



lyondellbasell

**Goldman Sachs
Chemical Intensity Conference
Propylene: The “Other” Olefin**

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EVP, Global Olefins & Polyolefins

March 15, 2016

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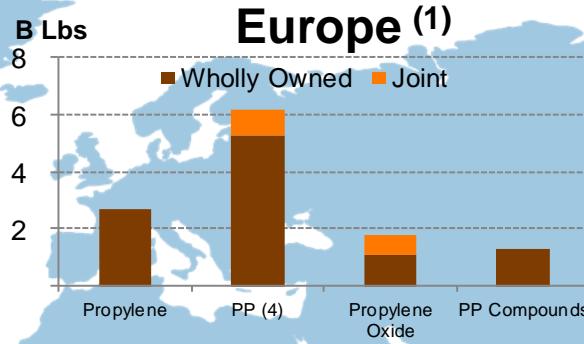
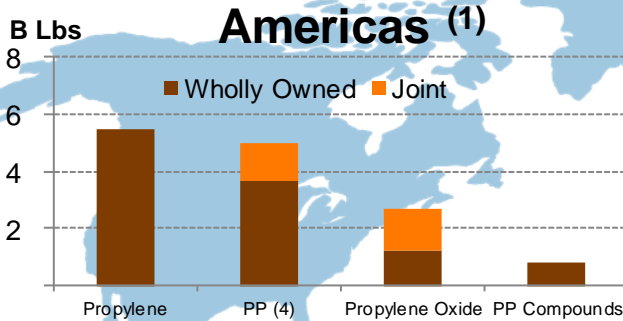
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Agenda

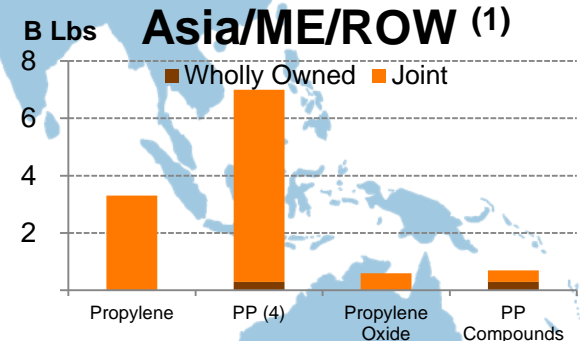


- Ethylene and propylene value chains
- Impacts of propylene on ethylene value
- Opportunities for polypropylene
- Differential value with advantaged propylene oxide technology
- Conclusions

LYB is a Leader in the Global Propylene Chain



LYB Global Capacity (B lbs)			
Product	LYB		LYB Global Ranking (1)
	Consolidated and Joint Share (2)	With 100% of Joint Capacity (1)	
Propylene (3)	8.6	11.5	#3
Polypropylene (4)	12.6	18.2	#1
Propylene Oxide	2.8	5.1	#2
Polypropylene Compounds	2.6	2.8	#1
Polypropylene Technology (5)	-	-	#1



Sources: IHS and LYB. All capacities as of December 31, 2015.

(1) Includes 100% of joint capacities.

(2) Includes LYB consolidated and proportional share of joint capacity.

(3) Includes only polymer-grade and chemical-grade propylene (excludes refinery-grade propylene).

(4) Includes *Catalloy* capacity.

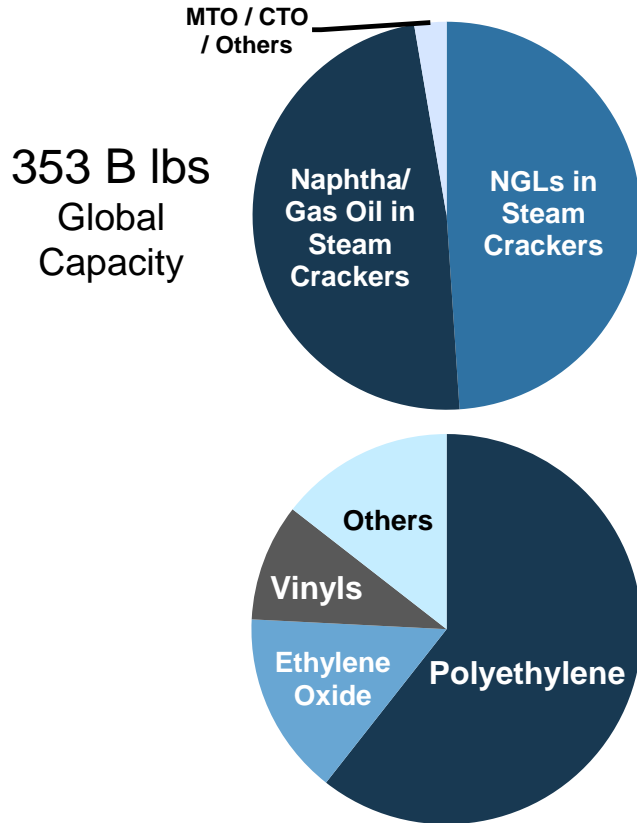
(5) LYB *Spheripol* and *Spherizone* technology is used in over 50 billion lbs. per year of global PP capacity.

Ethylene: primary product from steam crackers

Propylene: typically a co-product



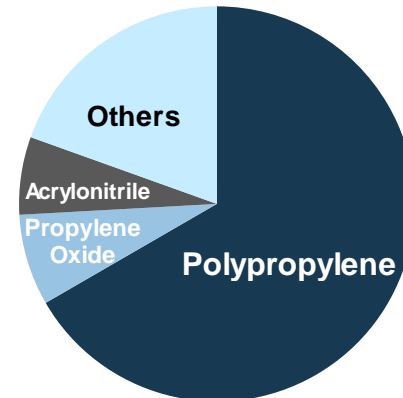
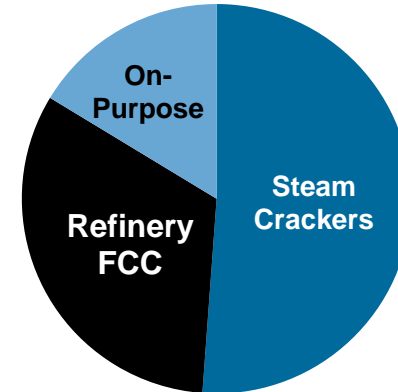
Ethylene Chain



Propylene Chain (1)

Sources

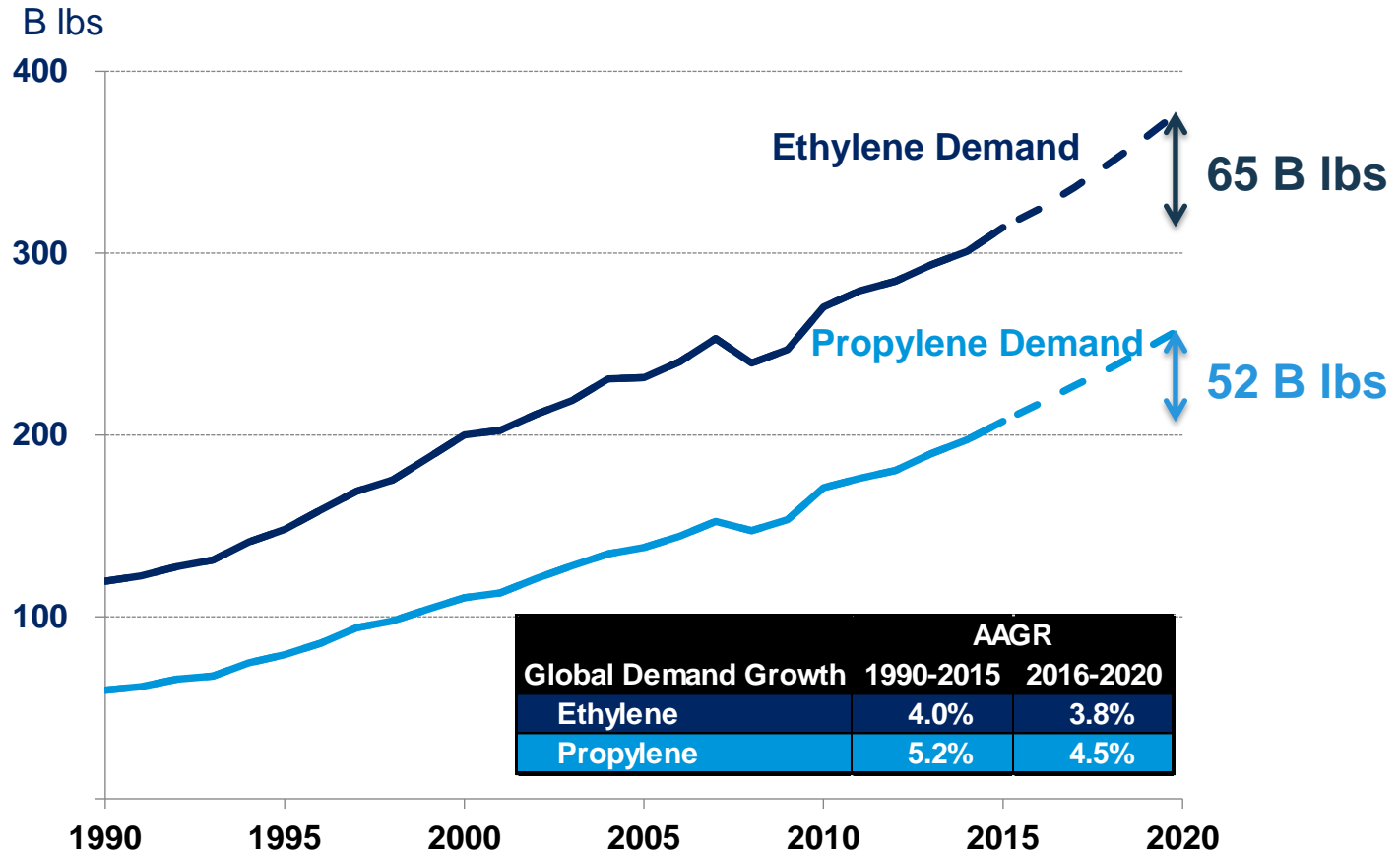
Products



Polyolefins and oxides are ~ 75% of demand for each olefin

Source: IHS global production and demand data. (1) Excludes refinery-grade propylene.

Propylene: a smaller market with stronger growth



	AAGR	
Global Demand Growth	1990-2015	2016-2020
Ethylene	4.0%	3.8%
Propylene	5.2%	4.5%

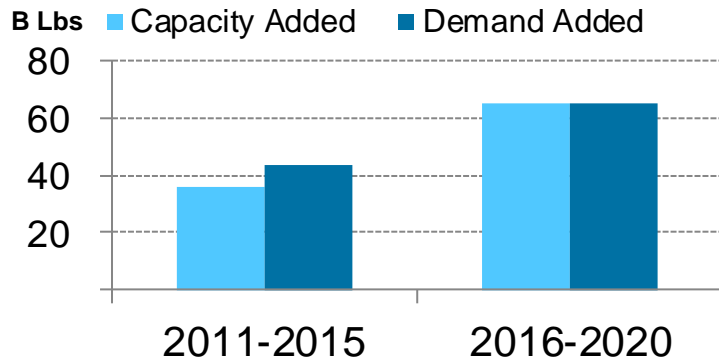
Past 25 years: Ethylene growth: 1.4x GDP
 Propylene growth: 1.9x GDP

Source: IHS. Excludes refinery-grade propylene.

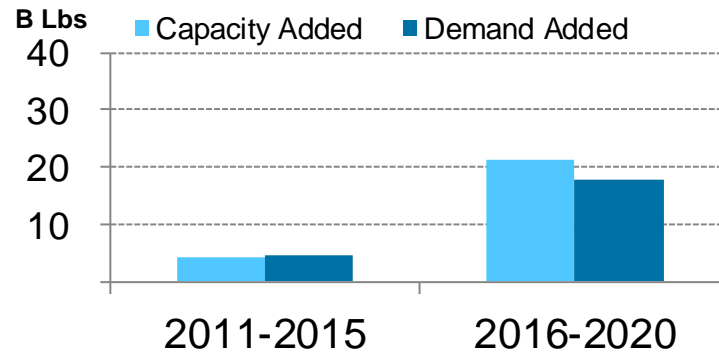
Supply and Demand for Olefins: Ethylene Balanced, Propylene Loosening



Ethylene

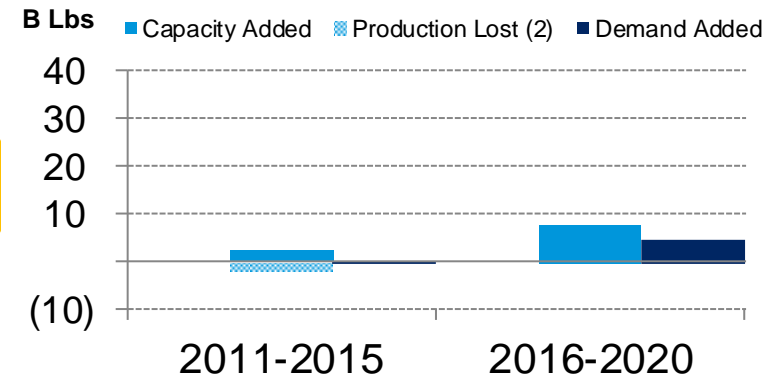
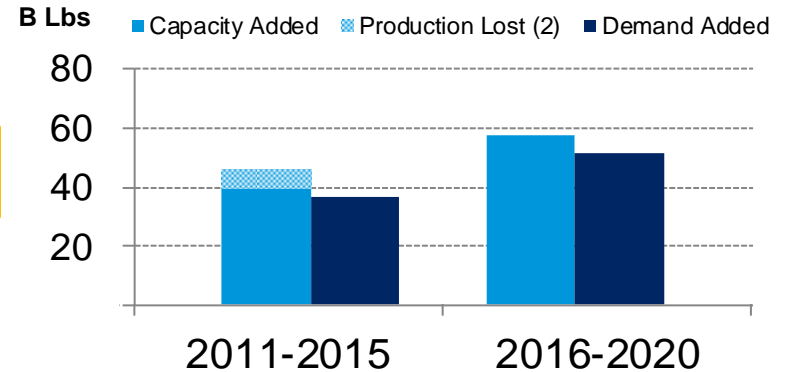


Global



U.S.

Propylene (1)



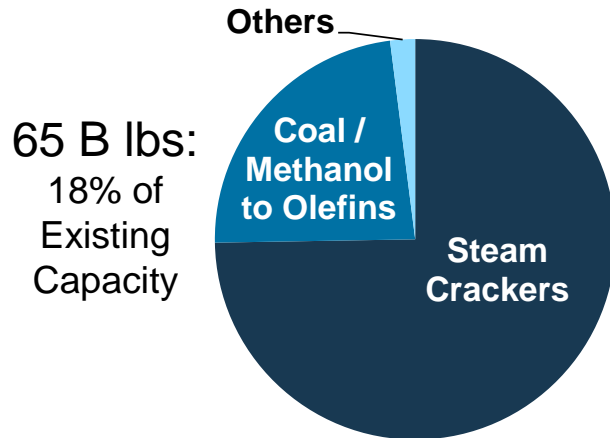
- Ethylene outlook: Balanced globally, additional derivative capacity expected for USA
- NA and EU propylene production fell by 7 B lbs due to increased NGL cracking
- Propylene outlook: Capacity additions outpacing global derivative demand

Source: IHS. (1) Excludes refinery-grade propylene. (2) U.S. and EU production lost due to increased ethane usage in steam crackers.

2016 – 2020: On-purpose Propylene Dominates Global Capacity Growth

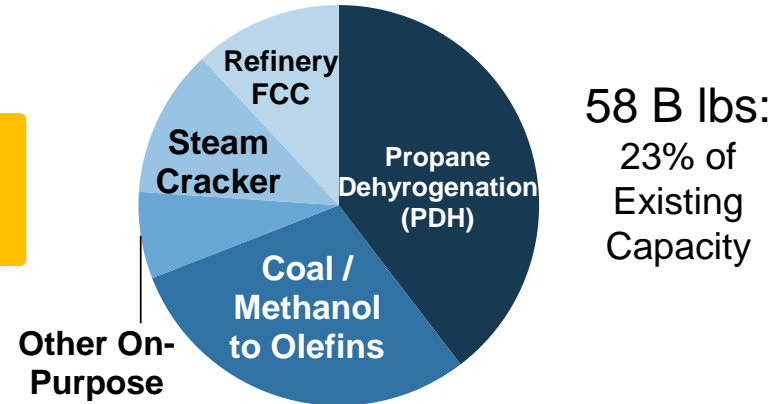


Ethylene Capacity Growth



Propylene Capacity Growth (1)

**2016 – 2020
Global
Growth**



Ethylene Supply Growth ~ 75% conventional;

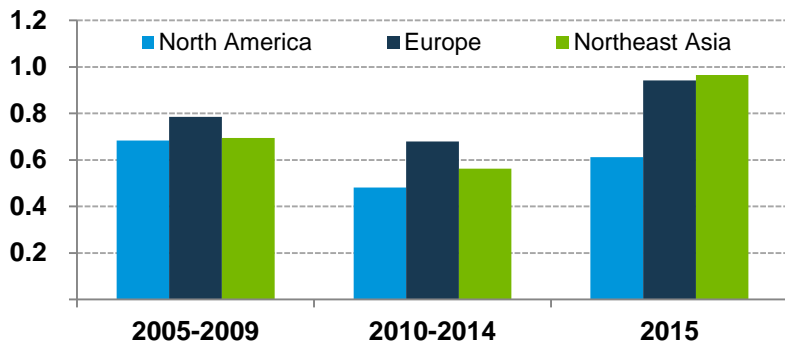
Propylene Supply Growth ~ 75% On-purpose

Source: IHS. (1) Excludes refinery-grade propylene.

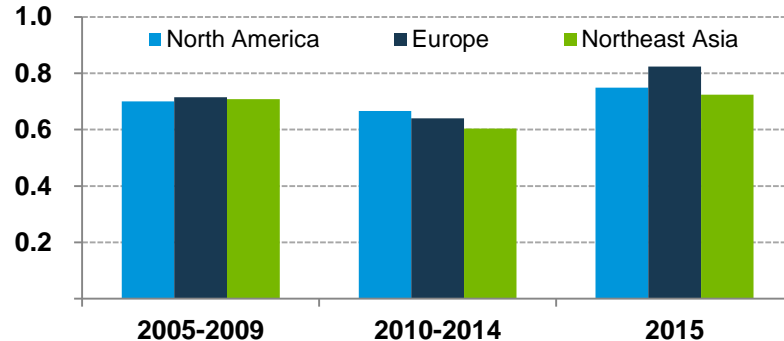


Pricing Driven by Several Factors

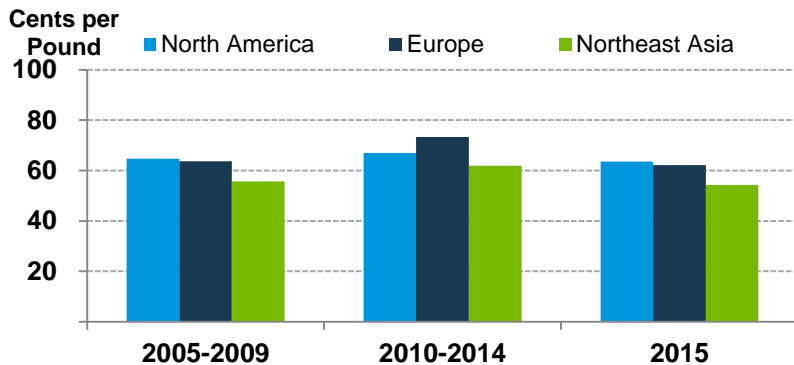
Ethylene / Brent Price Ratio



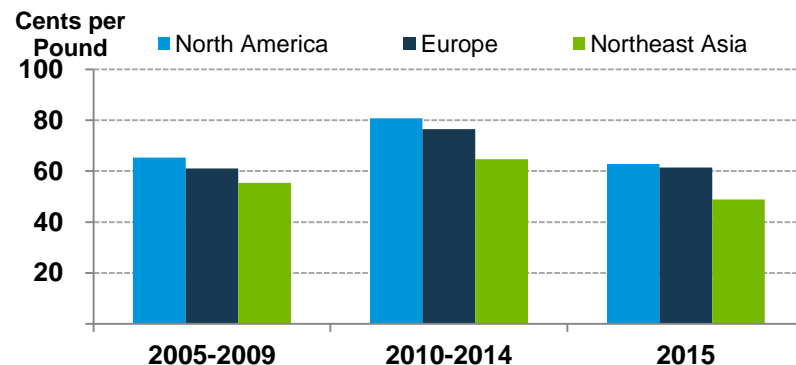
Propylene / Brent Price Ratio



Polyethylene Price



Polypropylene Price



Ethylene: Price driven by local supply/demand and feedstock costs

Propylene: Price correlated with crude oil

Polymers: Polypropylene prices more competitive. NEA arbitrage has been persistent.

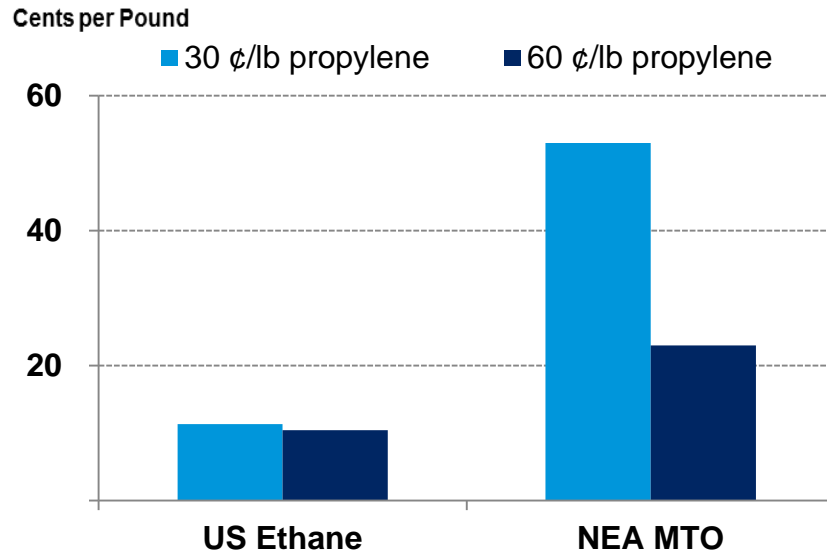
Source: IHS. Olefin prices are monthly contract pipeline prices (NA and EU) and monthly average spot (NEA) for ethylene and polymer-grade propylene. Price Ratio is olefin in U.S. cents per pound relative to Brent in USD per barrel. Polymer prices are IHS estimated net transaction (NA), discounted contract estimate (EU) and monthly average spot (NEA) for blow-molding HDPE and homopolymer PP.



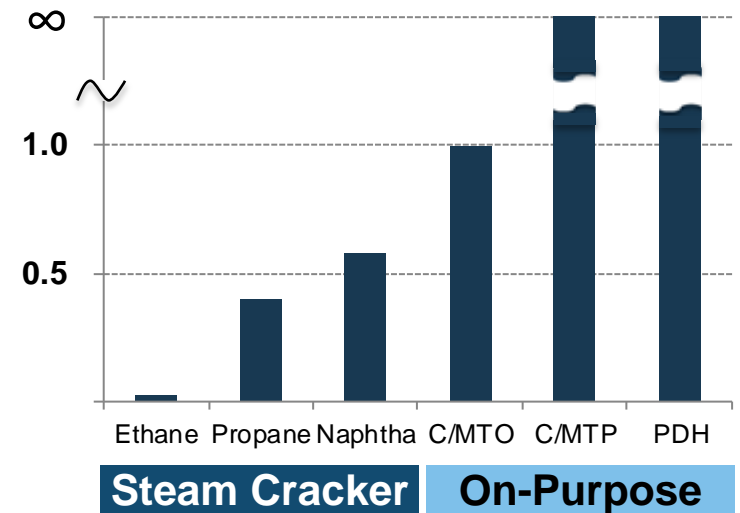
Propylene Price Effect on Cost of Ethylene

Propylene provides a coproduct cost benefit that reduces the Cost of Ethylene (COE)

Cost of Ethylene



Propylene / Ethylene Product Ratio

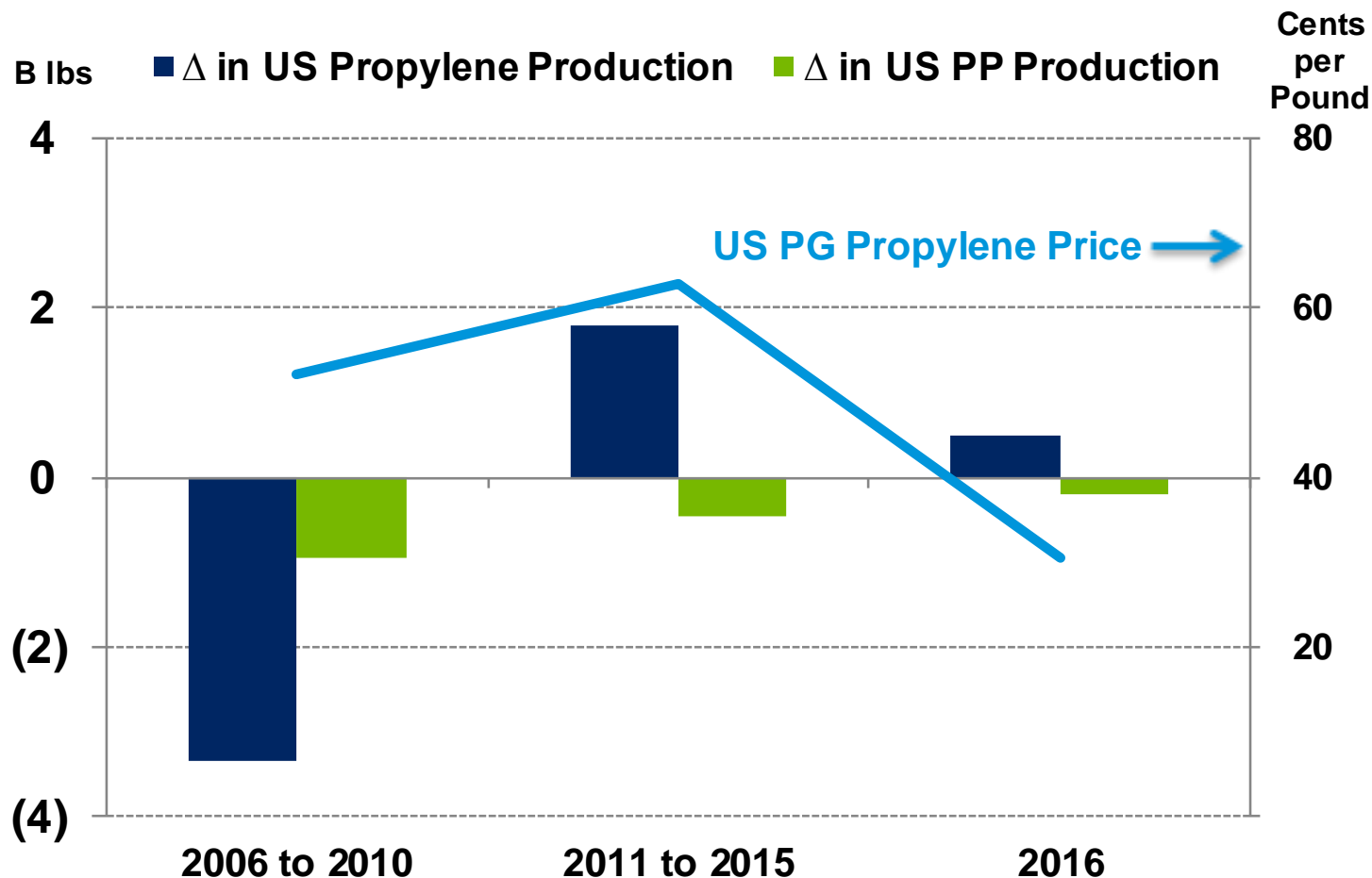


Abundant, low-priced propylene:

- 1) Increases the cost of non-ethane ethylene
- 2) Improves the advantage of U.S. ethane-based ethylene

Source: IHS 2016 World Analysis Production Economics. Coproduct propylene prices varied with all other feeds, product prices and costs held constant.

PP demand destruction in U.S. from high propylene prices: Reversing with increased supply and lower crude pricing



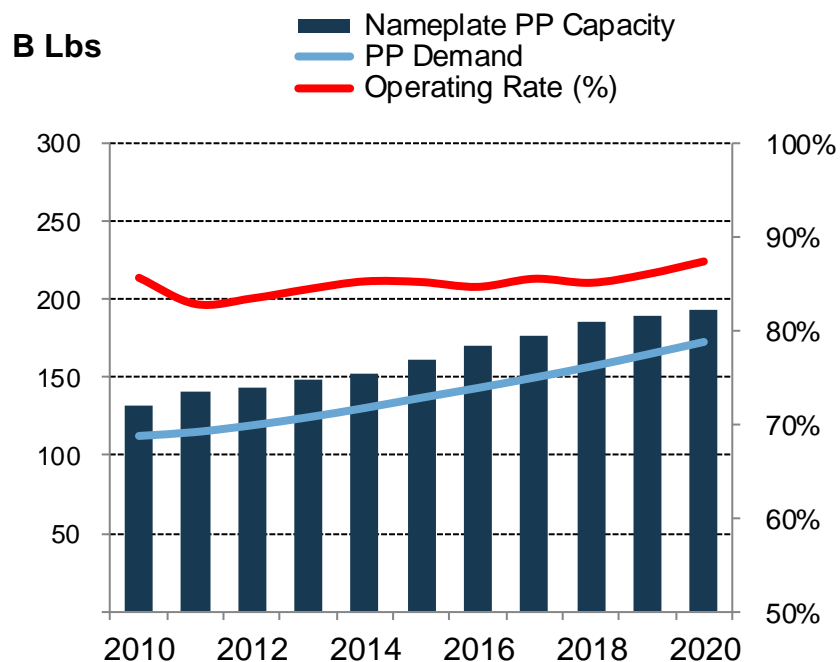
Increased Propane Cracking and New PDH Capacity Restoring U.S. Propylene Market Balance

Propylene price is NA contract polymer-grade propylene price. U.S. propylene production is chemical- and polymer-grade propylene
Source: IHS 2015 U.S. production data.

Global PP Supply/Demand



Polypropylene Supply / Demand



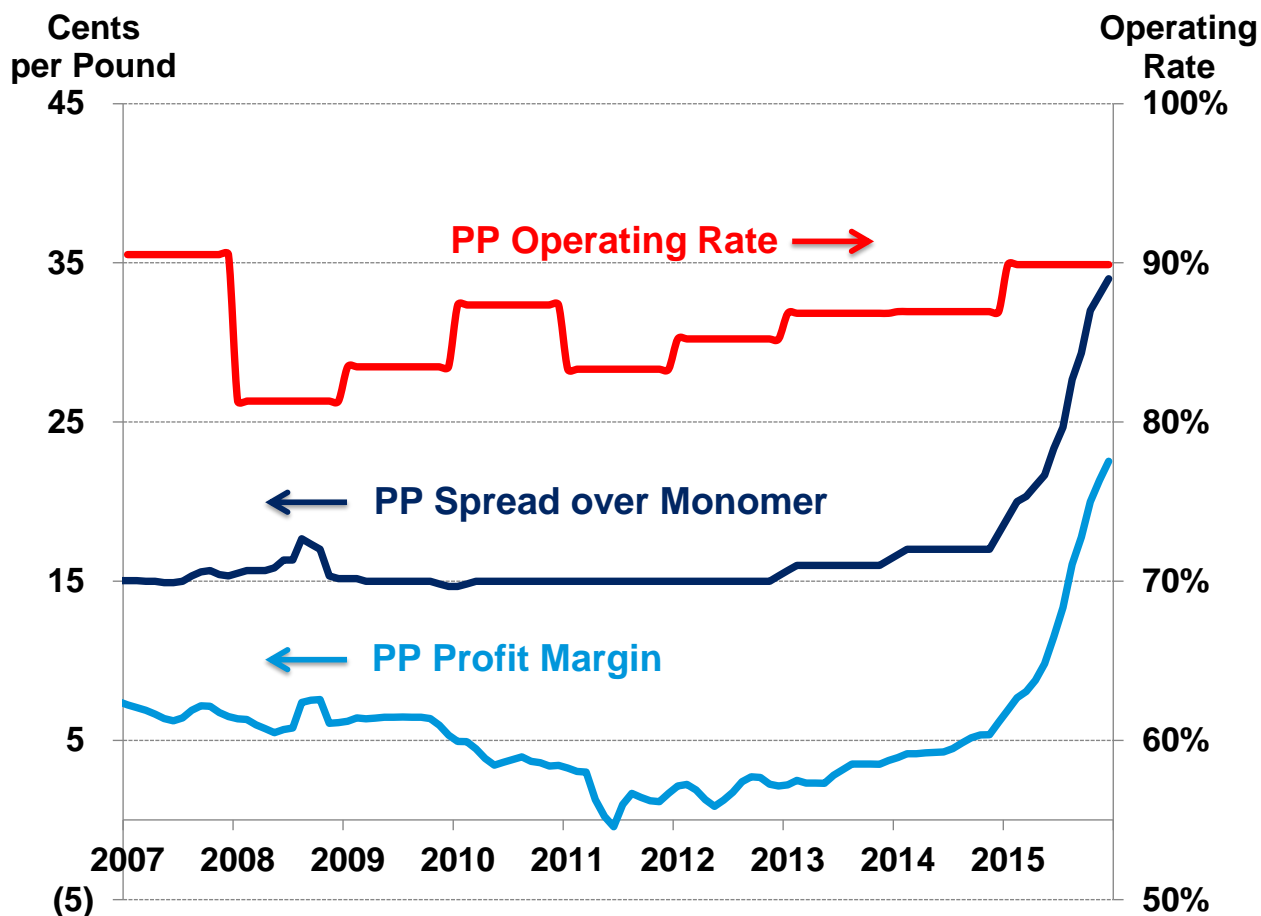
Polypropylene Advantages

- Low density, lightweight
- Impact resistance
- Recyclability
- Chemical resistance
- Wide temperature performance
- Plasticizer-free
- Replacement for higher-cost resins and PVC

Abundant, low-priced propylene will enable continued PP growth.

Source: IHS.

NA Polypropylene: Tight Market Driving Margin



Market-based PP pricing reflects the tight market with strong margins.

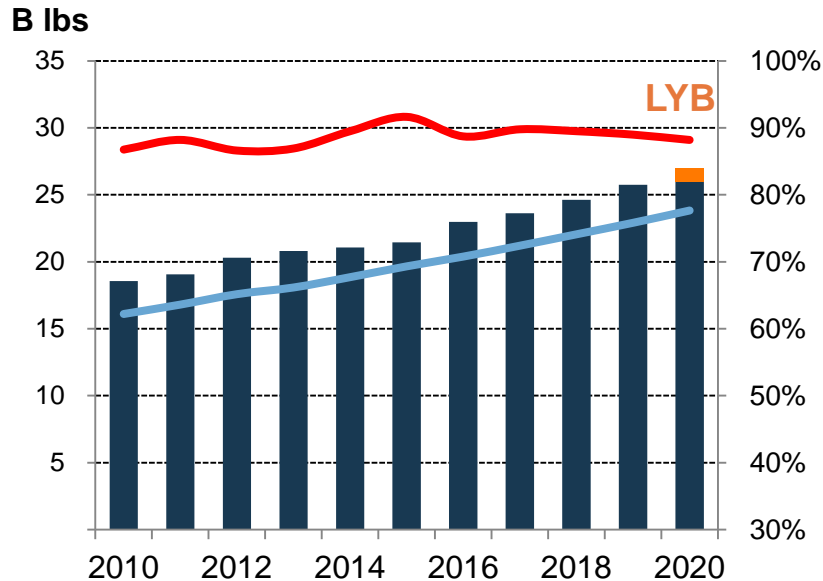
Source: IHS. Spreads and margins depicted as 3-month moving averages. Spread is contract homopolymer less contract polymer-grade monomer price. Homopolymer prices prior to 2015 are adjusted to account for the January 2015 IHS non-market reduction. Margin is IHS discounted contract pre-tax non-integrated margin.

Propylene Oxide: Steady Growth, Leading Technology

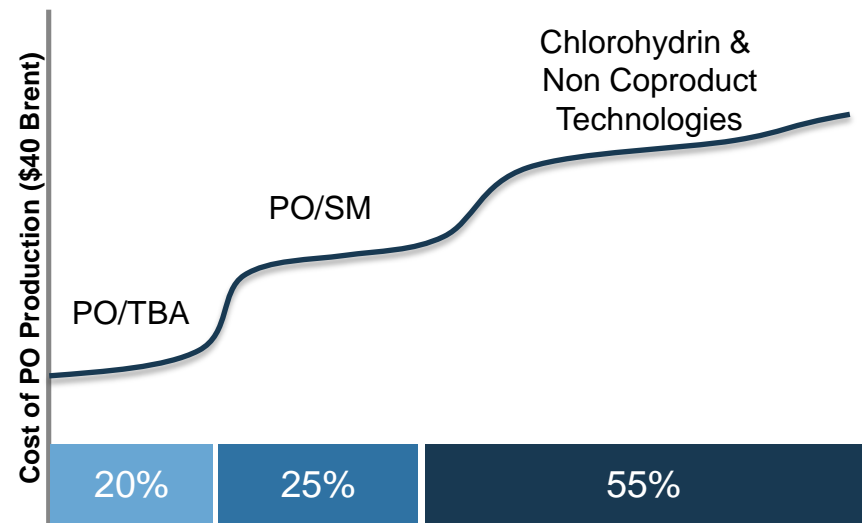


Global Propylene Oxide Supply / Demand

Effective Capacity Demand % Utilization



PO Cost Curve

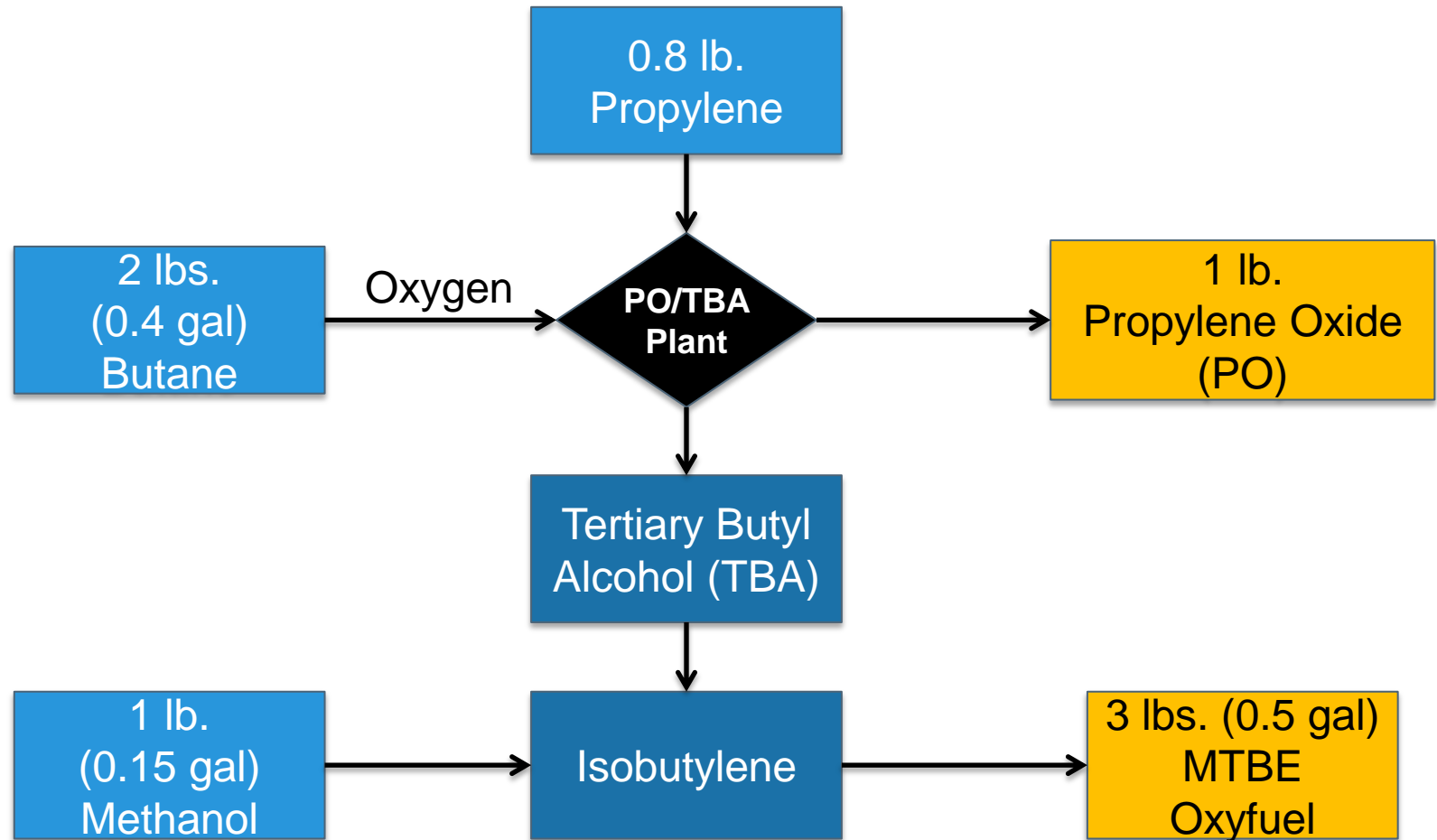


- Global demand growth supports ~ 1-2 new world-scale Propylene Oxide plants per year
- LyondellBasell's PO/TBA process is the lowest cost technology

Source: LYB, external consultants.

PO/TBA:

Proprietary technology that upgrades advantaged NA NGLs

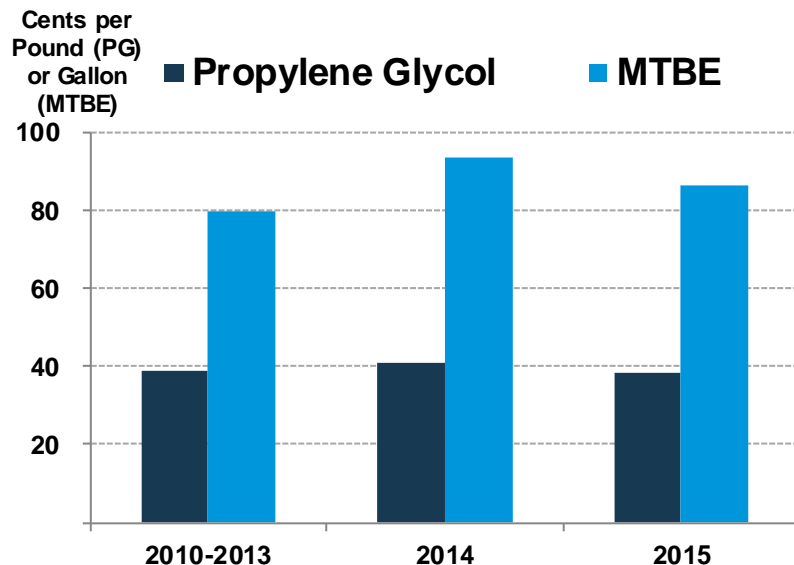


PO/TBA converts shale-based NGLs into high-octane oxyfuels

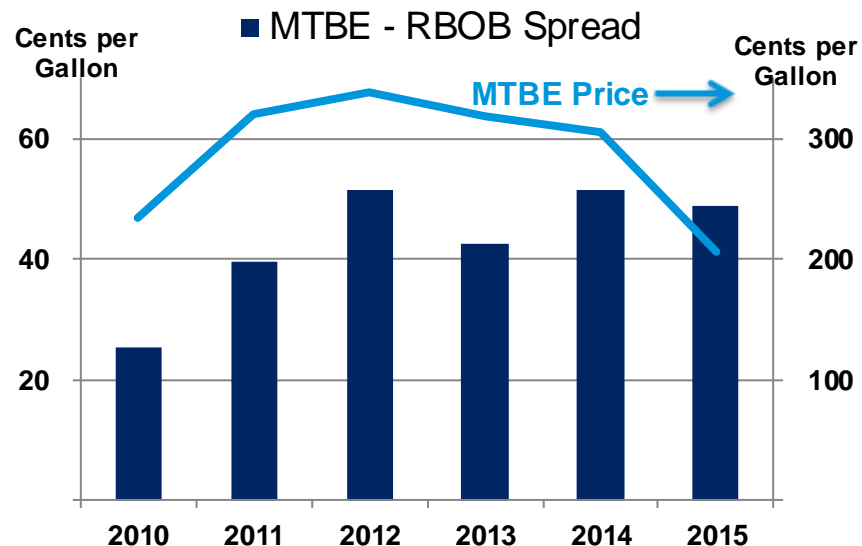
PO provides stability while oxyfuels leverages shale-based butane and octane trends



Propylene Glycol and MTBE Raw Material Margins ⁽¹⁾



MTBE / RBOB Octane Spread ⁽²⁾



Favorable outlook for both PO and TBA products.

(1) Source: CDI (propylene glycol) and Platts. (2) Source: IHS NWE MTBE spot prices.

Conclusions



- Propylene expected to be abundant
 - On-purpose technologies providing significant supply.
 - Abundant and affordable propylene supports global ethylene economics.
 - Global propylene market size is significant: 210 B lbs, 2/3 size of ethylene.
- Integrated downstream propylene derivatives and technologies can improve capture of value across the chain
 - PP expected to capture margin with affordable monomer and see increased demand with tight markets in NA and EU.
 - PO expected to maintain stable margins across all monomer price environments.
 - Oxyfuels anticipated to enjoy strong demand and profitability due to environmental demands, engine technology and advantaged shale feedstocks.
 - Polypropylene compounds, PP catalysts and PP licensing extend LYB's reach.

LYB is well-positioned to capture value from the “other” olefin



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Thank You

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