Natural Gas Monetization Options: A Global Economics Comparison

Special Report Prospectus
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Abstract

Natural gas has assumed an extremely important status worldwide as both a source of clean energy and a major feedstock for a number of chemicals. Its global value can be gauged by the economic, environmental, and sometimes political futures of countries that are dependent on their possession or lack of NG for domestic and global demand. The economic and political stature that natural gas holds today has divided the world into groups with a variety of affiliated interests. Today, this gift from nature is an economic weapon as well as an economic necessity.

This report analyzes the economic aspects of natural gas. It presents a study on the economic and profitable utilization of natural gas by converting it into diverse value-added products. The purpose of the analysis is to present a picture of different gas conversion options to potential investors in the gas or chemicals production business, so that an investment decision can be made that achieves the highest rate of return. The four options evaluated in this report are:

- Ammonia Production
- Fuels Production (Fischer-Tropsch Process)
- Liquefied Gas Production
- Methanol Production

Technologies selected to represent the manufacturing of the above-mentioned products include: Uhde Dual-Pressure Process (ammonia); Sasol Slurry-Phase Distillate Process (naphtha and diesel); Triple Mixed-Refrigerant Process (LNG); and Johnson Matthey Combined Reforming Process (methanol). The current and future global availability of natural gas is also given from the perspective of overall world energy demand, and with regards to the supply and demand information of individual products.

The economic analyses presented in this report are based upon US price/cost parameters. The written analysis focuses on the five natural gas abundant countries – the US, Canada, Saudi Arabia, Australia, and Russia. Also included with the electronic version of this report are two Excel-based cost calculation modules that can be used to calculate capital investment and production costs for these four gas-conversion options for other natural gas-abundant regions of the world. The first module, the iPEP Navigator, gives a snapshot of the production economics for US as well as other gas-rich regions. The second module, the iPEP Spectra, gives cost analysis based on the historical prices of raw materials/utilities. These tools can be used to do a comparative investment study of the above options in different parts of the world. Cost estimates and a comparative picture of gross margins for four products are given for Australia, Canada, Russia and Saudi Arabia in the iPEP Spectra tool.
Scope of Work

Natural gas is both a major chemical feedstock and a source of clean energy. The favorability of using natural gas to produce various downstream chemicals and fuels depends on regional market dynamics and pricing. This study examines the competing economics of using natural gas to produce four key products, using a leading representative technology for cost comparisons. The scope of work will include:

Global Energy Overview for liquid fuels and natural gas

Natural Gas Supply by region, including production and reserves

Ammonia, Methanol, Liquefied Natural Gas, and Gas-to-Liquid Fuels analyses, including:
  - Global product supply and demand overview
  - Commercial production technology background
  - Process description and schematic for the representative production process
  - Process economics evaluation including a utilities summary, total capital investment breakdown, and production costs snapshot

Conclusions on the relative competitiveness of each product from natural gas

Key Questions

- What is the overall competitive profitability of the four monetization options in major global regions?
- Which country presents the best investment opportunity for each natural gas monetization option?
- What impact could feedstock and product fluctuations have on the favorability of technology options?
Deliverables

The narrative-style written report focuses on comparing the natural gas monetization options in the countries with the most competitive natural gas prices. The written analysis focuses on the five natural gas abundant countries – the US, Canada, Saudi Arabia, Australia, and Russia. This report includes an economic comparison commentary for leading natural gas regions, supplemented by interactive Excel models of production economics. It also overviews the regional supply and demand for natural gas, ammonia, methanol, gas-to-liquid fuels, and liquefied natural gas.

Also included with the electronic version of this report are two Excel-based cost calculation modules that can be used to calculate capital investment and production costs for these four gas-conversion options for other natural gas-abundant regions of the world.

The first module, iPEP Navigator, gives a snapshot of the production economics for the US as well as other world gas-rich regions. With this module, one can select a process, region, and reporting unit in either English or metric systems. When a region is selected, the module automatically inputs the cost of raw materials, utilities, and labor of the selected region to generate production economics in situ. Using the module, one can compare the current economics of the same four monetization options in other gas-rich regions.

The second module, iPEP Spectra, gives production economics comparisons based on the historical prices of raw materials/utilities. Using this module, one can compare the economics of the same four monetization options from 2000 to 2014 quarterly in several gas-rich regions. The historical economics comparison allows an investor to see how well each investment option will stand the test of time with often wide fluctuation of raw material and utility costs. This module is written in Excel pivot table to give maximum flexibility in choosing a comparison parameter, such as variable cost, cash cost, or full production cost.
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Study Team

Syed N. Naqvi – Senior Principal Analyst, Process Economics Program

Syed is responsible for performing techno-economic evaluations for newly emerging commercial technologies for the IHS Chemical Process Economics Program. His expertise includes alternative and synthetic fuel technology, such as gas-to-liquids, and technologies for intermediate chemicals. Syed has 41 years of technical experience in plant operations, process and plant design, and commodity chemicals production.

Prior to joining IHS Chemical in 1996, Syed worked in operation and production management in alkalis, acids, and hydrometallurgical plants. He holds a bachelor’s degree in Chemical Engineering from the University of Engineering & Technology in Lahore, Pakistan.

Jamie Lacson – Principal Analyst, Process Economics Program

Jamie Lacson is a Principal Analyst for the Process Economics Program of IHS Chemical with over 17 years of experience in the chemical industry. He started as a Consultant for the Chemical Business Research Division of SRI Consulting in market research and business development. Late, Jamie joined the Process Economics Program where he works on process simulations, materials and energy balances, process flow diagrams, process equipment costs, and production cost economics. He also has over ten years of experience with Visual Basic for Applications.

In previous work, Jamie was a Research Analyst at the National Aeronautics and Space Administration (NASA) Thermal Protections Laboratory. He holds a bachelor’s degree in Chemical Engineering from San Jose State University.
Qualifications

IHS Chemical provides a wide range of multi-client products that provide chemical industry data insights, analytics, and solutions, including the Process Economics Program, Chemical Economics Handbook, and World Analysis program. In addition, the IHS Chemical Consulting team has conducted extensive single-client work in methanol markets, 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 is sponsored by 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.

The following reports are related to the contents of this study:
- “Advances in Ammonia Technology” by Victor Wan (November 2009)
- “Gas to Liquids Update” by George J. Apanel (December 2002)
- “Liquefied Natural Gas” by Marcos Cesar (November 2004)
- “Methanol” by George J. Apanel (March 2000)

Chemical Economics Handbook

The Chemical Economics Handbook (CEH) is a core market research program. It provides accurate and timely information on the history, status, and projected trends of hundreds of raw materials, primary and intermediate chemicals, and end products of the commercial chemical industry. Published continuously since 1954 and now more than 20,000 pages in length, CEH is supported by more than 250 sponsors in more than 35 countries.

CEH reports typically include a global summary and regional coverage of chemical markets, listing the producers and annual capacities in each region. The studies also include production and consumption volumes by region and
end-use application for each chemical product. Both trade imports and exports by region are also estimated in CEH reports.

Related CEH reports include:
- “Natural Gas” by Michael T. Devanney (April 2013)
- “Methanol” by Preeti Sriram, Mike Nash, and Olivier Maronneaud (May 2014)
- “Ammonia” by Bala Suresh, Ralf Gubler, Henry He, Yuko Yamaguchi, James Glauser, Chiyo Funada (February 2014)

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 updates. 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.

Single-Client Consulting Work
IHS Chemical Consulting has recently worked on a number of projects investigating the monetization of natural gas. IHS Chemical’s talented industry veterans collaborate with our clients leveraging IHS’ unparalleled industry knowledge, rigorous proprietary analytical techniques, and years of hands-on experience. The following projects are a few examples of the natural gas monetization-related single client work that IHS Chemical has conducted in the last couple years.

Methanol Scenario Feasibility Study
A fuel additives company specializing in the production of methanol and MTBE established in the Middle East had requested the assistance of IHS to provide a methanol scenario prefeasibility study. The study included analyzing a variety of build scenarios for both stand-alone methanol plants of varying capacities and an integrated facility involving both methanol and MTBE production.

IHS’ overall objective with this engagement was to assist the client in understanding the monetization of natural gas to either methanol or ammonia. As part of this overarching study, IHS recommended the best option for the client to monetize a quantity of gas that would be used to make a gas-based petrochemical that would generate the most profits and returns for a 25 year period.
Natural Gas Derivatives Cost Analysis

A large government entity requested IHS provide an economic analysis focusing on the competitive opportunities for the production of natural gas derivatives in Alberta. Specifically, IHS provided detailed understanding of the economics of producing specific methane derivatives in Alberta as compared to other producing regions such as the US, Middle East, and China.

Gas Monetization Options Study

IHS Downstream Energy and IHS Chemical were retained to examine potential options for the monetization of gas reserves for an independent gas producer with oil and gas production located in the Eastern Siberia region of Russia. The options considered included Gas-to-Liquids (GTL), methanol, methanol-to-olefins (MTO), ammonia/urea, sale into the local market for power generation and export as pipeline gas. For each option considered IHS examined the potential markets for the end product, reviewed the available process technology, developed capital and operating cost estimates and provided an export and netback price forecast. The recommended option was based on several criteria that included project economics (rate of return and profitability index), access to technology, size of and access to local and export markets and the quantity of gas consumed over the expected project life.

GTL Commercialization Status Study

For an independent project developer, IHS provided an assessment of the current state of the GTL industry, and a forecast of future GTL production from anticipated projects. Generic GTL project economics were developed and presented in terms of the breakeven crude price levels to support a range of feed gas values and capital costs, and by rate of return for varying assumptions on product values, feed gas cost, and capital/operating costs.
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, extend 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 Chemical 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:

- 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

IHS Chemical Special Reports address topical issues in the chemicals industry. Please find a list of available Special Reports below. If you would like to learn more about any of these products, please contact the Special Reports team at ChemicalSpecialReports@ihs.com.

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