



IHS CHEMICAL

Chemical Industry Capital Costs: A Global Spending Outlook

Special Report Prospectus



IHS Chemical Prospectus

Contents

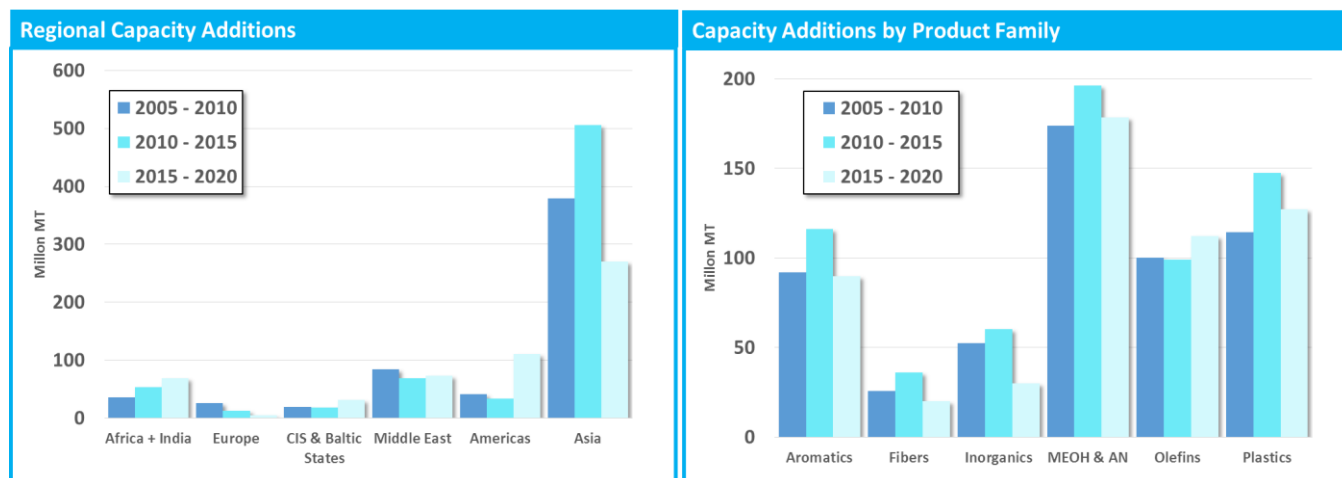
Introduction	3
Study Objective	4
Key Questions.....	6
Study Scope.....	7
Deliverables	8
Table of Contents.....	9
Methodology	11
Study Team.....	12
Qualifications.....	13
About IHS Chemical.....	16
About IHS.....	17
Contact Information.....	18



Introduction

The global chemical industry will spend more than \$2 trillion over the next 20 years. Do you need to know where, when, and how this money will be spent?

New sources of feedstocks have significantly impacted the chemical industry, causing shifts in how much capacity will be added and where it will be located. Over the last few years, coal-based processes have expanded in China, while shale gas has resulted in a renaissance of the North American chemical industry. From 2009 to 2013, Asia added close to 400 million metric tons of chemical capacity. From 2014 to 2018, North America is expected to add 60 million metric tons of chemical capacity, which is forecast to surpass the 50 million metric tons of chemical capacity added in the Middle East. Feedstock changes are impacting the process technologies used for chemical production, and the volume of product made in each region. Understanding the changing trends in chemical capital spending is essential for companies that service the downstream sector.



Current market uncertainty resulting from the sharp decline in oil prices has significant implications for upstream capital spending – what will be the impact downstream? Continued, but slower demand growth requires continuous investment; however, the industry is coming off a period of record downstream spending. The decline in oil prices will have implications on both feedstock and geographic decisions for capital projects – some regions may have to delay investments due to capital availability. The uncertainty surrounding oil prices and the resulting impact on downstream spending is critical information for the companies serving this market, who may need to quickly adjust their current spending plans.

This **Chemical Industry Capital Costs: A Global Spending Outlook** study merges a broad range of detailed information IHS Chemical maintains on markets, process technologies and projects, and future capacity requirements to provide a detailed bottom-up analysis of the outlook for capacity additions and associated spending in the chemicals industry. Utilizing detailed country-level analysis for nearly 80 chemical products, this analysis provides a unique insight into how capacity additions and associated spending will shift over the next decade.

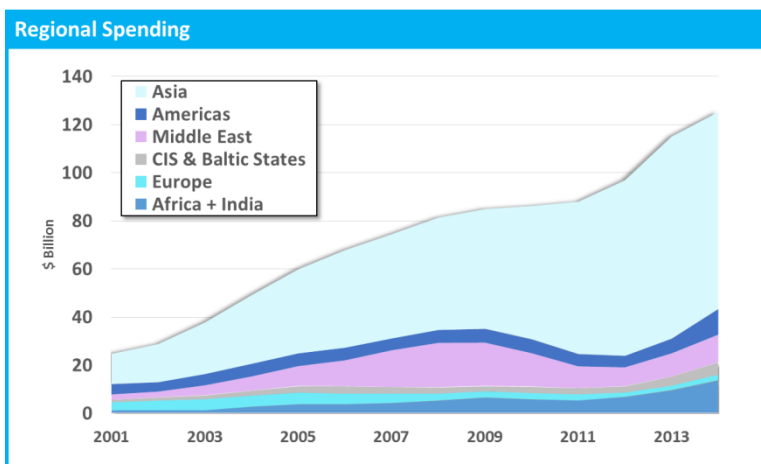
Study Objective

Companies involved with the chemical industry need information on the planned and forecast capital expenditures to make strategic decisions. General questions, such as:

- What geographic areas will see growth?
- What types of plants are being built?
- How much of this spending will be used for equipment versus labor?

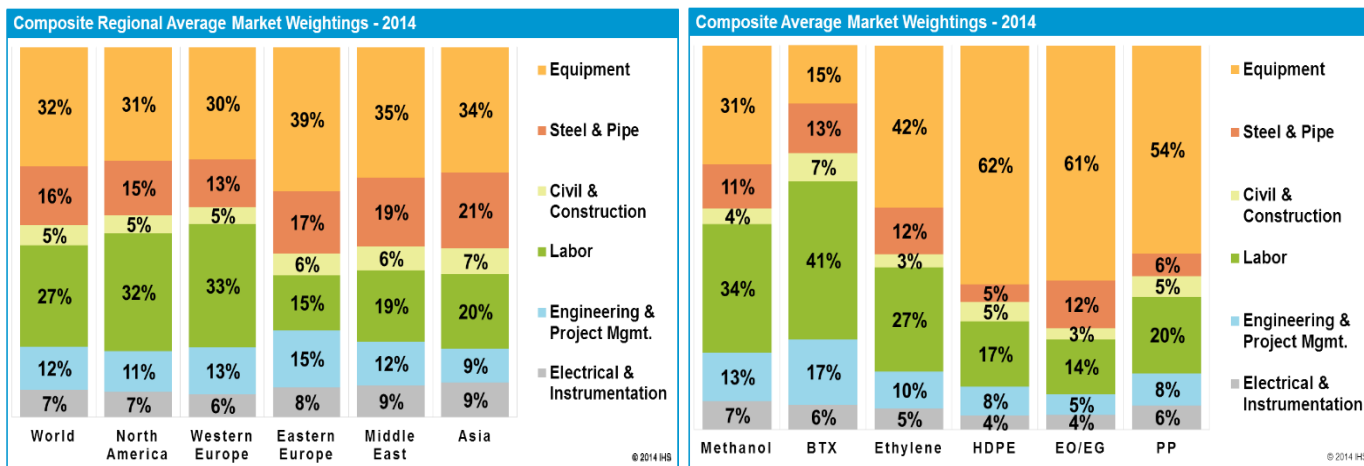
are impossible to answer without pulling information from a large number of chemical industry reports. IHS Chemical maintains an extensive information database on chemical product demand that can be used to provide a clear picture of historical trends and the future expenditures needed to support the anticipated growth over the next ten years.

Over the last decade, the expansion of downstream capacity has been dominated by Asia and the Middle East, but these trends are changing. The availability of low-cost chemical feedstocks has resulted in a large increase in activity in North America, which had previously remained dormant. In contrast, spending in China, which has dominated activity in Asia, appears to be slowing in response to overbuilding.



Over the next decade, the level of spending and the geographic distribution will shift due to changing market conditions. These shifts will also impact the types of capacity being added and industry spending trends.

IHS Chemical's capital spend analysis includes product and country level detail, showing the implications of shifts in process technologies and how changes to costs in each country impact the amount of spending for equipment, labor, steel and other items as shown below. This detailed approach allows better insight into the spending subcategories which are key indicators for companies servicing the downstream sector.



The purpose of this study is to provide a clear picture for downstream capital spending trends with detail relevant to the diverse set of companies serving the needs of this sector. This study will provide a 10-year outlook with analysis of key market drivers and an understanding of how these will impact:

- Chemical capacity additions and associated spending
- The complexity of added capacity
- Shifts in regional activity broken down by subsector

In this study IHS Chemical also provides our regional forecast for spending broken down into major spending categories such as equipment, construction labor and services, and other key components used in these projects. This level of insight provides clients the opportunity to spot new trends in the market and react based on a solid industry-recognized detailed analysis.

The intellectual content provided in this study spans a broad range of services offered by IHS that have never before been combined in this manner. This detailed but high-level overview provides the information needed to identify and explore downstream spending opportunities.

For companies providing the downstream industry with equipment, materials or services, this report will provide critical information to support planning needs.

Key Questions

This study will examine:

- Which regions and countries will see the greatest spending growth on chemical capacity over the next decade and which will experience declines?
- What types of chemical products and process technologies are seeing the greatest activity, and where?
- How much of this spending will be on equipment and how much will be construction labor and other services?
- How will the recent change in oil prices impact near-term and long-term spending?

Clients of this study will be able to determine:

- Is my company able to respond to the shifting regional needs of the downstream sector?
- Do the changes in process technologies being built match with my current capability?
- How does the spending on major classes of equipment shift over time?
- What impact will market changes have on labor availability?

Study Scope

The narrative study report will provide a high-level global economic outlook as well as a general overview of the major trends occurring in the chemical industry which affects the addition future capacity. The global forecast will then be displayed by region to highlight regional industry spending levels and the top process technology categories.

The study data will include a 15-year history of capital spending and a 10-year forecast. The combined spending will be separated into major spending categories providing spending outlooks for: EPC services, construction labor, equipment, steel, civils, instrumentation and electrical.

Chemical industry products will be summarized by product chain to allow high-level understanding of the trends in the industry spending; within each product area the top products will be identified.

Scope Detail

The regional analysis will cover:

- North America
- South America
- Europe
- CIS & Baltic States
- Middle East
- Africa
- Asia

For the purposes of this study “Downstream” refers to the chemical industry. The study will look at spending across nearly 80 different chemical products that account for the majority of the downstream industry’s production volume.

Deliverables

This study will include:

- ✓ WebEx presentation of key results
- ✓ Electronic copy of narrative report
- ✓ Excel file with regional and sector-level details
- ✓ Up to 3 hours of inquiry time with IHS Chemical capital cost experts

Sample graphics:

Global Downstream Spending by Categories 2015-2025 in Current US Dollars												
Categories	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
EPC services	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	
Construction labor	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	
Equipment	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	
Reactors	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	
Columns	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	
Vessels and tanks	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	
Heat exchangers	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	
Furnaces	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	
Compressors	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	
Pumps	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	
Steel	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	
Civils	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	
Instrumentation and electrical	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	

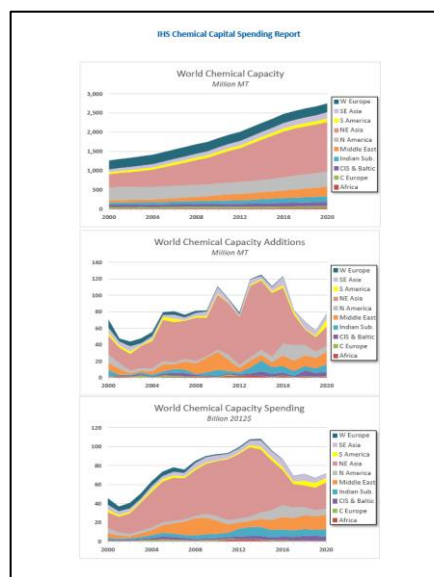
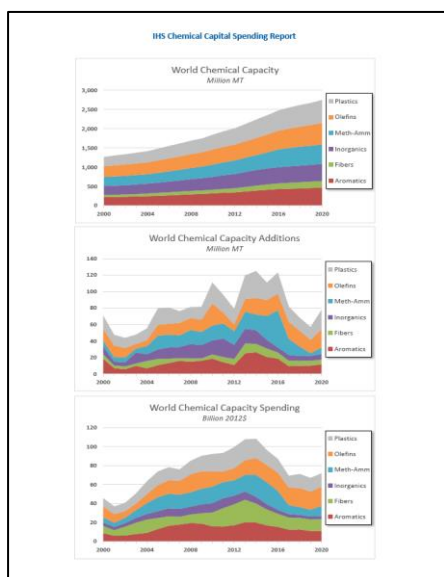


Table of Contents

- I. Introduction**
- II. Executive Summary**
- III. Global Outlook**
 - a. Economic Outlook – Overview
 - b. Chemical Industry Outlook (2015-2025)
 - i. Associated supply/demand and capacity forecast at the product chain level
 - ii. Analysis of how shifts in feedstocks are impacting key product chains
 - 1. Aromatics
 - 2. Fibers
 - 3. Inorganics
 - 4. Methanol-Ammonia
 - 5. Olefins
 - 6. Plastics
- IV. Methodology Overview**
 - a. Capacity addition forecast
 - b. Spending estimates and breakdowns
- V. Global Chemical Downstream Capacity and Spending Outlook (2015-2025)**
 - a. Breakdowns for the following capital spending categories (2015-2025)**
 - i. EPC services
 - ii. Construction labor
 - iii. Equipment
 - 1. Reactors
 - 2. Columns
 - 3. Vessels and tanks
 - 4. Heat exchangers
 - 5. Furnaces
 - 6. Compressors
 - 7. Pumps
 - iv. Steel
 - v. Civils
 - vi. Instrumentation and electrical

VI. Regional Summaries (2015-2025)

a. Capacity by Product Chain (aromatics, fibers, inorganics, methanol-ammonia, olefins, plastics)

- i. North America
- ii. South America
- iii. Europe
- iv. CIS & Baltic States
- v. Middle East
- vi. Africa
- vii. Northeast Asia
- viii. Southeast Asia

b. Spending (in total US current and constant dollars)

- i. North America
- ii. South America
- iii. Europe
- iv. CIS & Baltic States
- v. Middle East
- vi. Africa
- vii. Northeast Asia
- viii. Southeast Asia

c. Key region details

- i. North America
- ii. Middle East
- iii. Northeast Asia

Methodology

Bottom-Up

IHS Chemical is uniquely positioned with the information and tools needed to create this detailed bottom-up analysis. This study pulls information from a multitude of IHS Chemical services, which in aggregate cover hundreds of chemical product markets globally. Based on a common long-term economic and energy outlook, these services offer detailed forecasts for demand and supply for each chemical product. Additionally the services identify both the capacity changes that have been announced and qualified and IHS' assessment of what additional capacity will be needed to maintain market balance.

The detailed capacity outlooks are aggregated with information on technology process types. Project costs are estimated based on information from IHS Chemical's extensive databases on technology and capital costs. These programs provide the detail needed to not only break out the spending by category, but also account for historical and forecast changes in regional costs over time.

Using these inputs from IHS services, capacity additions and associated capital spending required by country, region, and product are determined and summarized in this Special Report.

Spending Boundaries

The spending reported in this study includes the cost of the non-site specific expenditures related to adding or expanding capacity. These costs include:

- Construction labor
- Equipment
- Steel (piping and structural)
- Engineering and project management
- Electrical and instrumentation
- Civils and materials

The analysis covers on-site and necessary off-site project costs, but does not include expenditures related to land, technology licensing, infrastructure improvements, off-site feedstock and product handling, and owner costs.

Study Team



Russell Heinen – Senior Director, Chemical Consulting

Russell Heinen is a Senior Director at IHS Chemical and has worked in energy and chemical consulting for over 30 years, with extensive experience in technology evaluation, market analysis and consulting. Prior to joining IHS, Russell was VP of Technology and Consulting for SRI Consulting.

In his current role in IHS Chemical, Russell utilizes IHS Chemical's different services to help companies monitor their competitiveness and understand how changes in market dynamics will impact their position. As part of his responsibilities, Russell monitors all new downstream plant additions and the cost of building and operating these facilities. He is also active in a number of different industry groups and initiatives that monitor downstream projects and the markets that impact the cost of building new facilities globally.

Russell earned a BS in Engineering and an MBA in Finance from Rice University.



Linda Ryan – Senior Manager, Downstream Capital Cost Service

Linda Ryan is the Senior Manager of the IHS Chemicals Downstream Capital Costs Service (DCCS). She has been part of the IHS Energy Insights/CERA Upstream Capital Costs service since 2011. In addition Linda covers the steel industry and engineering and project management markets for both the Upstream and Downstream Capital Cost Analysis Forums. She also researches costs of consumables for the Operating Cost Analysis Forum.

Linda has a B.S. in Chemical Engineering from Auburn University and earned an MBA from the University of Alabama at Birmingham.

Qualifications

IHS Chemical publishes a wide range of multi-client products that provide chemical industry data insights, analytics, and solutions, including the Process Economics Program, World Analysis program, and the Downstream Capital Cost Service. In addition, the IHS Chemical Consulting team has conducted extensive single-client work related to downstream spending, advising companies, governments, financial institutions, and technology providers operating at all point along the industry value chain.

Process Economics Program

The **Process Economics Program** (PEP) is the core technology and cost analysis program for the chemical and related industries at IHS Chemical. PEP provides thorough and up-to-date technical and economic evaluations of both state-of-the-art commercial processes and potentially promising processes under development.

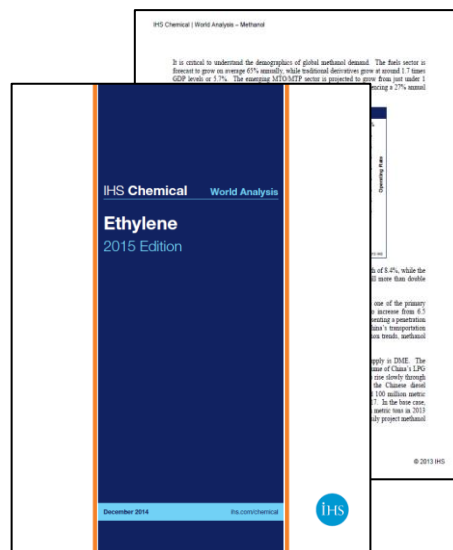
PEP serves more than 100 companies, many of which have been subscribers since the program began in 1963. The program's evaluations cover both commodity and specialty chemicals and polymers. Within the PEP program olefin processes, naphtha, gas and fuel oil cracking processes, polymer processes, and almost all process for major derivatives of cracker complexes have been evaluated on many occasions.



World Analysis

The IHS Chemical **World Analysis** program offers dozens of individual studies, each focusing on a key chemical, fiber, or plastic product or product family. Studies are produced on an annual basis with mid-year supply/demand balance updates and continuously updated on-line capacity database. Each study contains a 16-year analysis period (five years history, base year, ten years forecast). Clients receive detailed data on each chemical and its major derivatives in 10 geographic regions and for major countries within each region.

Each World Analysis includes detailed plant capacities, comprehensive supply and demand data, trade grids, location maps, company ownership, and subsidiary capacity integration. This service provides clients with annual strategic planning information on chemical markets at both the regional and country level.



Downstream Capital Costs Service

The IHS **Downstream Capital Costs Service** is responding to the needs of firms who seek to control costs in an era of rising project expenditures. The Service evaluates downstream project development costs through the application of a Downstream Capital Cost Index (DCCI). The DCCI tracks the costs of building a portfolio of refinery and chemical plants by updating the costs of the resources that go into these facilities, such as:

- Skilled and unskilled labor costs
- Engineering & project management costs
- Equipment costs
- Other civil costs including foundations (concrete), pipe racks, cranes, excavators, scaffolding, and insulation.

Armed with this knowledge, clients can achieve a clear picture of how specific inputs affect their portfolio's total construction costs. IHS analysts use the indexes to show how certain costs are interrelated and where savings can occur in specific areas to offset increased fees. Service members are privy to comprehensive cost data and participate in semiannual workshops during which they receive the latest research results and play a vital role in guiding the future research agenda.

Single-Client Consulting Work

IHS Chemical Consulting has conducted extensive work helping clients identify opportunities related to capital spending. IHS Chemical provides leading-edge solutions to the difficult problems facing clients operating in the extremely competitive and complex chemical industry. Our talented industry veterans collaborate with our clients leveraging IHS' unparalleled industry knowledge, rigorous proprietary analytical techniques, and years of hands-on experience.

Oil & Gas Market Analysis

One of the most widely recognized and respected brands in the global pump industry, serving customers in the oil and gas, mining, power generation, chemical, pulp and paper, and general industrial markets, needed to better understand the impact of sustained low oil price environments on their customers' capital spending. The client was specifically interested in the capital spending level on pumps across all segments of Oil & Gas value chain (upstream, midstream, refining, and petrochemical).

The client requested the assistance of IHS to develop spending forecast for pumps in the Oil & Gas sector in order to support its multi-year business plan. IHS was able to provide detailed coverage on specific markets



(e.g., pumps) by leveraging our CAPEX data and our analysts' leading market insight, as well as through our Market Survey System product, a comprehensive web-based tool for delivering in-depth market analysis and insights on 27 markets segments of the oil and gas industry. The analysis covered alternative oil price scenarios over the next 6 years (2015 – 2020), a 6-year annual spending level for pumps in Oil & Gas sector (2015 – 2020) under each oil price scenario, and the spending level for the pumps broken out by region / country defined by specific industry segments.

Overview of CAPEX Spending in Refining and Petrochemicals

A client focused on the supply of equipment and services relating to rotating and mechanical equipment such as compressors (reciprocating and centrifugal), turbines and pumps, was seeking business opportunities within the downstream oil & gas sector and sought the assistance of IHS to develop a credible business study that provided insights into the characteristics of the downstream industry as a first step towards focusing on those areas of greatest interest for business development. The project provided industry insight to the client in a stepwise manner. The order and nature of the steps included describing the extent of the downstream industry by providing an indicative order-of-magnitude size of the potential market for the client in terms of overall CAPEX and providing an indication of where most business might lie. IHS' approach included in-house data and analysis of global and European crude oil, refined products and refining markets contained within its Annual Strategic Workbook (ASW) multi-client service.

Heat Exchanger Industry Analysis and Due Diligence

A client focused on experience in energy, finance, acquisitions, direct investment and private equity, requested the assistance of IHS to provide an analysis of a potential investment or acquisition opportunity. The identity of the potential investment or acquisition ("Target" company) was not disclosed to IHS at the project onset given the confidential nature of the acquisition, but the scope description included information on the target company, who had engaged in heat exchanger manufacturing and maintenance, primarily for the downstream petroleum (refining) industry, the petrochemical industry and the fertilizer industry.

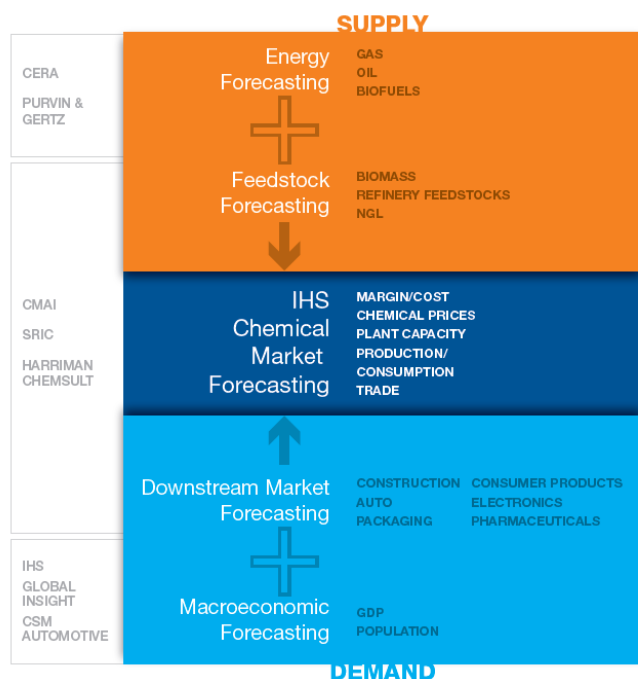
IHS used its industry experience, existing and new project databases and its proprietary cost estimating information and tools to develop an outlook for the heat exchanger and related equipment and services in the US with the primary focus being on PADD II and PADD III. IHS' overall objective included a due diligence of the target company engaged in heat exchanger manufacturing and maintenance, by performing the following work:

- Providing IHS' forecast for the petroleum refining, petrochemical and fertilizer industries in the US with regard to expected new plant capacities
- Developing a forecast for expenditures for shell and tube heat exchangers for new capacities and ongoing maintenance replacements, with the focus being PADD II and PADD III areas
- Developing IHS' views on the impact of imports of shell and tube heat exchangers from other low-cost manufacturing areas

About IHS Chemical

Best-in-Class Brands

IHS Chemical now combines the former CMAI and SRI Consulting groups together with Chemical Week Magazine, Harriman Chemsult, IntelliChem and PCI Acrylonitrile into one integrated business unit comprising its multiclient and single client services. IHS Chemical's experts, analysts and researchers who are well respected throughout the industry for their deep-rooted analysis and forecasts, extends the value that IHS can now offer by connecting clients with the vast resource of insight and expertise that exists across IHS including energy, supply chain and economics.



Comprehensive Coverage

IHS Chemical provides the most comprehensive chemical market content and industry expertise in the world. The company has more than 200 dedicated chemical experts working together to create a consistent and integrated view across more than 300 industrial chemical markets and 2,000 chemical processes for 95 industries. Ensure that your decisions are based on broad, comprehensive information, forecasts, intelligence, and analysis.

IHS has assembled a team of chemical experts that offers an unprecedented coverage level for core chemical markets and technologies. Backing them is a larger IHS community of experts covering related markets, from energy and the macro economy to the world's largest chemical-using industries, such as automotive, construction and others. IHS Chemical's intellectual capital is built on an operating model that utilizes over 1,800 consultants, researchers and economists to advance cross-disciplinary collaboration and analysis.

About IHS

IHS is the leading source of information, insight and analytics in critical areas that shape today's business landscape. Businesses and governments in more than 165 countries around the globe rely on the comprehensive content, expert independent analysis and flexible delivery methods of IHS to make high-impact decisions and develop strategies with speed and confidence.

IHS has been in business since 1959 and became a publicly traded company on the New York Stock Exchange in 2005. Headquartered in Englewood, Colorado, USA, IHS is committed to sustainable, profitable growth and employs more than 8,000 people in 31 countries speaking 50 languages around the world.

IHS serves businesses and all levels of governments worldwide ranging from 85% of Global Fortune 500 to small businesses. IHS provides comprehensive content, software and expert analysis and forecasts to more customers in more than 180 countries worldwide.



Information, analytics, and expertise

IHS offers must-have business information, advanced research and analytics, and deep expertise in core industry sectors, such as energy and natural resources, chemicals, electronics, and transportation. We focus on business-critical workflows that support our customers' needs, including:

Strategy Planning & Analysis: Strategic Planning, Corporate Development, M&A, Investment Analysis, Risk Assessment

Energy Technical: Exploration-Production, Geoscience, Engineering, Commercial Development

Product Design: Engineering Design, Research and Development

Supply Chain: Procurement, Logistics, Operations, Manufacturing

Environmental Health, Safety & Sustainability: Sustainability, Regulatory, Environment Health and Safety

This interconnected information, expertise, and analytics across industries and workflows allows IHS to provide best-in-class solutions that power growth and value for our customers.

Contact Information

To make an inquiry about this study, please reach out to the IHS Chemical Special Reports team at ChemicalSpecialReports@ihs.com.

IHS Chemical Special Reports

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China Coal Chemical Industry Analysis
Propane Dehydrogenation in China – Disruption on the Horizon?
North America Propylene Supply Study
Chemical Building Blocks from Renewables
Ammonia Value Chain
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Lubricants in Brazil