Competitive Intelligence

Sample Company

May 2016

IHS Markit™

Contents

Introduction

The IHS Chemical Competitive Company Analysis (CCA) is a multiclient program offering a unique combination of in-depth analysis and tools to compare peer companies. The 2016 series of reports has three main components which complement each other to provide analytics and data to compare the strategic direction of the selected companies.

- 24 Individual company profiles
- Global Competitiveness Report (GCR)
- Key Performance Indicators Dashboard Tool (KPI)

The peer group in this series are top global olefin producers, which were selected based on the size of their current and future ethylene capacity and company revenues. Ethylene is used as a surrogate for the performance of the petrochemical industry as a whole because of the large volume produced and broad end-use patterns. Together these companies represent nearly 60% of global olefins and aromatics output.

The companies included in the 2016 series of reports have each been assigned to a peer group based on scale, profitability, and geographical location. The following company profiles will be issued during the course of the year:

Peer Group #1	Peer Group #2	Peer Group #3
Chevron Phillips	BASF	Braskem
Dow	BP	ENI
ExxonMobil Chemical	CNPC (PetroChina)	IPIC*
LyondellBasell	Formosa Group	Mitsubishi Chemical
NPC-Iran	INEOS	Petronas
Royal Dutch/Shell	Sinopec	Reliance Industries
SABIC	Total	Siam Cement (SCG Chemicals)
Saudi Aramco	Westlake	Sumitomo Chemical

* Owner of Borealis, Borouge, and Nova.

Introduction

The individual company profiles focus on the global chemical operations of a single company, including subsidiaries and joint ventures. The primary objective is to compare the selected companies across key products (ethylene, propylene, and benzene) and major derivatives (polyethylene, polypropylene, and polystyrene). In addition, the profiles develop an understanding of the chemical producers and the business areas/products in which each producer participates and competes. Each company analysis contains a corporate snapshot, key financials, and competitive analysis for the three key products examined. Key performance indicators are covered including ethylene cash cost position, ethylene process efficiencies, product integration for ethylene, propylene, and benzene, and market proximity for polyethylene, polypropylene, and polystyrene. Additionally, the analysis provides manufacturing profiles with detailed descriptions of the company's major chemical manufacturing locations and a summary of major material flows (product chain integration). These reports will be issued throughout 2016.

The Global Competitiveness Report (GCR) covers 40 petrochemicals produced by the companies in the series. The top 15 producers of each product are ranked based on capacity size, market position, and manufacturing position. In addition, capacity ranking charts show how their ranking will change over the next five years. Refer to this report for more details about its content and the methodologies used. This report will be issued in the second quarter of 2016.

The Key Performance Indicators Dashboard Tool (KPI) allows comparison of selected companies for ethylene feedstock cost position, current and future ethylene feedslate by company, product integration for ethylene, propylene, and benzene, and market proximity relative to regional growth rates for polyethylene, polypropylene, and polystyrene. Refer to this report for more details on the methodologies used for its creation. This tool will be issued in the second quarter of 2016.

Most of the quantitative information contained in all of these reports is derived directly from IHS Chemical's capacity, supply/demand, econometric, and cost curve databases plus certain financials published by the subject company. Additional information contained in this analysis has been obtained from diverse sources, including trade associations, government organizations, and direct contact with companies affiliated with the petrochemical industry and reviewed by IHS experts.

We encourage your feedback and any suggestion for product enhancement. Please contact us if there are any questions or comments regarding the contents of this study.

If additional company-specific or more detailed analysis is needed, our consulting team will be glad to develop a specific scope to meet your needs.

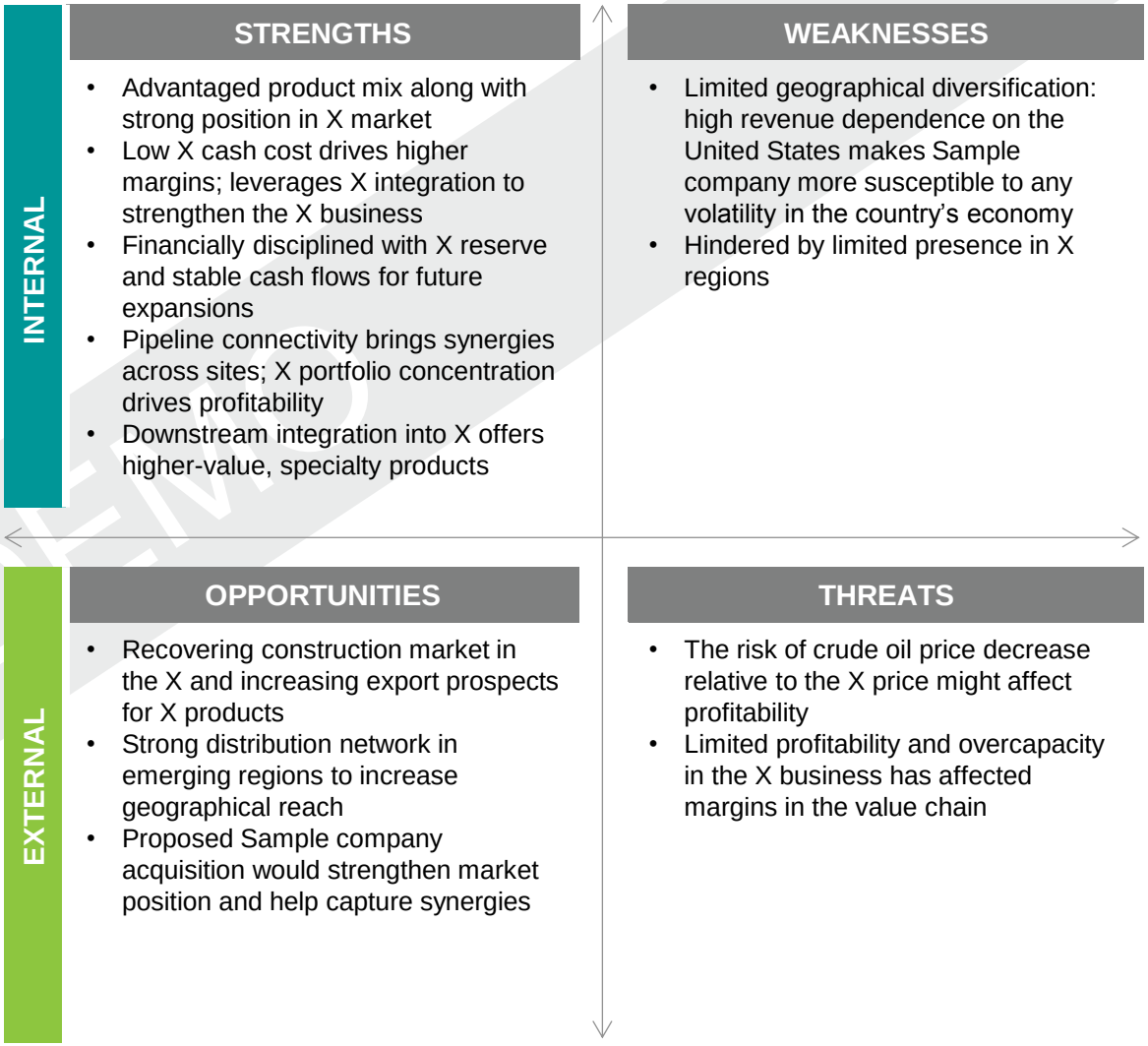
Focus area and terminologies

- The following report provides detailed overviews and analyses for Sample Company's basic chemicals, polymers, and intermediates as well as selected performance and specialty chemicals. Excluded or covered only in brief are PVC building products, tin tetrachloride, and hydrogen
- The focus is on Sample Company's Olefins and Vinyls business segments.
- Sample Company Chemical encompasses many affiliates, so for convenience terms like *corporation*, *company* and *its* are used as abbreviated references to indicate the operating companies.
- The competitive company analysis reports are written from a peer group comparison perspective. The peer group set of selected companies is based on scale, profitability, and geographic location. For Sample Company, the identified peer group set includes Formosa, CNPC, Sinopec, BP, Total, INEOS, and BASF SE.
- In the report the following product abbreviations have been used
  - Propylene (PG/CG) refers to propylene polymer grade/chemical grade
  - PVC refers to polyvinyl chloride
  - VCM refers to vinyl chloride monomer
  - EDC refers to ethylene dichloride
- All capacity units are in millions of metric tons per year (million mt/y) unless stated otherwise.
- All figures are in US dollars unless stated otherwise.

Sample Company: IHS Chemical view

IHS Chemical view

- Sample company benefits from an advantaged feedstock position in the X, having the lowest ethylene cash cost among major producers. This low cash cost position allows the company to achieve higher margins.
- Sample company pursues a strategy of product concentration and vertical integration through acquisitions, expansions and modifications of existing plants, and new projects.
- Sample company is among a few companies having X operations integrated into the X chain. In X, the company has integrated its X all the way to finished X products.
- Sample company has always been geographically focused and concentrated most of its operations around X with particular emphasis on the X. Sample company acquisition in 2014 has helped diversify its operations to X.
- Sample company also has 50% stakes in a X pipeline that supplies feedstocks to the X site. This helps the company improve the long-term reliability of feedstock supply at the site, hence improving overall operational efficiency.



Source: IHS Markit

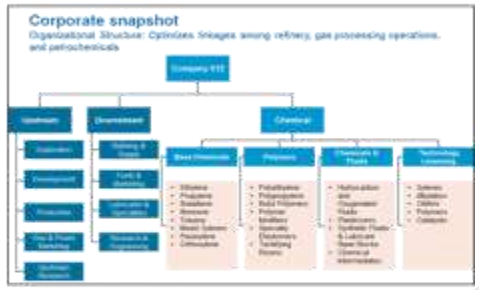
Sample Company: Corporate snapshot

Corporate snapshot

Covers information related to organization structure, JV's, history, strategy and strategic intent, product capacity and expansion/closure

Corporate snapshot: Company XYZ

Integration with upstream supply sources and refinery operations helps sustain chemical business competitive advantage



Corporate snapshot

Joint Ventures: Strong lineage of operational excellence and access to technology makes Company XYZ a partner of choice

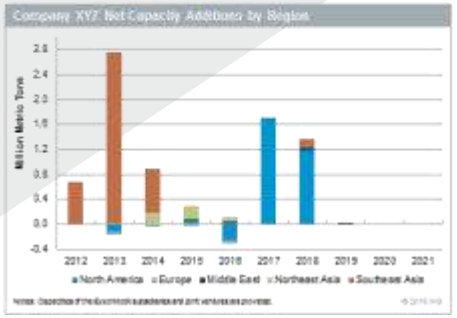
Corporate snapshot: Strategy Rationale

Vertical integration, strategic assets location, and product concentration to capture market share are key drivers for achieving sustainable growth

- Company XYZ's core strategy focuses on assuring supplier reliability, effective project execution, and collaborative customer relationships within a capital – intensive environment.
- The company has a strong focus on technology and remains a world leader in most of its selected product areas, supported by proprietary technology.
- Licenses offered for aromatics, olefins, polymers, and catalyst technology provide additional revenue.
- Strong refinery integration, provides flexibility to optimize feedstock for ethylene production and fuel prices and thus profitability.
- Company XYZ strategy involves rationalizing assets in certain developed economies, while adding new capacity to serve higher-growth developing countries.
- Company XYZ also focuses on adding supply in regions with advantaged feedstock, including North America, plus expanding commercial and technical

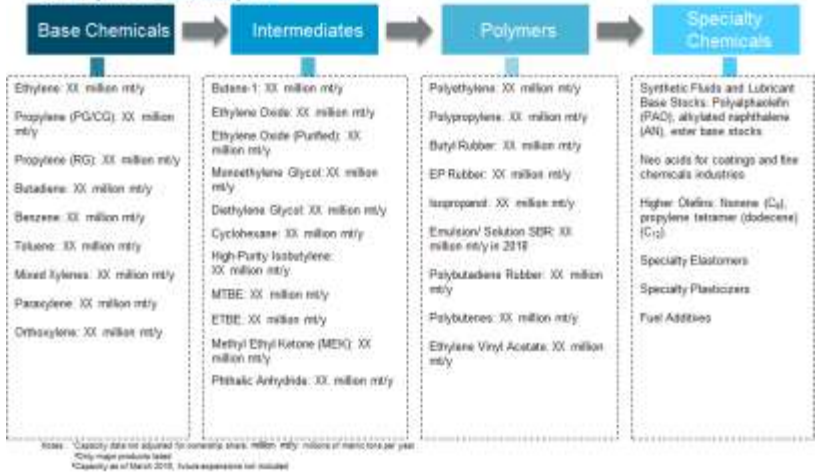
Corporate snapshot: Company XYZ

Investing in US Gulf Coast to gain maximum from business upcycle



Corporate snapshot—Capacity Data 2016

Company XYZ Slate (not adjusted for ownership share): Downstream derivative integration is mainly focused on ethylene

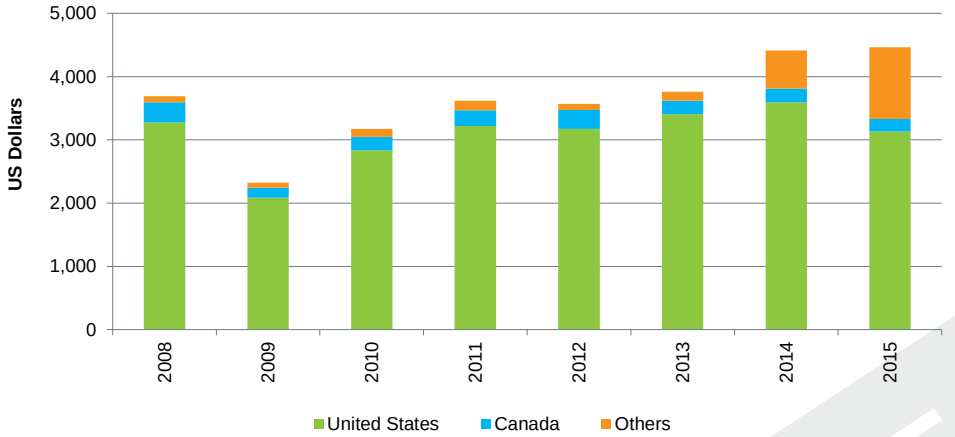


Sample Company: Key financials

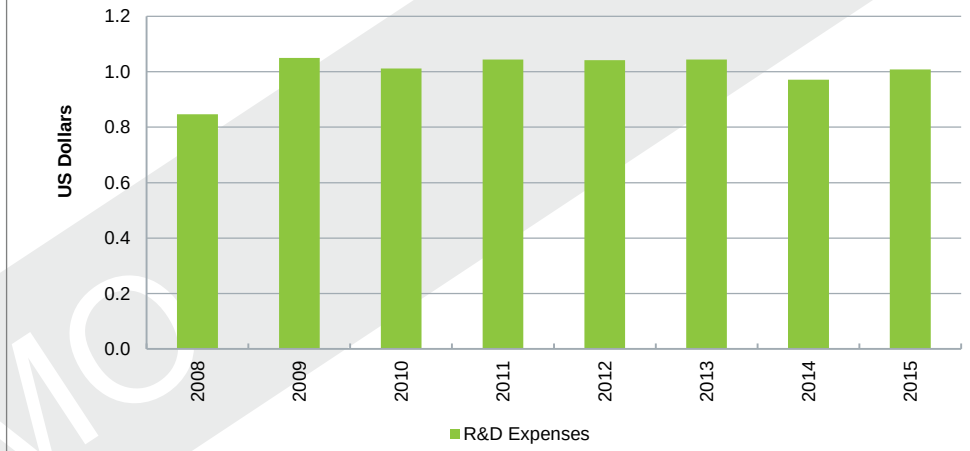
Sample Company

Financial analysis by of reviewing and analyzing a company's financial statements; Focus on identifying the trigger points and finding the explanation

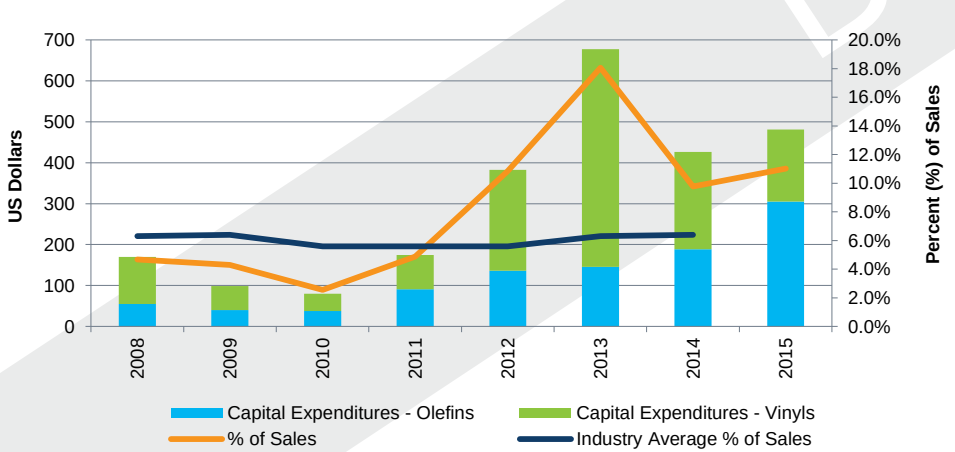
Revenue by Geography – Sample Company



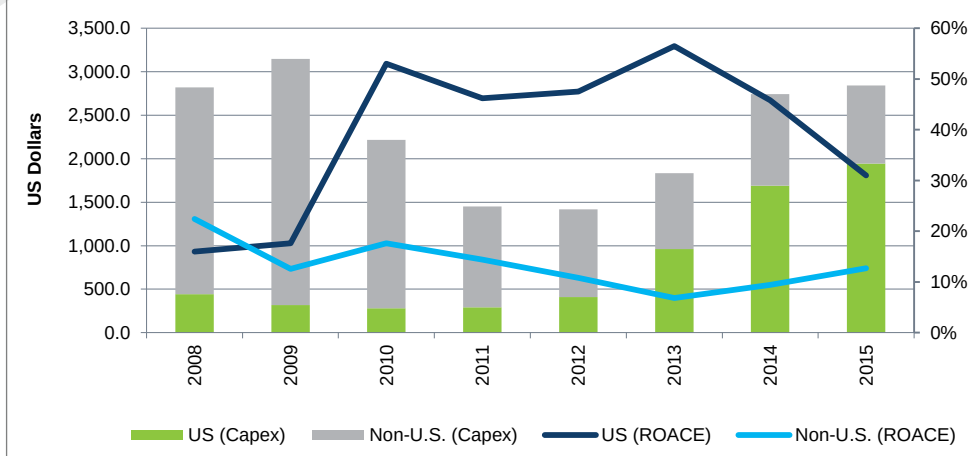
R&D expenditure - Sample Company



Capital Expenditures – Sample Company



Return on average capital employed - Chemical



Sample Company: Competitive analysis

Cash cost position: Ethylene

Methodology: Ethylene cash cost and process efficiency

Methodology: Ethylene cash cost curves

- Production cash cost is defined as the raw material feedstock costs, less coproduct credits, plus variable and estimated fixed production costs.
- Producers falling further to the left along the cost curve have the lowest production cash costs. Producers falling to the right have the higher production cash costs.
- A company-level cash cost curve is generated by aggregating the company's individual ethylene cash cost position by asset on a weighted average basis, taking into account the shareholding capacity. The model uses a fixed feedslate basis for all crackers operating in the year under analysis.
- For this section, we leverage the IHS Chemical: Competitive Cost and Margin Analytics (CCMA) product series. The data are based on assumptions for feedstock pricing that are applicable to the producing areas worldwide. Forecasts of future feedstock costs are based on energy forecasts provided by IHS Energy.
- This model should be viewed on an ethylene-only basis, which treats propylene as a by-product in cost estimates.
- While the cost curve has become a standard microeconomic tool for assessing the dynamics of a commodity market and predicting prices, construction of a realistic representation of chemical industry production costs requires assembling an extraordinary volume of data, the development of complex models, and the knowledge and insight of experienced market experts to properly analyze and interpret the results.
- Steam cracking (also known as thermal pyrolysis) of hydrocarbons is the primary process for production of ethylene. Since the process used for ethylene extraction is the same for most producers, we have focused on the feedslate used to assess the cost-effectiveness of the operations and mapped them over a five-year period.

Cash cost position: Ethylene

Methodology: Ethylene cash cost and process efficiency

Ethylene: Key market trends

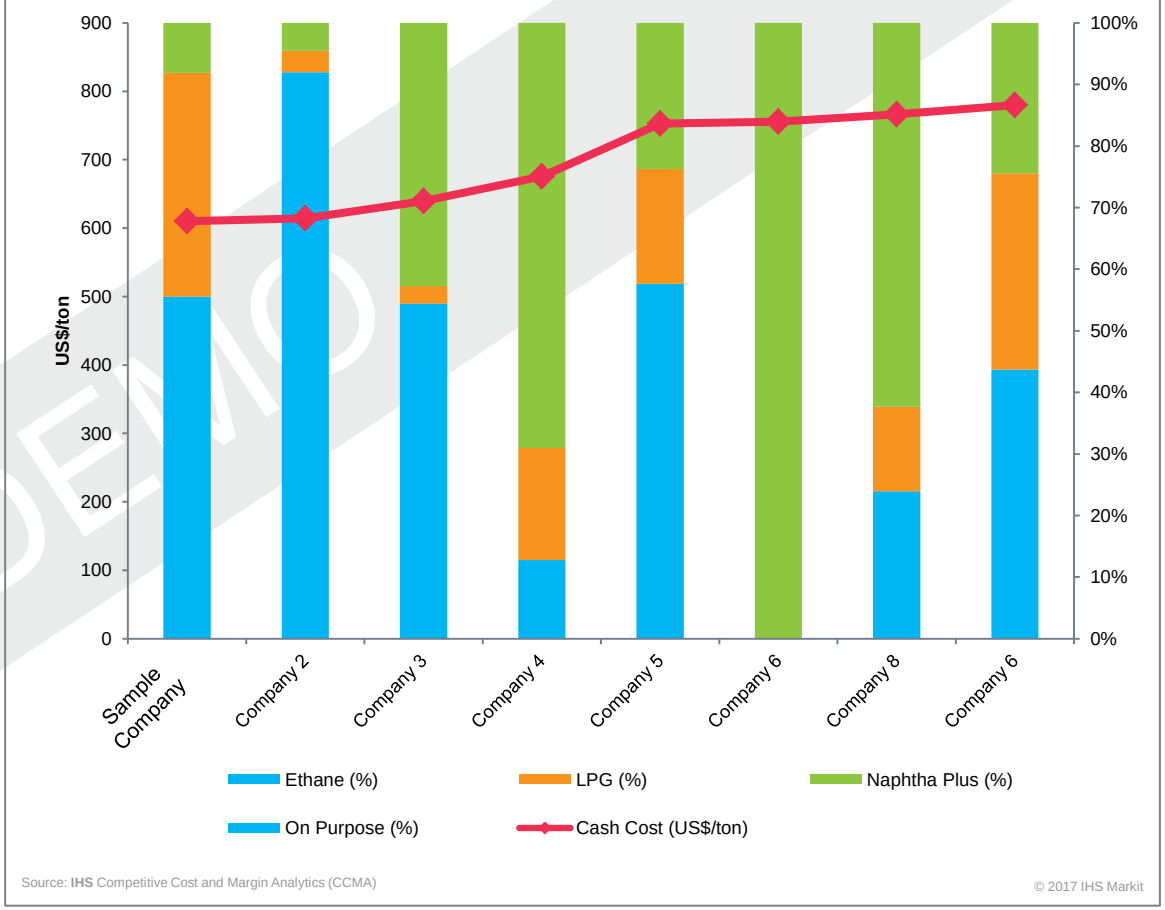
- The two most common feedstocks for ethylene are ethane, which provides a cost-advantaged high ethylene yield where it is stranded, and naphtha, which offers a wider product slate, which can offset some of the feed cost and provides ease of transport. Propane and butane (LPG) are also being increasingly used in the Middle East, as ethane becomes scarce as a result of increasing demand.
- In Western Europe and parts of Asia, slow domestic demand growth, thin margins, and lack of any cash cost advantage are expected to limit investments in new capacity and encourage rationalization. Producers in these regions will focus capital investment on cost efficiencies for improvements in energy usage, greater feedstock flexibility, and plant modernizations.
- A few producers in Europe are planning to import US ethane to increase cracker margins. However, lower oil prices have helped companies that rely on naphtha feedstock (e.g., in Asia and Europe) become less disadvantaged versus those in advantaged feedstock regions.
- North American producers are taking advantage of the forecast growth in ethane supply to pursue new investment opportunities. Ethane in the United States (and Canada) is now, and will continue to be, the second-cheapest ethylene feedstock in the world.
- The Middle East will remain an advantaged ethylene supply location because of controlled ethane feedstock pricing.
- The emergence of coal as a potential olefins feedstock in Northeast Asia, especially in China, has attracted great attention in recent years. As a result of high oil prices in the past several years, there has been tremendous domestic interest to further develop and utilize the abundant coal resources in China. This is via coal-to-methanol and then methanol-to-olefins on integrated sites and for coal chemistry that bypasses what would have traditionally been ethylene-based chemistry. In these processes, ethylene is not consumed for the production of ethylene dichloride (EDC) or for ethylene glycol.

Cash cost position: Ethylene

Lowest cash cost position supported by well-positioned assets and X% lighter feedslate

- The feedstock cost curve illustrates individual ethylene cash cost positions, taking into account the raw materials mix for 24 chemical companies. The graphs give a relative comparison of the companies and provide an idea of profitability down the value chain.
- • Ethylene production cash cost is defined as the raw material feedstock costs, less coproduct credits, plus variable and estimated fixed production costs.
- A company-level cash cost curve is generated by aggregating the company's individual ethylene cash cost positions by asset on a weighted average basis, taking into account the capacity on a shareholder basis. The model uses a fixed feedslate basis for all crackers operating in the year under analysis.
- • For this section, data are derived from the IHS Chemical: Competitive Cost and Margin Analytics (CCMA) product series. The data are based on assumptions for feedstock pricing that are applicable to the producing areas worldwide.

Feedstock slate and ethylene cash cost curve by company (2016)



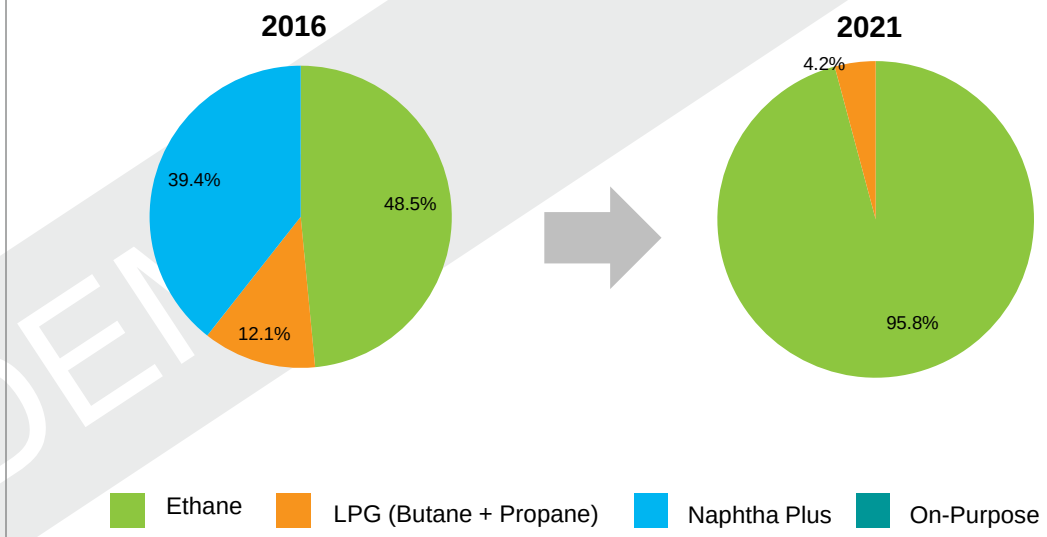
Source: **IHS** Competitive Cost and Margin Analytics (CCMA)

Process efficiencies

2021 feedslate likely to remain unchanged; benefits from X expected to continue

- Steam cracking (also known as thermal pyrolysis) of hydrocarbons is the primary process for production of ethylene. Since the process used for ethylene extraction is the same for most producers, we have focused on the feedslate used to assess the cost-effectiveness of the operations and mapped them over a five-year period.
- The company-level feedstock slate is calculated by taking a weighted average of that company's ethylene capacity (on a shareholder basis) and feedstock mix by asset Propane and butane are included under the LPG category. Naphtha and fuel oil are included in the Naphtha Plus category.

Sample Company feedslate proportion (2016 and 2021)



Source: **IHS** Competitive Cost and Margin Analytics (CCMA)

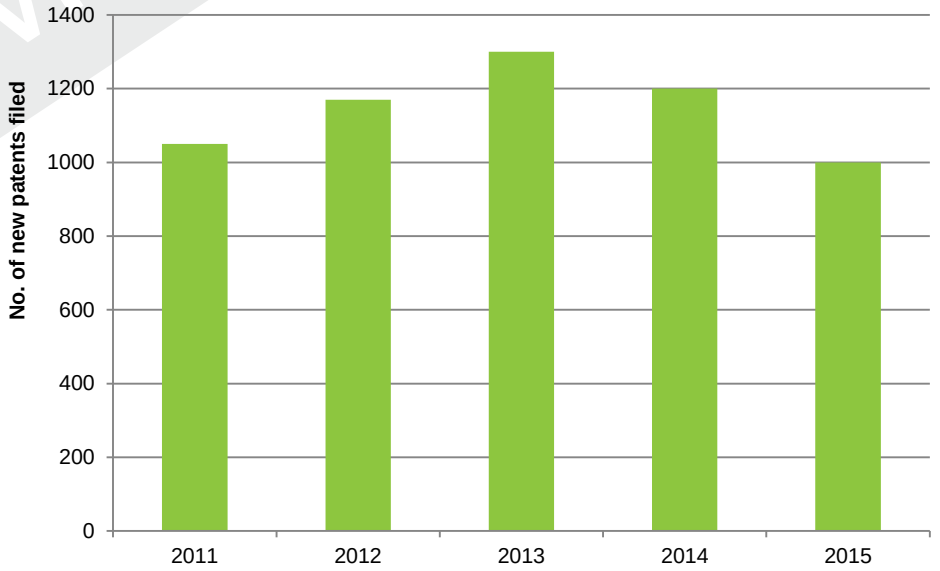
Technology position

X acquisition has strengthened Sample company technology position

Sample Company Proprietary Technology Portfolio	
Polyethylene	• Low Density Polyethylene • Ethylene Vinyl Acetate
Styrenics	• Ethylbenzene • Styrene • General Purpose Polystyrene • High Impact Polystyrene • Suspension Expandable Polystyrene • Acrylonitrile Butadiene Styrene • Styrene Acrylonitrile Resin
Elastomers	• Emulsion Styrene Butadiene Rubber • Solution Styrene Butadiene Rubber • High/Low cis Butadiene Rubber • Nitrile Butadiene Rubber • Stryene Butadiene Styrene Rubber • Ethylene Propylene Diene Monomer • Styrene butadiene Latex
Catalyst Technologies	• Titanium Silicalite • Silicalite • PBE-1 Zeolite • PRE-2 Zeolie

Patents Owned as of 31 Dec 2015	US	Other
Agricultural Sciences	650	2800
Consumer Solutions	1400	3200
Catalysts	800	4000
Polyolefins	280	2100

Sample Company – Number of new patents filed



Technology position

X acquisition has strengthened Sample company technology position

Chemical value chain color coding

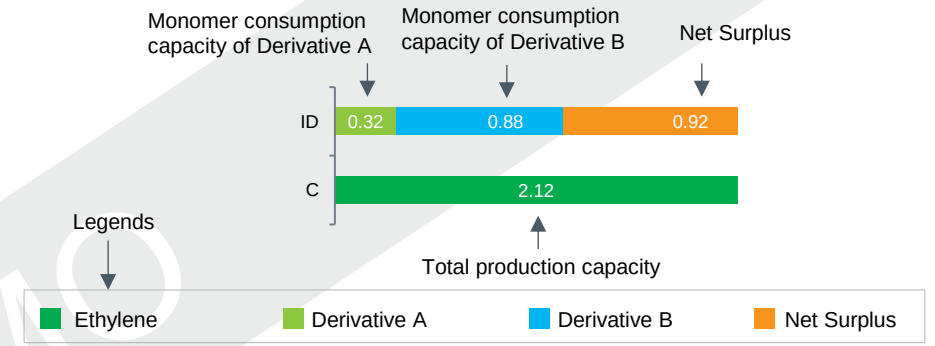
The flowcharts demonstrate the potential regional integration level of the company for three key value chains: the ethylene value chain, propylene value chain, and benzene value chain. The lower bar in the chart ("C") depicts the total monomer production capacity while the upper bar ("ID") represents the monomer consumption for different derivatives at full capacity. Each derivative's monomer consumption is assigned a color that is unique and similar for each chart. The net surplus/deficit position of the company is also shown in the chart. The analysis is based on the assumption that all the units are running at a 100% operating rate, indicating potential excess and deficit.

Consumption figures

Example 1 indicates Company A's ethylene integration level in North America. The lower bar indicates Company A has ethylene production capacity of 2.12 million tons per year. The upper bar represents ethylene consumption for two derivatives of ethylene, derivative A and derivative B. Company A has capacity to consume 0.32 million tons of ethylene for derivative A and 0.88 million tons of ethylene for derivative B. The net surplus position of ethylene for Company A is shown in green in the upper bar. Example 2 indicates Company X's propylene integration level. The lower bar indicates Company X has propylene production capacity of 1.3 million tons per year. The upper bar represents that Company X produces three derivatives of propylene, Derivative A, Derivative B, and Derivative C. The company has capacity to consume 0.3 million tons of propylene for derivative A, 0.9 million tons of propylene for derivative B and 0.4 million tons of propylene for derivative C. Thus there is a net deficit position in propylene for Company X, which is shown in red in the lower bar.

Example 1: Integration charts (Company A)

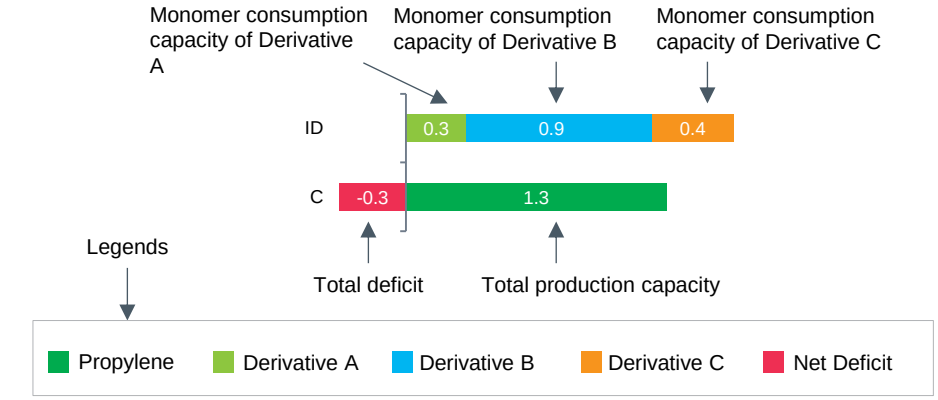
All figures in million metric tons per year (million mt/y)



Source: IHS Markit

Example 2: Integration charts (Company X)

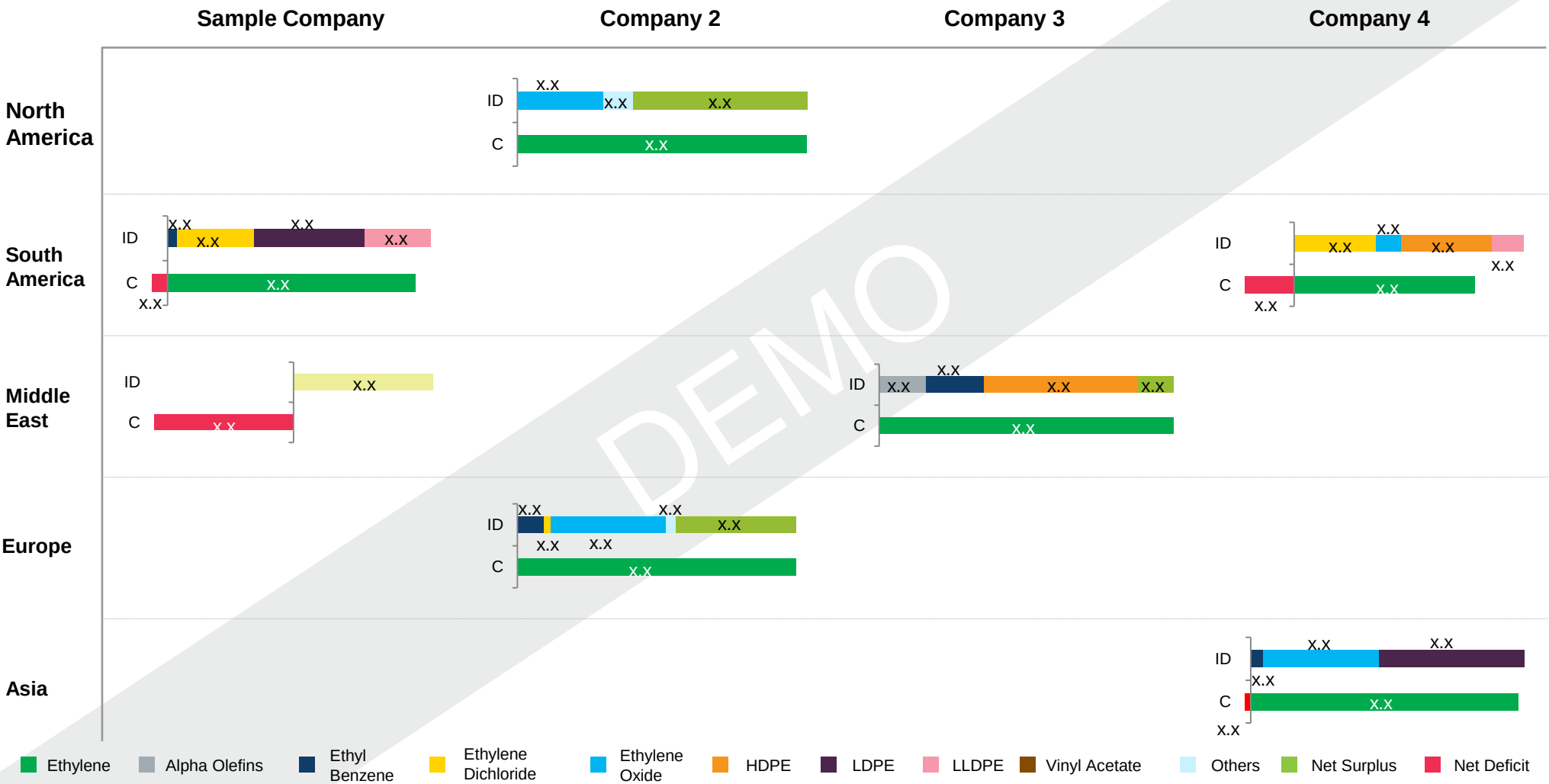
All figures in million metric tons per year (million mt/y)



Source: IHS Markit

Product integration: Ethylene peer group

Sample Company: Lacks geographic diversification but maintains a strong position in X

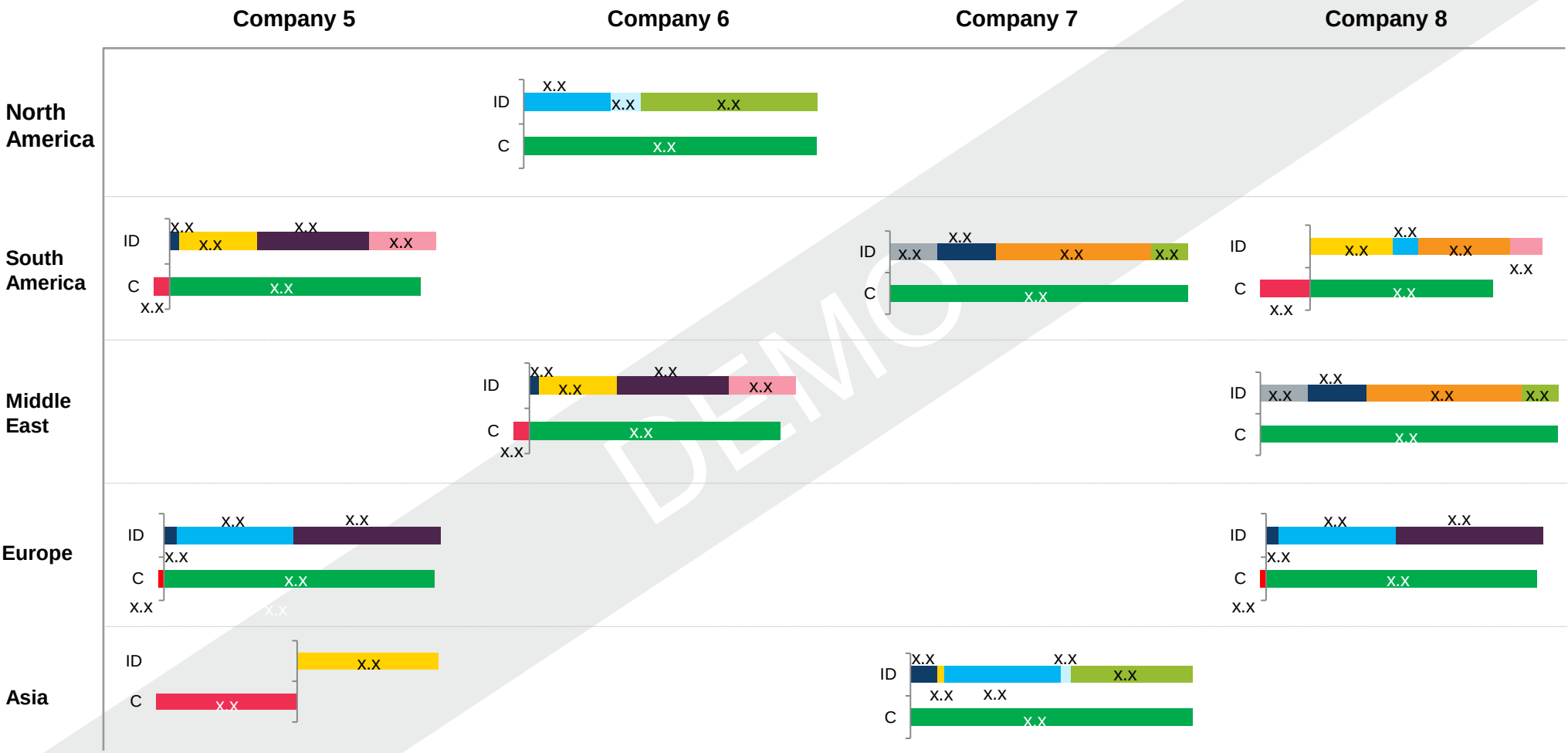


All values are in millions of metric tons per year.
C = Capacity; ID = internal demand.

Source: IHS Markit

Product integration: Ethylene peer group

Domestic presence for X companies; only X is geographically diversified



All values are in millions of metric tons per year.
C = Capacity; ID = internal demand.

Source: IHS Markit

Product integration: Ethylene peer group

Sample Company: X operations deeply integrated to X as well as to X business

Geographical diversification

- Most of the top global ethylene manufacturers are X across products and regions, enabling them to serve more markets. However, the peer companies of this group are not diversified across all regions. X is the most diversified company compared with industry peers, with operations in all regions except X.
- Sample company lags in geographical diversification of its ethylene operations compared with the peers and its operations are limited to X. The company currently has around a X.X% capacity share for ethylene in X, which is expected to decrease to around X.X% in 2021 with the addition of a number of upcoming ethylene projects in the region.
- State-owned companies like X and X, with a focus on X, have operations primarily in their home countries, limiting their geographic diversification.

Ethylene capacity integration

- Sample company has integrated its ethylene operations into the X value chain as well as in the X value chain, producing X for X production. Except for Sample company and ABC, no major company in the X has integrated its ethylene operations with the X value chain. This enables the company to capture most of the margins in the X chain of products.
- Access to advantaged feedstock has driven ethylene expansion in X and the X and as a result the companies in these regions figure in the X for ethylene supply and derivatives integration.
- Sample company has no refinery operations and procures feedstock for its ethylene operations through several pipelines from a variety of suppliers in X. The company's ethylene assets are well placed in the heart of the shale gas play with access to ethane from the X, X, X and X.
- Sample company has a very focused product portfolio and has limited its operations to X, X, and X. Ethylene consumption for producing derivatives marginally exceeds ethylene supply (assuming a 100% operating rate) in the X and the company is reliant on X of ethylene in X for its X segment.
- Sample company is the leader in terms of production capacity for X in North America and also has the highest share of X as a percentage of total X capacity among its peers.
- Sample company is also among the top five X producers in the X. It has no X production.

Sample Company ethylene capacity

Sample Company: Lighter feedstock−based production but flexibility to shift remains; operations limited to X

Company XYZ - Ethylene Capacity

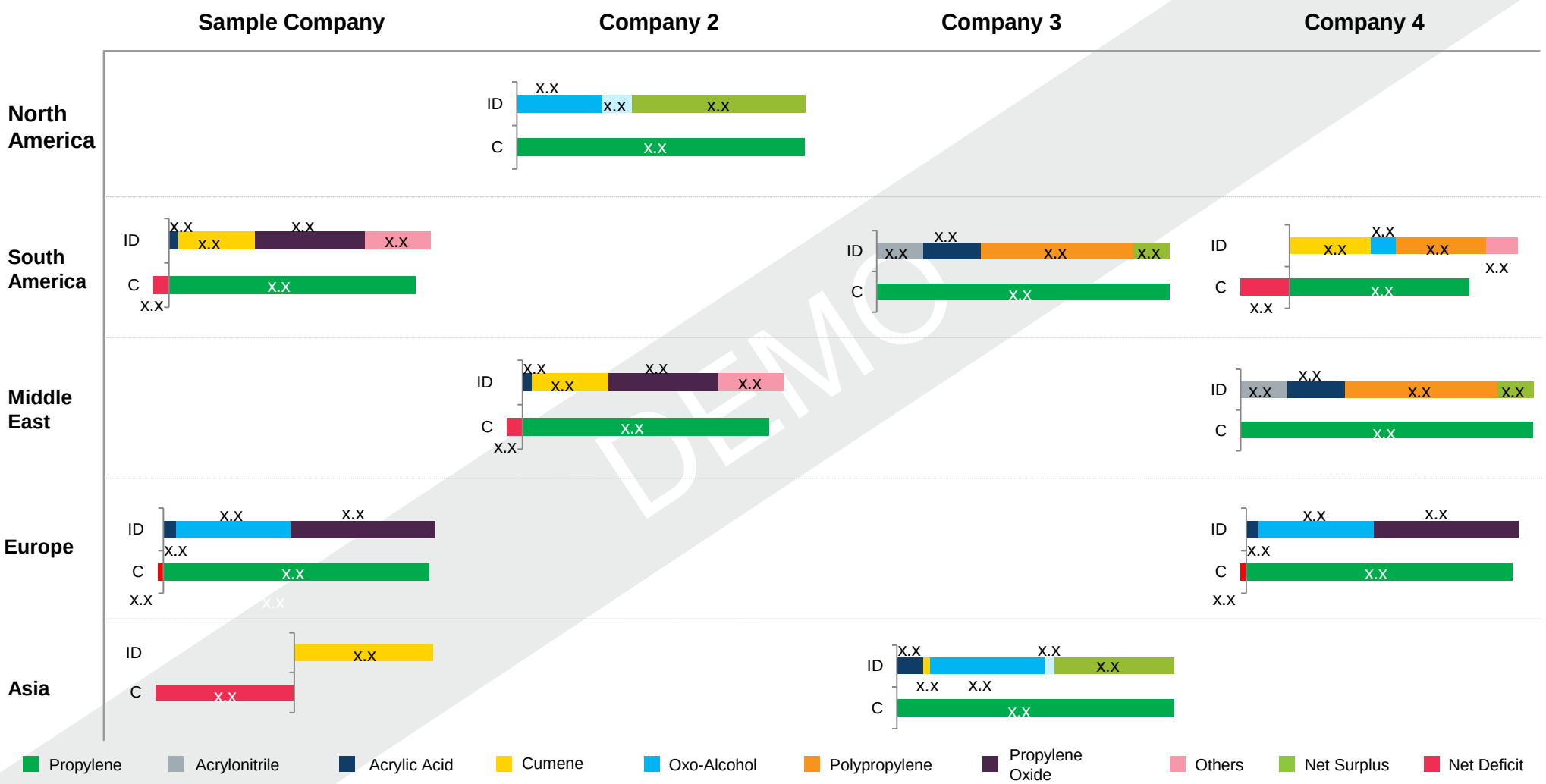
Average Annual Capacities - (Thousand Metric Tons); Not Adjusted for Ownership Share

COMPANY	LOCATION	PROCESS	2016	2021	OWNERSHIP
Company XYZ	ABC City	(1) Ethane	400	400	87.50%
XYZ Inc.	BBB City	(2) Ethane/Propane	600	600	88.00%
XYZ Corp	CCC City	(4) EPB/Naphtha	----	1,200	100.00%
		TOTAL(S)			
		SubTotal - (1) Ethane	400	400	
		SubTotal - (2) Ethane/Propane	600	600	
		SubTotal - (4) EPB/Naphtha	----	1,200	
Total - ETHYLENE			**1,000**	**2,200**	

Source: IHS Markit

Product integration: Propylene peer group

Sample Company:

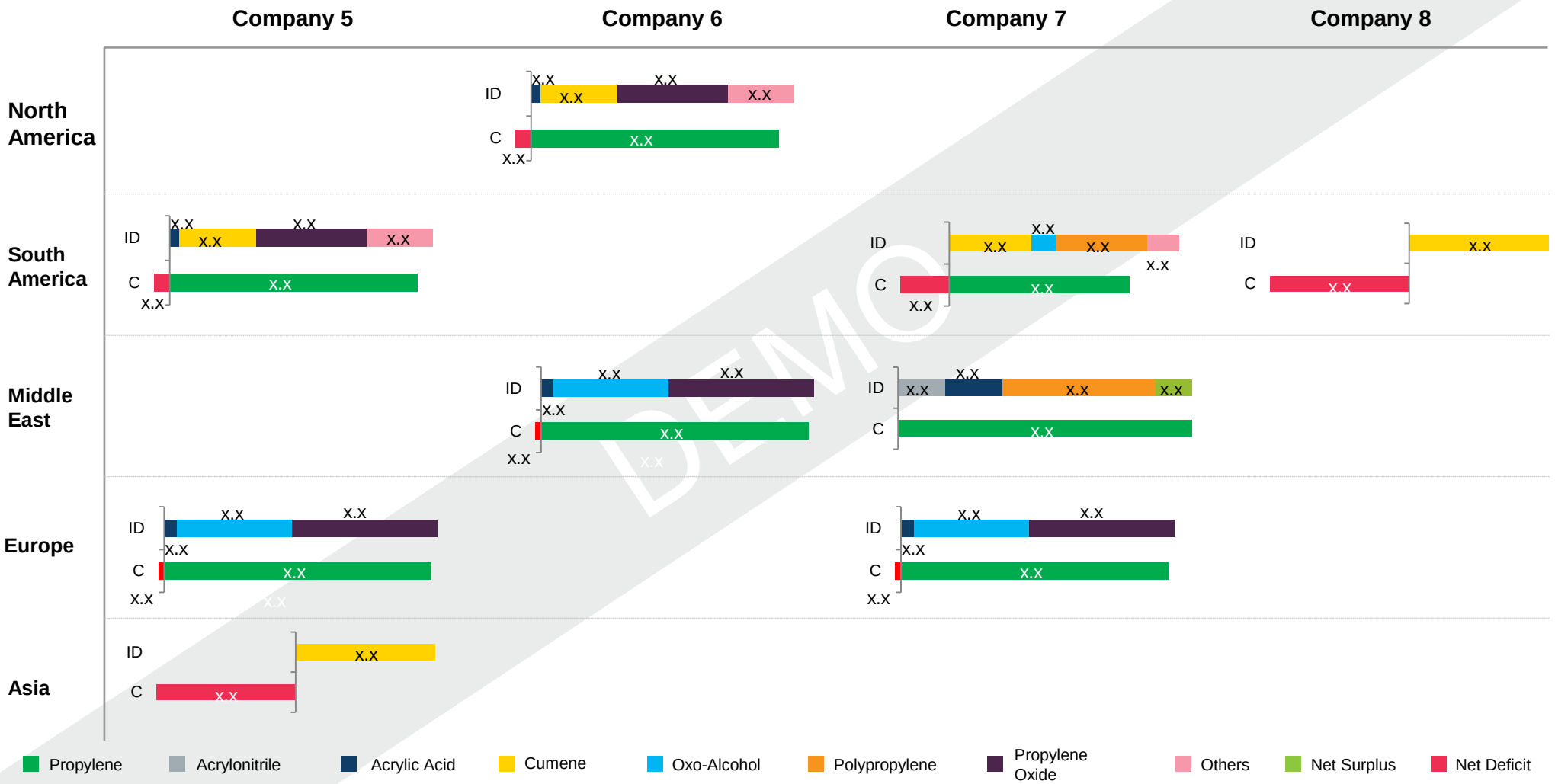


All values are in millions of metric tons per year.
C = Capacity; ID = internal demand.

Source: IHS Markit

Product integration: Propylene peer group

Sample Company:



All values are in millions of metric tons per year.
C = Capacity; ID = internal demand.

Source: IHS Markit

Product integration: Propylene peer group

Sample Company:

Geographical diversification

- Similar to ethylene, most of the top global propylene manufacturers have a globally X asset base. Among peers, Company 2 and Company 6 are the least diversified due to X.
- Sample company owns a total capacity of X.X million metric tons per year (on a pro-rated ownership basis), with just under X% of this share located in X and X.
- Accounting for X% of sample company's propylene capacity, the X region is one of the major consumers of propylene and with limited supply has to depend on X. The region alone contributes to X% of sample company's total propylene deficit of X.X million tons per year.
- Globally, producers in X are still producing majority of propylene from naphtha crackers. With a sharp decline in naphtha costs and a weak propylene market balance in X there is likely to be significant pressure for a price drop which would favor sample company.

Propylene capacity integration

- International and National oil companies like company 1, company 3, company 4 and company 5 lead propylene supply due to X integration. However, like its chemical peers company 3 and company 4 bulk of sample company propylene production is based on steam cracking operations (X%).The remaining X% is accounted by on-purpose technologies like olefin metathesis, propane dehydrogenation, and refinery operations.
- Ranked number X globally in polypropylene and propylene oxide, Sample company derivative demand exceeds propylene supply. Sample company relies on its joint venture partners and third party players for sourcing propylene in X and X. The sample company lack of feedstock security is unlike other X chemical companies like company 3 and company 4.
- Sample company's presence across high value propylene derivatives (X and X) helps hedge itself from the cyclical X business whose competitiveness have been reduced due to X propylene price levels.

Sample Company propylene (PG/CG) capacity

xx

Company XYZ - Propylene: Polymer/Chemical Grade Capacity

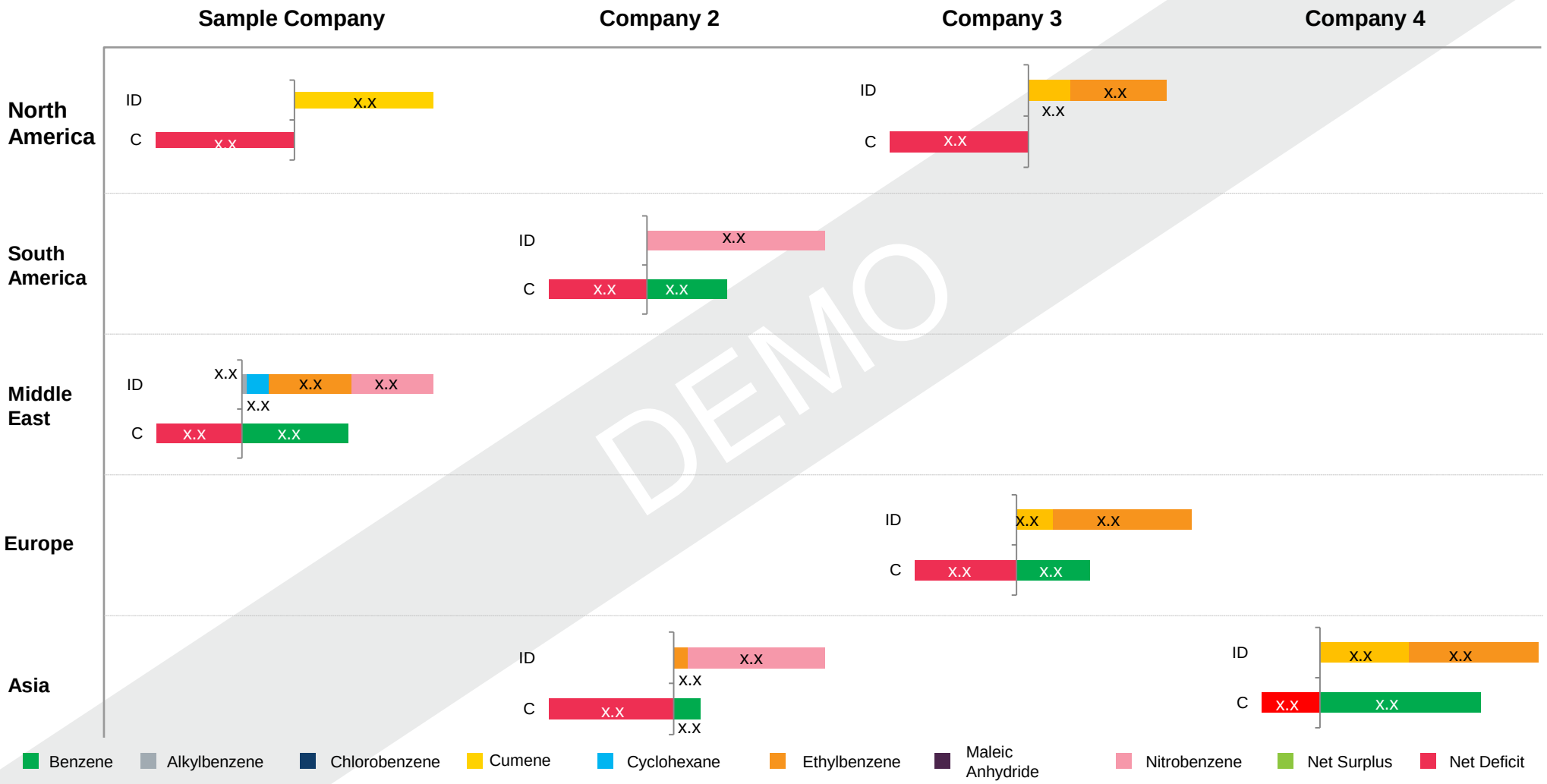
Average Annual Capacities - (Thousand Metric Tons); Not Adjusted for Ownership Share

COMPANY	LOCATION	PROCESS	2016	2021	OWNERSHIP
Company XYZ	ABC City	(1) Steam Cracker-Chem. grade	95	95	100.00%
XYZ Inc.	BBB City	(7) C3 Dehydro-Poly. grade	300	300	100.00%
XYZ Corp	CCC City	(2) Steam Cracker-Poly. grade	----	661	100.00%
XYZ Subsidiary 1	DDD City	(5) Refinery-Poly. grade	----	600	50.00%
XYZ Subsidiary 2	EEE City	(7) C3 Dehydro-Poly. grade	80	80	45.00%
		TOTAL(S)			
		SubTotal - (1) Steam Cracker-Chem. grade	95	95	
		SubTotal - (2) Steam Cracker-Poly. grade	----	661	
		SubTotal - (5) Refinery-Poly. grade	----	600	
		SubTotal - (7) C3 Dehydro-Poly. grade	380	380	
Total - PROPYLENE: POLYMER/CHEMICAL GRADE			**475**	**1,736**	

Source: IHS Markit

Product integration: Benzene peer group

Sample Company:



All values are in millions of metric tons per year.
C = Capacity; ID = internal demand.

Source: IHS Markit

Product integration: Benzene peer group

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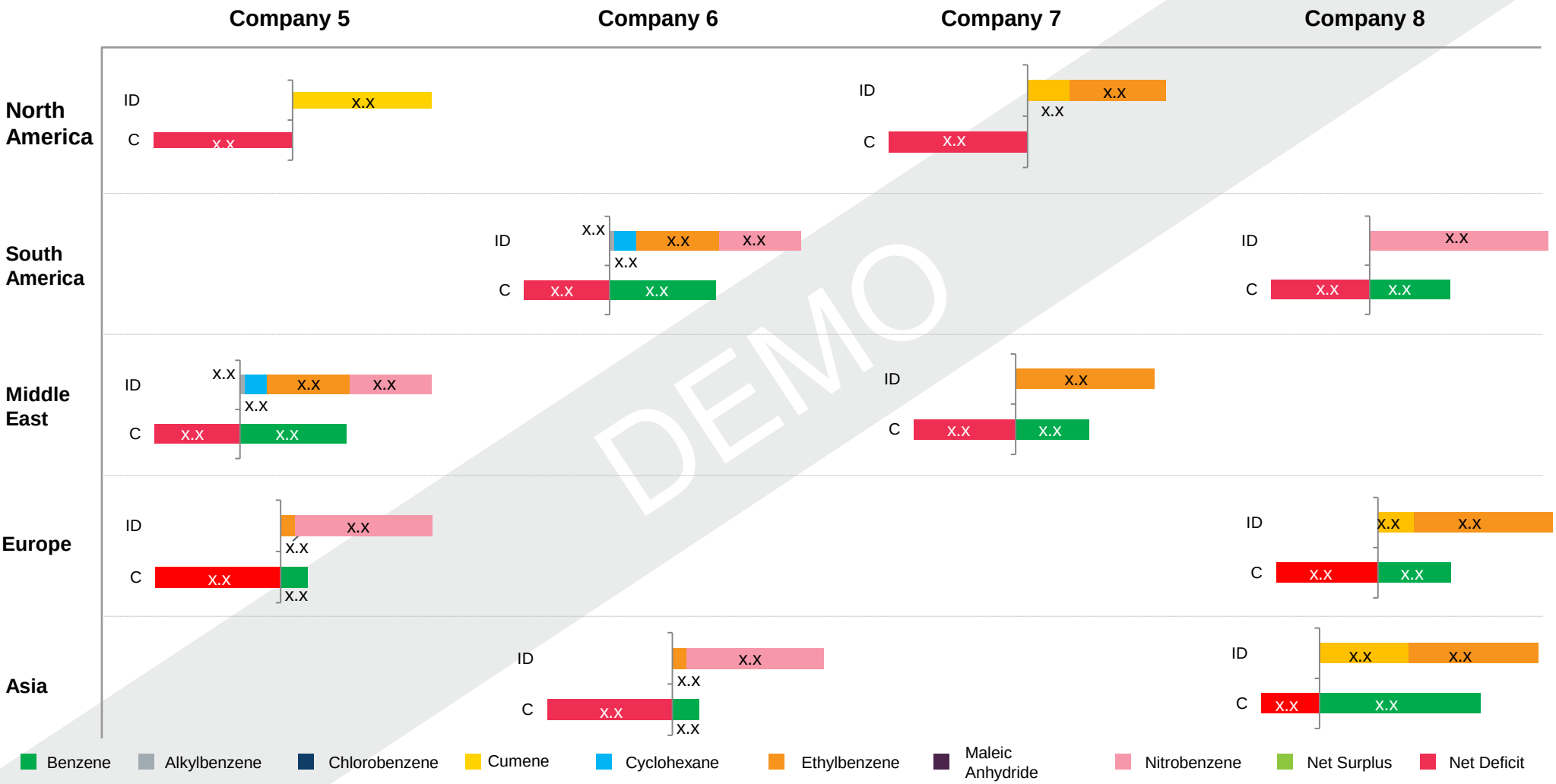


All values are in millions of metric tons per year.
C = Capacity; ID = internal demand.

Source: IHS Markit

Product integration: Benzene peer group

Sample Company:

Geographical diversification

- Most of the IOC's have a more X asset base with company 3 leading its peers in scale. The diversified chemical companies like company 2 and company 1 have significant operations in X and X which primarily use naphtha feedstock for steam cracking.
- Sample company ranked X out of X producers in terms of global benzene production with a total capacity of X metric tons per year (on a pro-rated ownership basis), located in the X and X. The company has a x.x% share of global benzene capacity.
- Globally, sample company benzene operations are constrained by limited regional strength, narrow geographic focus, high purchase requirements and modest growth prospects in the X region.
- X is the largest net importing region, since demand for benzene and its derivatives has grown more quickly than by-product production from steam cracking for ethylene, naphtha reforming for octane, p-xylene production for polyesters, and coke production for the steel industry. X will remain the second-largest importer. Most other regions will be net exporters of benzene.

Benzene capacity integration

- Among peers, company 2 has a higher level of downstream integration when compare to other oil companies like company 3, company 6 and company 8. Also, when compare to company 3 and company 6, company 8 have a wider portfolio diversification and a net surplus position.
- For sample company, coproduct benzene from X and X plants is the major source of supply and accounts for its total production capacity. All of the benzene produced is used as a feedstock for X and the deficit is met through market-based contracts with regional suppliers.
- Sample company's benzene assets rank high on scale and the plants are relatively new when compared to peers. There is complete downstream integration with X which is an intermediate for X production. The company's leading position in the X production makes benzene a key raw material whose prices effects the overall X segments profitability.

Sample Company benzene capacity

Sample Company:

Company XYZ - Benzene Capacity

Average Annual Capacities - (Thousand Metric Tons); Not Adjusted for Ownership Share

COMPANY	LOCATION	PROCESS	2016	2021	OWNERSHIP
Company XYZ	ABC City	(1) Reformate	150	150	100.00%
XYZ Inc.	BBB City	(7) Disproportionation	75	75	100.00%
XYZ Corp	CCC City	(1) Reformate	10	10	50.00%
XYZ Subsidiary 1	DDD City	(4) Pygas	----	230	45.00%
		TOTAL(S)			
		SubTotal - (1) Reformate	160	160	
		SubTotal - (4) Pygas	----	230	
		SubTotal - (7) Disproportionation	75	75	
Total - BENZENE			**235**	**465**	

Source: IHS Markit

Market proximity: Polyethylene (PE) – World

Sample Company

Chemical value chain color coding

The chart demonstrates the share of the top 5 players in the region for 2012, 2016, and 2021, as well as the shares of peer group companies. For each year, the chart depicts two bars, one bar for the top 5 players and the other one for the peer group companies. Legends for the top 5 players are listed on the left hand side of the chart while peer group company legends are listed on the right of the chart.

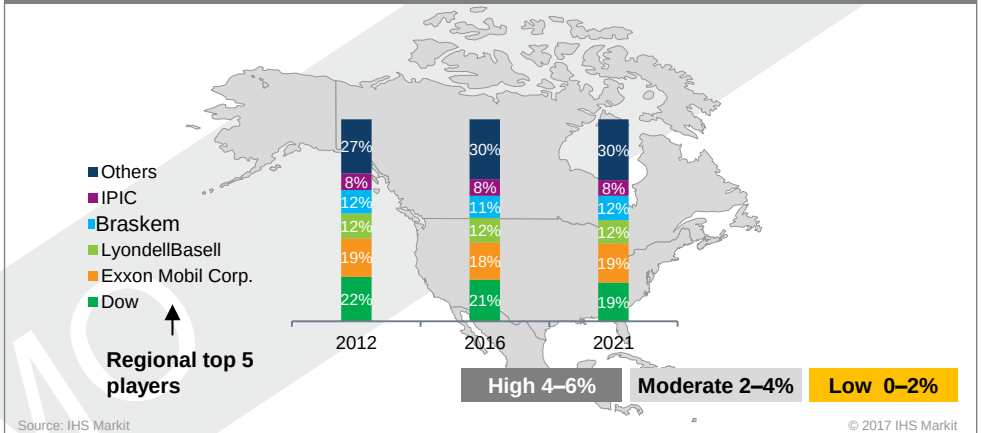
The colors attached to company names are not unique and depend on the company's position in the chart. The color of the region represents the compound annual growth rate (CAGR) for the product demand (domestic consumption plus exports) from 2016 to 2021 as per the legend provided at the bottom.

Consumption figures

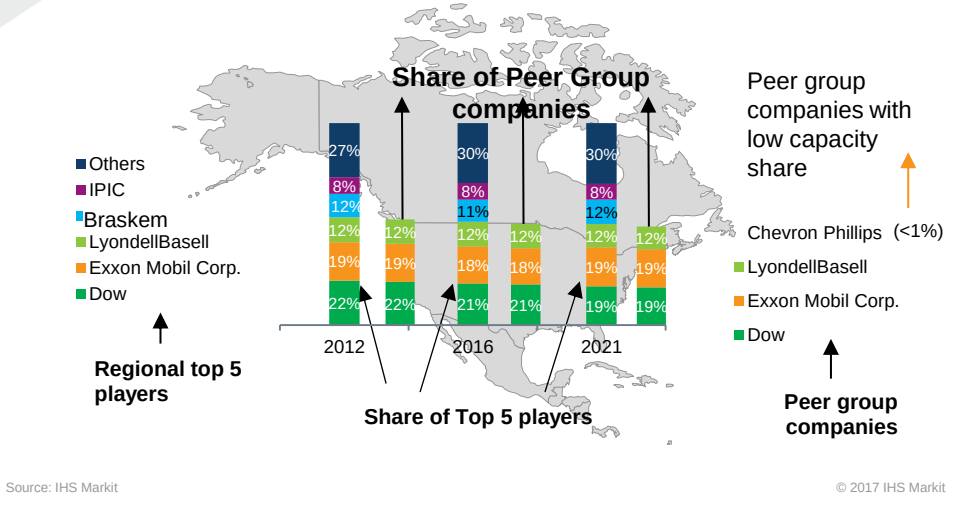
Example 1 indicates the capacity share of polyethylene manufacturers in North America for 2012, 2016, and 2021. The legend on the left side of the chart (Dow, Exxon Mobil Corp., LyondellBasell, Braskem, and IPIC) is for the top five North American ethylene manufacturers. The capacity shares of these top five players are depicted in the left-hand bar chart for the individual years. Example 2 is very much similar to example 1. However, it shows additional information around share of peer group companies. The legend on the right of the chart indicates the peer group companies with their capacity shares shown in the right-hand bar graphs for each year. When the share is too small to show in the chart, the values are shown in the peer companies legend, e.g., Chevron Phillips.

In example 1, the color of the region indicates the demand growth rate (including exports) for polyethylene between 2016 and 2021 as per the legend.

Example 1: Market proximity: With top 5 players

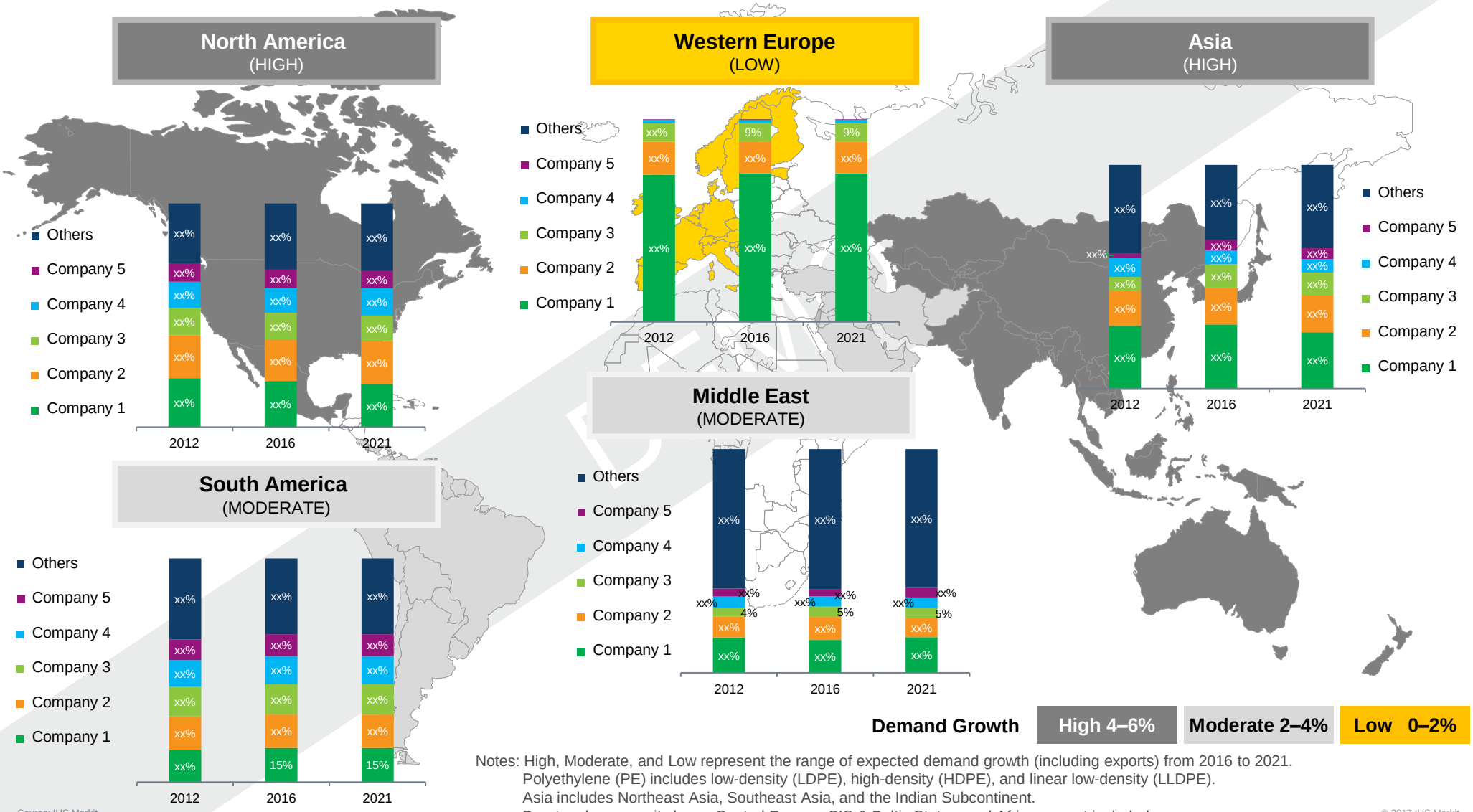


Example 2: Market proximity: With top 5 players and peer group



Market proximity: Polyethylene (PE) – World

Sample Company

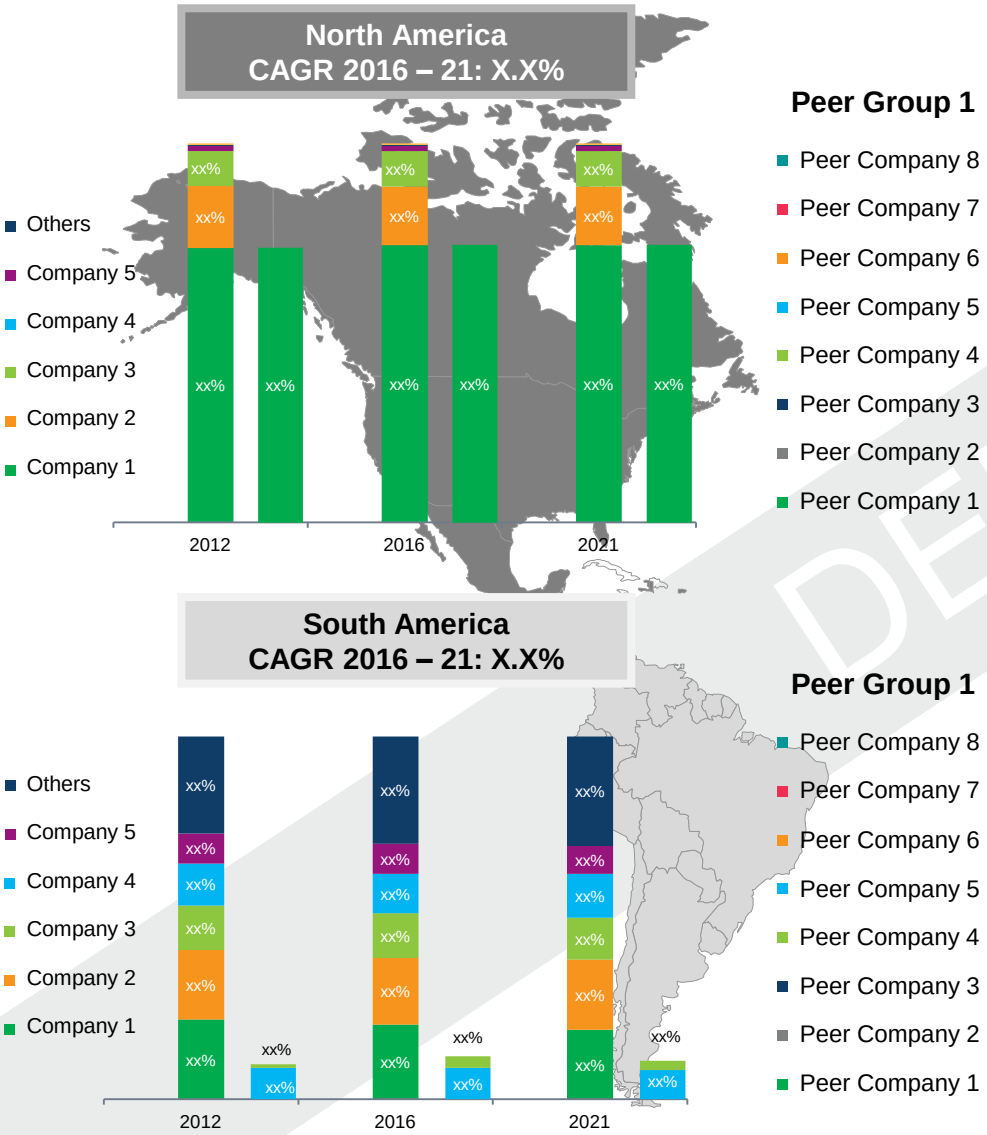


Source: IHS Markit

Notes: High, Moderate, and Low represent the range of expected demand growth (including exports) from 2016 to 2021.
Polyethylene (PE) includes low-density (LDPE), high-density (HDPE), and linear low-density (LLDPE).
Asia includes Northeast Asia, Southeast Asia, and the Indian Subcontinent.
Due to a low capacity base, Central Europe, CIS & Baltic States, and Africa are not included.

Market proximity: (PE) – Americas

Sample Company: Limited geographical diversification; PE assets located only in X

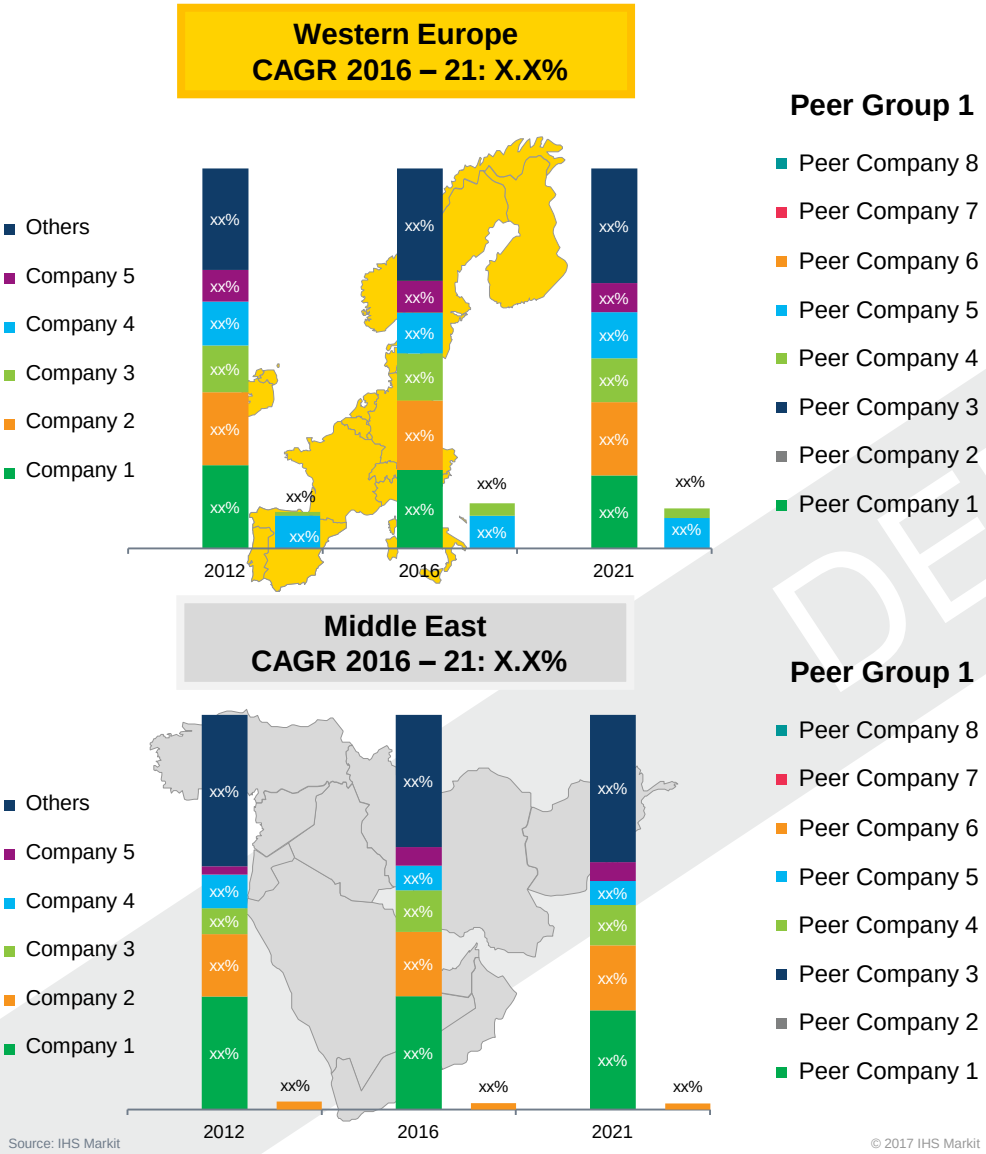


Source: IHS Markit

- The polyethylene industry in North America and South America is consolidated, with the top X players contributing to more than XX% of ethylene capacity in 2016.
- The North American polyethylene market is being transformed by the shale gas plays. Access to low-cost feedstocks is driving capacity expansions, with approximately XX million mt/y of new PE production capacity announcements to date.
- Presence in North America provides Sample company with the dual advantage of access to both X and X.
- North America is expected to have the strongest polyethylene demand growth from 2016 to 2021, with average annual growth rates of X.X%.
- Sample company is the leading market player in X production capacity and is among the top XX market players in XX production capacity in North America. The PE market in the region is dominated by X capacity, followed by X capacity, which rules Sample company out of the top X North American PE market players.
- PE production in South America is concentrated in Brazil, which accounts for about XX% of regional production, with Argentina and Venezuela contributing XX% and XX%.
- In the peer group, no company has direct access to the South American markets.

Market proximity: (PE) – Western Europe and Middle East

Assess production capability and ability to serve customers close to demand centers

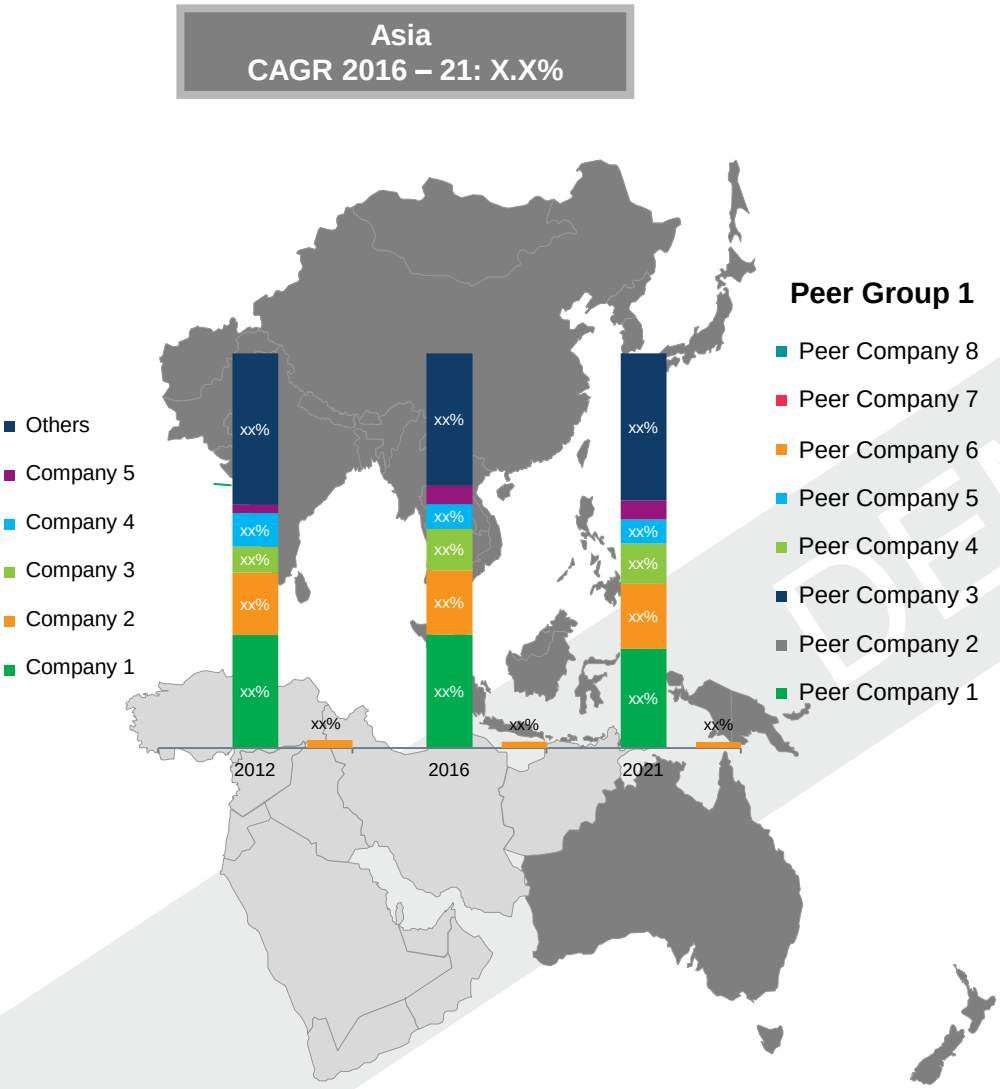


Source: IHS Markit

- Insights on industry structure, major regional players, effect of regional trends on sample company as well as competitors and major customers served

Market proximity: (PE) – Asia

Assess production capability and ability to serve customers close to demand centers



- Insights on industry structure, major regional players, effect of regional trends on sample company as well as competitors and major customers served

Source: IHS Markit

Sample Company linear low-density polyethylene capacity

XX

Company XYZ- Linear Low Density Polyethylene Capacity

Average Annual Capacities - (Thousand Metric Tons); Not Adjusted for Ownership Share

COMPANY	LOCATION	PROCESS	2016	2021	OWNERSHIP
XYZ	AAA City	(1) Gas Phase	120	120	100.00%
XYZ Inc.	BBB City	(1) Gas Phase	----	350	100.00%
		TOTAL(S)			
		SubTotal - (1) Gas Phase	120	470	
Total - LINEAR LOW DENSITY POLYETHYLENE			**120**	**470**	

Sample Company low-density polyethylene capacity

XX

Company XYZ - Low Density Polyethylene Capacity

Average Annual Capacities - (Thousand Metric Tons); Not Adjusted for Ownership Share

COMPANY	LOCATION	PROCESS	2016	2021	OWNERSHIP
XYZ Inc.	AAA City	(2) Tubular	255	255	60.00%
		TOTAL(S)			
		SubTotal - (2) Tubular	255	255	
Total - LOW DENSITY POLYETHYLENE			**255**	**255**	

Sample Company high-density polyethylene capacity

XX

Company XYZ - High Density Polyethylene Capacity

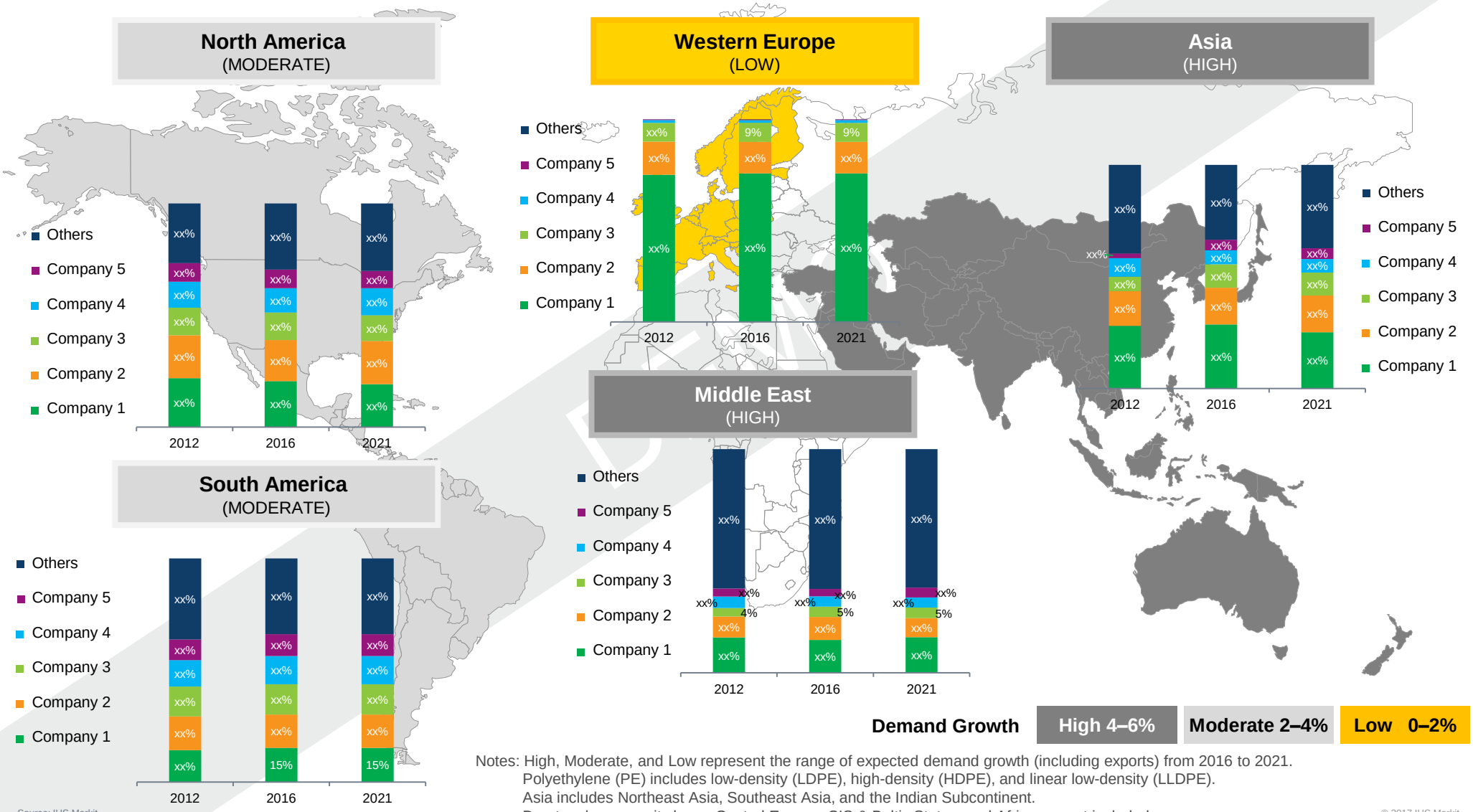
Average Annual Capacities - (Thousand Metric Tons); Not Adjusted for Ownership Share

COMPANY	LOCATION	PROCESS	2016	2021	OWNERSHIP
XYZ	AAA City	(4) Slurry Continuous Stirred Tank (CSTR)	120	120	100.00%
XYZ Inc	BBB City	(4) Slurry Continuous Stirred Tank (CSTR)	----	400	100.00%
		TOTAL(S)			
		SubTotal - (4) Slurry Continuous Stirred Tank (CSTR)	120	520	
Total - HIGH DENSITY POLYETHYLENE			**120**	**520**	

Source: IHS Markit

Market proximity: Polypropylene (PP)– World

Sample Company

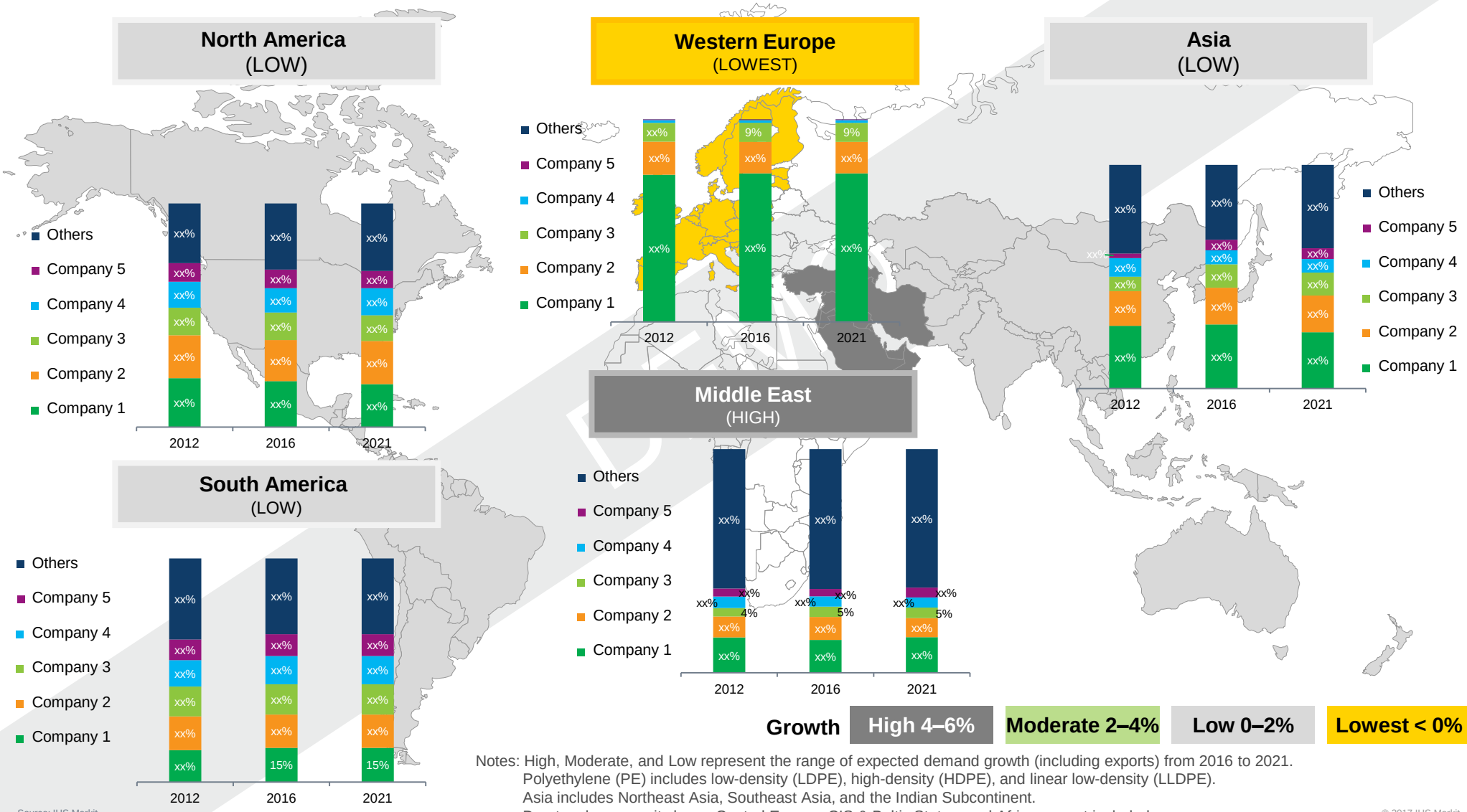


Source: IHS Markit

Notes: High, Moderate, and Low represent the range of expected demand growth (including exports) from 2016 to 2021.
Polyethylene (PE) includes low-density (LDPE), high-density (HDPE), and linear low-density (LLDPE).
Asia includes Northeast Asia, Southeast Asia, and the Indian Subcontinent.
Due to a low capacity base, Central Europe, CIS & Baltic States, and Africa are not included.

Market proximity: Polypropylene (PP)– World

Sample Company



Source: IHS Markit

Notes: High, Moderate, and Low represent the range of expected demand growth (including exports) from 2016 to 2021.
Polyethylene (PE) includes low-density (LDPE), high-density (HDPE), and linear low-density (LLDPE).
Asia includes Northeast Asia, Southeast Asia, and the Indian Subcontinent.
Due to a low capacity base, Central Europe, CIS & Baltic States, and Africa are not included.

Sample Company: Manufacturing profiles

Manufacturing profiles

The following key definitions provide an explanation of the numbers and symbols shown in the manufacturing site flowcharts

Chemical value chain color coding

The flowcharts are color-coded on the basis of the key monomer chemicals: benzene, crude C_4s, ethylene, propylene, chlor-alkali, styrene, toluene, and xylenes. Each of these key monomers has been assigned a color, which is then applied to derivatives that primarily consume the monomer as feedstock. The chart on the bottom right illustrates this, highlighting polypropylene (a propylene derivative) in green and EDC—a major ethylene derivative—in yellow.

Consumption figures

The derivative's capacity to consume a particular feedstock is shown in the top left corner in italics in the figure on the right. If there are two base chemical feedstocks, then two consumption figures will be identified in italics, one in the top left corner and the other in the top center. The colors behind the two numbers identify the feedstock.

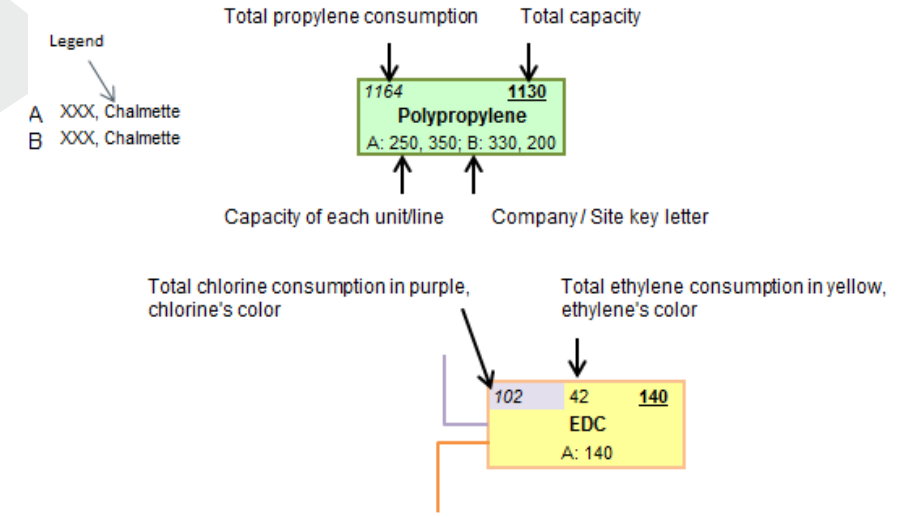
For instance, the EDC example indicates that 42 thousand mt/y of ethylene (in yellow) and 102 thousand mt/y of chlorine (in purple) are required to produce a total of 140 thousand mt/y of EDC.

Capacity figures

The last row in each box in the figure below refers to the product capacity listed separately by company and also by unit/line. Each letter refers to a key, which identifies the companies that operate at the site. A legend key on the flowchart shows the company names.

Finally, the underlined number in the top right corner gives the total capacity for the combined set of companies and units/lines.

Example: Capacity and consumption figures



Source: IHS Markit

Manufacturing profiles

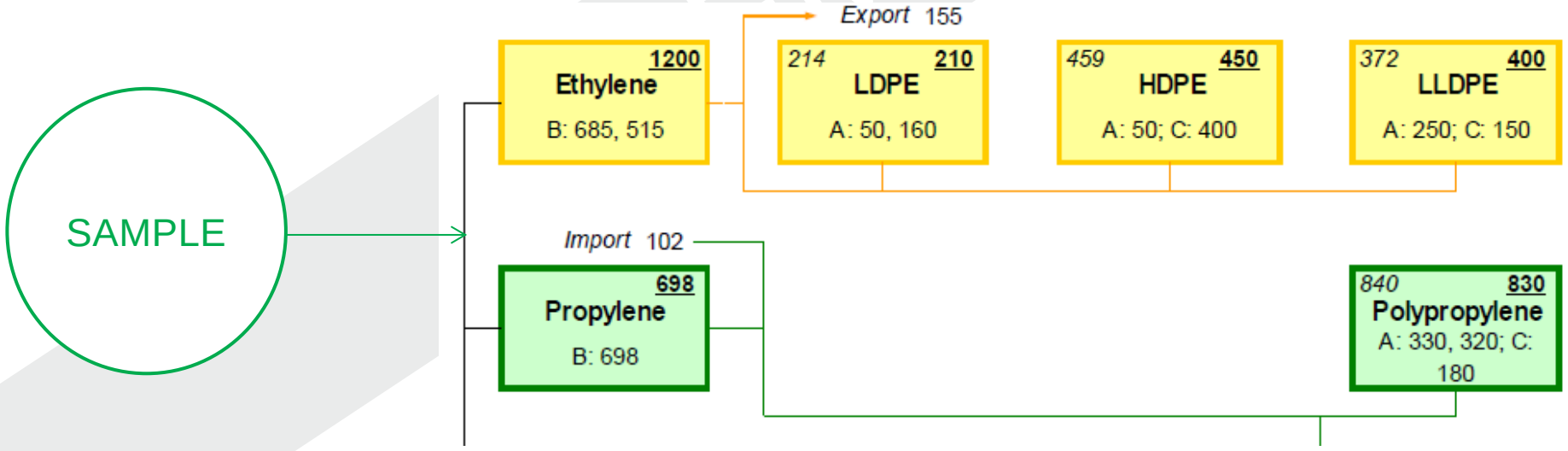
The following key definitions provide an explanation of the numbers and symbols shown in the manufacturing site flowcharts

Deficits as imports, surpluses as exports

The difference between the calculated feedstock requirements and the actual available feedstock capacity is shown as imports or exports. If the feedstock capacity falls short of the calculated requirements, the difference is shown as “Import” indicating the necessity to bring in feedstock from other locations to the site. Conversely, if the amount of available feedstock capacity exceeds the calculated combined requirements of the derivative units at the site, the difference will be listed as “Export.”

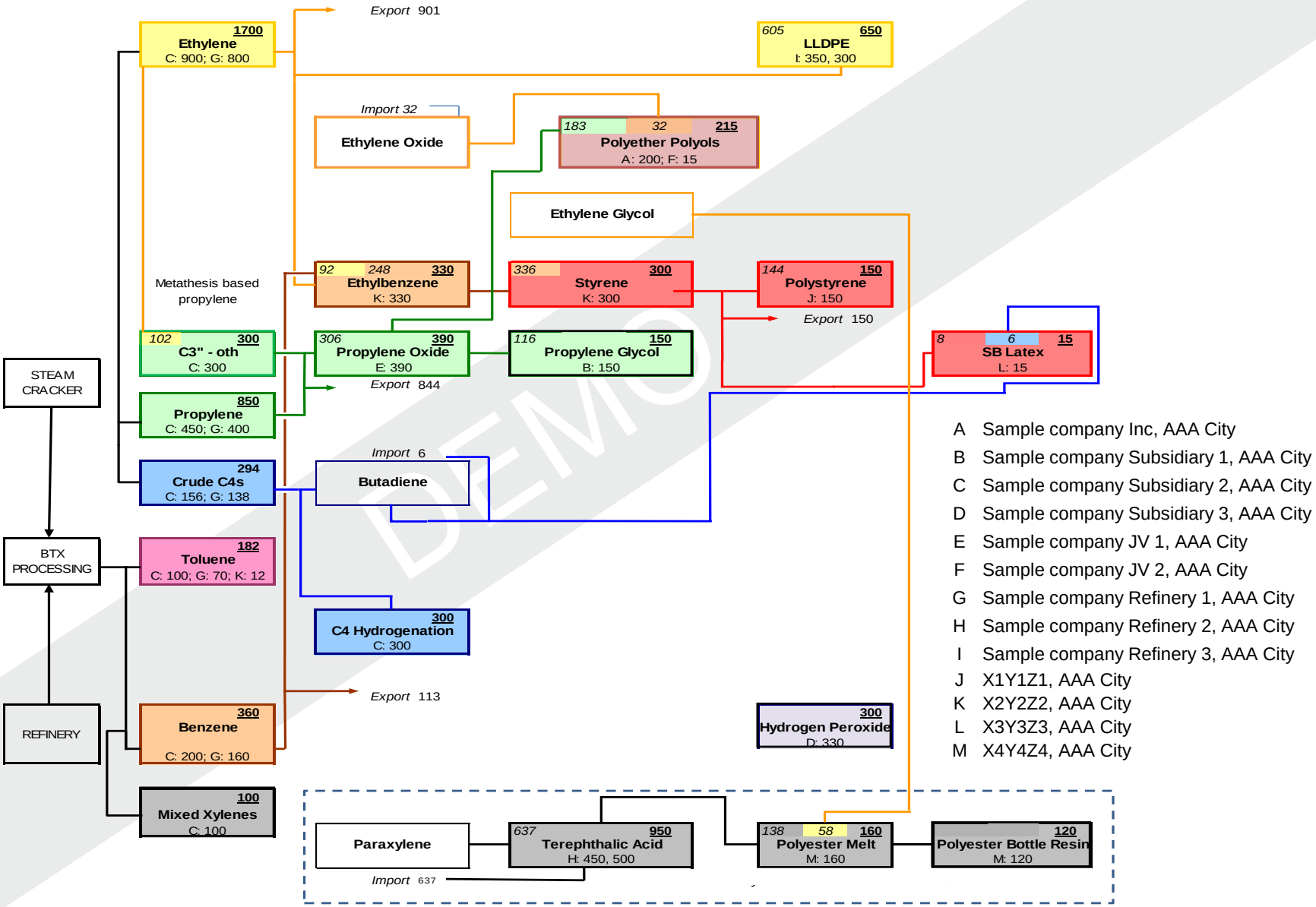
The terms do not suggest physical movements by ship or rail. In fact, the products may move only 100 meters (about 328 feet) via a pipe to a third party. However, within the definitions of the site/company balance under examination, when the site material balance shows a deficit or surplus, this is referred to as an “Import” or “Export” on the flowcharts.

Example: Understanding product deficit (import) and surplus (export) terminology



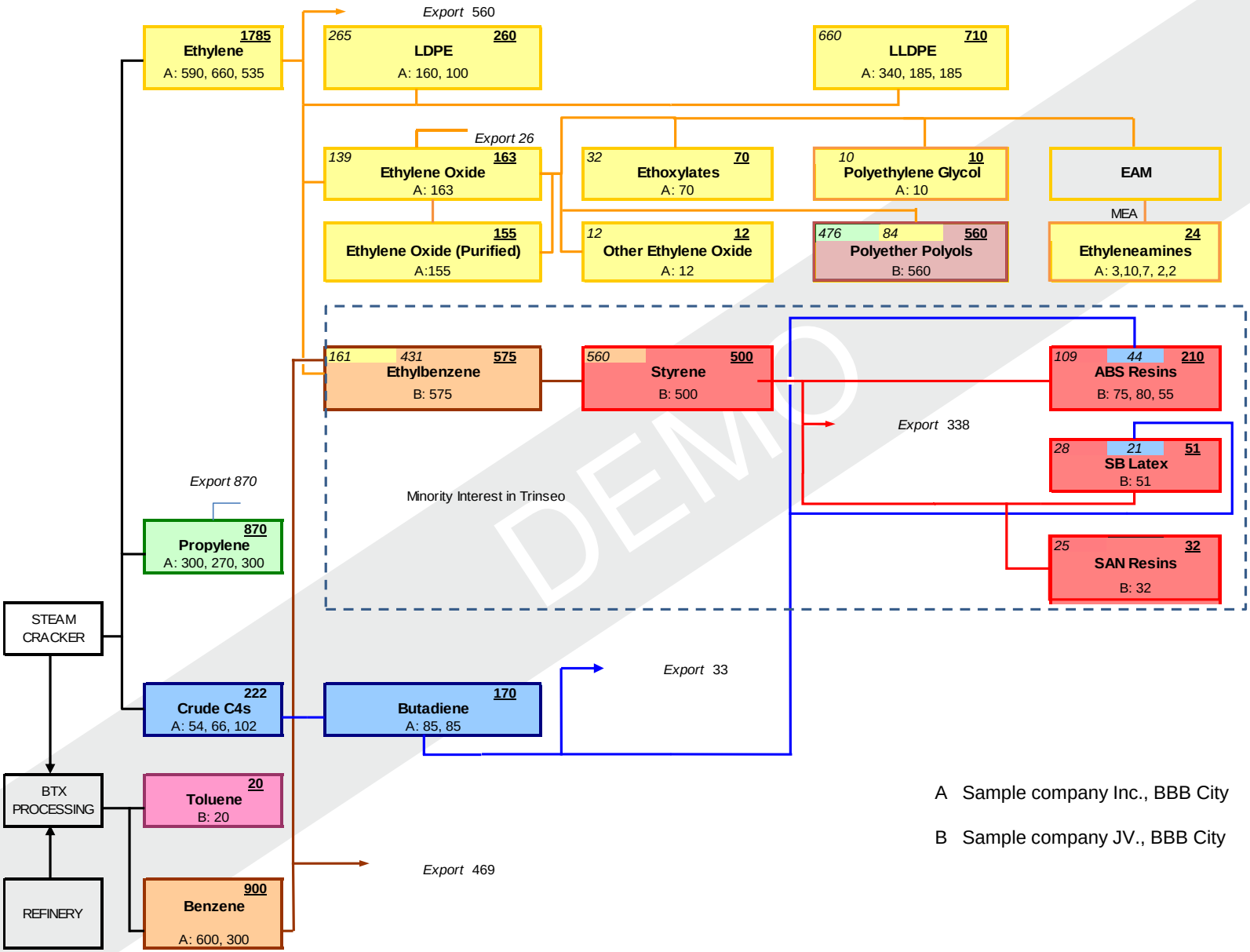
Source: IHS Markit

Sample Company at AAA City



Source: IHS Markit

Sample Company at BBB City



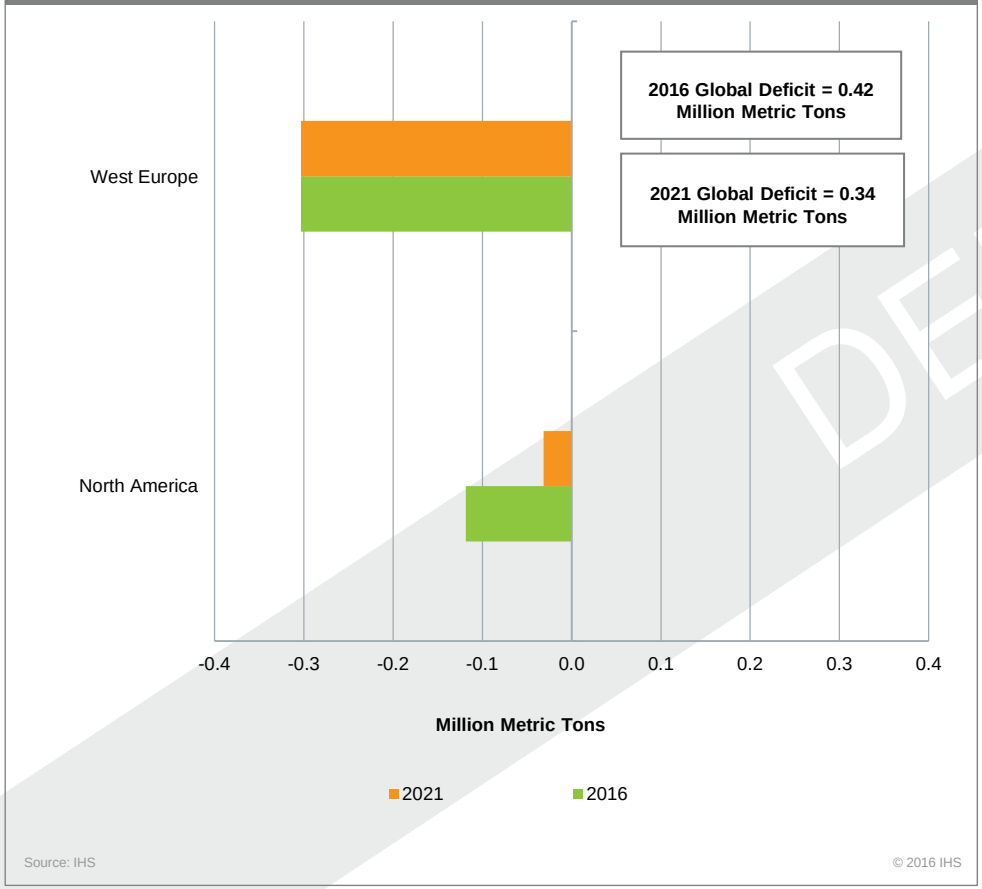
Source: IHS Markit

Sample Company: Integration analysis

Sample Company: Ethylene

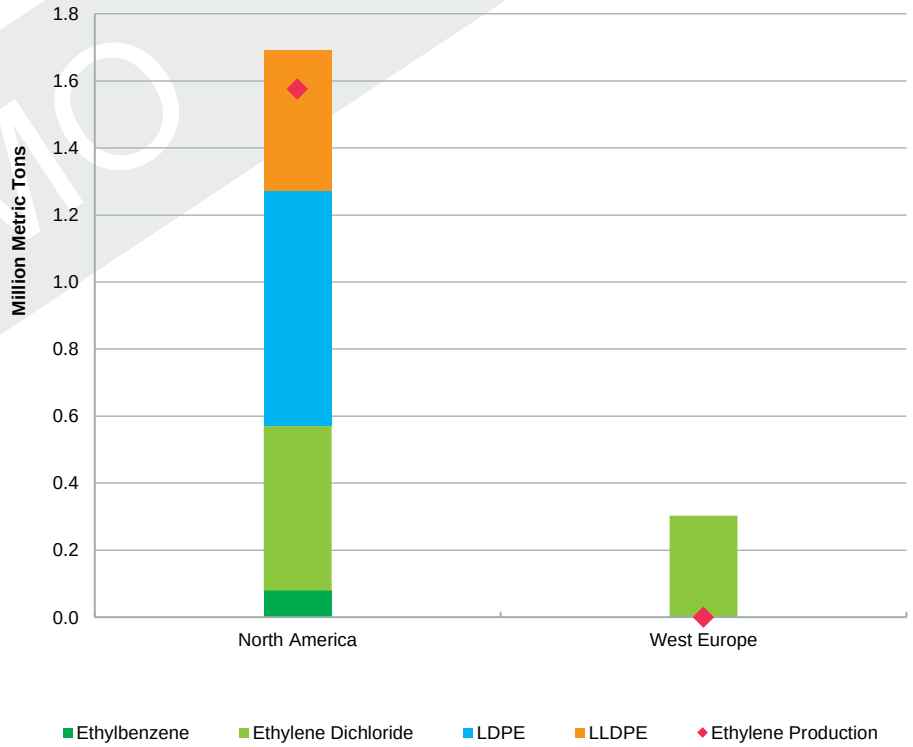
- Product Integration across geographies over a 5 year time horizon
- Insight on integration synergies, derivative slate, geographic reach and net surplus/deficit position.

Sample Company Regional Ethylene Surplus & Deficits



Source: IHS

Sample Company Ethylene Production & Derivative Consumption Capacity by Region - 2016

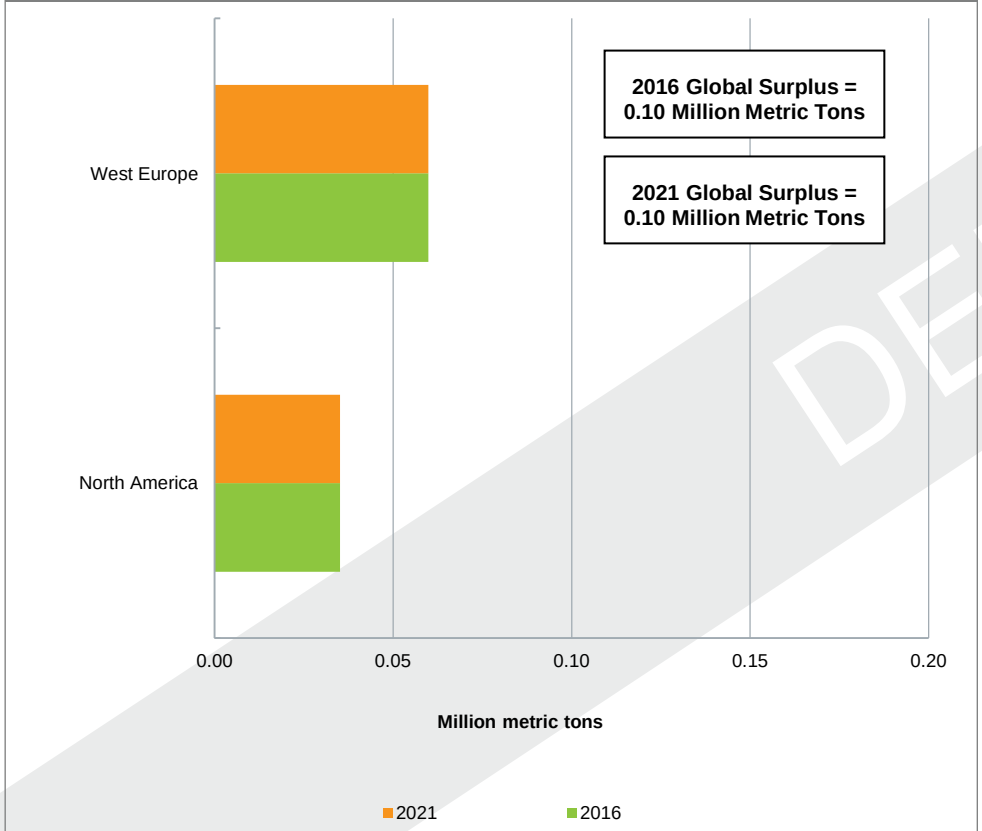


Source: IHS

Sample Company: Chlorine

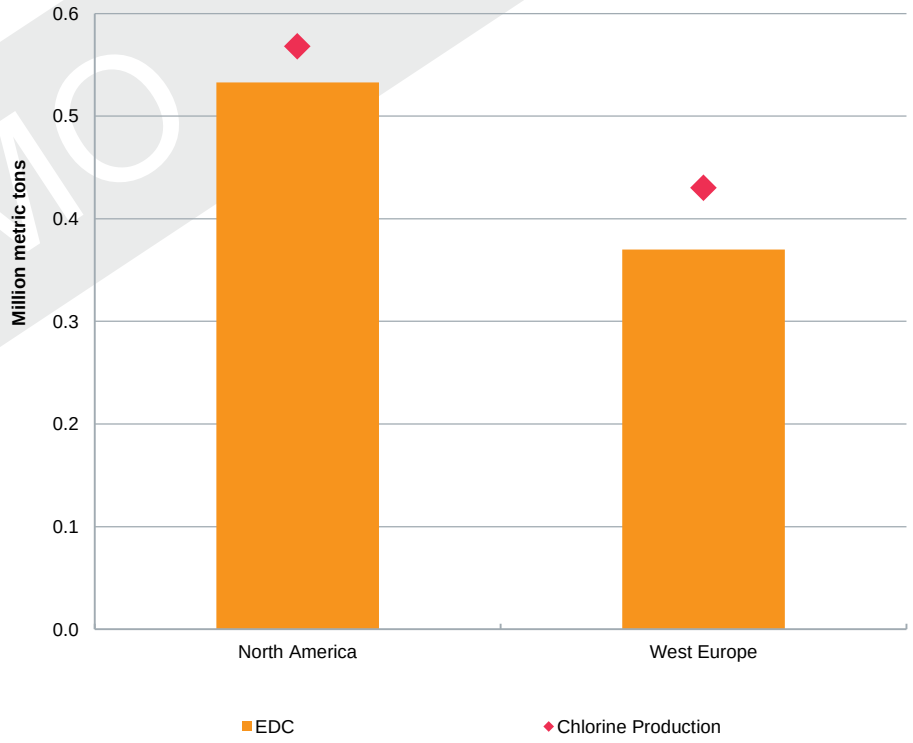
- Product Integration across geographies over a 5 year time horizon
- Insight on integration synergies, derivative slate, geographic reach and net surplus/deficit position.

Sample Company Regional Chlorine Surplus and Deficit



Source: IHS

Sample Company Chlorine Production and Derivative Consumption by Region—2016



Source: IHS

Appendix

Sample Company: Ethylene capacity integration

Company XYZ Ethylene Capacity Integration - 2016

Thousand Metric Tons - Shareholder Basis

				Capacity to Consume Ethylene					
Shareholder	Location	Ownership	Ethylene Capacity	Ethyl benzene	Ethylene Oxide	HDPE	LDPE	LLDPE	NET
SOUTHEAST ASIA									
Malaysia									
XYZ	AAA City	87.5%	350	----	----	----	----	----	350
XYZ Subsidiary 1	BBB City	30.0%	----	23	----	----	----	----	(23)
XYZ Subsidiary 2	CCC City	88.0%	528	----	----	----	----	----	528
XYZ Subsidiary 3	DDD City	100.0%	----	----	----	121	----	111	(232)
XYZ JV 1	EEE City	60.0%	----	----	----	----	155	----	(155)
XYZ JV 2	FFF City	100.0%	----	----	327	----	----	----	(327)
TOTAL - Malaysia			878	23	327	121	155	111	141
TOTAL - SOUTHEAST ASIA			878	23	327	121	155	111	141
WORLD									
WORLD TOTAL			**878**	**23**	**327**	**121**	**155**	**111**	**141**

Note: Capacities are pro-rated for ownership share.

Company XYZ Ethylene Capacity Integration - 2016

Thousand Metric Tons - Shareholder Basis

				Capacity to Consume Ethylene					
Shareholder	Location	Ownership	Ethylene Capacity	Ethyl benzene	Ethylene Oxide	HDPE	LDPE	LLDPE	NET
SOUTHEAST ASIA									
Malaysia									
XYZ	AAA City	87.5%	350	----	----	----	----	----	350
XYZ Subsidiary 1	BBB City	30.0%	----	23	----	----	----	----	(23)
XYZ Subsidiary 2	CCC City	88.0%	528	----	----	----	----	----	528
XYZ Subsidiary 3	DDD City	100.0%	----	----	----	121	----	111	(232)
XYZ JV 1	EEE City	60.0%	----	----	----	----	155	----	(155)
XYZ JV 2	FFF City	100.0%	----	----	327	----	----	----	(327)
TOTAL - Malaysia			878	23	327	121	155	111	141
TOTAL - SOUTHEAST ASIA			878	23	327	121	155	111	141
WORLD									
WORLD TOTAL			**878**	**23**	**327**	**121**	**155**	**111**	**141**

Note: Capacities are pro-rated for ownership share.

Source: IHS Markit

Sample Company: Product capacity (2011–2021)

Petrochemical Capacities - Company XYZ
Thousand Metric Tons - Shareholder Basis

COMPANY	PRODUCT	OWNERSHIP	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
			AFRICA										
South Africa													
XYZ SA	ALKYLATION	100%	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830
XYZ SA	BENZENE	100%	10	10	10	10	10	10	10	10	10	10	10
XYZ SA	FLUID CATALYTIC CRACKING UNITS	100%	22,600	22,600	22,600	22,600	22,600	22,600	22,600	22,600	22,600	22,600	22,600
XYZ SA	MIXED XYLENES	100%	20	20	20	20	20	20	20	20	20	20	20
XYZ SA	POLYGAS/DIMERSOL	100%	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
XYZ SA	CATALYTIC REFORMING	100%	21	21	21	21	21	21	21	21	21	21	21
XYZ SA	PROPYLENE: REFINERY GRADE	100%	40	40	40	40	40	40	40	40	40	40	40
XYZ SA	TOLUENE	100%	39	39	39	39	39	39	39	39	39	39	39
			SOUTHEAST ASIA										
Malaysia													
XYZ Malaysia	BENZENE	100%	150	150	150	150	150	150	150	150	150	150	150
XYZ Malaysia	BENZENE	100%	75	75	75	75	75	75	75	75	75	75	75
XYZ Malaysia	MIXED XYLENES	100%	374	374	374	374	374	374	374	374	374	374	374
XYZ Malaysia	MIXED XYLENES	100%	300	300	300	300	300	300	300	300	300	300	300
XYZ Malaysia	PARAXYLENE	100%	550	550	550	550	550	550	550	550	550	550	550
XYZ Malaysia	TOLUENE	100%	160	160	160	160	160	160	160	160	160	160	160
XYZ Malaysia	2-Ethylhexyl Acrylate	100%	60	60	60	60	60	60	60	60	60	60	60
XYZ Malaysia	ACRYLATE ESTERS	100%	50	50	50	50	50	50	50	50	50	50	50
XYZ Malaysia	ACRYLATE ESTERS	100%	60	60	60	60	60	60	60	60	60	60	60
XYZ Malaysia	ACRYLIC ACID - CRUDE	100%	160	160	160	160	160	160	160	160	160	160	160
XYZ Malaysia	BUTANEDIOL	100%	100	100	100	100	100	100	100	100	100	100	100
XYZ Malaysia	DIOCTYL PHTHALATE	100%	100	100	100	100	100	100	100	100	100	100	100
XYZ Malaysia	2-ETHYLHEXANOL	100%	80	80	80	80	80	80	80	80	80	80	80
XYZ Malaysia	Gamma-Butyrolactone	100%	13	13	13	13	13	13	13	13	13	13	13
XYZ Malaysia	ISOBUTANOL	100%	25	25	25	25	25	25	25	25	25	25	25
XYZ Malaysia	MALEIC ANHYDRIDE	100%	113	113	113	113	113	113	113	113	113	113	113
XYZ Malaysia	N-BUTYL ACRYLATE	100%	100	100	100	100	100	100	100	100	100	100	100
XYZ Malaysia	NORMAL BUTANOL	100%	135	135	135	135	135	135	135	135	135	135	135
XYZ Malaysia	PHTHALIC ANHYDRIDE	100%	40	40	40	40	40	40	40	40	40	40	40
XYZ Malaysia	POLYISOBUTYLENE (Highly Reactive)	100%	----	----	----	----	----	----	----	50	50	50	50
XYZ Malaysia	Tetrahydrofuran	100%	16	16	16	16	16	16	16	16	16	16	16
XYZ Malaysia	ACETIC ACID	100%	500	500	500	500	500	500	500	500	500	500	500
XYZ Malaysia	C4s HYDROGENATION	100%	20	20	20	20	20	20	20	20	20	20	20
XYZ Malaysia	Crude C4s (Contained Butadiene)	100%	10	10	10	10	10	10	10	10	10	10	10
XYZ Malaysia	ETHYLENE	100%	400	400	400	400	400	400	400	400	400	400	400
XYZ Malaysia	ETHYLBENZENE	100%	273	273	273	273	273	273	273	273	273	273	273
XYZ Malaysia	STYRENE	100%	240	240	240	240	240	240	240	240	240	240	240
XYZ Malaysia	TOLUENE	100%	10	10	10	10	10	10	10	10	10	10	10
XYZ Malaysia	Coker	100%	30	30	30	30	30	30	30	30	30	30	30
XYZ JV	BUTYL ACETATE	45%	49	49	----	----	----	----	----	----	----	----	----
XYZ JV	ETHANOLAMINES	45%	75	75	----	----	----	----	----	----	----	----	----
XYZ JV	ETHOXYLATES	45%	85	85	----	----	----	----	----	----	----	----	----
XYZ JV	GLYCOL ETHERS (E-SERIES)	45%	65	65	----	----	----	----	----	----	----	----	----
XYZ JV	NORMAL BUTANOL	45%	135	135	135	135	135	135	135	135	135	135	135
XYZ JV	POLYETHYLENE GLYCOL	45%	15	15	15	15	15	15	15	15	15	15	15
XYZ JV	DIETHYLENE GLYCOL	45%	20	20	----	----	----	----	----	----	----	----	----
XYZ JV	ETHYLENE OXIDE	45%	385	385	----	----	----	----	----	----	----	----	----
XYZ JV	MONOETHYLENE GLYCOL	45%	380	380	----	----	----	----	----	----	----	----	----
XYZ JV	ETHYLENE OXIDE (PURIFIED)	45%	140	140	----	----	----	----	----	----	----	----	----
XYZ JV	TRIETHYLENE GLYCOL	45%	1	1	----	----	----	----	----	----	----	----	----
XYZ JV	Crude C4s (Contained Butadiene)	45%	20	20	20	20	20	20	20	20	20	20	20
XYZ JV	ETHYLENE	45%	600	600	600	600	600	600	600	600	600	600	600
XYZ JV	PROPYLENE: POLYMER/CHEMICAL GRADE	45%	95	95	95	95	95	95	95	95	95	95	95
XYZ JV	HIGH DENSITY POLYETHYLENE	45%	150	150	150	240	190	120	120	120	120	120	120
XYZ JV	LINEAR LOW DENSITY POLYETHYLENE	45%	100	100	100	10	60	120	120	120	120	120	120
XYZ JV	LOW DENSITY POLYETHYLENE	45%	255	255	255	255	255	255	255	255	255	255	255
XYZ JV	METHANOL	45%	70	70	70	70	70	70	70	70	70	70	70
XYZ JV	CATALYTIC REFORMING	45%	21	21	21	21	21	21	21	21	21	21	21
XYZ JV	PROPYLENE: POLYMER/CHEMICAL GRADE	45%	300	300	300	300	300	300	300	300	300	300	300
XYZ JV	METHANOL	45%	750	750	750	750	750	750	750	750	750	750	750
XYZ JV	METHANOL	45%	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700
XYZ JV	CATALYTIC REFORMING	45%	24	24	24	24	24	24	24	24	24	24	24
XYZ JV	CATALYTIC REFORMING	45%	28	28	28	28	28	28	28	28	28	28	28
XYZ JV	BUTADIENE	45%	----	----	----	----	----	----	----	----	----	180	180
XYZ JV	BENZENE	45%	----	----	----	----	----	----	----	----	----	230	230
XYZ JV	Crude C4s (Contained Butadiene)	45%	----	----	----	----	----	----	----	----	----	173	173
XYZ JV	DIETHYLENE GLYCOL	45%	----	----	----	----	----	----	----	----	----	50	50
XYZ JV	ETHYLENE OXIDE	45%	----	----	----	----	----	----	----	----	----	560	560
XYZ JV	ETHYLENE	45%	----	----	----	----	----	----	----	----	----	1,200	1,200
XYZ JV	FLUID CATALYTIC CRACKING UNITS	45%	----	----	----	----	----	----	----	----	----	200,000	200,000

Source: IHS Markit

Sample Company: Product capacity (2011–2021)

Petrochemical Capacities - Company XYZ
Thousand Metric Tons - Shareholder Basis

TOTAL(S)		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
2-Ethylhexyl Acrylate	SubTotal - (1) via 2-Ethylhexyl Alcohol and Acrylic Acid	60	60	60	60	60	60	60	60	60	60	60
Total - 2-Ethylhexyl Acrylate		**60**	**60**	**60**	**60**	**60**	**60**	**60**	**60**	**60**	**60**	**60**
ACRYLATE ESTERS	SubTotal - (1) Butyl Acrylate	50	50	50	50	50	50	50	50	50	50	50
ACRYLATE ESTERS	SubTotal - (4) 2-Ethylhexyl Acrylate	60	60	60	60	60	60	60	60	60	60	60
Total - ACRYLATE ESTERS		**110**	**110**	**110**	**110**	**110**	**110**	**110**	**110**	**110**	**110**	**110**
ACRYLIC ACID - CRUDE	SubTotal - (1) Propylene Based	160	160	160	160	160	160	160	160	160	160	160
Total - ACRYLIC ACID - CRUDE		**160**	**160**	**160**	**160**	**160**	**160**	**160**	**160**	**160**	**160**	**160**
ALKYLATION	SubTotal - (2) Hydrofluoric Acid	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830	2,830
Total - ALKYLATION		**2,830**	**2,830**	**2,830**	**2,830**	**2,830**	**2,830**	**2,830**	**2,830**	**2,830**	**2,830**	**2,830**
AMMONIA	SubTotal - (1) Natural Gas	945	945	945	945	945	945	1,638	1,638	1,638	1,638	1,638
Total - AMMONIA		**945**	**945**	**945**	**945**	**945**	**945**	**1,638**	**1,638**	**1,638**	**1,638**	**1,638**
ANHYDROUS HCL	SubTotal - (3) VCM By Product	234	234	----	----	----	----	----	----	----	----	----
Total - ANHYDROUS HCL		**234**	**234**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**
BUTYL ACETATE	SubTotal - (1) Esterification	49	49	49	49	49	49	49	49	49	49	49
Total - BUTYL ACETATE		**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**
BUTADIENE	SubTotal - (3) By-Product Extraction	----	----	----	----	----	----	----	----	----	180	180
Total - BUTADIENE		**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**180**	**180**
BUTANEDIOL	SubTotal - (2) N-Butane (Maleic Anhydride)	100	100	100	100	100	100	100	100	100	100	100
Total - BUTANEDIOL		**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
BENZENE	SubTotal - (1) Reformate	160	160	160	160	160	160	160	160	160	160	160
BENZENE	SubTotal - (4) Pygas	----	----	----	----	----	----	----	----	----	230	230
BENZENE	SubTotal - (7) Disproportionation	75	75	75	75	75	75	75	75	75	75	75
Total - BENZENE		**235**	**235**	**235**	**235**	**235**	**235**	**235**	**235**	**235**	**465**	**465**
C4s HYDROGENATION	SubTotal - (2) C4s Hydrogenation	20	20	20	20	20	20	20	20	20	20	20
Total - C4s HYDROGENATION		**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**
Crude C4s (Contained Butadiene)	SubTotal - (1) Ethane	10	10	10	10	10	10	10	10	10	10	10
Crude C4s (Contained Butadiene)	SubTotal - (2) Ethane/Propane	20	20	20	20	20	20	20	20	20	20	20
Crude C4s (Contained Butadiene)	SubTotal - (5) Naphtha	----	----	----	----	----	----	----	----	----	173	173
Total - Crude C4s (Contained Butadiene)		**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**203**	**203**
ETHYLENE DICHLORIDE	SubTotal - (2) Oxychlorination only	320	320	----	----	----	----	----	----	----	----	----
Total - ETHYLENE DICHLORIDE								**----**	**----**	**----**	**----**	**----**
Coker	SubTotal - (1) Delayed	30	30	30	30	30	30	30	30	30	30	30
Total - Coker		**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**

Source: IHS Markit

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