Petrochemical Industry - Key Geographies Experiencing Change in Feedstock Scenario

Reference Code: GDCH005TR

The global petrochemical industry is witnessing significant changes in the feedstock supply trend. The most important change is occurring in the Middle East petrochemical industry, which is experiencing a decline in the supply of ethane feedstock. Simultaneously, North American countries are hugely benefitting from newly-discovered petroleum reserves, which are potential feedstock sources for the petrochemical industry. The petrochemical industries in South America, Central America and Europe are also anticipating feedstock availability from pre-salt and shale gas reserves respectively. These developments in the petroleum and natural gas industries will cause a substantial change in the availability and type of petrochemical feedstock used in the major geographies of the world.

Naphtha, Natural Gas and Coal are the Major Petrochemical Feedstocks Which Determine the Cost Structure of a Plant

Feedstock cost is the most important factor that determines the competitiveness of the petrochemical producers. It accounts for the largest portion of production cost, making it imperative for the petrochemical producers to choose a feedstock that provides a cost advantage. However, feedstock options for the petrochemical producers are limited and depend on the location of the manufacturing facilities. Naphtha, natural gas and coal are the three major feedstocks used in the global petrochemical industry. Most of the regions are dominated by one feedstock. While naphtha is a dominant feedstock used for petrochemical production in Asia Pacific and Europe, natural gas is dominant in the Middle East, Africa, and North America.

Naphtha and natural gas are converted into petrochemicals by a process known as steam cracking. Naphtha is a liquid mixture of hydrocarbon produced from distillation of crude oil and is directly used in the steam cracking. Natural gas is not used directly in steam cracking but its components such as ethane, propane and butane are used to produce petrochemical. These components are produced as by-products during extraction of methane from natural gas. Mixtures of these gases are known as Natural Gas liquids (NGLs) and are most prevalent in the Middle Eastern countries for the petrochemical production. Coal is another major feedstock used for petrochemical production but its use is limited to the Chinese market, which accounted for more than XX% of coal consumption as a feedstock in 2010.

Selection of Feedstock for a Plant Depends on the Availability of Petroleum Resources and Production Cost

The global petrochemical industry is dominated by naphtha feedstock, which accounts for the largest share in the petrochemical production. However, the selection of feedstock depends on many factors, such as the availability of petroleum resources and the production cost of the feedstock in the region. The Middle Eastern petrochemical producers use natural gas as key feedstock as it is available to them at subsidized prices. The subsidies on natural gas in the Middle Eastern countries make it XX-XX% cheaper compared to natural gas in Europe and North America. Availability of huge natural gas resources has brought the Middle East to the forefront of global petrochemical industry, making it the most competitive region in the world.

Apart from the Middle East, natural gas is also the dominant feedstock in North America, which holds large natural gas reserves. Recent discoveries of shale gas reserves have further boosted natural gas production in North America, and the petrochemical industry is aligning itself to utilize NGL production from these reserves. Use of naphtha and natural gas is balanced in the South and Central American regions, with the availability of sufficient liquid and gaseous feedstock.

Asia Pacific is the largest and fastest growing petroleum and petrochemical market with the highest demand for crude oil. Refineries in Asia Pacific produce naphtha when processing crude oil, making naphtha the preferred feedstock in the region. Europe is scarce in petroleum resources forcing it to rely on imported naphtha or crude oil, since these can be transported easily.

Globally, XX% of basic petrochemical installed capacity is based on naphtha in 2010. It was followed by natural gas which accounted for XX% of basic petrochemical capacity.

![Global Petrochemical Industry, Basic Petrochemical Installed Capacity by Feedstock, %, 2010](source: GlobalData, Petrochemicals eTrack)
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2 Introduction

2.1 Overview

The global petrochemical industry is witnessing change in the pattern of feedstock usage. The major feedstocks used for the petrochemical production are naphtha, natural gas and coal. In North America and the Middle East, natural gas is the dominant feedstock used for petrochemical production, whilst in Asia Pacific, Europe, and South and Central America, naphtha is dominant. However, there has been a gradual shift in the type of feedstock used in the major geographies of the world. The most crucial change is happening in the Middle East where the majority of the crackers are gas-based. The petrochemical industry in this region has benefited from the natural gas subsidies given by the governments to the producers. These brought down the production cost significantly, thereby making the Middle East the most competitive region.

Ethylene is a basic building block which is produced from any of the feedstock mentioned above, and approximately XX% of all other petrochemicals are derived from it. Ethylene yield in naphtha cracker is much lower compared to an ethane cracker, due to the high ethane content of ethylene.

In a cracker, propylene and butadiene are produced along with ethylene but in relatively lower amounts. The Middle East established itself as a global hub for petrochemical production on account of subsidized gaseous feedstock, but this advantage is fast depleting as the availability of natural gas in the region is decreasing. Petrochemical producers in the region are shifting from natural gas to naphtha because of the scarcity of gaseous feedstock. The decline in the gaseous feedstock can be attributed to the subsidies extended to other sectors of the economy, such as power and transportation. Rising demand for natural gas from other sectors has made it difficult for petrochemical producers to secure a regular feedstock supply. Due to this, the region is now losing the advantage of cheaper feedstock. New petrochemical projects, which are expected to come on-stream in the next five years in the Middle East, are therefore switching from natural gas to naphtha. This is evident by the choice of feedstock in the upcoming petrochemical projects in the region.

A change in feedstock pattern is also being observed in North America where natural gas is a dominant feedstock, but the bulk of the natural gas supply is expected to come from shale gas sources. Discovery of new shale gas sources in many states of North America has further increased the possibility of shale gas as the major source of petrochemical feedstock. The region has immense potential to lead the global petrochemical industry utilizing its huge shale gas reserves, as many of the shale gas reserves in the region contain wet natural gas. The shale gas sources are expected to produce petrochemical feedstock commercially from 2015 onwards. Many petrochemical projects planned in the US are using feedstock produced from shale gas.
2.2 GlobalData Report Guidance

- The report starts with an executive summary, which captures the key points of the global petrochemical industry and the major forces impacting the feedstock supply scenario in different regions.
- Chapter three discusses the major petrochemical feedstocks such as naphtha, natural gas and coal, and also their sources. It also discusses the factors controlling the feedstocks supply dynamics.
- Chapter four gives details of petrochemical feedstock usage by geographies such as Asia Pacific, North America, the Middle East, Europe, and South and Central America.
- Chapter five discusses the ethane feedstock supply scenario in the Middle East. It analyzes the natural gas supply situation in the Middle East and the factors responsible for the shortage. It also gives detailed information about naphtha-based projects planned in the Middle East.
- Chapter six analyzes the potential impact of shale gas and oil sand discoveries on feedstock supply in the North American petrochemical industry. It describes the impact of shale gas discoveries on the US natural gas production, and the impact of oil sand discoveries on the crude oil supply in Canada.
- Chapter seven analyzes the development of the Brazilian pre-salt reserves on its petroleum and petrochemical industry. It also discusses the government’s role in developing the pre-salt reserves.
- Chapter eight analyzes the present status of shale gas reserves and the impact of their development on the European petrochemical industry.
4.2 Natural Gas Reserves in North America Provide Ethane Feedstock for the Petrochemical Industry

North America has vast natural gas reserves in the Gulf of Mexico and the state of Texas, which provide feedstock for its petrochemical industry. The US holds the world’s XX largest proven natural gas reserves, providing feedstocks such as ethane, propane and butane. Most of the domestic natural gas reserves in the US are concentrated in five states: Louisiana, New Mexico, Oklahoma, Texas, and Wyoming. Canada also holds substantial natural gas reserves in Alberta and British Columbia. These reserves provide fuel as well as the petrochemical feedstock required in the region. Under the North American Free Trade Agreement (NAFTA), companies in these two countries can trade freely with each other, making it easier for both to access feedstock.

Natural gas prices are relatively more stable than naphtha prices, which makes it attractive for petrochemical production. Well-developed transportation, good infrastructure and the lower cost of extraction makes natural gas the preferred feedstock. Therefore, most of the crackers in North America are based on natural gas.

The following figure provides the basic petrochemicals capacity split by feedstock in North America in 2010. Natural gas accounted for XX% of the basic petrochemicals capacity, followed by naphtha and coal which accounted respectively for XX% and XX% of the basic petrochemical capacity in the region. Other feedstocks accounted for XX% of the basic petrochemicals capacity.

![Graph showing petrochemical capacity by feedstock in North America in 2010.](image)

Source: GlobalData, Petrochemicals eTrack

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Natural Gas</td>
<td></td>
</tr>
<tr>
<td>Naphtha</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
</tr>
</tbody>
</table>

Source: GlobalData, Petrochemicals eTrack
5.3.4 Increase in the Domestic Demand has Brought Down Saudi Arabia’s Ethane Exports

Saudi Arabia is the largest producer of ethane, but stopped exporting it in order to satisfy domestic demand. Large scale ethylene capacity expansion in Saudi Arabia led to an increase in domestic demand for ethane feedstock. This caused the export of ethane from Saudi Arabia to start declining, eventually stopping in 2006. The following figure shows the comparison between ethane production and exports in the period 2002–2010.

Figure 14: Saudi Arabia Petrochemical Industry, Ethane Production and Exports, Trillion BTU, 2002–2010

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
<th>Exports</th>
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<tbody>
<tr>
<td>2002</td>
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<td>2003</td>
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<td>2010</td>
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</table>

Source: GlobalData, Saudi Aramco
9 Appendix

9.1 Definitions

9.1.1 Installed Plant Capacity
The maximum rated output of a plant under specific conditions designated by the manufacturer. The installed capacity is usually indicated in units of tons on a nameplate physically attached to the plant.

9.1.2 Key Feedstock
The key feedstock in the petrochemical industry refers to the primary raw materials that serve as a building block for the entire petrochemical industry. Naphtha, natural gas, Liquefied Petroleum Gas (LPG), ethanol and coal are the key feedstocks being used in the petrochemical industry.

9.1.3 Process
A process is a combination of unit operations used in the manufacturing of petrochemicals to change the composition of chemicals.

9.1.4 Technology
Technology is referred to as a technical process used in the petrochemical industry, which is developed by a specific business entity.

9.2 Abbreviations

OPEC – Organization of the Petroleum Exporting Countries

MMtpa – Million Metric Tons per Annum

CAGR – Compound Annual Growth Rate

WCSB – Western Canadian Sedimentary Basin

MMcf – Million cubic feet

bcf – Billion cubic feet

tcf – Trillion cubic feet

MMbbl – Million barrels

MMbtu – Million British thermal unit

NGLs – Natural Gas Liquids

9.3 GlobalData's Research Methodology
GlobalData’s dedicated research and analysis teams consist of experienced professionals with a pedigree in marketing, market research and consulting backgrounds in the petrochemical industry, with advanced statistical expertise.

GlobalData adheres to the Codes of Practice of the Market Research Society (www.mrs.org.uk) and the Society of Competitive Intelligence Professionals (www.scip.org).

All GlobalData databases are continuously updated and revised. The following research methodology is followed for all databases and reports.
9.3.1 Coverage
- The objective of updating GlobalData coverage is to ensure that it represents the most up-to-date vision of the industry as possible.
- Changes in the industry taxonomy are built on the basis of extensive research of company, association and competitor sources.
- Company coverage is based on three key factors: market capitalization, revenues and media attention/innovation/market potential.
- An exhaustive search of 56 member exchanges is conducted and companies are prioritized on the basis of their market capitalization.
- The estimated revenues of all major companies, including private and governmental, are gathered and used to prioritize coverage.
- Companies which are making the news, or which are of particular interest due to their innovative approach are prioritized.
- GlobalData aims to cover all major news events and deals in the petrochemical industry, updated on a daily basis.
- The coverage is further streamlined and strengthened with additional inputs from GlobalData’s expert panel (see below).

9.3.2 Secondary Research
The research process begins with exhaustive secondary research on internal and external sources, carried out to source qualitative and quantitative information relating to each market.

The secondary research sources that are typically referred to include, but are not limited to:
- Company websites, annual reports, financial reports, broker reports, investor presentations and SEC filings.
- Industry trade journals and other literature.
- Internal and external proprietary databases.
- National government documents, statistical databases and market reports.
- News articles, press releases and web-casts specific to the companies operating in the market.

9.3.3 Primary Research
GlobalData conducts hundreds of primary interviews a year with industry participants and commentators in order to validate its data and analysis. A typical research interview fulfills the following functions:
- It provides first-hand information on the market size, market trends, growth trends, competitive landscape, and future outlook.
- It helps in validating and strengthening the secondary research findings.
- It further develops the analysis team’s expertise and market understanding.

Primary research involves e-mail correspondence and telephone interviews as well as face-to-face interviews for each market, category, segment and sub-segment across geographies.

The participants who typically take part in such a process include, but are not limited to:
- Industry participants: CEOs, VPs, business development managers, market intelligence managers and national sales managers.
- Outside experts: investment bankers, valuation experts, research analysts and key opinion leaders specializing in the petrochemical industry.
9.3.4  Expert Panel Validation

GlobalData uses a panel of experts to cross verify research and forecast methodologies, and drive its analytical content.

The GlobalData expert panel comprises marketing managers, product specialists, international sales managers from petrochemical companies; academics from research universities and consultants from professional services companies.

9.5  Disclaimer

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