Planning for Tomorrow: PIRA’s Five-Year Outlook for Crude Oil and Refined Product Markets, 2015-2020

A Multi-Client Study to Support Corporate Planning and Global Market Research

OVERVIEW

The oil market developments and price collapse of the past six months have created another wave of market uncertainty. With lower prices and potentially a new strategic direction for OPEC, all of the key variables that drive upstream and downstream project economics will be impacted. How fast will production slow, particularly for higher cost, high quality shale? Will global demand respond to lower prices? If so, how quickly will prices recover?

Effective strategic planning in the oil industry requires a set of assumptions that is comprehensive, global, and internally consistent. Developing these detailed assumptions and bases requires time-consuming analysis by experts in many different disciplines. In its re-launched annual multi-client study, Planning for Tomorrow: PIRA’s Five-Year Outlook for Crude Oil and Refined Products Markets, 2015-2020, PIRA saves companies the time associated with this arduous task by bringing together its global energy analysis, models, and forecasting intelligence to provide a comprehensive, internally consistent, and up-to-date outlook for oil industry planning and market research.

Planning for Tomorrow, 2015-2020 is comprehensive, not only covering conventional liquids, the rapidly growing volume of alternative fuels, and refined-product markets, but also placing oil demand and supply in the context of all other fuels and the specific characteristics of each end-use. While the study covers the global market as a whole, it also delves deeply into key regions and countries, taking into account the trade and arbitrage opportunities between them. And it is internally consistent between these regions/countries and across products to allow the accurate comparison of project economics in different business units and regions.

Planning for Tomorrow draws on PIRA’s Global Crude Oil & Refined Products Retainer Service, Global Biofuels Service, World Refinery Database, and Freight Market Outlook, as well as PIRA’s detailed and unique country-by-country energy demand and oil supply models. It provides an invaluable tool for oil industry planning and market research by offering these features:

• A comprehensive online database. Providing history back to 1995 and forecasts through 2020, the database covers, by key region and country:
  ‣ economic growth and energy demand
  ‣ crude oil supply (by quality) and demand, call on OPEC, and prices
  ‣ refined products supply and demand, prices, cracks, and margins
  ‣ refinery configuration and capacity, trade flows, and freight rates.

See page 3 for a complete outline.
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• The outlook for global energy demand. Starting with the outlook for economic and population growth in key countries and regions, the outlook is examined and quantified by fuel and end-use sector, placing the demand for each oil product in its proper context. In addition, trends in energy intensity and energy-related CO₂ emissions are calculated for key countries and regions.

• The outlook for liquids supply. Based on PIRA’s models of resource base, project development, new exploration and decline rates, the study provides the outlook for crude oil production divided into six major quality grades, distinguishing production both by region and between OPEC and non-OPEC, as well as by onshore and offshore (shallow and deep). In North America, additional detail on major shale plays and oil sands is also provided. The outlook for other liquids production, including NGLs and biofuels, completes the supply-demand balance.

• A forecast for crude oil pricing. Based on the outlook for overall energy demand, the detailed outlook for crude oil demand is matched with PIRA’s outlook for liquids supply. The crude oil supply/demand balance and call on OPEC production lead to the outlook for crude oil prices, which is reported for the benchmark crudes Brent, WTI and Dubai, plus more than 30 other important crude grades.

• The outlook for global refining. Drawing on information contained in our World Refinery Data Portal, the outlook includes projections of crude oil refinery runs by region, refinery configuration, and capacity (including a list of planned refinery projects with PIRA’s expected probability of completion), taking into consideration the impact of changing product specifications.

• The outlook for refined product pricing. The study provides PIRA’s outlook for prices for five major products (naphtha, jet/kero, gasoline, gasoil/distillate and fuel oil) in the U.S. Gulf, Rotterdam, the Mediterranean, Singapore and the Arabian Gulf. Product cracks and refining margins are calculated from the product and crude oil prices.

• The outlook for crude and refined product trade. The study details the outlook for trade between regions for crude oil and refined products, based on PIRA’s regional outlook for oil product demand, refinery production and crude oil runs. Also included is PIRA’s outlook for crude oil freight rates for the key crude oil voyages.

• A PowerPoint presentation — delivered via WebEx and available in print and online — that communicates the study's key findings. This comprehensive presentation — some 100 slides in length — explains the assumptions, analysis and conclusions, allowing Planning for Tomorrow subscribers to get the most out of the study. Option: For an additional fee, the presentation may be provided to a subscribing company via a private WebEx briefing or in person at a client site.

WHAT HAS CHANGED SINCE THE STUDY’S PREVIOUS EDITION

The oil market has always been dynamic, and never more so than over the past year. After remaining in a tight $102 - $112/Bbl range for more than a year, the price of Brent plummeted $64/Bbl (almost 60%) from June 2014 through January 2015. This drastic change in the oil market landscape raises several critical questions: Will lower crude prices stimulate oil demand? How will the crude price collapse impact oil supply, especially from North American shale production? How will OPEC respond to the new price environment? How will refining economics be impacted? And perhaps most critical, How long will crude oil prices remain near current levels?

The 2015 edition of Planning for Tomorrow incorporates PIRA's latest insights and analysis around these questions. In addition, the outlook extends through 2020 to provide the latest guideposts for five-year strategic plans. Like its predecessors, this edition of Planning for Tomorrow
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provides a comprehensive, global, and internally consistent outlook covering the key aspects of the oil market: demand, supply, and price; refined products, cracks, and margins; trade flows; and freight rates.

DATABASE OUTLINE

Central to the study is a comprehensive database (see full list of study deliverables on page 5), the contents of which are shown below. Unless otherwise noted, all concepts/series are provided for each of the following country/regions.

<table>
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<tr>
<th>Regions and Countries Covered in the Study Database</th>
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<td>Western Europe</td>
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A. Energy Demand and Key Drivers
   a. Real GDP level and growth
   b. Population level and growth
   c. Energy demand by fuel (oil, natural gas, hydro, nuclear, solid fuels, biofuels, etc.) and sector (industrial, electric generation, transportation and residential/commercial)
   d. Measures of energy intensity; e.g. energy/GDP, energy/population, etc.
   e. Energy-related CO₂ emissions

B. Liquids Supply
   a. Global crude/condensate production
      • by region and OPEC/Non-OPEC
      • by 6 quality categories (light sweet, medium sour, etc.)
      • by onshore/shallow/deep
   b. Other liquids
      • by region and OPEC/Non-OPEC
      • by type (NGL, biofuels, etc.)
   c. In addition, North America is split by major shale play; Canada split into subtype (bitumen, syncrude, shale, non-shale)

C. Crude Oil Pricing
   a. Prices for the key crudes Brent, WTI, and Dubai plus more than 30 additional important crude grades

D. Refined Products Marketsbryan
   a. Demand for major refined products (naphtha, jet/kero, gasoline, gasoil/distillate, low sulfur fuel oil and high sulfur fuel oil) plus demand for LPG
   b. Crude oil refinery runs by region
   c. Refinery configuration and expected total capacity by region
   d. Major projects, both expansion and upgrading, with expected probability of completion
WHO WILL BENEFIT FROM THIS STUDY

Effective strategic planning and budgeting in the oil industry requires more than just an outlook for crude oil prices. The decisions faced by oil companies are far more complex and require detailed assumptions covering a range of crude oil and refined product prices with all the associated arbitrages, cracks and margins. For capacity and transportation planning, the level of demand and inter-regional product flows need to be projected for each key region. These, in turn, need to consider the relationship between regional crude availability, refining capacity, and product demand. All these assumptions need to be internally consistent by means of an integrated, global, bottom-up analysis of all aspects of the oil market.

This is a very time-consuming effort, requiring the development of models and tools covering oil supply, demand and transportation and expertise in many different disciplines: macroeconomics, energy demand, refined product demand, oil supply, refinery economics and logistics, and more. As a practical matter, many companies find it difficult to justify hiring and developing the internal expertise and models in all these areas. Rather than attempting to duplicate this entire complex analytical effort themselves, industry participants such as these should take advantage of the work of PIRA’s expert analysts:

• **Integrated state and private oil companies**, which need to have a consistent basis for planning and project evaluation covering the entire spectrum of the oil market, from crude oil to refined products and including the impact of alternative fuels, transportation costs and regional differences.

• **Crude producers**, who need to understand not only the global outlook for crude oil supply, demand and pricing, but also how the changing slate of crude qualities will interact with the evolving refining system to change the relative value of different crude streams. The study provides them an outlook for strategic planning that incorporates PIRA’s detailed analysis of crude oil production, refined product demand, and the current and future capabilities of the global refinery system.

• **Refiners**, who need to understand the interplay between regional demand by product, changing product specifications, changing crude quality, growth in non-conventional liquids such as biofuels and the evolution of regional refinery capability. The outlook provided by PIRA’s **PLANNING FOR TOMORROW** study allows refiners to evaluate a range of alternative strategies.

• **Trading companies**, which need to anticipate regional supply/demand changes and price dynamics. The study’s five-year outlook provides the longer-term context for short-term trading strategies.
Other investors in oil infrastructure, such as storage, pipelines or crude by rail facilities, who need to understand the prospective changes in crude oil and refined product flows on a regional basis and the implications for supporting infrastructure.

WHAT STUDY SUBSCRIBERS RECEIVE

Each authorized user of the Planning for Tomorrow study obtains the following valuable set of deliverables upon release of the study in April 2015.

A COMPREHENSIVE ONLINE DATABASE that provides historical data back through 1995 and forecasts through 2020 in Excel spreadsheets covering the study regions and countries for:

- Economic growth and energy demand, by fuel and by sector
- Supply and demand for crude oil, call on OPEC, and crude oil prices
- Refined products supply and demand
- Refined product prices, cracks, and refining margins
- Crude oil and key refined products trade flows, including freight rate outlook

See a more complete description of the database starting on page 3.

AN EXECUTIVE SUMMARY, printed and online, that documents the medium-term outlook for oil and petroleum products. Approximately 30 pages in length, it discusses PIRA’s Reference Case outlook for the demand, supply and price of oil and refined products by grade in key countries and regions of the world.

A POWERPOINT PRESENTATION, via a WebEx workshop, in print, and on PIRA online, that explains the key assumptions, analysis and conclusions of the study. Option: For an additional fee, the presentation may be provided to a subscribing company via a private online briefing or in person at a client site. See below for details.

FEES AND OPTIONS

Planning for Tomorrow can be purchased by both PIRA retainer clients and non-clients. Existing PIRA clients receive a reduced price. Companies that order before March 31, 2015, receive a 25% “early bird” discount. Subscriptions allow for three authorized users (3 user IDs to access online content and 3 printed copies of the Executive Summaries and PowerPoint presentations).

Optional Add-Ons:

1. Private Presentation:
   The PowerPoint Presentation deliverable may be provided via a private WebEx briefing for an additional fee. Please contact your PIRA sales representative if you are interested in this option.

ABOUT PIRA ENERGY GROUP

PIRA Energy Group, founded in 1976, is an international energy consulting firm, offering Retainer Client Services as well as multi-client studies and customized consulting on a broad range of subjects in markets.
for international oil, natural gas (and LNG), coal, electricity, biofuels, and freight, as well as related environmental issues. PIRA provides evaluation of key U.S. and international energy issues that impact the behavior and performance of the industry and its various markets and sectors. Currently, more than 500 companies spread across some 60 countries retain PIRA, including international and national integrated oil and gas companies, independent producers, refiners, marketers, oil and gas pipelines, electric and gas utilities, industrials, trading companies, financial institutions, and government agencies.

THE STUDY TEAM

Peter Jaquette (Senior Director, Global Oil) is a key contributor to PIRA's Scenario Planning Service, managing PIRA’s World Energy Demand Forecast Portal and working closely with PIRA’s Global Oil, Refining, Biofuels, and Freight groups. He was the study leader for the 2013 North American Crude by Rail multi-client study and is the coordinator of the Planning for Tomorrow study series. Peter joined PIRA in 2007 with more than 25 years of experience in corporate strategic planning and economic consulting, including 14 years with ARCO and nine years with Weyerhaeuser. Peter has a B.A. in economics from Swarthmore College and an M.A. in economics from Stanford University.

Richard L. Joswick (Managing Director, Global Oil) develops PIRA’s outlook for crude and product pricing, refinery margins, and inter-regional supply balances. He is the lead consultant for PIRA’s newly created Oil Producer Marketing Service (OPMS). Rick authors PIRA's monthly European Oil Market Forecast. He was the study leader for a series of multi-client studies examining product markets: Bottom of the Barrel: The Future for Residual Fuel Oil; Heart of the Barrel: The Future of Middle Distillate Fuels; Top of the Barrel: The Future for Gasoline, Naphtha, and LPG, and the 2012 Updated Outlook for Residual Fuel Oil. Rick joined PIRA in 2004 after 20 years with ExxonMobil in supply logistics, planning, refining, and engineering. During his time at ExxonMobil, he had assignments developing near-term oil market forecasts, designing heavy oil upgrading processes and evaluating refining economics. Rick has M.S. and B.S. degrees from Rutgers University in chemical engineering.

Dr. Mark A. Schwartz (President and Managing Director, Scenario Planning) works closely with PIRA's Global Oil, Natural Gas and Coal groups to evaluate the key assumptions underlying their outlooks and to develop plausible alternative assumptions and outcomes. Before joining PIRA in 2002, he was the Chief Economist of Exxon, where he was responsible for developing the company’s long-range economic and energy outlook. Mark designed and managed the implementation of the energy modeling system and database that allowed ExxonMobil to develop its base-case global energy outlook as well as alternative cases to capture the impact of changes in price, economic growth, environmental policy and other critical assumptions. Prior to this position, Mark spent five years in Exxon’s International Gas Marketing Company, where he developed the Asian gas supply/demand balance. During his 25 years at Exxon he also had assignments in Upstream Planning, Treasurers, and Corporate Planning functions. He holds a Ph.D. in economics from the University of Pennsylvania.
David A. Zinamon (Managing Director, Refining and NGLs) specializes in refined products, refinery operations, NGLs, alternative fuels and environmental matters, particularly as they affect petroleum product markets. Among other activities he is responsible for PIRA’s World Refinery Data Portal. He also authors PIRA’s NGL Monthly Market Outlook and the Global LPG Weekly Scorecard. Dave joined PIRA in 1984 after seven years of international energy consulting experience with Chem Systems. This followed several years of manufacturing, marketing and planning positions with Celanese Chemical, GAF Corp., and Airco. He has a BCHE from City College of New York and an M.B.A. from Rutgers University.

Frederick W.A. (Bill) Fuller (Senior Director, International Oil) had over 30 years of energy forecasting and analytical experience with Exxon International before joining PIRA in 1997. He now oversees PIRA’s analysis and forecasting of near-term industry oil balances, with particular emphasis on international supplies. He also develops PIRA’s long-term oil supply outlook and monitors events impacting PIRA’s oil market view. Bill has a B.S. in chemical engineering from Cornell University.

Kenneth M. Bogden (Director, Freight Markets) is responsible for PIRA’s monthly Freight Market Outlook. Prior to joining PIRA in 2005, Ken worked for ExxonMobil for 27 years, primarily in its oil supply and trading and planning functions, and also served as Coordinator of Transportation Planning. Ken has a B.S. in chemical engineering from Lafayette College and an M.B.A. from Columbia University.

Joseph T. (Joe) Pezzino (Director) maintains PIRA’s Worldwide Refinery Database, including capacity analysis, product quality implications, and margins. Before joining PIRA in 2000, he led refinery process tech services, economics, and planning during a 30-year career at Mobil. He also worked in Corporate Supply & Distribution and subsequently at Mobil Research specializing in supply chain optimization. Joe has an M.B.A. and B.S. in chemical engineering from S.U.N.Y. at Buffalo.

Miriam Levy (Director, Political Risk) oversees the Global Political Risk Service and is responsible for forecasting OPEC oil production. She also leads PIRA’s upstream modeling efforts, including play-by-play shale liquids models and PIRA’s new web-based World Oil Supply Data Portal. From 2006 to 2009, she consulted electric utilities on power procurement at NERA Economic Consulting. Prior to that, she worked at an emerging markets hedge fund. Miriam has a B.A. in ethics, politics, and economics from Yale University and an M.A. from Columbia University in International Energy Management and Policy.

Dr. Naing Oo (Associate Director, Global Oil) joined PIRA’s Global Oil Group in 1995. He focuses on quantitative and econometric analysis for forecasting oil demand and is responsible for maintaining PIRA’s global short-term oil demand model. Naing is also involved in both short- and long-term analysis of crude and product supply/demand balances and trade flows, and he has contributed to numerous PIRA multi-client studies and consulting projects. Naing holds a Ph.D. in economics from the City University of New York.

Ethan Groveman (Manager of Project Consulting) oversees PIRA’s project consulting practice. In addition, he built and currently manages PIRA’s North American rail and pipeline infrastructure databases and contributes to PIRA’s work on refining, supply/demand balances, and vehicle technologies. He led the rail cost and capacity modeling for PIRA’s 2013 North American Crude by Rail Study. From 2008 to 2011, he served in product strategy and corporate development roles at Better Place, an electric vehicle infrastructure provider. Ethan has a B.S. in management science and engineering from Stanford University.