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Petrochemical Outlook

May 25, 2017

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Main Themes

Macro Context

Petrochemical Demand

Feedstock Availability

Projected Investments

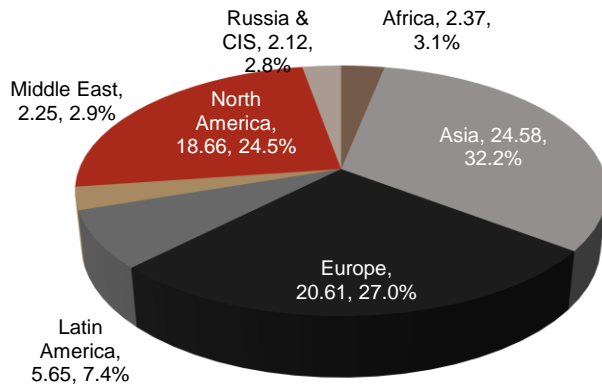
Key Takeaways



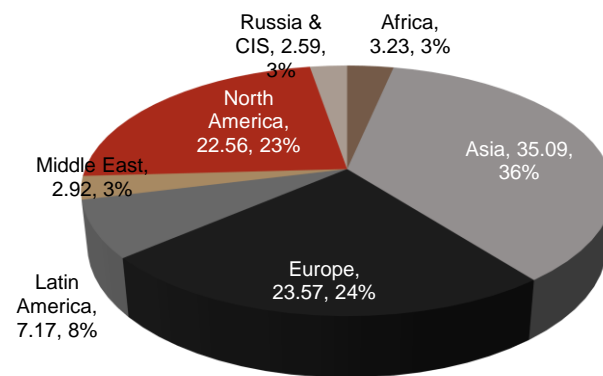
Macro Context

GDP Forecast

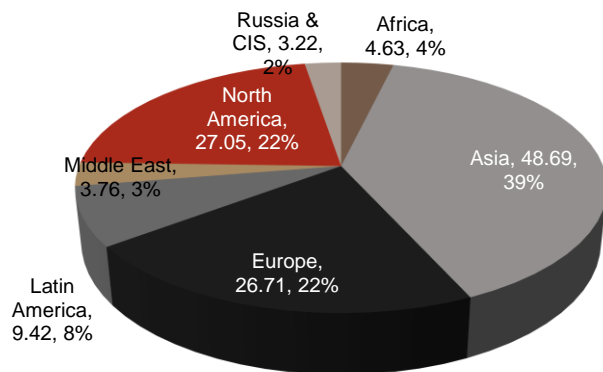
2016 Total GDP: 76.24 trillion USD



2025 Total GDP: 97.13 trillion USD



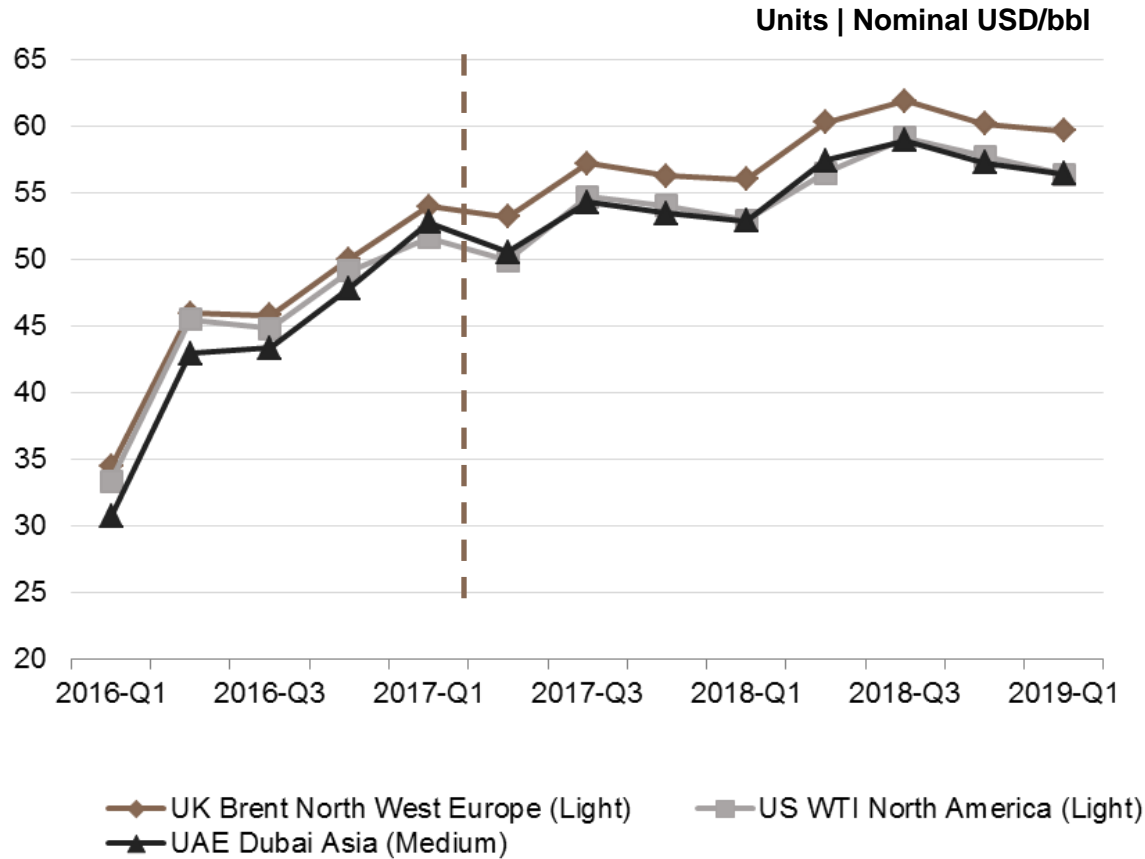
2035 Total GDP: 123.47 trillion USD



- Asia and Africa GDP will double by 2035
- Latin America and Middle East GDP will grow 70% by 2035
- North America and Russia & CIS GDP will grow by 50% by 2035
- Global GDP will grow 60% by 2035

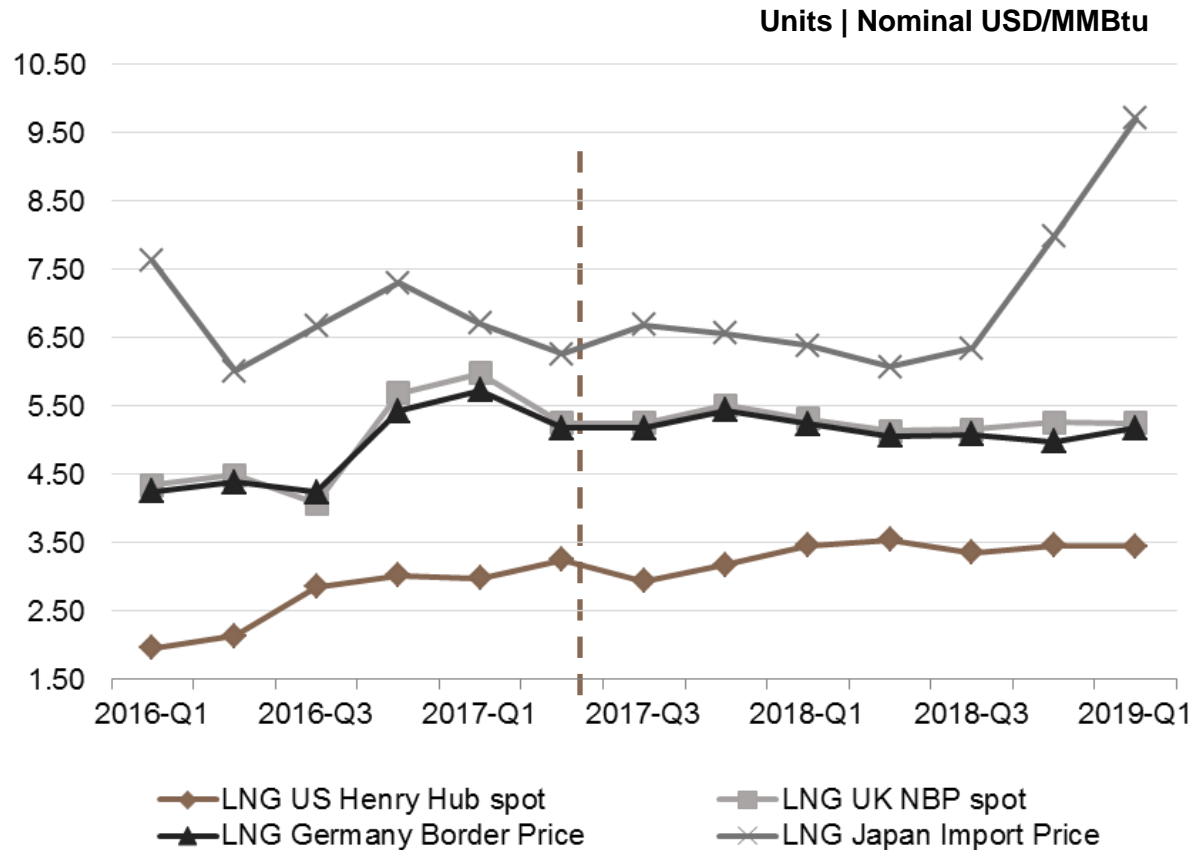
Source: Stratias Advisors , 2010 prices and exchange rates

Short-Term Energy Prices – Crude Oil



Source: Stratas Advisors

Short-Term Energy Prices – Natural Gas

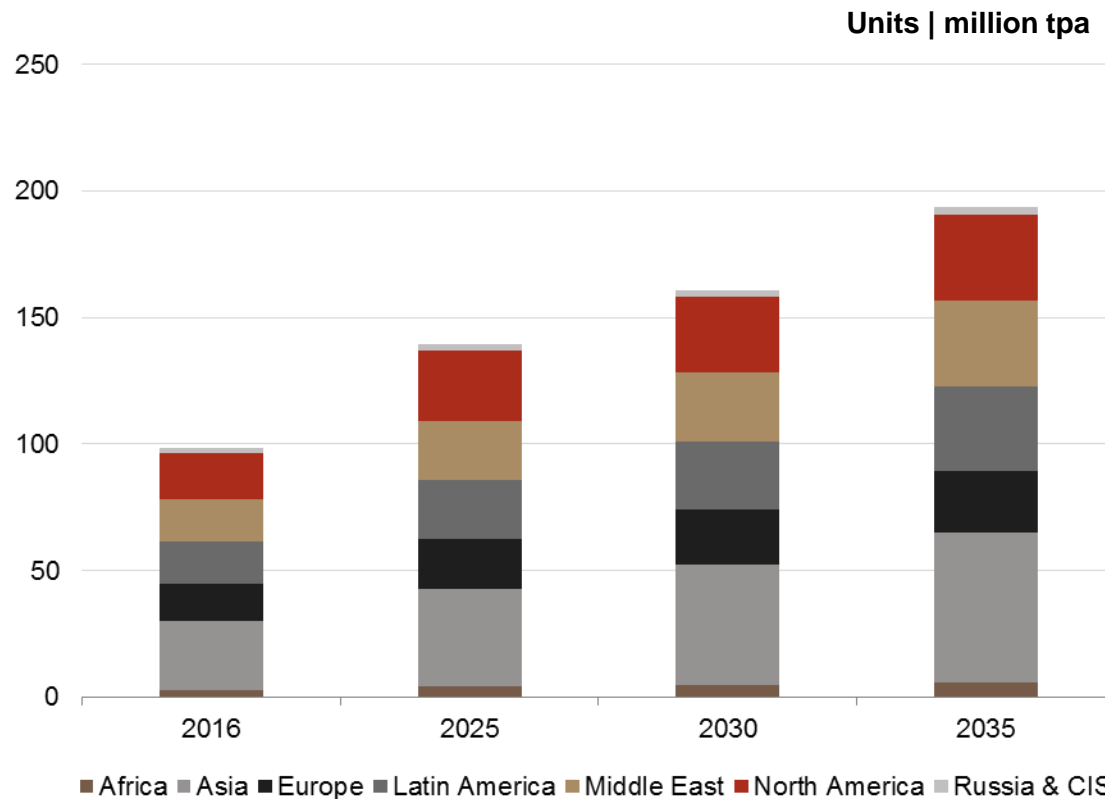


Source: Stratas Advisors



Petrochemical Demand

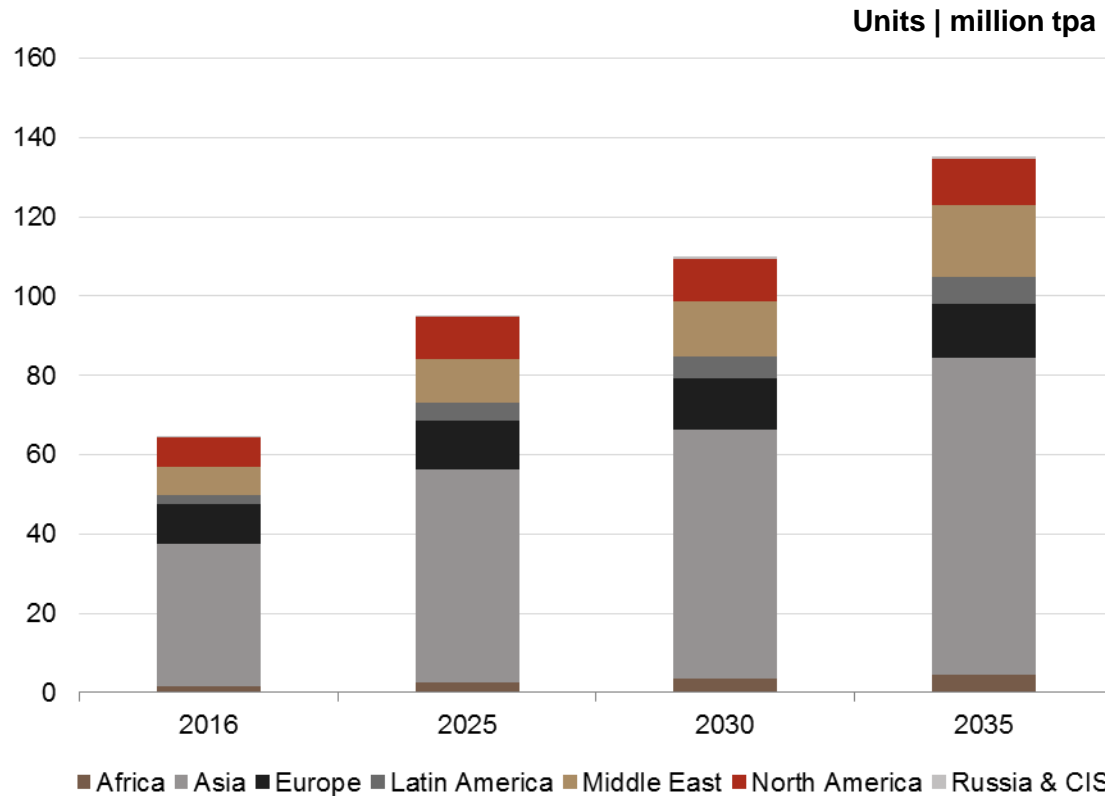
Regional Demand – Polyethylene



Source: Stratas Advisors

- Polyethylene demand will double in next 20 years from 85 to 170 million tpa
- Asia demand will increase by 30 million tpa by 2035 from 2016

Regional Demand – Polypropylene



Source: Stratas Advisors

- Polypropylene demand will double in next 20 years from 65 to 130 million tpa
- Asia demand will increase by 45 million tpa by 2035 from 2016

Relative Demand

Polyethylene

Units | kg per person / year

Region	2016	2017	2018	2019	2020	2025	2030	2035
Africa	2.45	2.45	2.40	2.51	2.54	2.83	2.95	3.29
Asia	6.78	7.17	7.29	7.55	7.66	8.94	10.60	12.80
Europe	26.95	27.14	27.77	29.48	30.89	35.29	39.16	44.03
Latin America	5.51	5.60	6.17	6.02	5.94	9.95	10.93	13.51
Middle East	47.79	48.13	47.76	50.40	51.47	59.72	65.20	75.84
North America	50.46	53.98	62.72	62.39	62.16	70.49	73.28	82.48
Russia & CIS	7.75	7.87	7.29	8.12	8.25	8.83	9.50	10.23

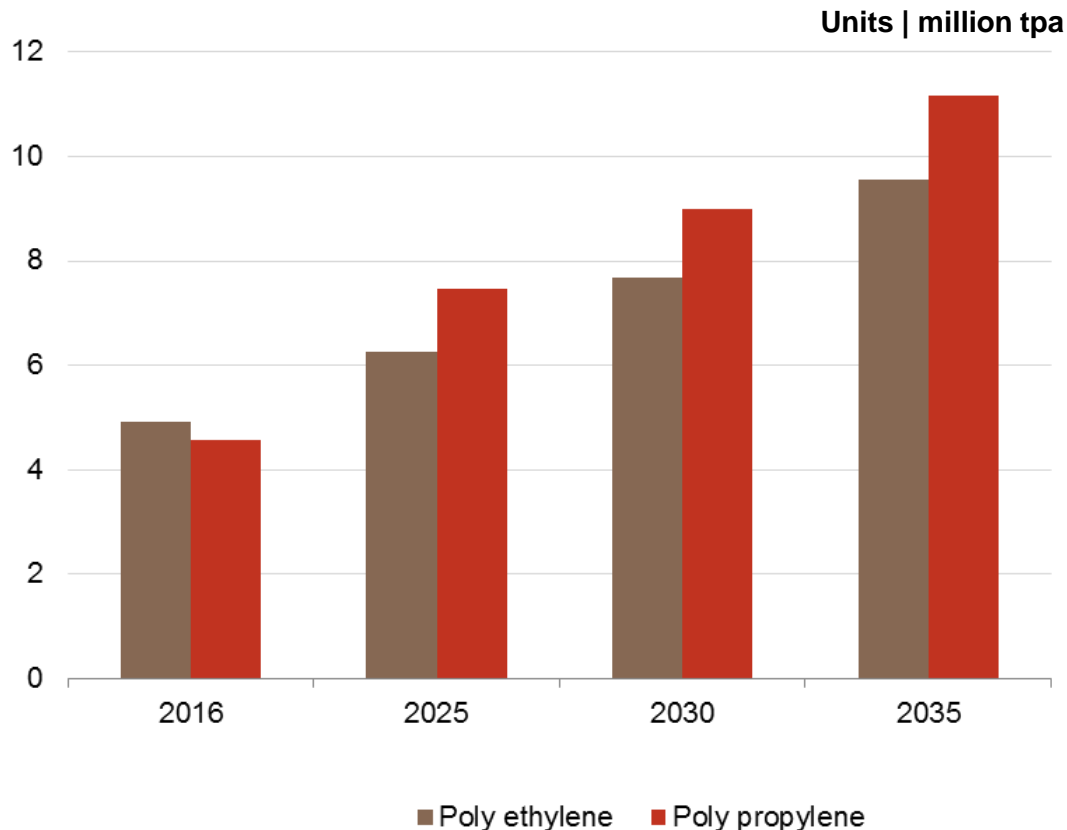
Polypropylene

Units | kg per person / year

Region	2016	2017	2018	2019	2020	2025	2030	2035
Africa	1.48	1.48	1.51	1.55	1.53	1.87	2.17	2.52
Asia	8.87	9.58	10.24	10.52	10.72	12.35	14.07	17.27
Europe	18.20	18.22	18.30	18.40	19.10	22.63	23.20	24.92
Latin America	3.97	4.05	4.07	4.25	4.47	6.66	7.48	9.08
Middle East	20.29	20.60	21.21	21.94	21.88	27.80	33.74	41.00
North America	20.11	20.47	21.28	23.21	23.73	27.02	26.47	28.64
Russia & CIS	1.38	1.38	1.39	1.40	1.41	1.61	1.85	2.12

Source: Stratas Advisors

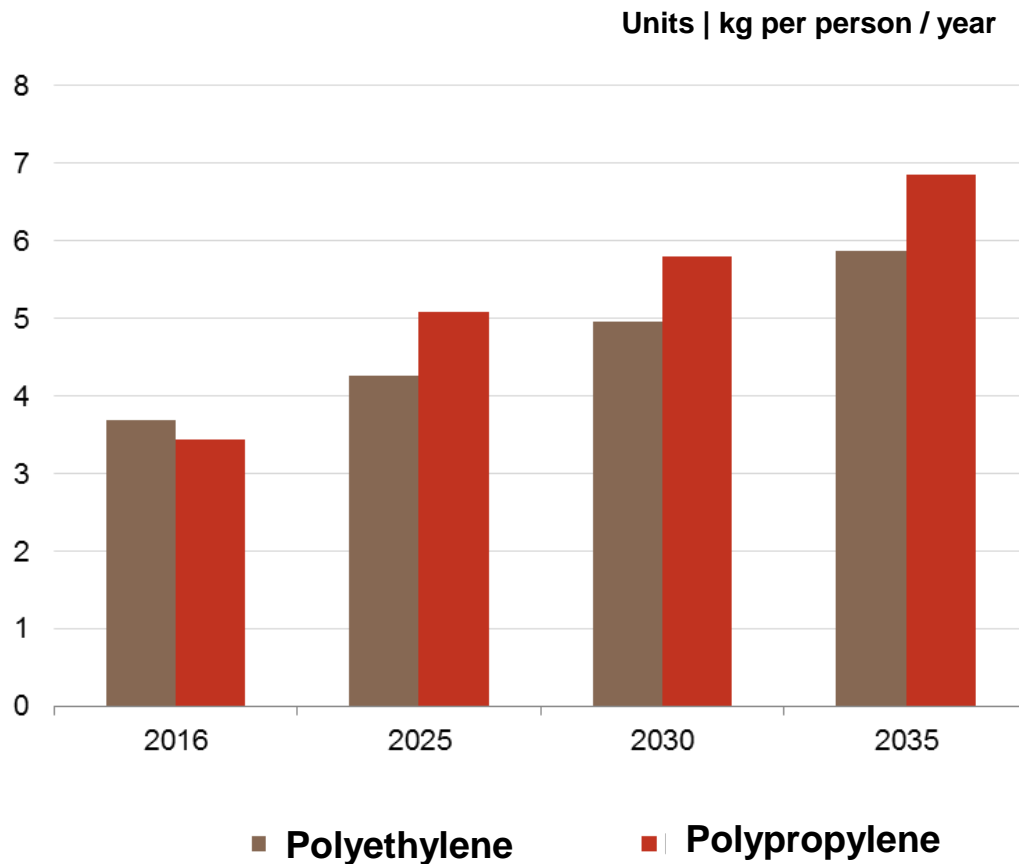
Petrochemical Demand – India



Source: Stratas Advisors

- Growth of polypropylene demand will remain strong in India through 2035
- Growth is mainly due to higher growth in food packaging and replacement of costlier and heavier PVC pipes in agriculture with cheaper and lighter PP pipes
- Polyethylene demand is projected to pick up after 2019

India – Per Capita Demand

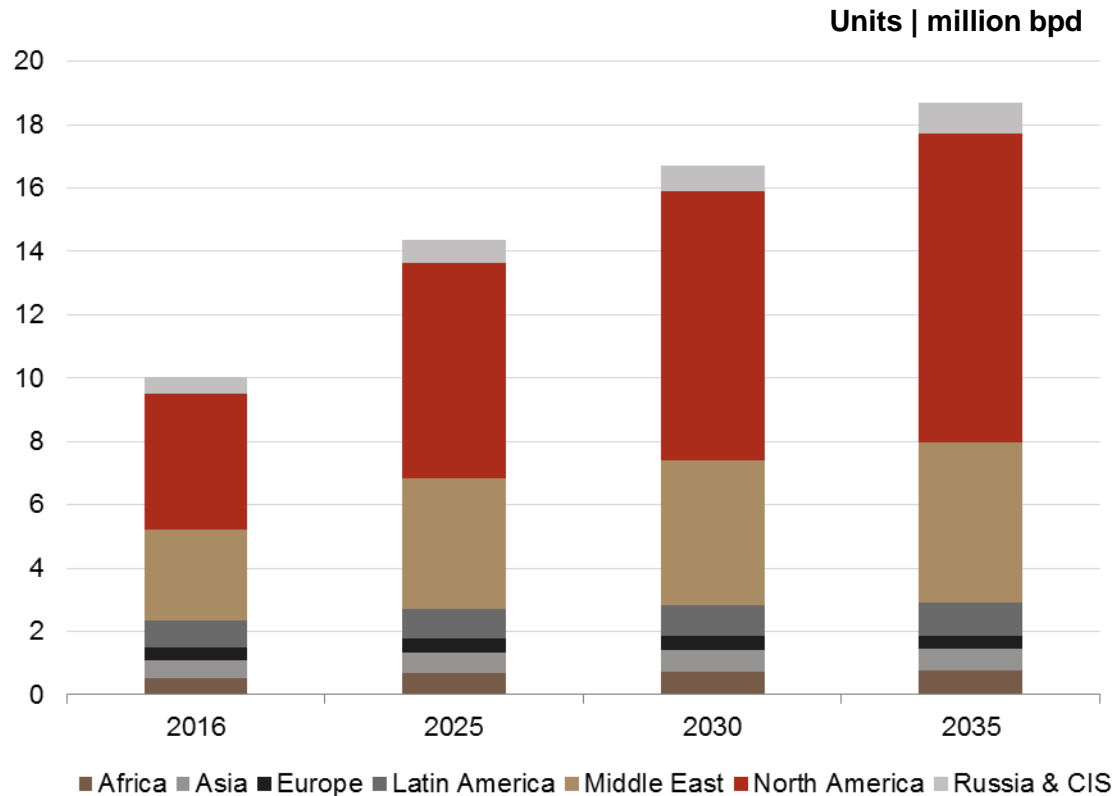


Source: Stratas Advisors



Feedstock Availability

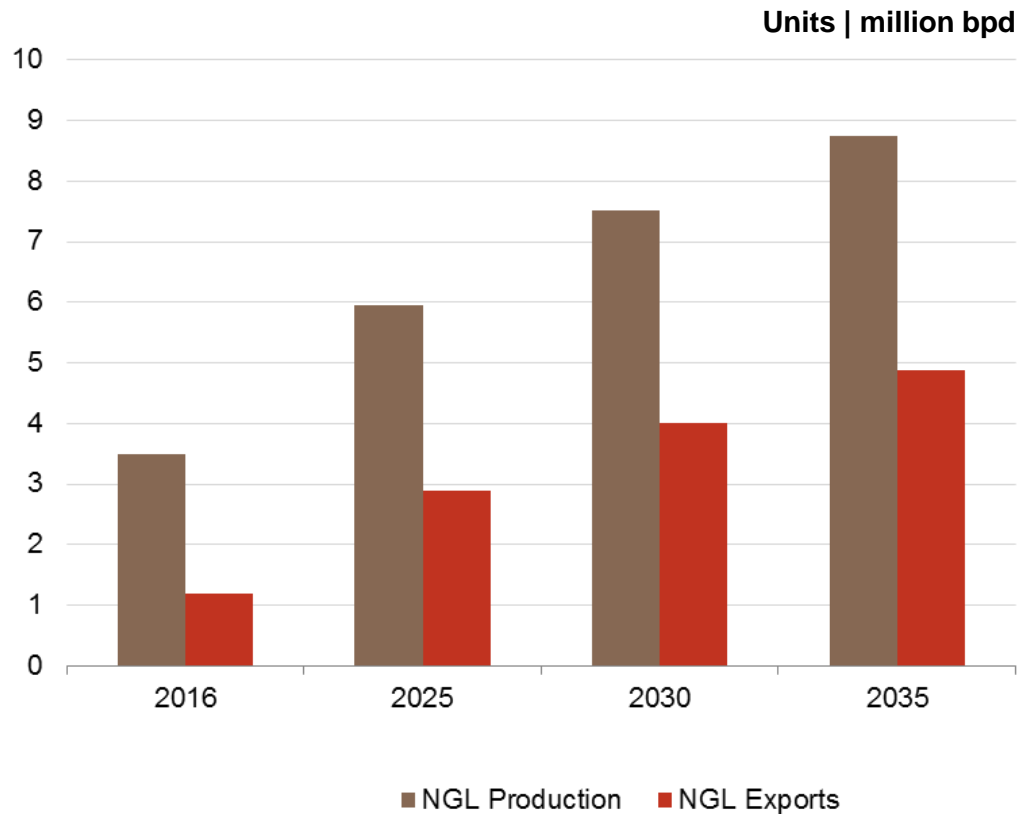
Global NGL Production



Source: Stratas Advisors

- Global NGL production will almost double to 18.68 million bpd by 2035 from 10.05 million bpd in 2016
- Growth in NGL production will remain strong through 2035 for Middle East from 2.89 million bpd in 2016 to 5.07 million bpd by 2035

US NGL Production and Exports



Source: Stratas Advisors

- US NGL production will increase 2.5 times to 8.74 million bpd by 2035 from 3.49 million bpd in 2016
- NGL exports will increase 4 times to 4.87 million bpd from 1.20 million bpd in 2016

NGL Trade Flows

Units | million bpd



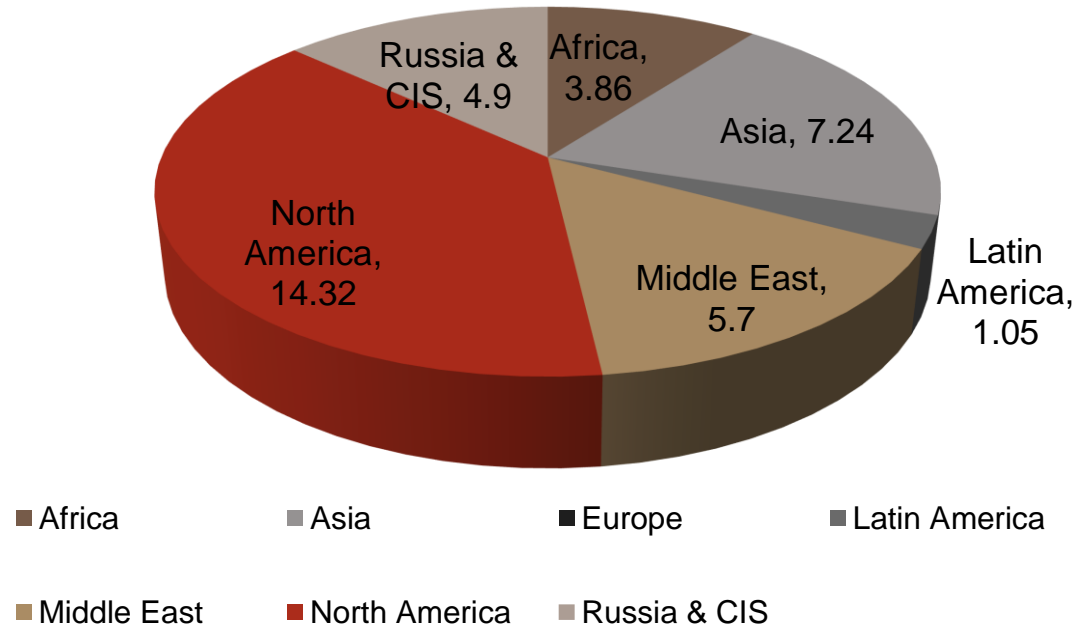
- In addition to Middle East and Africa, US will be main exporting country to Asia to meet Asia NGLs growing demand
- Australia will be the main supplier of NGLs within Asia region (0.02 million bpd)



Projected Investments

Petrochemical Investments (2016 – 2022)

Total Steam Cracker Capacity Additions: 37 million tonnes / year

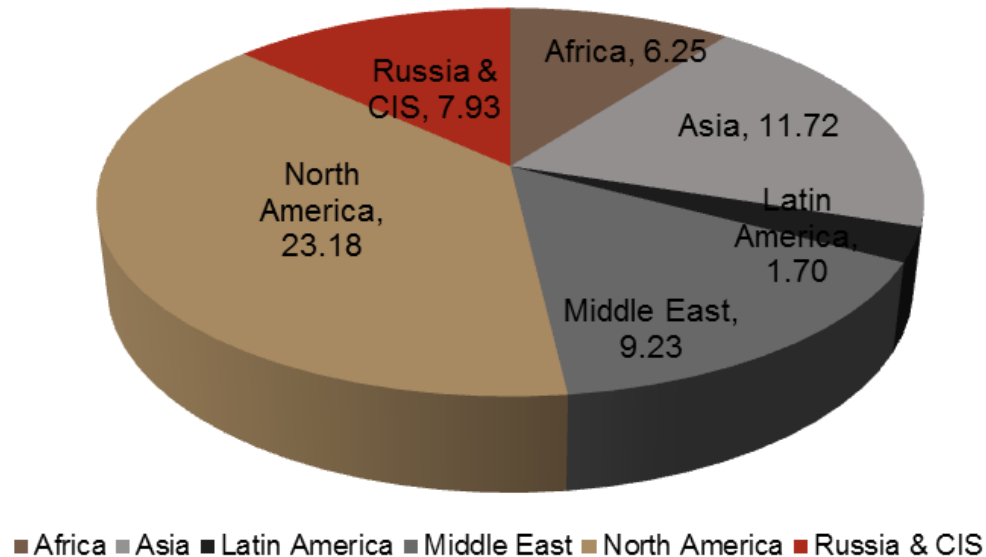


Source: *Stratas Advisors*

- US will be adding 14 million tpa by 2022 followed by Asia adding 7 million tpa
- Russia, Middle East and Africa, each will be adding 4-5 million tpa of cracker capacity

Petrochemical Investments (2025 – 2035)

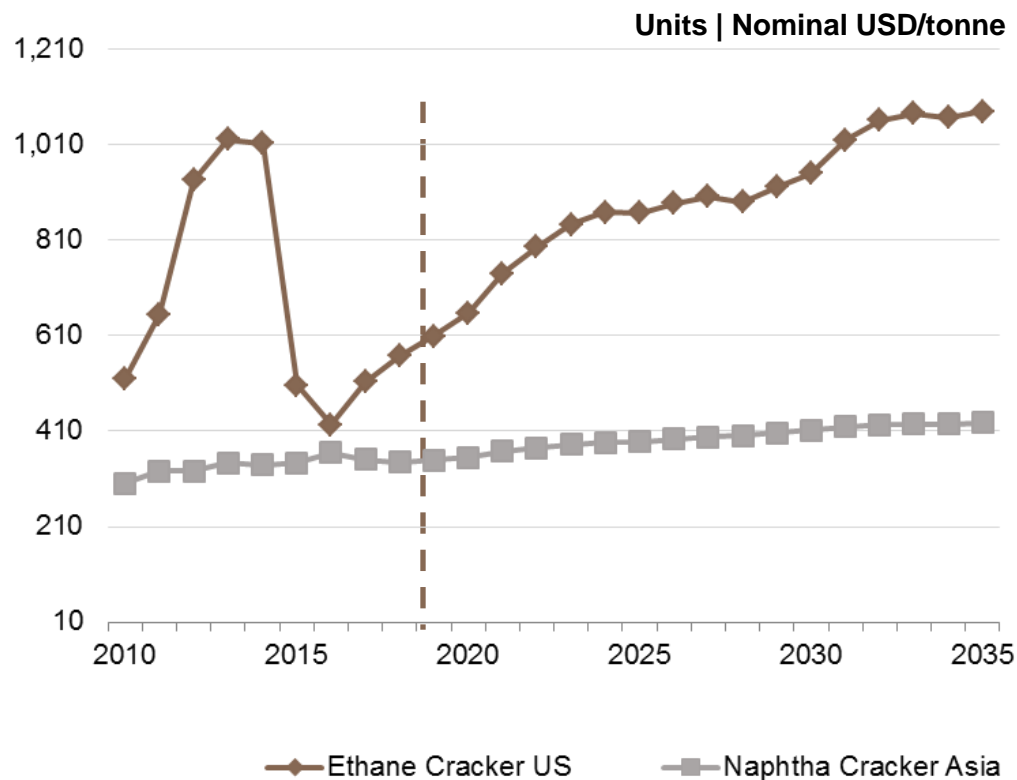
Total Steam Cracker Capacity Additions: 60 million tonnes/year



Source: Stratas Advisors

- US will add an additional 24 million tpa by 2035
- Asia is projected to add 12 million tpa of capacity
- Russia, Middle East and Africa, each will be adding 6-9 million tpa of capacity

US Ethane Cracker vs Asia Naphtha Cracker



Source: Stratas Advisors

- Differential between Asia naphtha cracker margin and US ethane cracker margin fell below 100\$/tonne due to drop in US ethylene price in 2016
- US ethylene price recovery will increase the differential back towards the 2014 level (672 USD/tonnes) by 2035



Key Takeaways

Key Takeaways

- Global economy will continue to grow with Asia's share of the global economy reaching almost 40% by 2025
- Energy prices in nominal terms will rebound in the short-term and will continue to increase through 2035
- Global demand for ethylene and propylene will nearly double during the next 20 years
- Asia demand for base petrochemicals will increase substantially in absolute terms and on a per capita basis
- India's demand will be especially strong -- and demand for polypropylene increasing by nearly three-fold
- Supply of NGLs will increase with the US and the Middle East being major sources of petrochemical feedstocks
- US, Asia and Middle East will be the major investment centers for future additions in petrochemical capacity

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