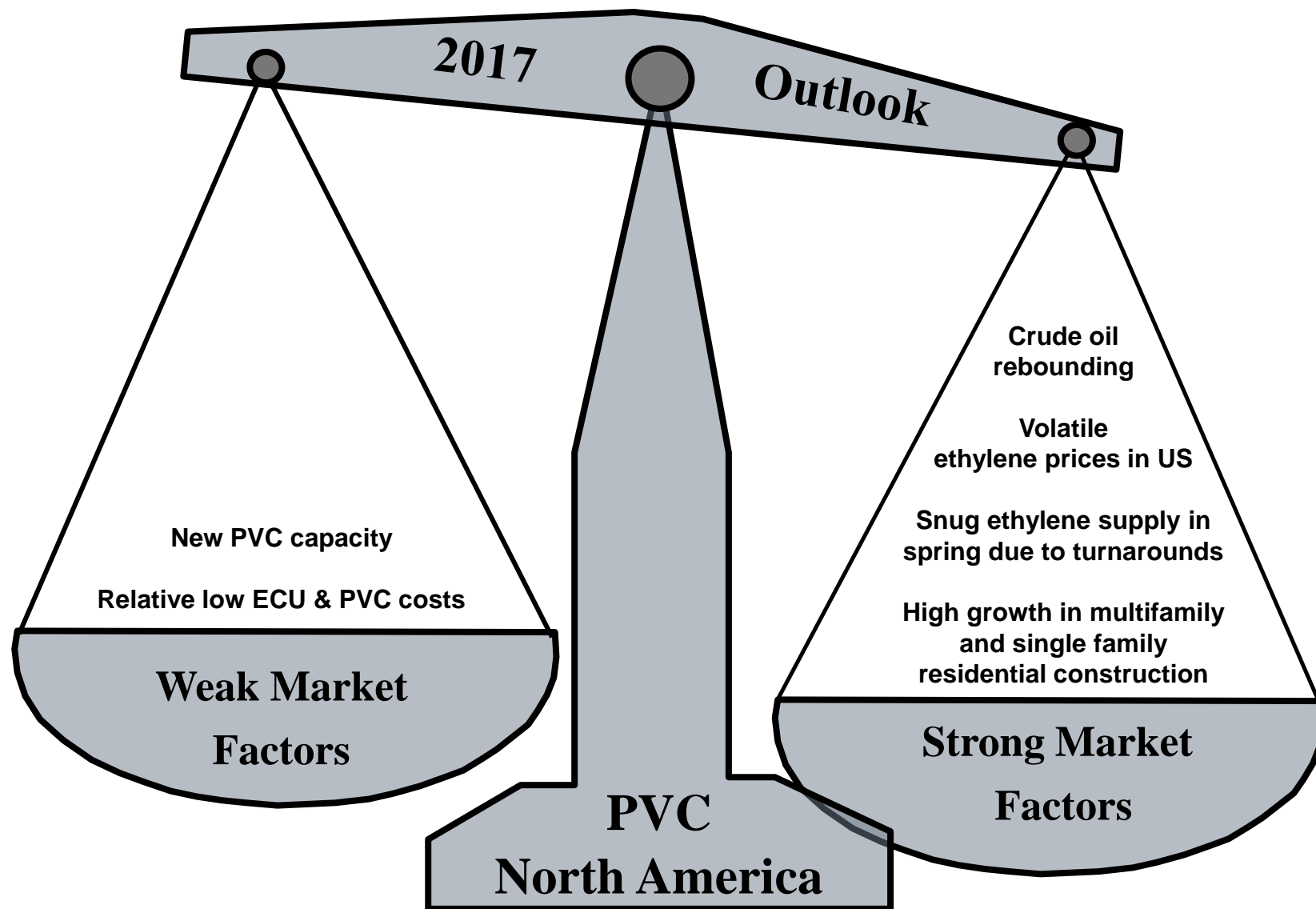


Note: Contracts After Discount and Freight

Source: IHS

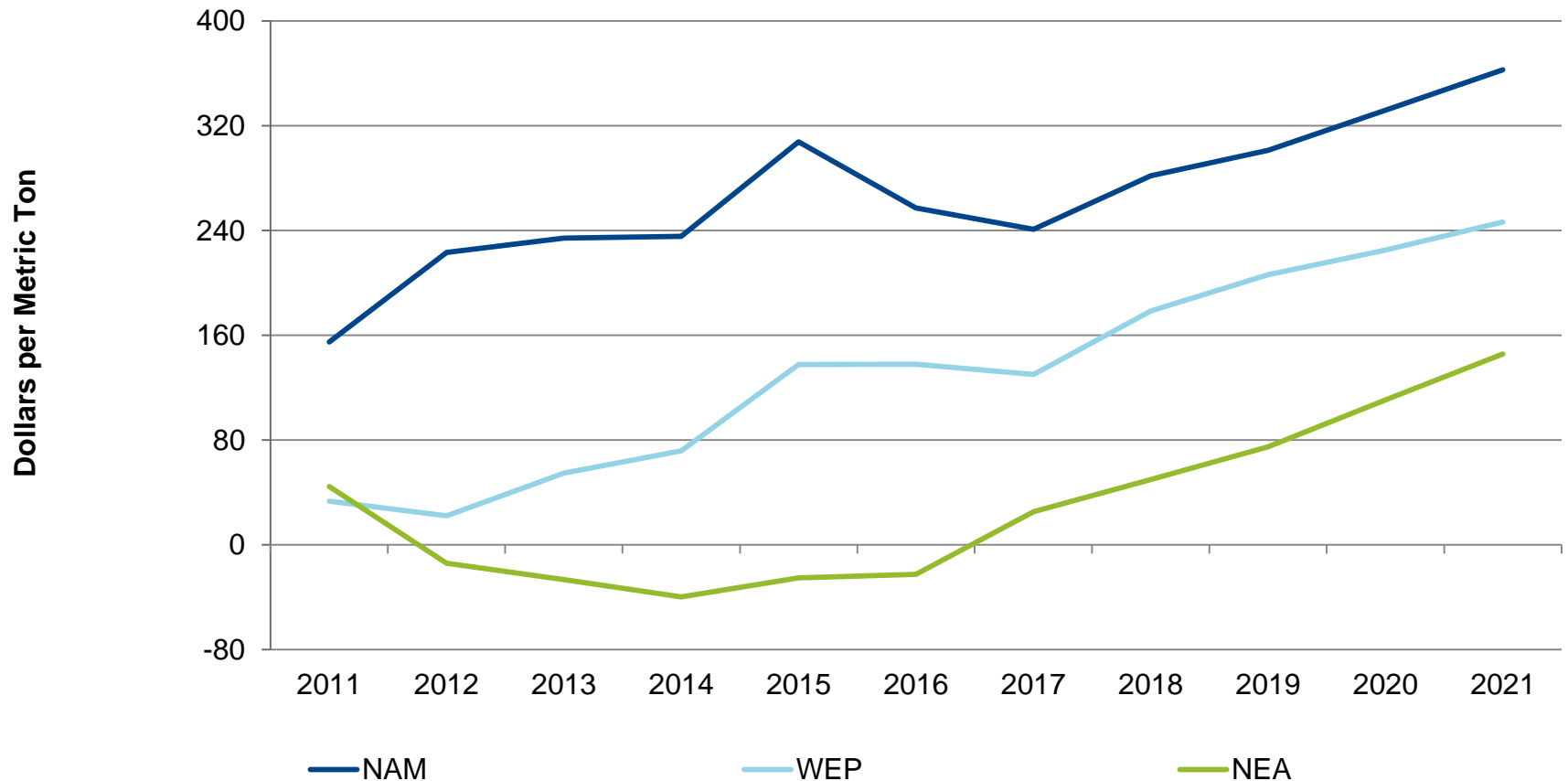
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# PVC Market in the Balance



# PVC Margins: Recovery On The Horizon

## Regional PVC Margins



Source: IHS

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# PVC Key Take-Aways



- Ethylene trend is a key driver for PVC prices.
- The cost advantage for PVC producers in North America has narrowed, but rising oil price will increase advantage.
- US housing starts are still increasing.
- Excess PVC capacity curtailments in China.
- No more new PVC capacity announced, hence operating rates are expected to increase in the next few years.
- Growth demand in Asia is key for the global market.

# The Big Picture: Road map take-aways for the CAV Future



- Caustic soda, PVC and ethylene prices trend up through the forecast period
- Until operating rates reach a level sufficient to sustain reinvestment grade returns, there will be no significant new capacity
- Location of new investment will be defined by relative energy costs
- South American growth will be fueled by caustic soda and vinyls imports through the forecast period



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