

IHS ENERGY & CHEMICAL

2016 Light and Heavy Naphtha: International Market Analysis

Prospectus



IHS Energy and Chemical Prospectus

Contents

The Market	3
Objective	4
Key Questions	5
Scope of work.....	6
Deliverables.....	7
Methodology	8
Table of Contents	10
Expert Team.....	13
Qualifications	14
About IHS Chemical	16
About IHS Energy.....	17
About IHS	18
Contact Information	19



The Market

Oversupply of North American unconventional crude oil and natural gas has increased exports of most hydrocarbons and has profoundly impacted global energy and refined products prices. A slowdown in Asian demand and capital investments coupled with increase in North American and European commerce has resulted in large drop in prices of all the commodities, and has slowed-down international trade. From oversupply of light naphtha that IHS reported last year, world petrochemical feedstocks will be oversupplied in the short term. But what to expect in the longer term, up to the life span of a new asset?

Strategy, operation and planning managers from around the world are asking for how long will the energy and feedstocks prices, as well as their corporate profits, be low? And, how will eventual increase in energy, commodity prices, and emergence of new demand centers impact future refining and petrochemical investments.

As the most important petrochemical feedstock and important gasoline blendstock, naphtha supply, demand and prices are directly or indirectly impacting refining and petrochemical margins. Knowledge of naphtha supply demand balances and prices will help you to:

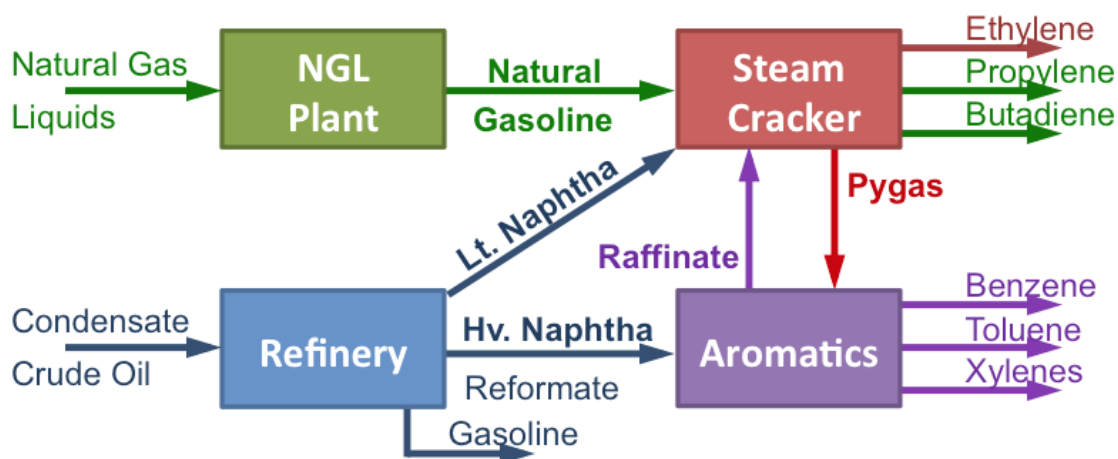
- Understand gasoline and petrochemical demand growth in different regions, and whether those regions will have adequate amount of naphtha production to meet increase in demand
- See anticipated changes in naphtha trade routes and volumes, and develop longer term strategy about where should you expect to buy and where to sell naphtha
- Understand regional naphtha pricing dynamics and how much will different demand centers, like gasoline, be able to pay for naphtha in the future
- Be able to estimate the cost of production in different locations, and with that information decide in which regions around the world you should invest and in which regions you should decrease exposure
- Understand how the increased utilization of coal, natural gas and its liquids will impact supply of naphtha cracking downstream chemicals, and help you develop your company feedstock diversification strategy
- Provide you a direct access to IHS naphtha experts with whom you will be able to verbally vet your understanding and ideas



Objective

IHS Energy and Chemical provide this unique fully integrated in-depth analysis of global markets for light and heavy naphtha. This is a comprehensive global market analysis, including long-term supply, demand, trade, and price forecasts.

The Light Naphtha analysis covers light naphtha, natural gasoline, and includes heavy paraffinic naphtha that is not suitable feed for reforming. The Heavy Naphtha analysis covers naphtha with high naphthenic and aromatic content that is suitable feed for reforming. However, although with significantly different applications light and heavy naphtha balances and prices are closely intertwined. Each section quantifies, analyzes, and explains market fundamentals, trends, future risks, and opportunities through regional and global narratives. The review provides a 5-year history, the base year, and an annual 15-year forecast of supply, demand, trade, and regional pricing (2010-2030).



This analysis integrates deep IHS expertise in crude refining, condensate splitting, natural gas processing, aromatics, and olefins. The analysis:

- Differentiates **light** and **heavy** naphtha in supply, demand, and trade data
- Aggregates **supply** of light and heavy naphtha from all different sources
- Reconciles **interregional trade** separately for light and heavy naphtha
- Provides **price forecasts** of light and heavy naphtha in five main regions
- Defines price-setting mechanisms through a **full price tier analysis**

Key Questions

- How will the emergence of **North America** unconventional oil, gas and natural gas liquids (NGL) impact **Asia** naphtha and gasoline markets?
- How will availability of relatively cheaper propane impact consumption of naphtha in **Europe** and **Asia**, as well as international naphtha trade?
- Will the **Middle East** invest in intraregional or **Asian** naphtha based petrochemical assets, and how will that strategy impact global naphtha and NGL markets?
- Will **Asia** consumption of heavy and light naphtha continue to grow in spite of recent over-investments in aromatics, olefins and refining sectors?
- Will **South America** light naphtha demand be more or less balanced with its production?
- How will the global **light naphtha surplus** be resolved?
- How and when more balanced supply/demand conditions may result in **increase in naphtha prices**, relative to crude and gasoline?
- How will **lower energy prices** impact the regional competitiveness for naphtha production?
- Where are the **capital investment opportunities** related to naphtha production and consumption?

Scope of work

For light and heavy naphtha this analysis provides:

- **Market Analysis** by region, discussing key issues, market fundamentals, and trends
- **Supply/Demand Balance** by country and region (2010–2030)
 - Production from petroleum refining, natural gas processing, and condensate splitting
 - Demand from aromatics (benzene, toluene, xylene) and olefins (ethylene, propylene, butadiene)
 - Fuel-driven demand for gasoline and crude blending
 - Imports and exports by country
- **Price Forecasts** for the US Gulf Coast, Western Europe, and Asia
- **Production Capabilities** and operating rates for light and heavy naphtha, by country
- **Price Tier Economics** by end-use and region with price setting rationale

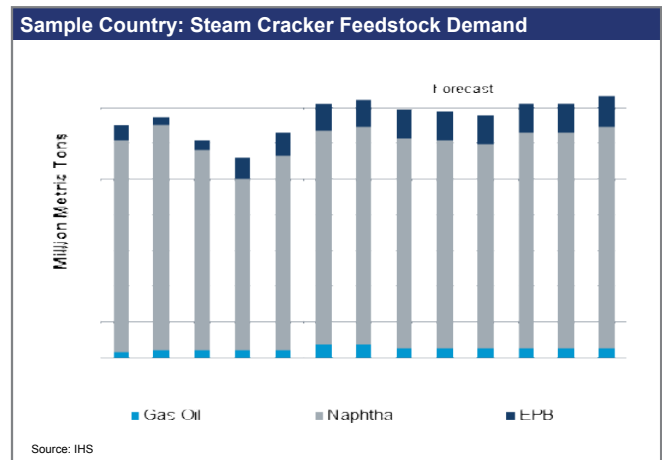
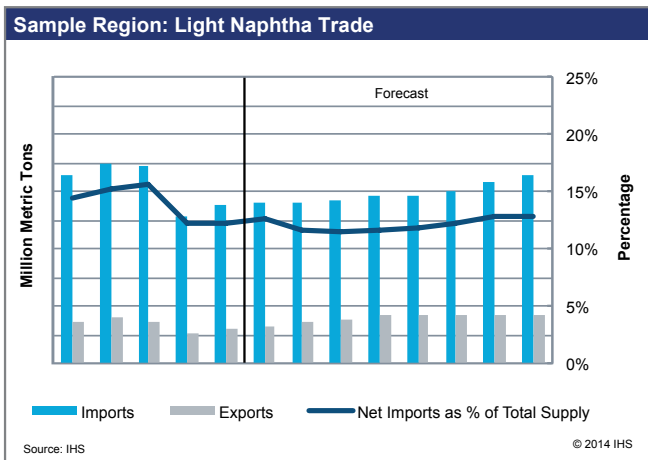
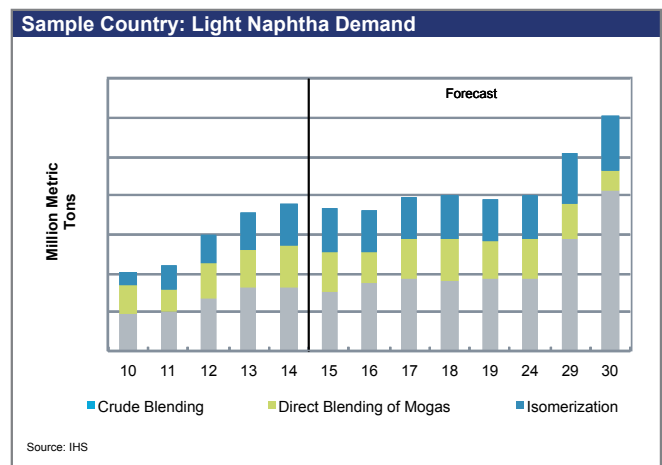
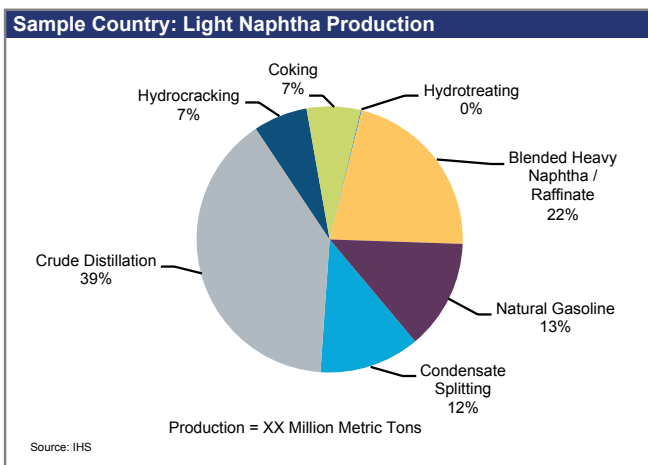


Deliverables

This service provides:

- ✓ A full set of narratives about underlying market fundamentals, developments, and trends
- ✓ Online access to full spreadsheet file data sets
- ✓ Access to IHS naphtha experts, who can provide additional explanation about market fundamentals and trends discussed in the review

Sample Report Graphics



(y-axis values will be provided in the analysis)

Methodology

IHS Energy and Chemical believe that this naphtha service is the first comprehensive long-term analysis that provides separate light and heavy naphtha supply and demand balances, international trade data, and prices. Traditionally, “naphtha” refers to the first liquid fraction from a crude distillation tower. In more general terms, naphtha is a refinery stream of C₅–C₁₁ material and is a major constituent of motor gasoline.

The balances account for all sources of naphtha – from the large volumes produced in refineries, condensate splitters and natural gas plants to the small amount of raffinate naphtha co-produced with aromatics and olefins. The supply and demand balances in this analysis account for all naphtha demand sectors, including production of gasoline, solvents, aromatics, olefins, methane, syngas and burning for energy.

Global naphtha is divided into two streams: light paraffinic and heavy reforming naphtha.

Light Naphtha

The light naphtha analysis provides balances for light paraffinic / lean naphtha that is used as a feed for steam crackers, and boils typically between 50°F (C₅) and 160°F. Light naphtha balances include natural gasoline, the lightest naphtha that is produced in natural gas processing plants. Light naphtha balances also include heavy naphtha that has low N+A content and is therefore a better feed for steam cracking than for heavy naphtha reforming. The majority of light naphtha is produced in refineries.

The light naphtha supply and demand balances account for:

Light Naphtha Supply Sources:

- Natural gasoline
- Condensate splitting
- Crude distillation
- Hydrocracking
- Coking
- Hydrotreating
- Blended heavy naphtha
- Raffinate
- Gas- and Coal-to-Liquids

Light Naphtha Demand Sectors:

- Crude blending
- Steam cracking
- Paraffinic solvents
- Direct blending of motor gasoline
- Isomerization
- Reforming to mogas and avgas
- Reforming to aromatics
- Other (e.g. burning for heat generation, gasification to methane/syngas, losses, etc.)

Heavy Naphtha

The heavy naphtha analysis provides balances for heavy naphthenic / rich naphtha that is good feed for heavy naphtha reformers, and typically boils between 160°F and 370°F (C₁₁). Heavy naphtha balances exclude heavy naphtha that has low N+A, content below approximately 35%. However, the heavy naphtha balances include an excess of good or slightly lower-quality heavy naphtha that is blended into full range paraffinic naphtha (which is part of the light naphtha balances), whose trade is more liquid. As with light naphtha, a majority of heavy naphtha is produced in refineries. Total production of heavy naphtha is about twice as large in volume as the production of light naphtha.

The heavy naphtha supply and demand balances account for:

Heavy Naphtha Supply Sources:

- Condensate splitting
- Crude distillation
- Hydrocracking
- Coking
- Hydrotreating

Heavy Naphtha Demand Sectors:

- Reforming to mogas and avgas
- Reforming to aromatics
- Direct blending of motor gasoline
- Blending of full range naphtha
- Other (burning of heat generation, gasification to methane/syngas, change in kero demand, losses, etc.)

Production Capabilities

Production capabilities (defined as the maximum processing capability with the same quality feed) and actual production rates are fully consistent with IHS natural gasoline, crude distillation, condensate splitter, refinery, aromatics, and olefins capacity databases and supply / demand balances. In order to better assess naphtha production and consumption rates, this analysis has divided production and demand capacity into several groups of processes, which yield and consume different amounts of light and heavy naphtha.

Pricing

In this analysis, a starting point for pricing of both light and heavy naphtha was light naphtha spread versus Brent and Dubai crude in Singapore and Tokyo. On one side, this spread was assessed based on IHS expectation of East-West trade, i.e. trade of full range open spec naphtha from Russia, West Europe and Mediterranean via Singapore to Northeast Asia. On the other side, the spread was assessed by IHS' expectation of refining and steam cracking margins in Asia. Although trade of full range naphtha from Middle East to Northeast Asia is much larger, the volume of marginal East-West trade is impacting price of light naphtha in Asia the most.

Table of Contents

- I. Methodology**
 - a. Definitions
 - b. Production Capabilities
 - c. Supply & Demand Balancing
 - d. Pricing Methodology

- II. Executive Summary**
 - a. World Overview
 - b. Supply / Demand Tables for: *World*
 - c. Inter-Regional Trade Grid Tables for 2010, 2015, 2020 and 2025
 - d. Regional Price Tables

- III. North America**
 - a. Market Review and Outlook
 - b. Production and Demand
 - c. International Trade
 - d. Supply / Demand Tables for: *North America, US, Canada, Mexico*

- IV. South America**
 - a. Market Review and Outlook
 - b. Production and Demand
 - c. International Trade
 - d. Supply / Demand Tables for: *South America, Brazil, Venezuela*

- V. Europe**
 - a. Market Review and Outlook
 - b. Production and Demand
 - c. International Trade
 - d. Supply / Demand Tables for: *West Europe, Central Europe*

- VI. FSU ¹**
 - a. Market Review and Outlook
 - b. Production and Demand
 - c. International Trade
 - d. Supply / Demand Tables for: *FSU Region, Russia*

¹ Former Soviet Union, including Baltic States

VII. Africa

- a. Market Review and Outlook
- b. Production and Demand
- c. International Trade
- d. Supply / Demand Tables for: *Africa, Algeria, Egypt*

VIII. Middle East

- a. Market Review and Outlook
- b. Production and Demand
- c. International Trade
- d. Supply / Demand Tables for: *Middle East, Iran, Kuwait, Saudi Arabia, UAE*

IX. Indian Subcontinent

- a. Market Review and Outlook
- b. Production and Demand
- c. International Trade
- d. Supply / Demand Tables for: *Indian Subcontinent, India*

X. Northeast Asia

- a. Market Review and Outlook
- b. Production and Demand
- c. International Trade
- d. Supply / Demand Tables for: *Northeast Asia, China, Japan, South Korea, Taiwan*

XI. Southeast Asia

- a. Market Review and Outlook
- b. Production and Demand
- c. International Trade
- d. Supply / Demand Tables for: *Southeast Asia, Indonesia, Singapore, Thailand*

XII. Price Forecasts & Price Tier Economics

- a. Price Forecasts for: *US Gulf Coast, Western Europe, Middle East, Singapore, Tokyo*
- b. BEV² for Direct Gasoline Blending
- c. Reforming BEV for Heavy Naphtha / Isomerization BEV for Light Naphtha
- d. Petrochemical Production BEV (BTX for Heavy Naphtha / Cracking for Light Naphtha)
- e. Regional Freight-Based Netbacks
- f. Fuel Value for Light Naphtha / Density Adjusted Price of Heavy Naphtha

XIII. Appendices

- a. Explanatory Notes
- b. World Trade Maps for: 2010, 2015, 2020
- c. Contact List

XIV. On-Line

- a. Excel Files with all Regional and Over 50 Country Supply / Demand Tables
- b. Excel Tables with Regional Pricing
- c. Inter-Regional Trade Grid Tables

² Break Even Value

Expert Team



Nick Rados, Ph.D. – Global Business Director, Chemical Feedstocks

Nick is responsible for IHS business and expertise in the area of chemical feedstocks, including effects of current and anticipated changes in petroleum refining and gas plant operations onto aromatics and olefins chemicals. Nick joined IHS in 2013, with 20 years of experience in the chemical and petroleum refining industries. His experience includes a 10 year tenure with ExxonMobil, working on a variety of refining and petrochemical assignments involving: business strategy, capital investment, operations improvement, competitive intelligence, and technology licensing

Nick has a Doctorate in Chemical Engineering from Washington University in St. Louis and executive business training from Northwestern University and the University of North Carolina.



Debnil Chowdhury – Director, Natural Gas Liquids Research

Debnil is the primary author of the North American NGLs research service and is responsible for global feedstocks pricing. He has also directed a number of refined product and NGLs, pricing, and market entry strategy studies for clients. He is the primary creator of the IHS proprietary long-term ethane analytics price forecast model, which can be used to provide insight on and quantitatively link ethane supply/demand to long-term pricing. Prior to IHS, he worked at Valero as a Senior Market Analyst, responsible for strategic planning and market analysis support for downstream, renewable, and retail assets globally and at Halliburton-KBR as a Process Engineer in Refining Technology Development.

Debnil holds a BS in Chemical Engineering and Certificate in International Affairs from the Georgia Institute of Technology, MS in Predictive Analytics from Northwestern University, and an Executive Certificate in Management and Leadership from the Massachusetts Institute of Technology's Sloan School of Management.

Qualifications

IHS Energy and Chemical's talented industry veterans collaborate with our clients leveraging IHS's unparalleled industry knowledge, rigorous proprietary analytical techniques, and years of hands-on experience. The following projects are a few examples of the naphtha-related single-client work that IHS Energy and Chemical has conducted in the last couple years.

Condensate and Naphtha Analysis

IHS completed a comprehensive East of Suez condensate and naphtha study for a multi-national client. The study included a country-by-country balance of both olefin and aromatics feedstocks. East of Suez supply/demand analysis and projections were included, considering impact of rapidly growing sour Middle East condensate supplies. The consumption of condensate in dedicated splitting capacity and in crude units was quantified and projected.

Market Analysis of Naphtha-based Petrochemicals

A major National Gas Company in Asia with a presence along the entire natural gas value chain covering pipeline, gas processing, petrochemicals, city gas distribution, LNG and E&P, was exploring the possibility of setting up a naphtha-based petrochemical plant of ethylene, propylene, butadiene, pygas, and heavy oil capacities. IHS assisted the client with a petrochemical market study for various products, and included naphtha sourcing options. IHS provided the supply and demand data for the target market countries taking into account existing and future production and consumption. In addition to data, a description of the key supply and demand fundamentals in each of the target countries was described in a written review.



Global Market and Logistics Review of LPG and Naphtha

A client sought market insight to develop an LPG trading business from its production facilities in Asia. A large portion of the LPG from this planned project was expected to be sold the global markets. The client requested a proposal the assistance IHS for a LPG (propane and butanes) and naphtha market and logistics study in support of the project in Asia in order to evaluate the feasibility of the project from a market and commercial perspective, and to assess risks and issues arising from transporting LPG and naphtha to global markets.

Petrochemical Evaluation

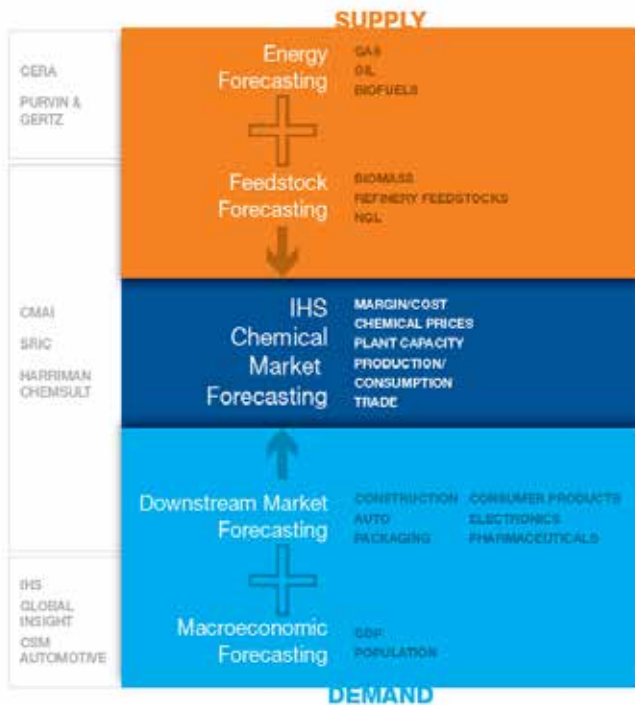
IHS performed market screening evaluations for various petrochemical value chains for a major client in the Middle East to identify potential opportunities for olefins, aromatics and derivatives production. IHS Chemical developed integrated olefins and aromatics petrochemical complex economics to evaluate a wide cross section of complex configurations including naphtha steam cracking & reforming, aromatics extraction, polyester, styrenics, cumene/phenol, and cyclohexane value chains. Modeling included cash flow and financial analysis for project return and sensitivity analysis.



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 and PCI Acrylonitrile into one integrated business unit comprising its multiclient and single client services. IHS Chemical offers over 200 chemical experts, analysts and researchers who are well respected throughout the industry for their deep-rooted analysis and forecasts, and 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.

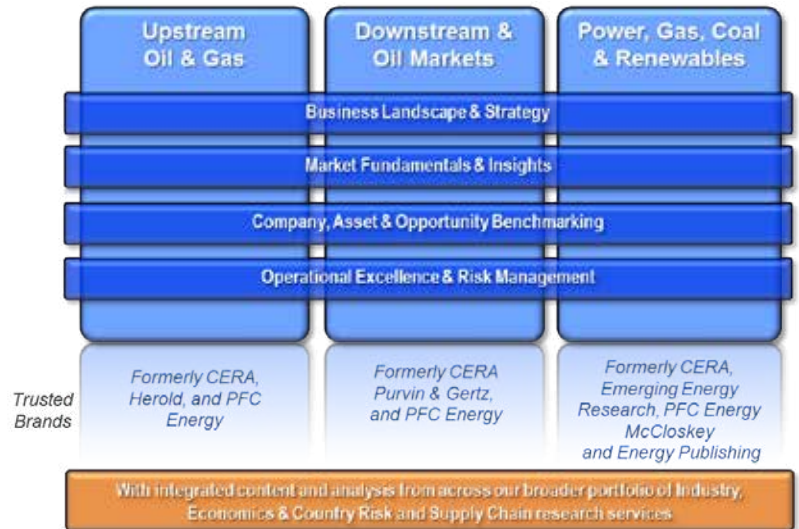
IHS has assembled a team of chemical experts that offers an unprecedented coverage level for core chemical markets and technologies. Backing them is a larger IHS community of experts covering related markets, from energy and the macro economy to the world's largest chemical-using industries, such as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



About IHS Energy

IHS Energy is a leading provider of information and insight in the energy business. IHS Energy’s expertise spans the global energy business chain – from upstream oil and gas extraction, through midstream gas, oil refining, and electric power, to energy services, technology sectors, and end users. IHS Energy has been assembled through the integration of leading energy brands, including IHS CERA, IHS Purvin & Gertz, IHS ODS-Petrodata, Fekete Associates, and IHS Herold.

IHS Energy is uniquely positioned to provide timely, integrated data and insights for critical investment decisions support, with approximately 1,200 team members conducting industry and market analysis around the globe. The IHS Energy Oil Market & Downstream Services provide regional and global market, company, and cost insights across the oil markets value chain.



<p>Insights & Forecasts</p> <ul style="list-style-type: none"> Short & long-term outlooks Detailed analyses & reporting Forecasts available for easy download Proprietary methods & industry indices World Class Experts 	<p>Crude</p> <ul style="list-style-type: none"> Produced streams Production forecasts Trade by crude type & stream Crude grade prices & market spreads Condensate trade Regional, sub-region & country details 	<p>Refining & Products</p> <ul style="list-style-type: none"> Demand by product Operating utilization Projects & capacity rationalization Prices & Margins Regional trade by major product Regional, country & PADD analyses 	<p>Natural Gas Liquids (NGL/LPG)</p> <ul style="list-style-type: none"> Ethane, Propane, Normal & Isobutane, Natural Gasoline Detailed analyses Forecasts of supply, demand & trade Pricing & freight Weekly Economics Stock Reports 	<p>Waterborne LPG</p> <ul style="list-style-type: none"> LPG flow data: monthly gross & net export / import volumes by vessel, terminal, destination, source Propane/Butane/iso butane volumes differentiated Vessel Schedules Spot Prices, freight rates, netback tables 	<p>Petrochemical Feedstocks</p> <ul style="list-style-type: none"> Naphtha, Ethylene, Propylene, Benzene, Paraxylene Supply & regional demand outlooks Cracking economics Downtime outlook Pricing & margins Project impacts 	<p>Canadian Oil Sands Dialogue</p> <ul style="list-style-type: none"> Publicly released independent analysis addressing the benefits, costs, and impacts of choices associated with Canadian oil sands development Research focus based on facilitated dialogues with community, industry and government stakeholders
<p>Market Drivers</p> <ul style="list-style-type: none"> Global economics Geopolitical forces Capital factors Adjacent industries Cross fuel issues Renewable energy World balances & trade 	<p>Downstream Country Profiles (150 markets)</p> <ul style="list-style-type: none"> Downstream value chain analysis by country & across seven regions (ME, AF, Asia, EU, CIS, LA, NA) Refining, midstream & marketing Regulatory Competitive landscape 	<p>Downstream Company Profiles (24 companies)</p> <ul style="list-style-type: none"> Benchmarking of refining and marketing businesses of major operators Strategies Asset portfolio Operating metrics High-level financials 	<p>Downstream Financial Benchmarking</p> <ul style="list-style-type: none"> Detailed financial performance benchmarking (learning-focused) of individual downstream companies vs. industry averages Covers IOCs & regional players in North America, Europe/FSU & Asia 	<p>Lubricants & Base Oils</p> <ul style="list-style-type: none"> Base of margins Global finished Lubricant markets and competitors Global lubricants demand database Trial matrix lubricant markets and competitors Finished lubricants & marine lubricants demand models also available 	<p>Global Retail (55 countries)</p> <ul style="list-style-type: none"> Gasoline and Diesel retail demand Monthly Prices & Margins Quarterly Retail Trends Analysis by country and market 	
<p>Global Scope</p> <ul style="list-style-type: none"> OPEC/non-OPEC Regions (8) Subcontinents (6) Countries (150) U.S. PADDs 						



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 65 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 3 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 80 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.

AEROSPACE & DEFENSE

100+ years' experience delivering unrivaled news, insight and intelligence on defense and security equipment, markets, industries and risk

CHEMICAL

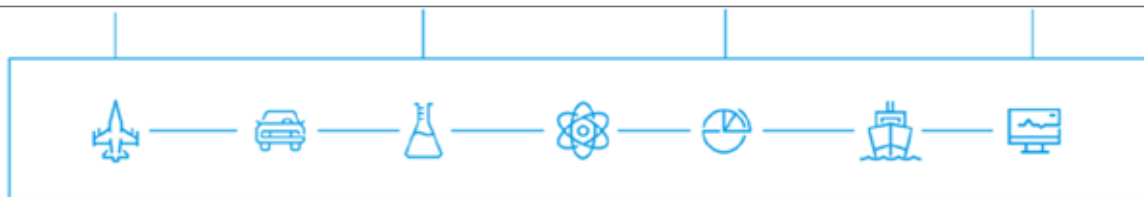
Over 200 leading industry authorities creating integrated views and analysis across more than 300 chemical markets and 2,000 processes for 95 industries

FINANCE

Research on 200+ countries and territories with harmonized indicators from IHS analysts and economists

TECHNOLOGY

World's largest electronics component database with more than 350 million parts



AUTOMOTIVE

The world's largest team of automotive analysts with hundreds of experts located in 15 key markets around the world covering the entire automotive value chain

ENERGY

Extensive Oil & Gas well information on 5.5+ million wells worldwide dating back as far as 1860

MARITIME

World's largest maritime database with an information gathering heritage of 250+ years with comprehensive information on all vessels 100 GT and over



Contact Information

www.ihs.com/chemical

AMERICAS

ChemicalSalesAmericas@ihs.com

EUROPE, MIDDLE EAST, AFRICA

ChemicalSalesEMEA@ihs.com

ASIA PACIFIC

ChemicalSalesAPAC@ihs.com

ABOUT IHS

IHS (NYSE: IHS) is the leading source of information, analytics and expertise in critical areas that shape today's business landscape. Businesses and governments in more than 140 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 nearly 9,000 people in 33 countries around the world.