



HMC's Customer Seminar 2016

Polypropylene Industry Briefing

Chommanad Thammanayakatip

May 2016

A Global Advisor to the Energy & Chemicals Industry with Proven Track Record



Global Footprint

- Strong international presence provides valuable insights through our consultants' **local market knowledge** and our **vast network of sector specialists**

Our People

- Over **150 consultants** worldwide in Energy & Chemicals Advisory
- Expertise covering strategic, commercial, operational and technical aspects with **deep energy and chemicals sector knowledge**
- Nexant's consultants are typically Chemical Engineers, Economists and MBA graduates who have **significant prior experience working at energy & chemical producers**

Proven Track Record

- Advising clients in the energy & chemicals industry **for 50 years**
- Completed **over 2,000 client assignments** including market assessments, technology evaluations, valuations / appraisals and due diligence

Nexant's consulting services cover the entire energy value chain

Energy

Chemicals

POWER & RENEWABLES



- Grid Management
- Distribution Software
- Energy Efficiency
- Demand Side Management
- Renewables
 - Solar
 - Biomass
 - Municipal Waste
 - Wind
 - Clean Coal

GAS



- Gas Monetization
- LNG
- Gas Pipelines
- Regulatory Frameworks

DOWNSTREAM OIL



- Petroleum Refining
- Storage & Distribution
- Biofuels
- Oxygenates
- Coal to Liquids
- Gas to Liquids
- Base Oils
- Lubricants

C1 CHEMICALS & FERTILIZERS



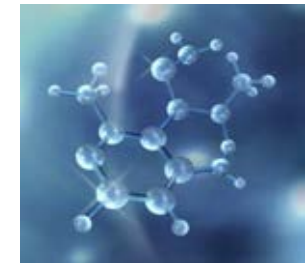
- Ammonia
- Urea
- Melamine
- Ammonium Nitrates
- Phosphate & NPK Fertilizers
- Methanol
- Formaldehyde
- Acetyls
- Other syngas derivatives

BASE PETROCHEMICALS & POLYMERS



- Olefins
- Aromatics
- Polyolefins
- Vinyls
- Styrenics
- Polyesters
- Polyamides
- Acrylates
- Rubbers
- Other olefin and aromatic derivatives

INTERMEDIATE & SPECIALITY CHEMICALS



- Surfactants
- Oleochemicals
- Engineering & Speciality Polymers
- Coatings, Adhesives, Sealants & Elastomers (CASE)
- Polyurethanes
- Resins
- Biochemicals
- Speciality & Fine Chemicals

Nexant Capability

Agenda

Petrochemicals recent performance
Investment Landscape
South East Developments



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What a difference a year makes

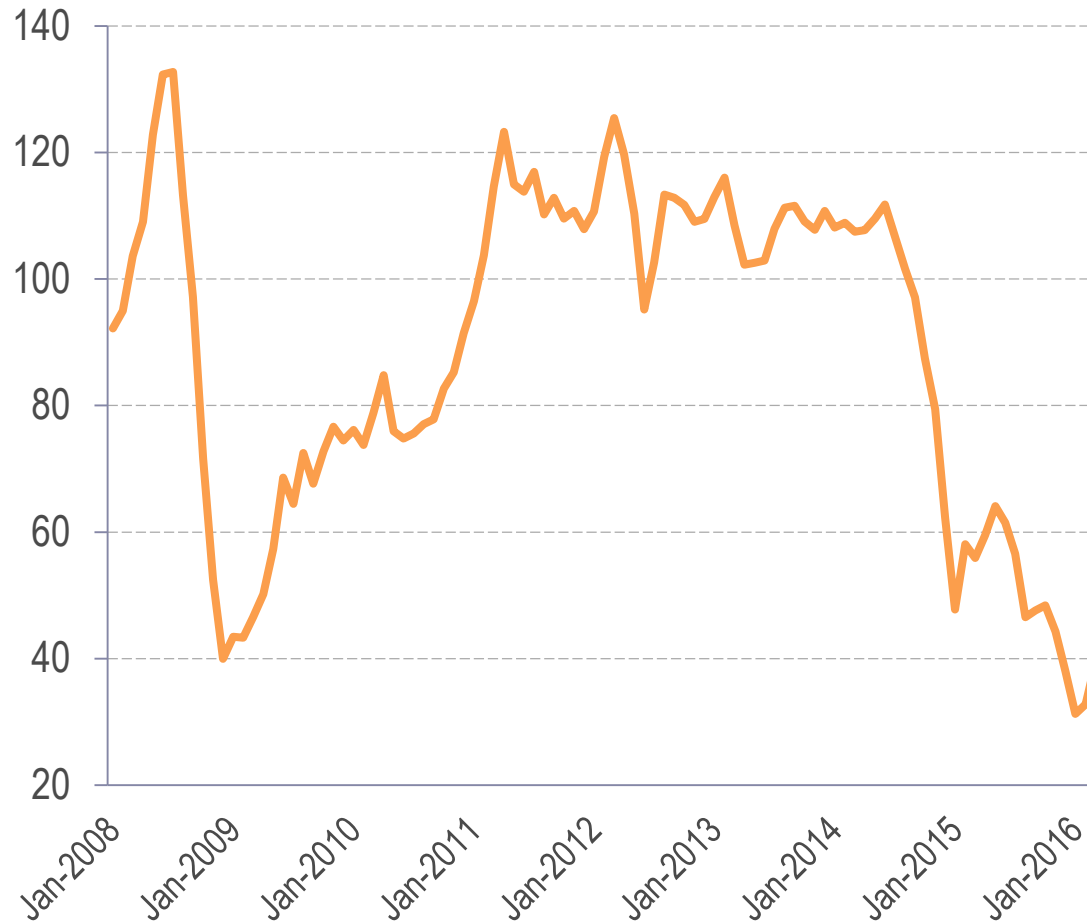
Brent Crude Oil Price Decline, mth average



Source: Nexant

What does low oil mean for the petrochemicals sector?

Brent Crude Oil Prices – US\$/bbl

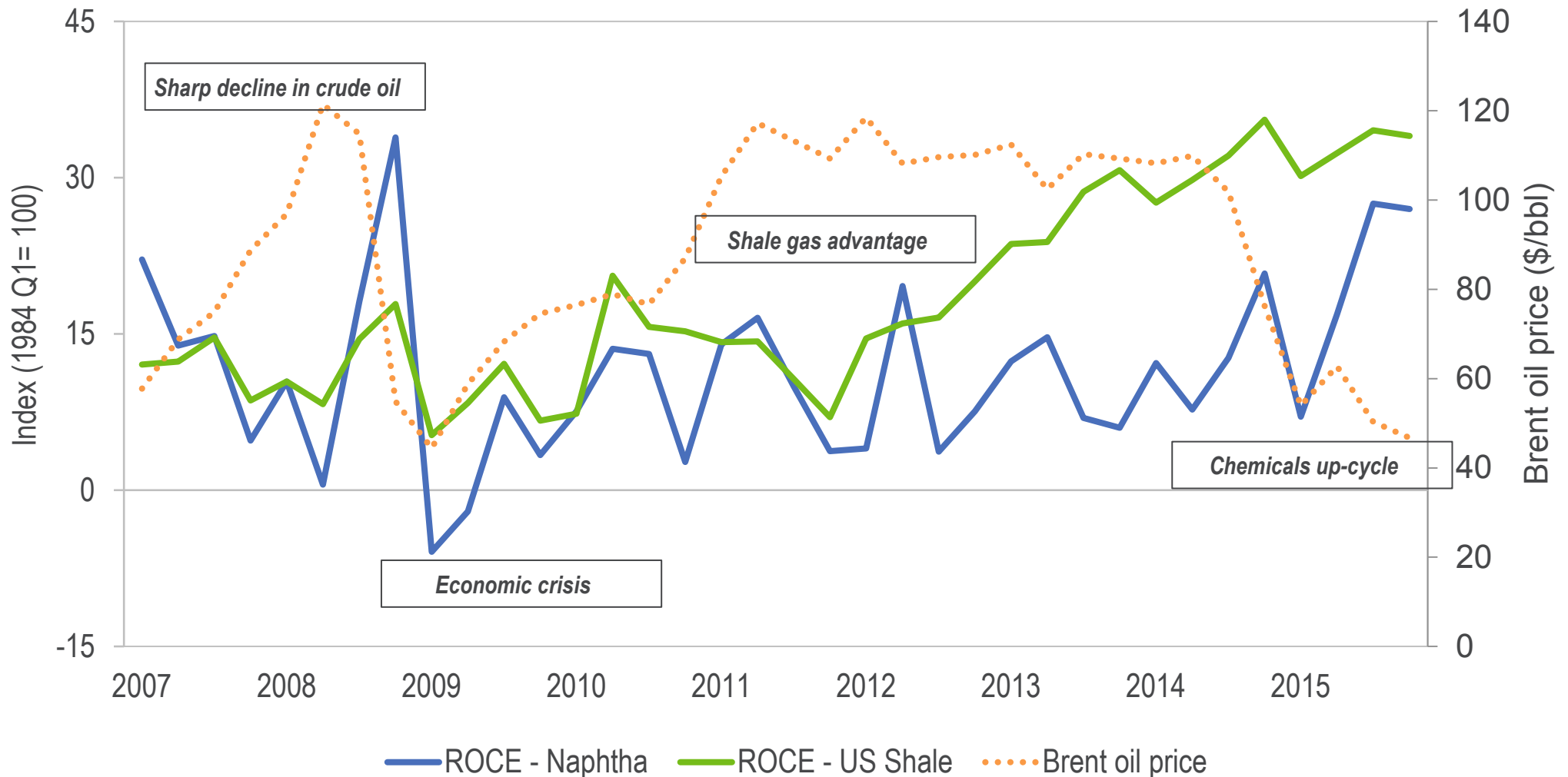


Issues for Global Chemicals:

- Investment slowdown in Middle East and in other geographies. Partly associated with Middle East sponsors.
- Shifts in industry competitiveness. Naptha cracking has become more competitive.
- Feedstock alternatives have become less attractive e.g. coal, bio etc.
- Pricing correction across the value chain due to falling cost base. However margins have improved for some products
- Demand upside for some geographies – increased disposable income?

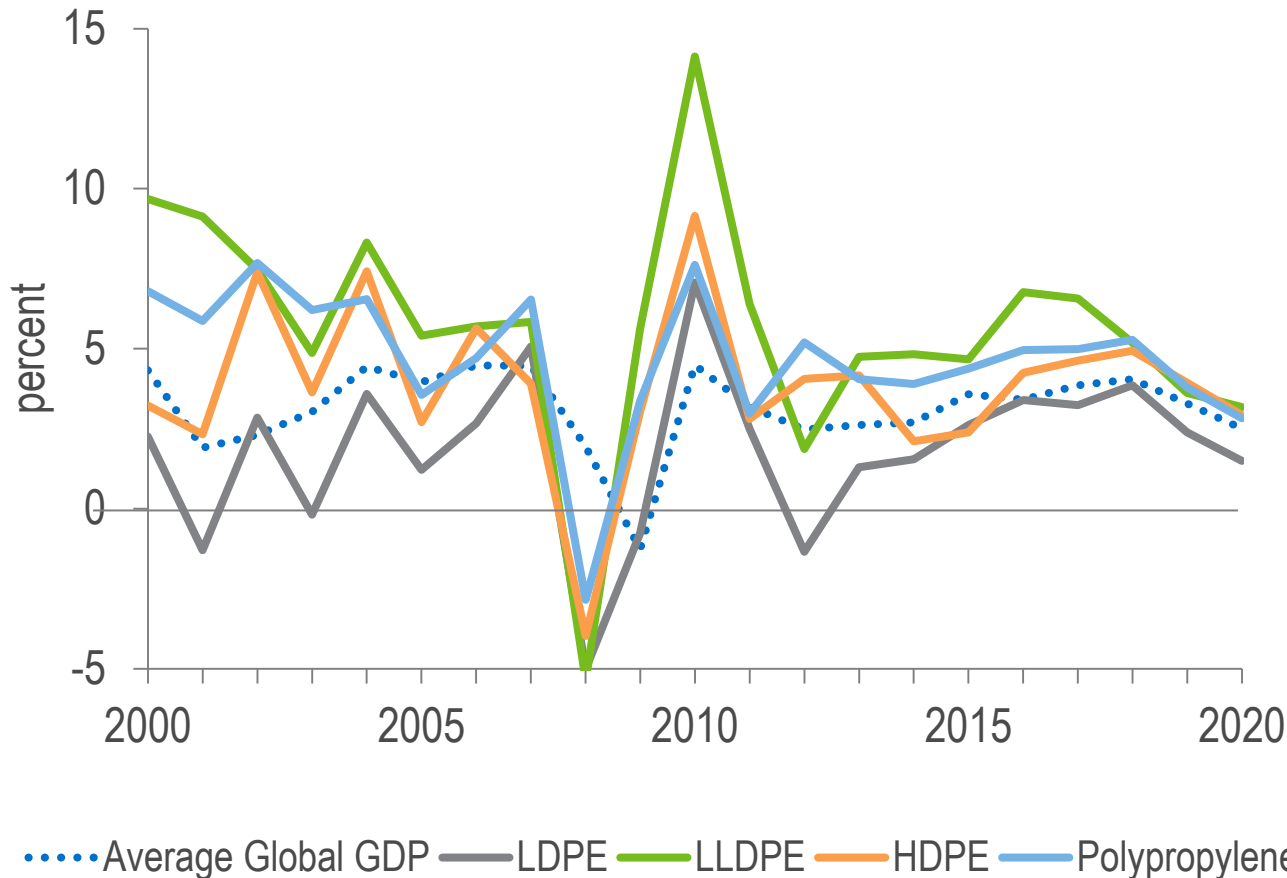
Shale gas advantage has been eroded as naphtha cracking competitiveness improves with lower oil prices

Petrochemicals Return on Capital Employed Index



Demand growth for polyolefins has varied over time yet the trend remains link to economic growth

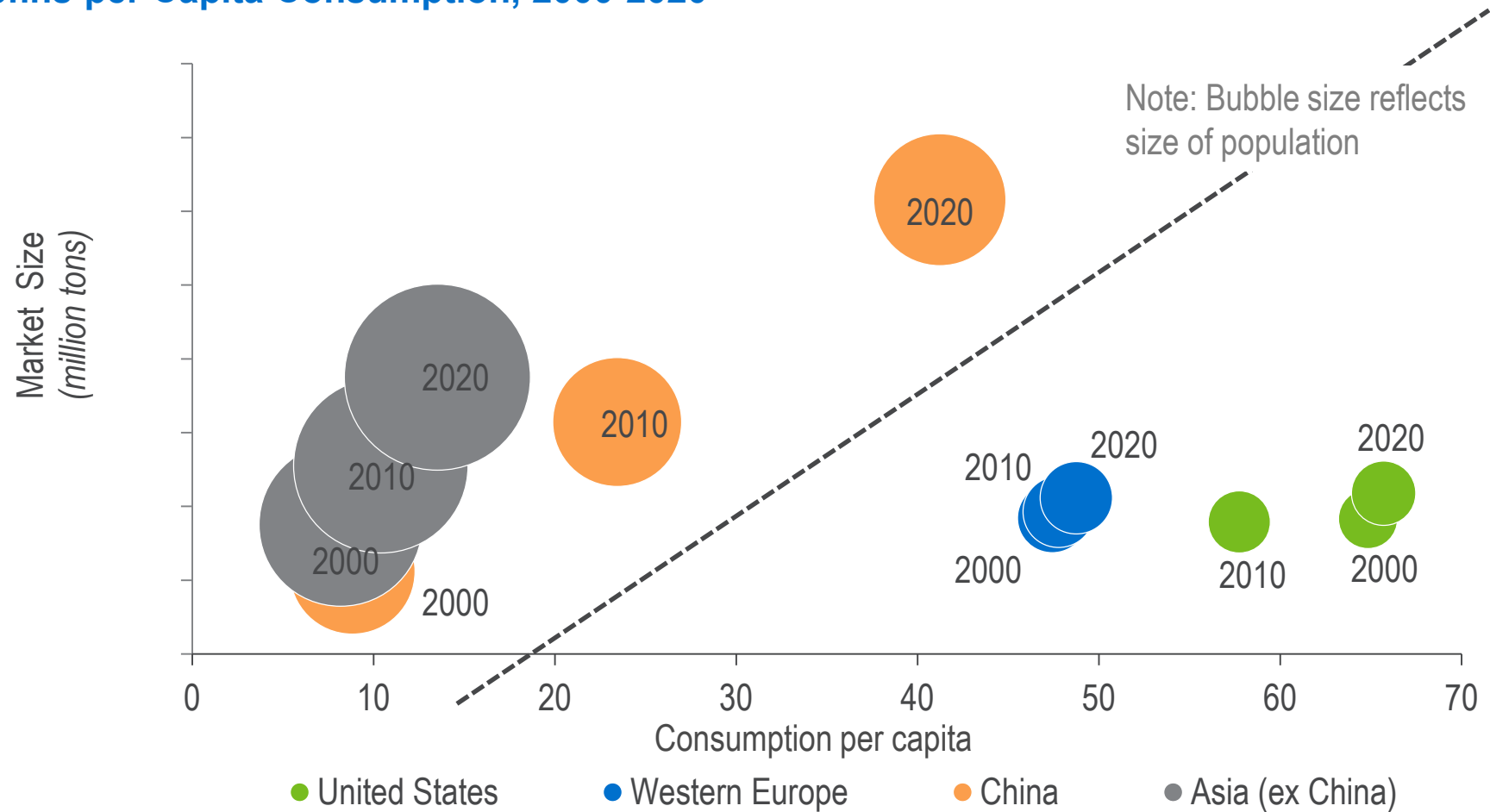
Global Polyolefins Demand Growth and Economic Growth



- Polymer consumption growth is driven by economic growth, or in more developed countries, by industrial production indices and consumer trends
- Estimated global PP demand CAGRs for 2000-2015 / 2015-2020 are 4.6% and 4.4% percent respectively
- Estimated global GDP growth for 2000-2015 / 2015-2020 is 2.9% / 3.2%
- Short-term global GDP forecasts (through 2020) have recently been reduced by almost 0.5% due to on-going low oil prices, uncertainty about China, and other economic factors

China is by far the largest polyolefins market and the gap is continuing to widen

Polyolefins per Capita Consumption, 2000-2020



Polymer demand is driven by industrial production and consumer trends, varying by country maturity

Investment Landscape

A number of new petrochemical projects are expected to be delayed due to the impact of low oil prices

Regional Petrochemical Feedstock Sources and Trends

US Shale Reserves

- Increased oil & gas production, resulting in lower energy prices.
- Increased production of co-produced ethane and other NGLs.
- Improved competitive position, resulting in reinvestment in commodity products.

Middle East Oil and Gas Reserves

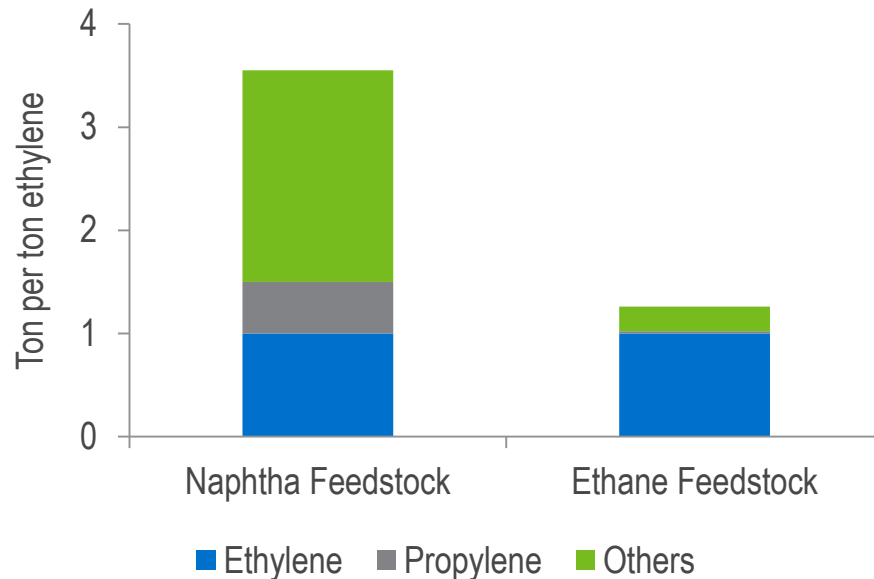
- Further utilisation of ethane and other available NGLs.
- Investment in new refinery with a focus on refinery/petchem integration.
- Declining competitive position off-set by mixed feeds, integration/scale and higher value products.

China Coal Reserves

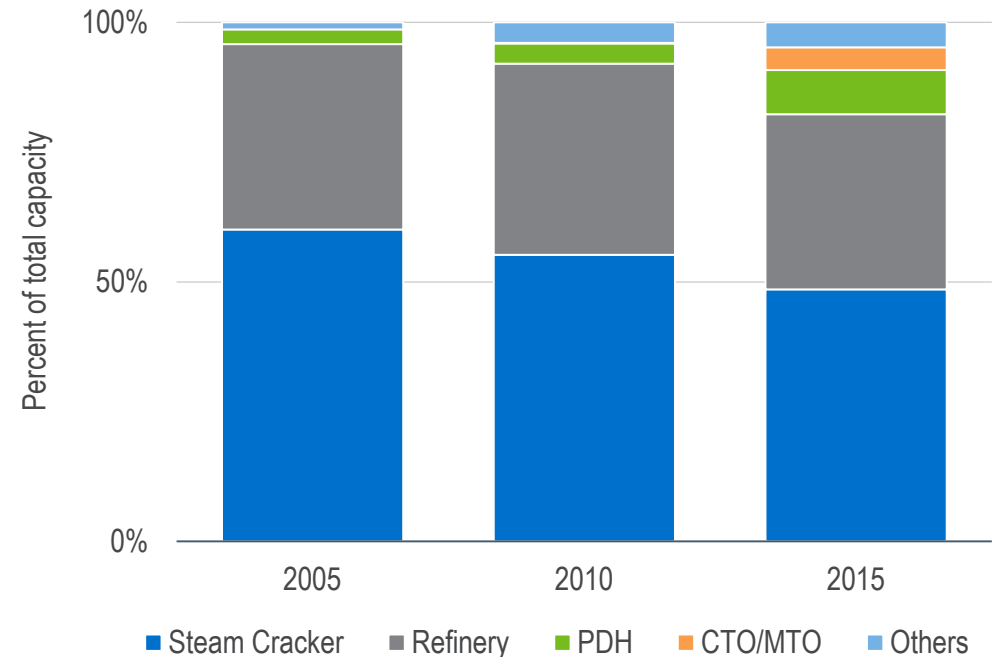
- Increase focus on coal to chemicals and PDH (via propane imports).
- Investment in new refinery capacity with a focus on refinery/petchem integration.
- Variable competitive position depending on feedstock. Access to markets is key.

New propylene supply trending towards on-purpose technology

Steam Cracker Products: Naphtha vs. Ethane



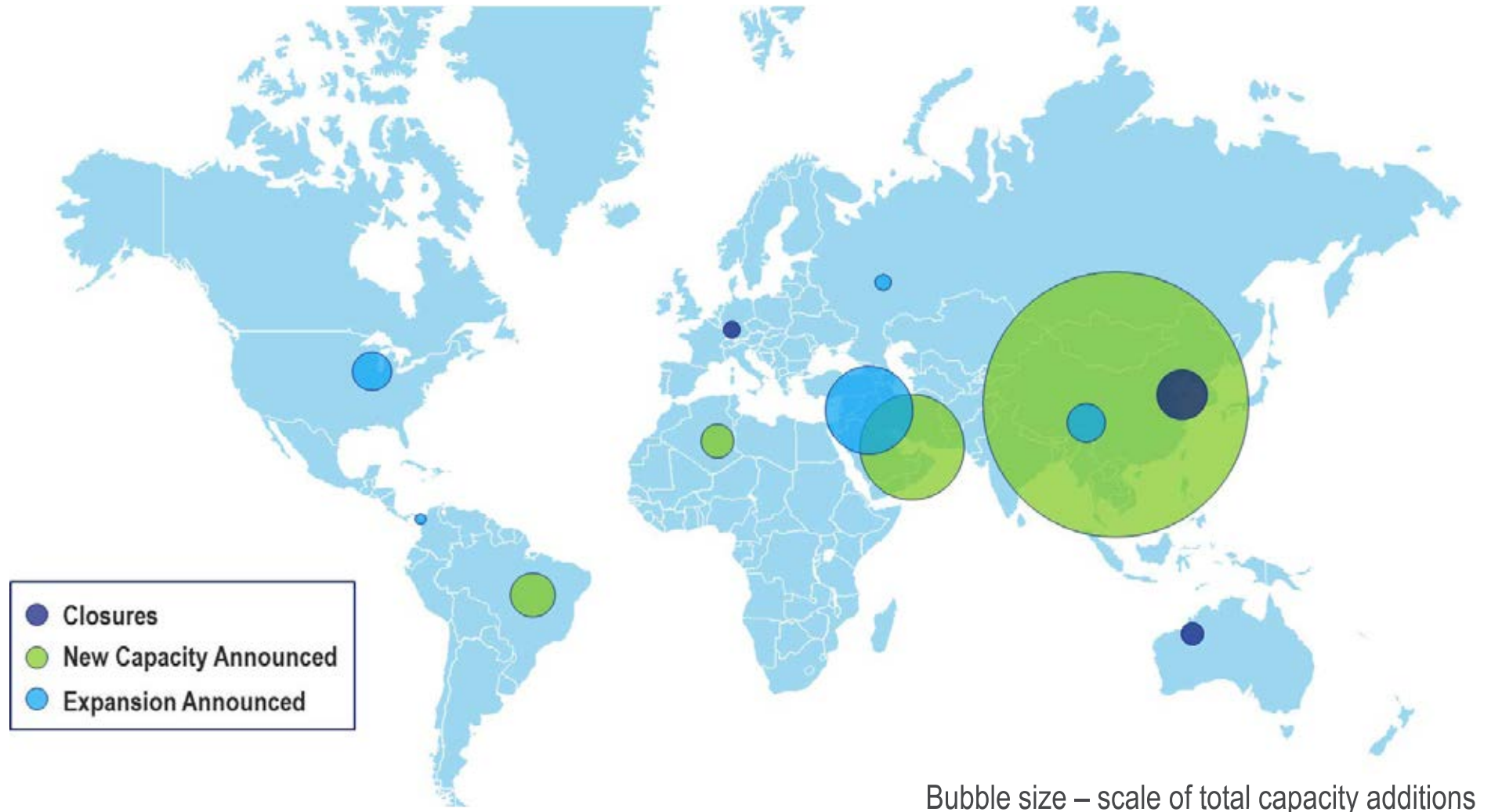
Global Propylene Capacity Profile



- CTO/MTO and PDH processes are increasingly becoming important sources of incremental global propylene supply. This trend has been due to higher growth in propylene demand than refinery and cracker investments, and also prompted by trends towards using a lighter feedstock slate for global ethylene production.
- Globally, incremental propylene capacity from cracker and refinery developments is forecast to remain insufficient to balance propylene demand growth
- Firm CTO projects are limited to China and supported by the local availability of low-cost mine-mouth coal
- PDH investments are taking place in North America, Middle East and Asia. Propane exports from the US and the Middle East are also supporting PDH projects in Asia.

New refinery investments heavily concentrated in China and India

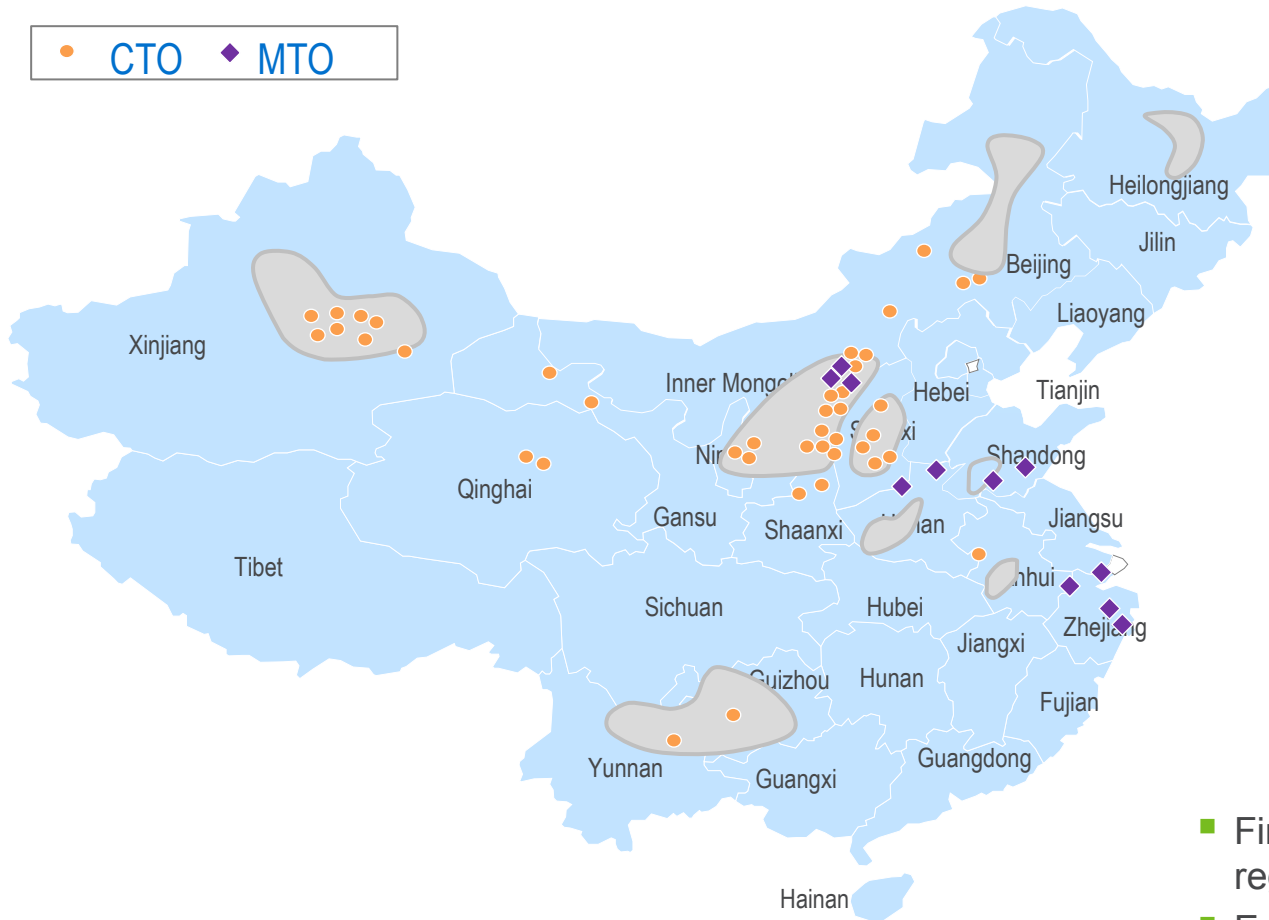
Global Refinery Capacity Changes 2014-2017



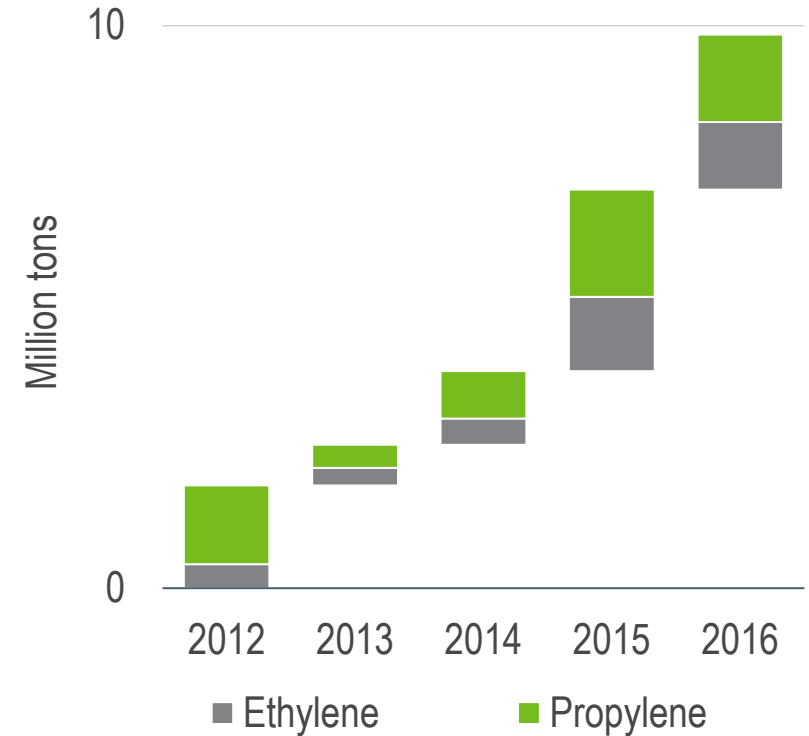
More than 20 CTO/MTO projects are under various stages of development in China

CTO/CTP Operating Plants in China

● CTO ◆ MTO



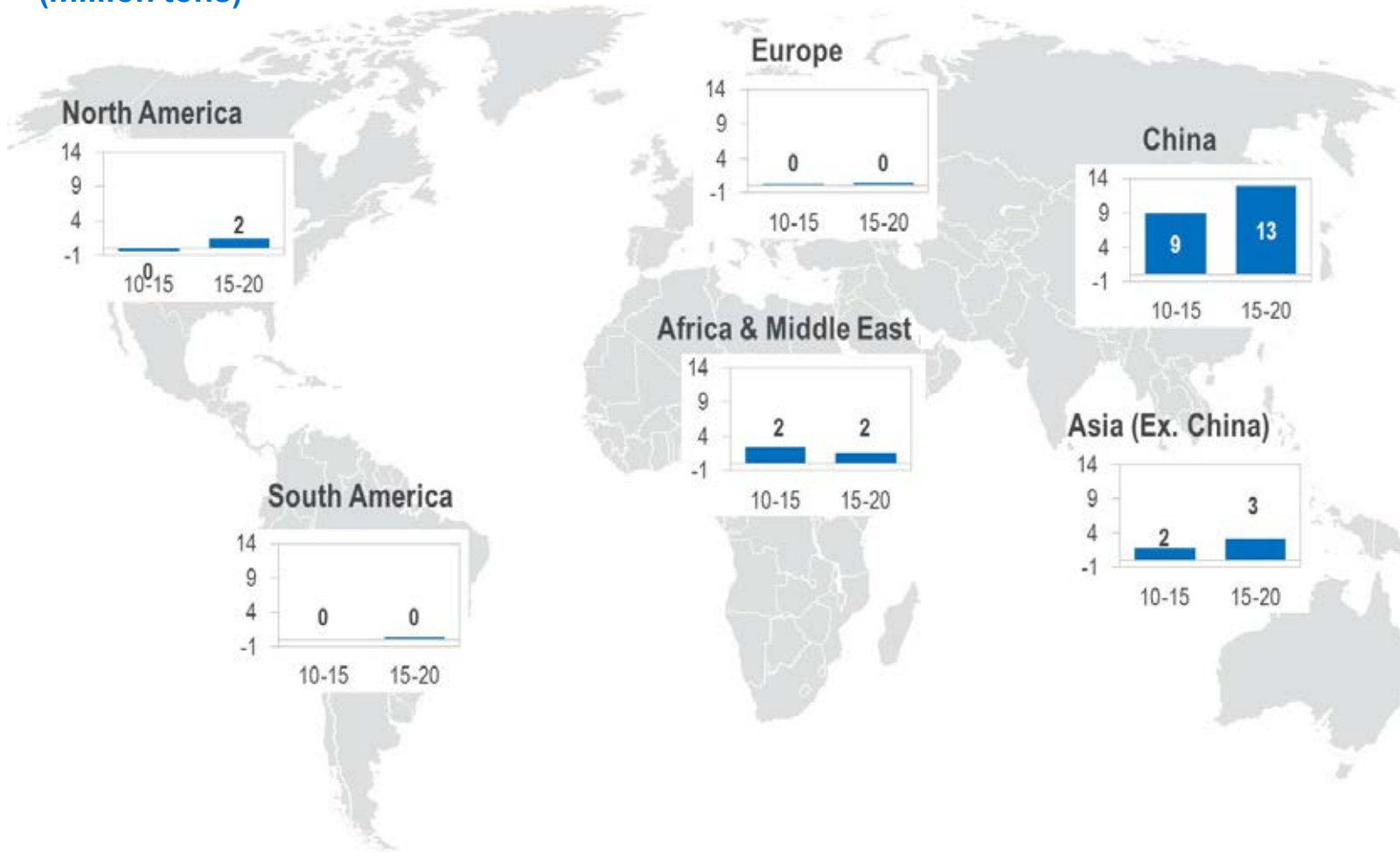
CTO/CTP Capacity



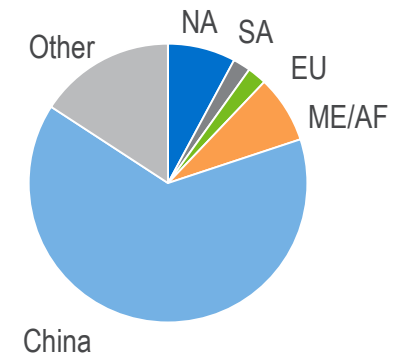
- First phase CTO project concentrated in the western regions exploiting lower cost coal reserves.
- East coast developments are focused on methanol imports for new MTO projects.
- Higher cost projects may not succeed.

PP additions highly concentrated in China, strong emphasis around new refinery and on-purpose propylene

Regional Polypropylene Incremental Capacity Additions (million tons)



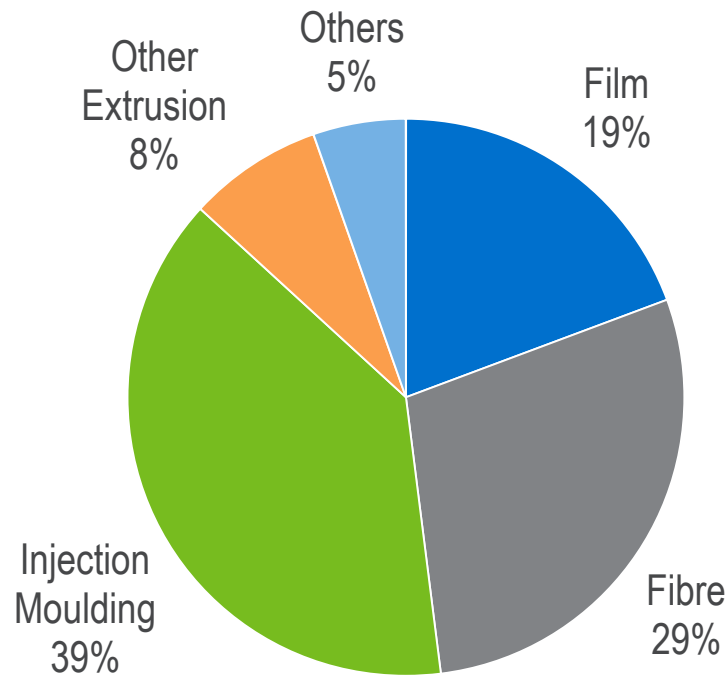
Incremental Changes 15-20



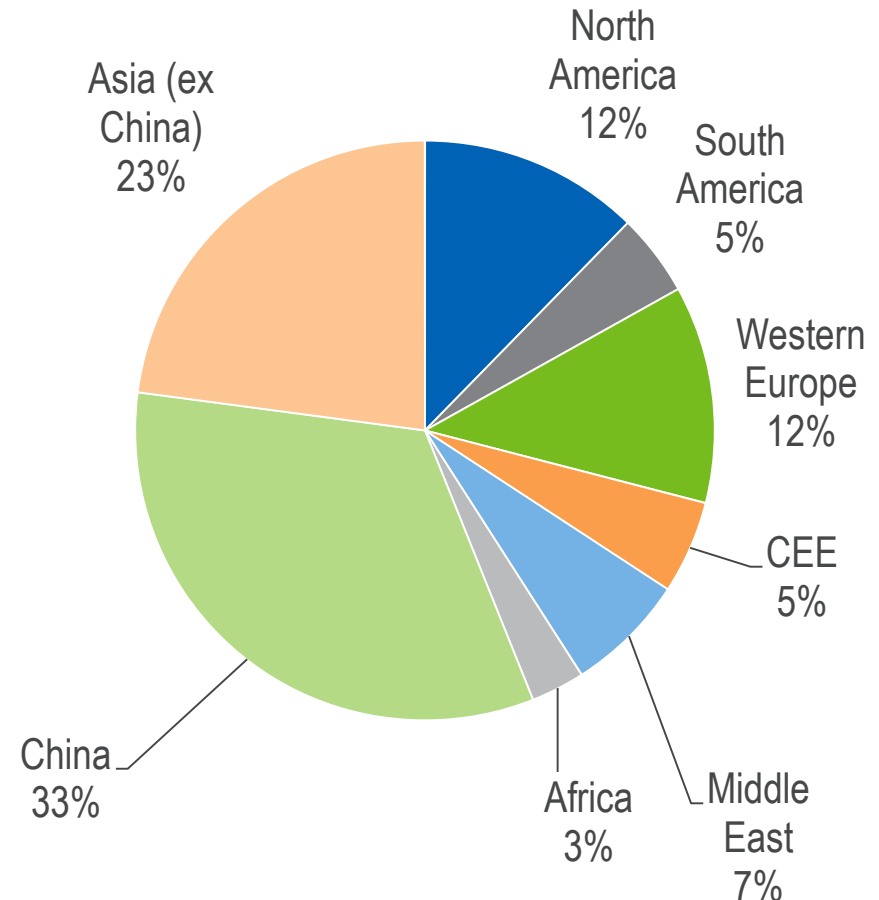
Over the next five years, polypropylene capacity will increase by almost 20 million tons

Global polypropylene demand was estimated at 60 million tons in 2015, following growth of 4.4% from 2014

Global Polypropylene Demand by End Use, 2015-e
(Global demand 60 million tons)



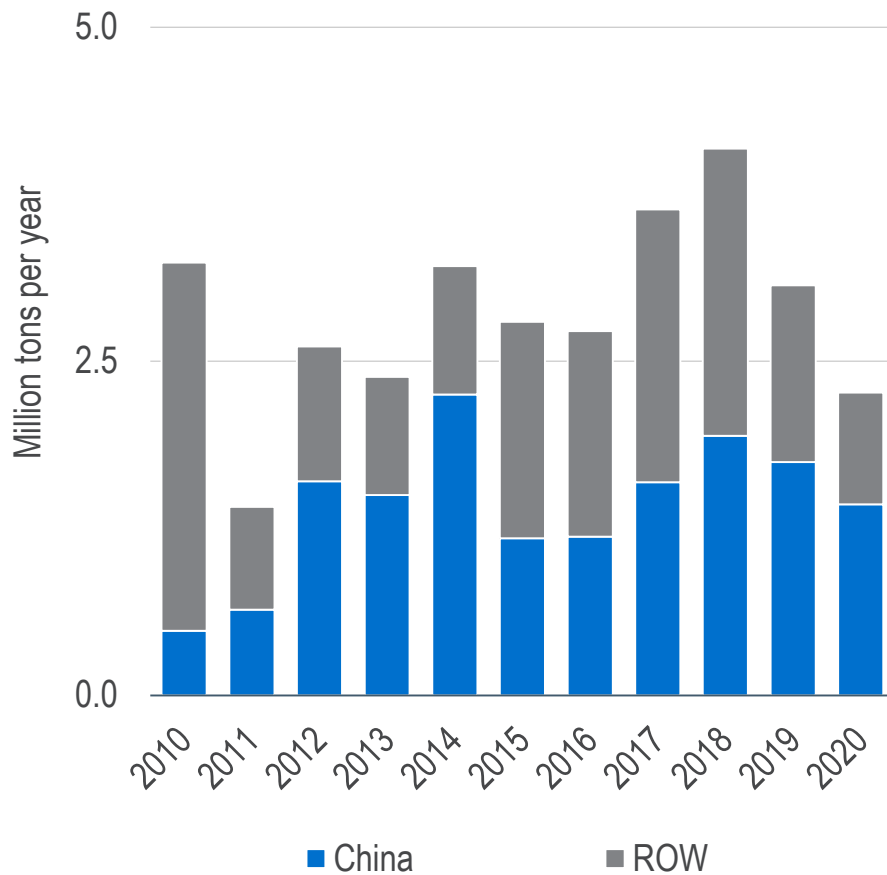
Regional Polypropylene Demand, 2015-e
(Global demand 60 million tons)



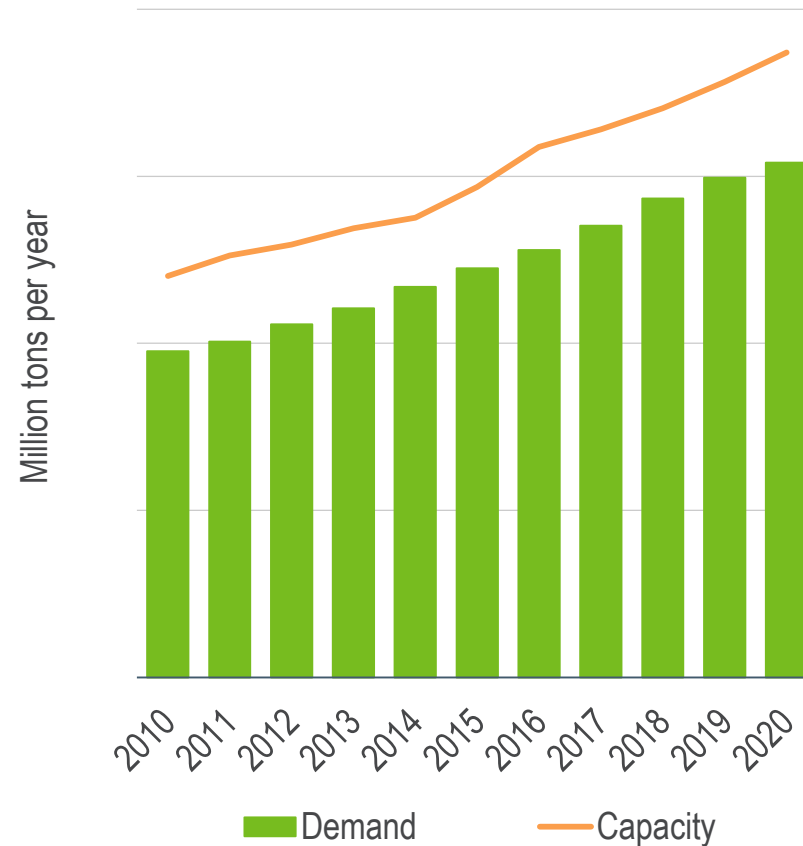
Film applications are expected to have the highest growth rate, but almost all applications are forecast to have good growth

Polypropylene volume growth set to remain highly dependent on China

Incremental PP Consumption Growth, million tons

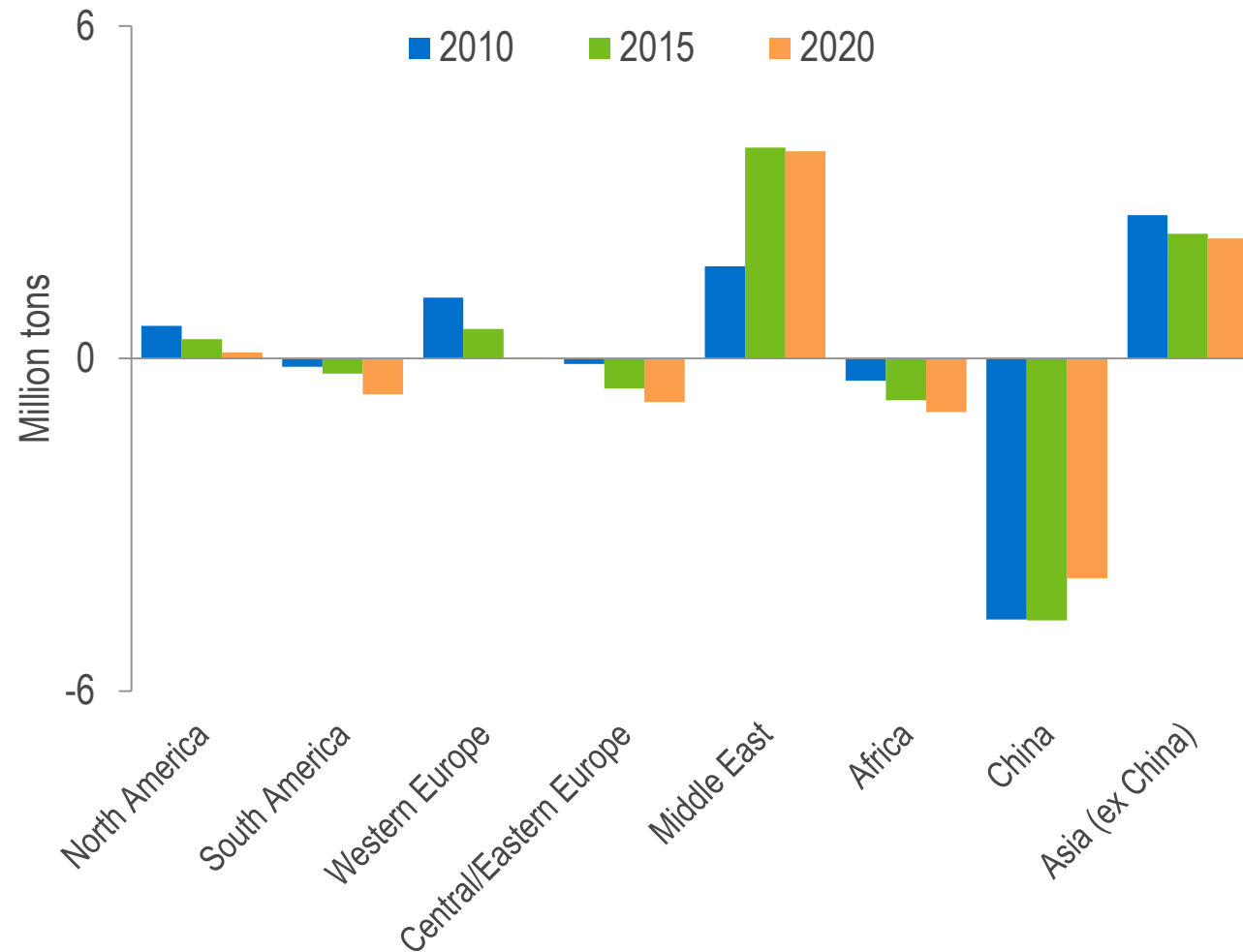


Global Polypropylene Demand and capacity, million tons



The Middle East will continue to be the dominant export region, while China will remain the largest importer

Global Polypropylene Net Trade
Million tons

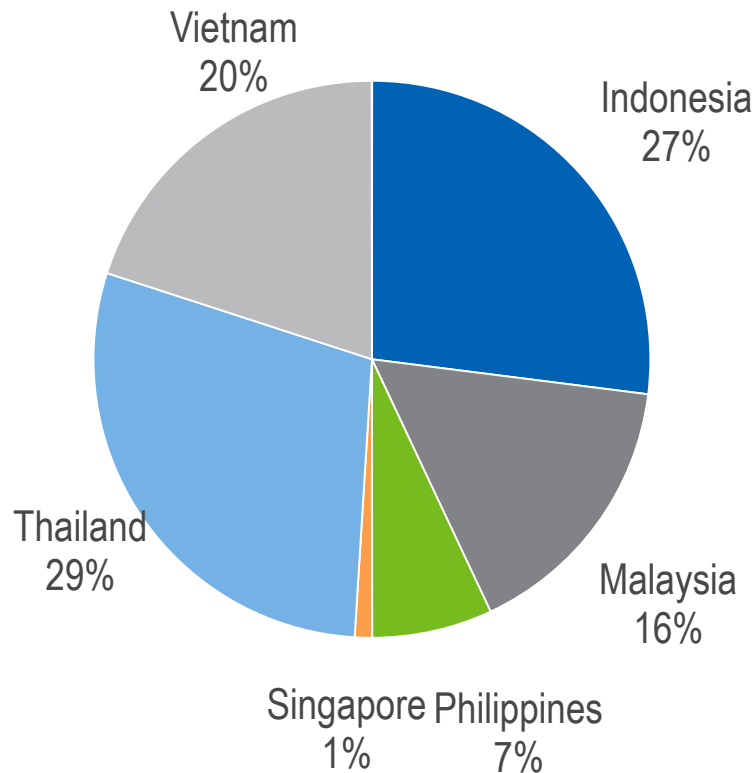


- With its low-cost production base, the Middle East is the dominant net export region, and this is not expected to change
- North America, Western Europe, and Asia (ex China) are also net exporters
- Despite its low-cost propane position and large additions of PDH capacity, very little polypropylene capacity has been announced in North America
- Despite large capacity additions, China continues to be the largest net importer, although this position will decline slightly

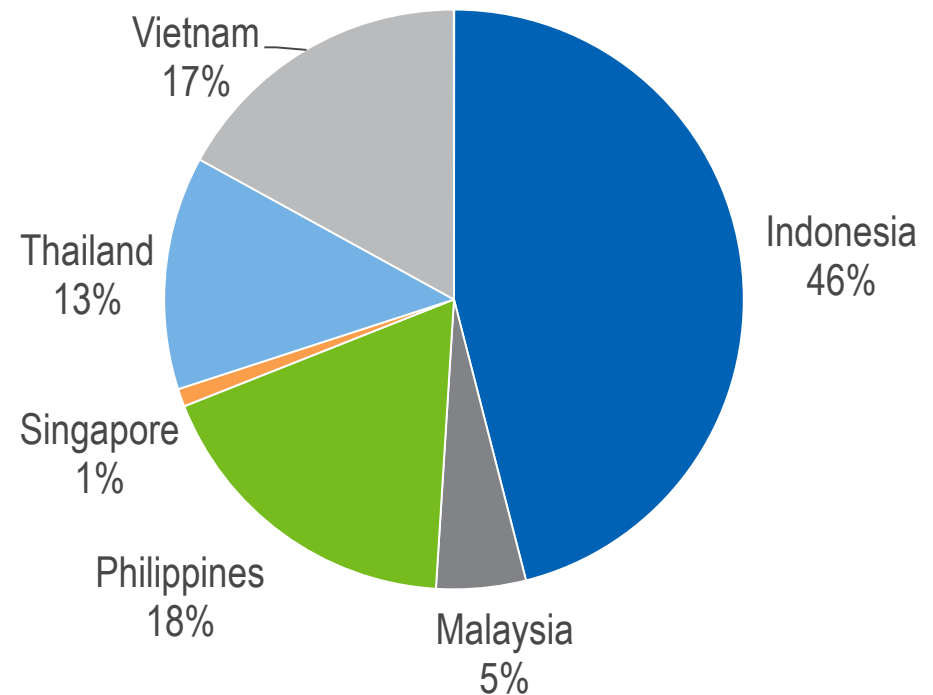
South (East) Asia Developments

Economically, South East Asian is a major market with half a billion people registering U\$2.4 trillion GDP in 2014

GDP of six major countries, 2014
(Total GDP 2.4 trillion dollars)

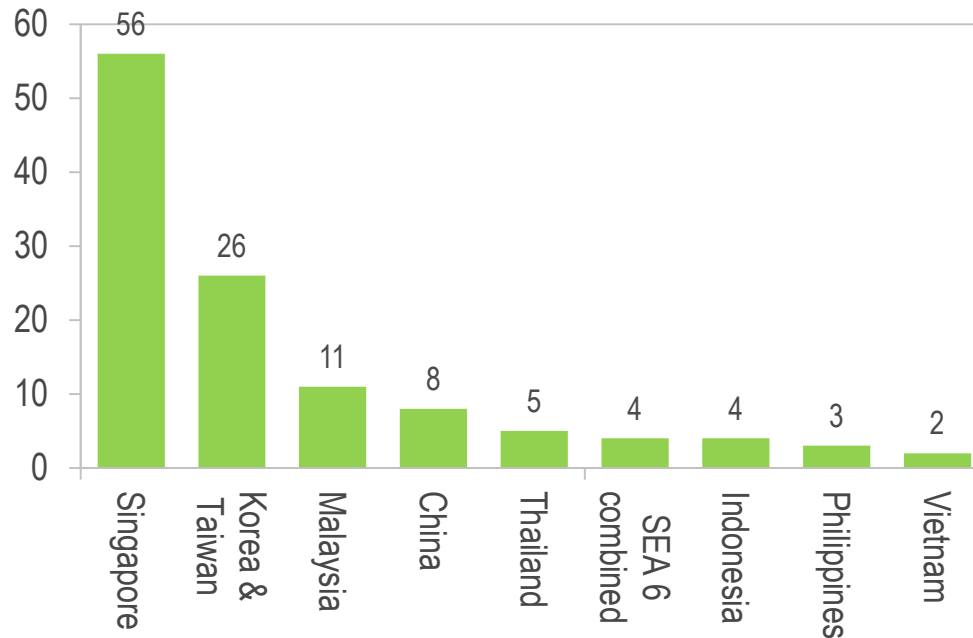


Population of six major countries, 2014
(Total Population 560 million people)



Although in relative term, not as big as China – the GDP is 5 times smaller, half slower growth and half GDP per capita consumption

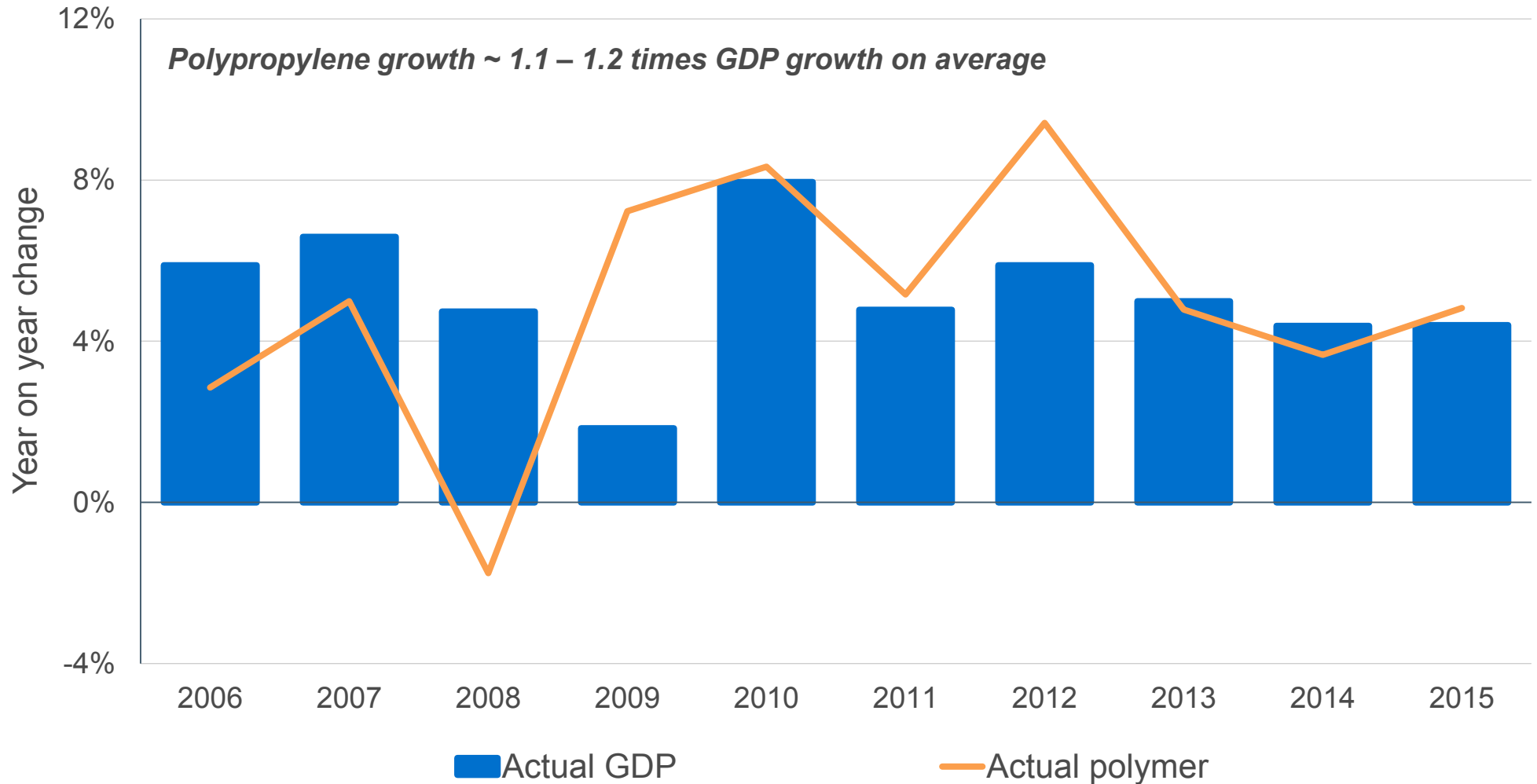
GDP per Capita (estimated US\$ thousand, 2014)



- The region's fragmented market is illustrated by the highly varied GDP per capita
- Singapore is 5 times per capita larger than Malaysia (second largest per capita market) and Malaysia is 5 times larger than Vietnam (the smallest market in the analysis).

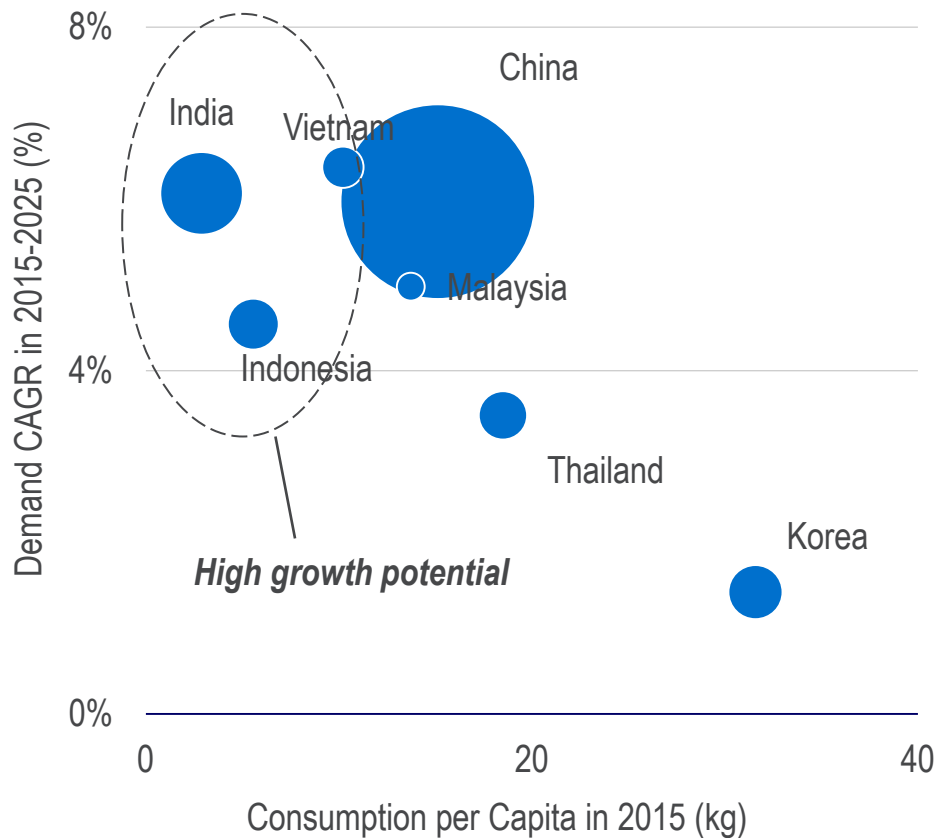
For the past decade, SEA PP markets have grown about as fast as GDP

SEA Polypropylene Demand and Economic Growth

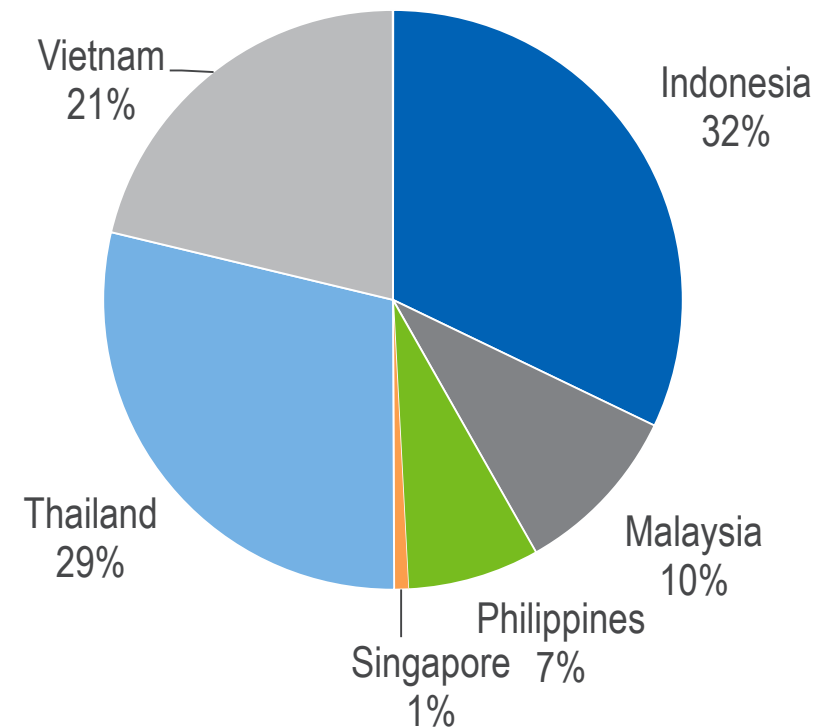


High growth opportunities still exist in specific markets

Asia Polypropylene Demand Growth



Polypropylene consumption by major countries (total demand 4.4 million tons)



- Consumption growth in polymers is associated with the substitution of traditional materials, infrastructure development and population demographics (income, urbanisation etc.)

Major Projects are progressing in India, however elsewhere project delays are occurring

Reliance Refinery & Cracker

- Jamnagar, Gujarat
- Reliance Industries
- C2/C3: 1400/200 kta, no new PP only expansion
- Status: Under Construction, Start-up 2016

ONGC Petro Additions Limited (OPaL)

- Dahej, Gujarat
- ONGC, Gail, GSPC
- C2/C3: 1100/400 kta, PP 340 kta
- Status: Under Construction, Start-up 2016

South Korea

- Hyosung 200 kta, 2017
- S-Oil 400 kta, 2018

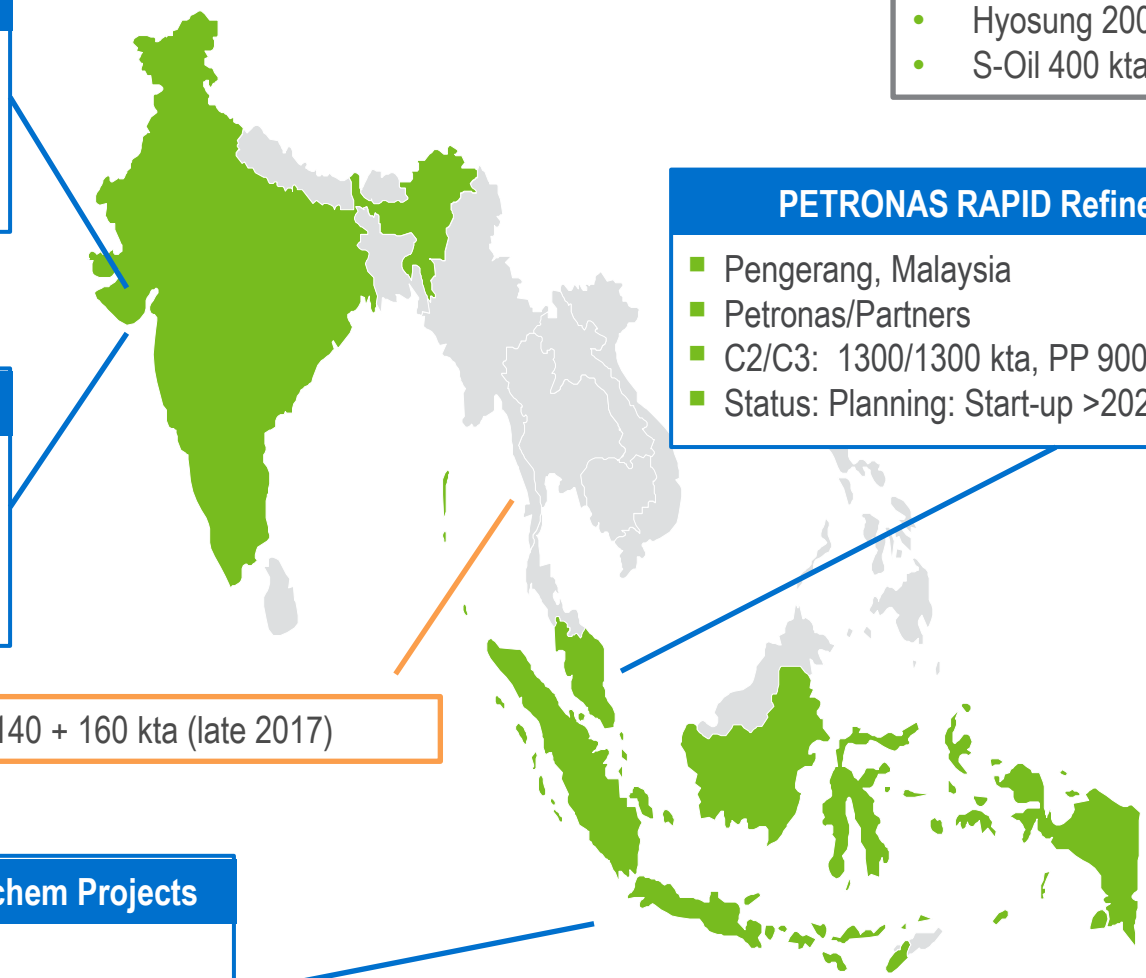
PETRONAS RAPID Refinery & Cracker

- Pengerang, Malaysia
- Petronas/Partners
- C2/C3: 1300/1300 kta, PP 900 kta (Spheripol)
- Status: Planning: Start-up >2021

IRPC, Thailand 140 + 160 kta (late 2017)

Indonesia integrated Refinery/petchem Projects

- Balongan
- Pertamina/ Partners
- C3: 500-2000 kta, derivatives not announced yet
- Status: Under Evaluation



Overview of major refinery/petrochemical investments in Vietnam



Nghi Son Refining & Petrochemical

- Located at Thanh Hoa Province
- PetroVietnam/Idemitsu/Mitsui/Kuwait Petroleum
- C3/PP: 370/370 kta
- Status: Start-up 2017/Q4

Binh Son Refining & Petrochemical

- Located at Dung Quat economic zone
- PetroVietnam
- C3/PP: 150/150 kta
- Status: Operational since 2010

Long Son Petrochemical

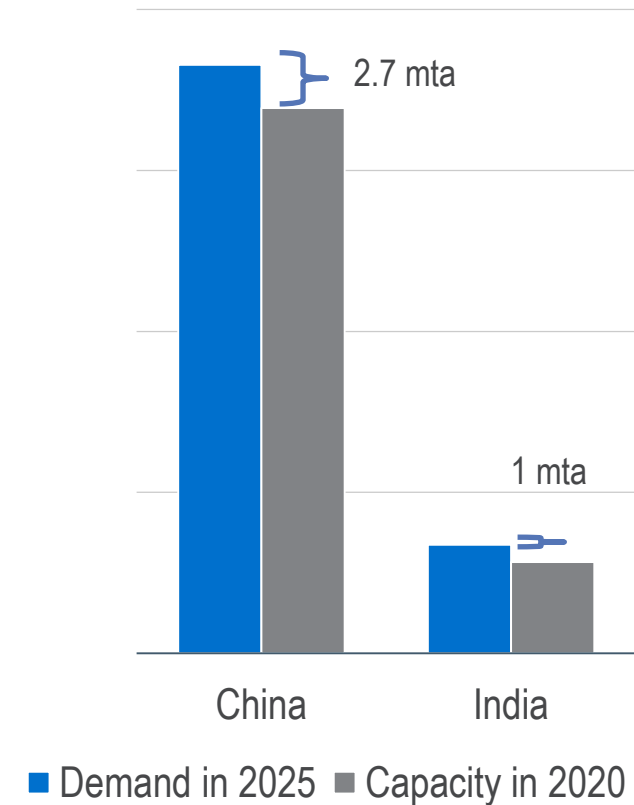
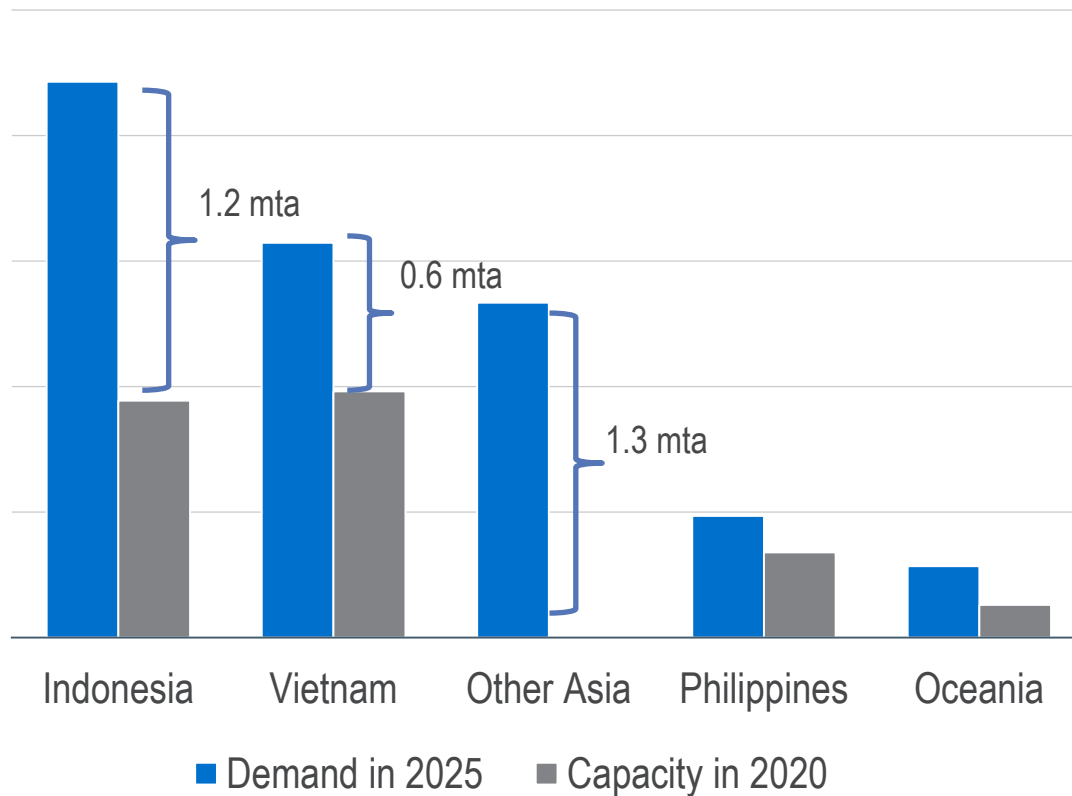
- Located at Ba Ria - Vung Tau
- PetroVietnam/SCG – (QP exit 2015)
- C2/C3: 1000/500 kta
- Status: Start-up 2020-21

Vung Ro Refining & Petrochemical

- Located at Phu Yen Province
- PetroVietnam/Technostar/Telloil
- C3/PP: 900/900 kta
- Status: Not Firm

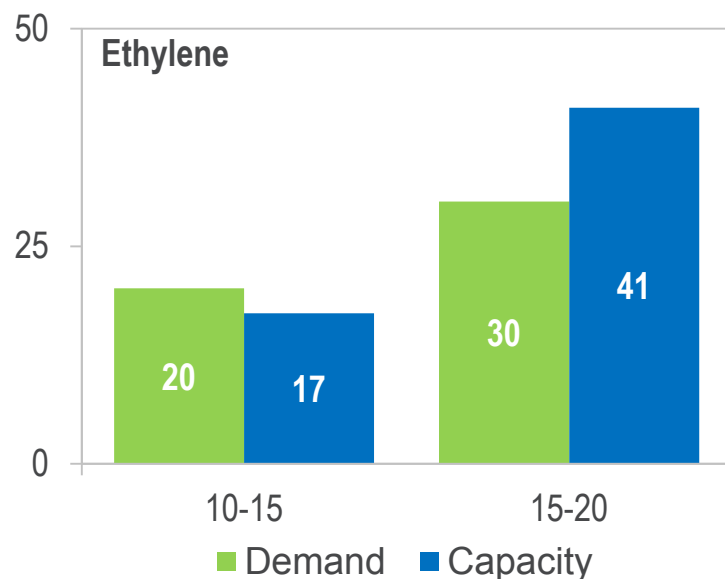
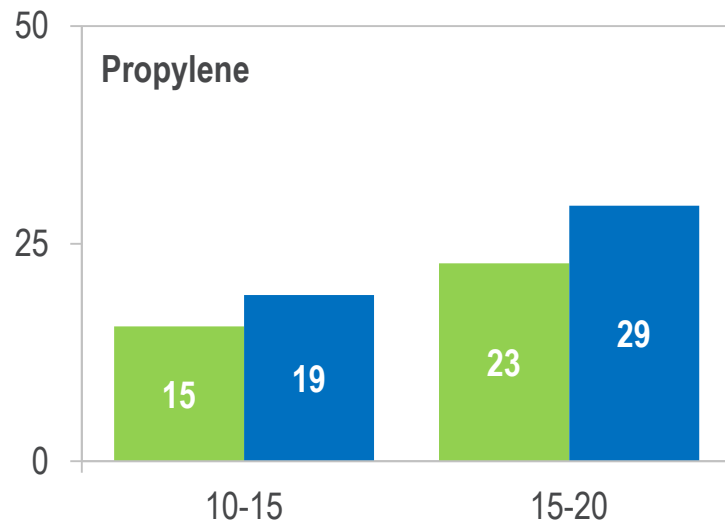
Despite regional expansions many markets are expected to rely on imports

Polypropylene Potential Market Deficits (million tons)

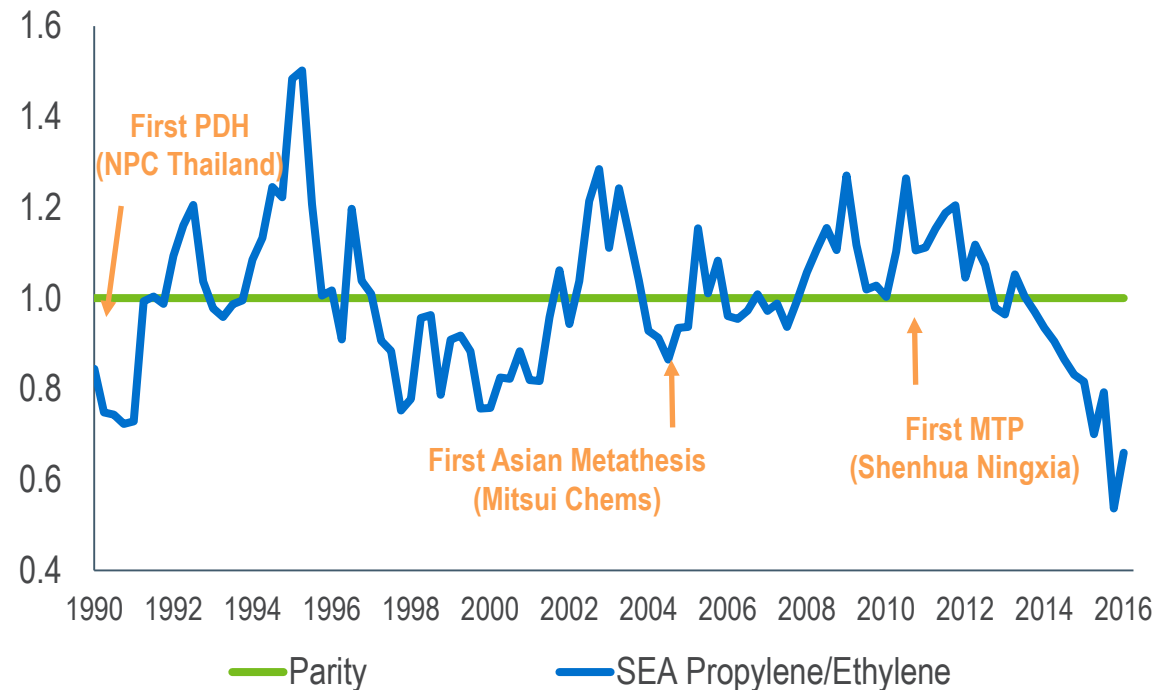


Olefin pricing dynamics show a reversal of previous trends

Incremental Supply & Demand Changes, million tons



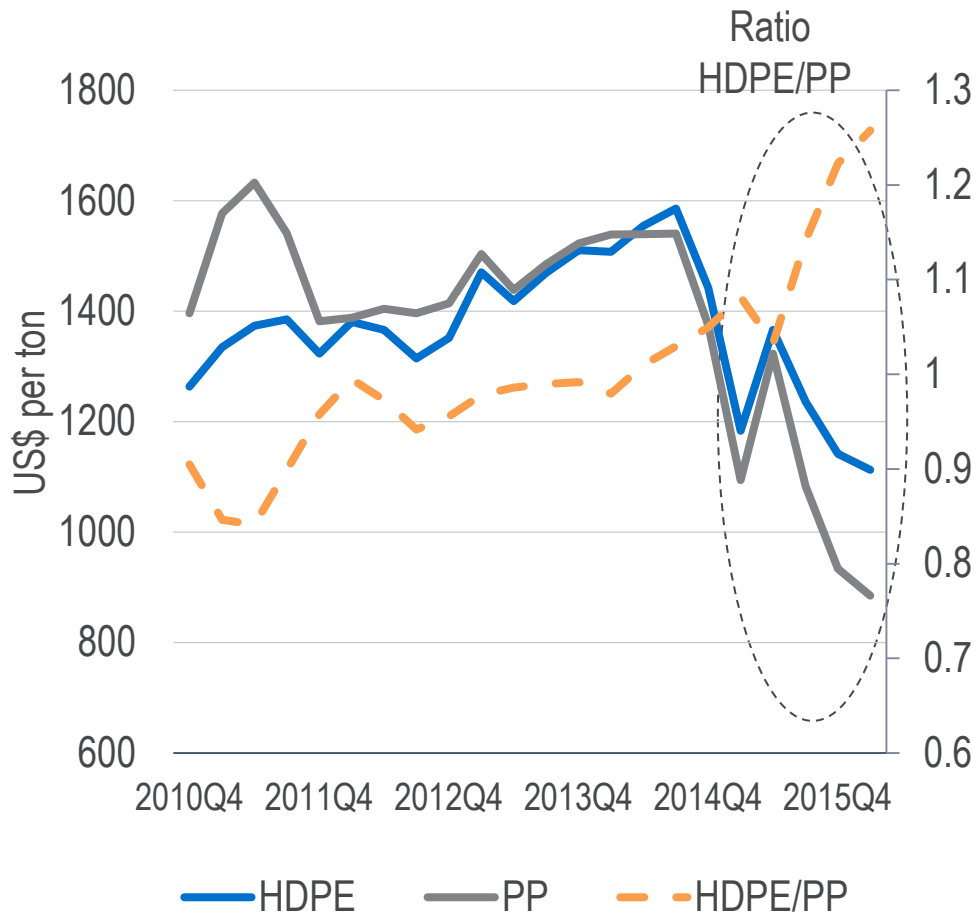
Ethylene and Propylene Pricing Ratio Dynamics



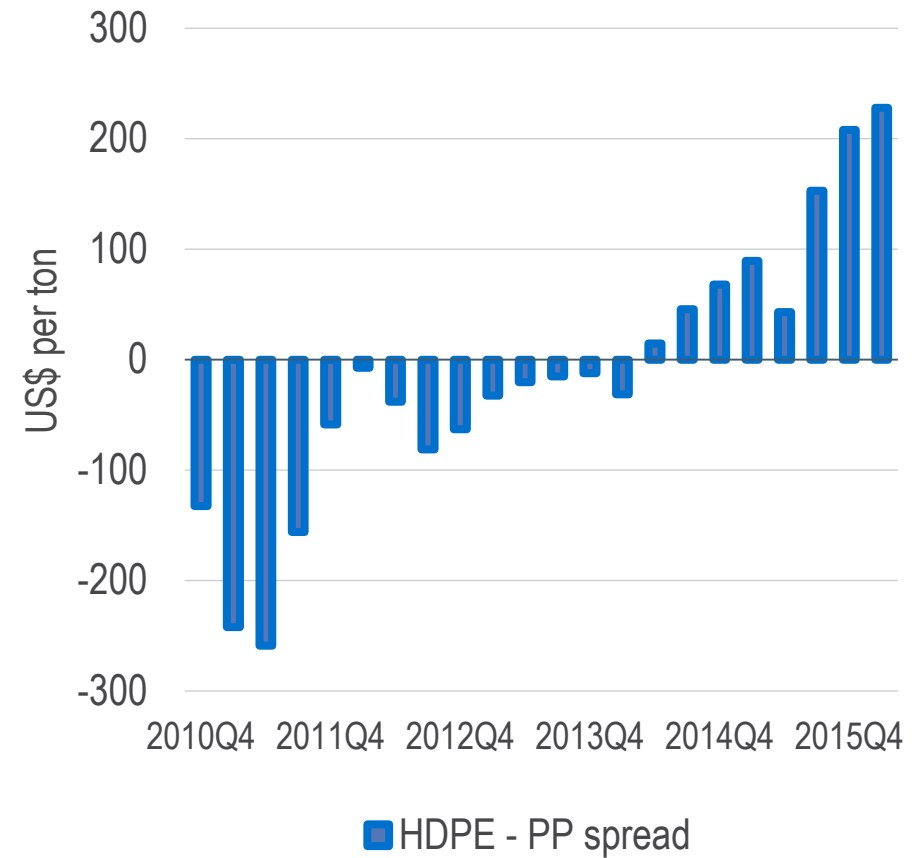
- Initial price premiums on propylene reversed due to market oversupply
- Increase in merchant propylene sales reflected in quoted pricing – more liquidity versus ethylene market
- Future pricing corrections expected longer-term due a combination of C3 cost structure, value chain integration and polymer substitution.

Olefin price trends are reflected in downstream polymer markets

HDPE & PP Pricing Trends (US\$/ton, CFR SEA)



HDPE & PP Price Spreads (US\$/ton, CFR SEA)



Summary of Polypropylene Market Developments

Demand Outlook:

Demand fundamentals are expected to remain strong in the outlook

- Global polypropylene demand was estimated at 60 million tons in 2015, an increase of 4.4% compared with 2014
- Global growth driver is Asia – China is forecast to account for 65% of Asia's incremental demand over the next five years
 - On-going low oil prices, uncertainty about China, and other economic factors have reduced short-term global GDP forecasts and polymer demand growth forecasts

Supply Developments and Net Trade:

New capacity additions slowed in recent years, but will reach unprecedented levels in the next few years

- Total polypropylene production increased from 44 million tons to 73 million tons per year from 2005 to 2015
- Developments in the Middle East and Asia will contribute to capacity expansions up to 2020
- Global capacity additions planned for 2016 and 2017 will exceed the amount of demand growth
- Low oil prices have caused some longer term projects to be delayed or cancelled



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