Prospectus

Stranded Gas Utilization: Steps to Commercialization
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Section 1

Abstract

Natural gas is the fastest growing energy resource in most regions of the world, driven by superior environmental performance as well as attractive economics for baseload use in power generation. However, much of the world’s gas resources are remote from consuming markets, resulting in a drive to develop new technologies to allow efficient and cost-effective monetization of these stranded assets. Figure 1.1 provides a breakdown of global reserves, indicating the relatively low reserves in the major consuming centers of North America, Europe and Asia.

![Figure 1.1](image)

**Distribution of Proved Natural Gas Reserves, 2001**

*Trillion Cubic Meters*


Nexant, Inc. (“Nexant”) has performed a number of non-confidential analyses of technology and market prospects for stranded natural gas. Our multiclient report, *Stranded Gas Utilization – Methane Refineries of the Future*, issued in 2001, provided a comprehensive evaluation of the situation at that time. Now, technologies, markets and general industry capabilities have advanced, and the time is right for an update.

On-going technical developments over the past few years include rapid advances in designs for mega methanol facilities, with maximum capacity now approaching 10,000 metric tons per day. Several emerging gas-based technologies, such as Methanol to Olefins, remain to be commercialized, but are being actively evaluated. Finally, the number of announced or planned Gas-to-Liquids (GTL) projects now includes projects under consideration in locations such as the Middle East (e.g. Qatar and Iran), North Africa (e.g. Egypt), West Africa (e.g. Nigeria), Southeast Asia (e.g. Malaysia and Indonesia), and Australia. These new plants could add as
much as 1 million barrels per day of high quality petroleum products within the next 10-15 years. A summary of projected major GTL projects is shown in Figure 1.2.

This new study, *Stranded Gas Utilization – Steps to Commercialization*, provides a timely update and expansion of the previous report.

In the current global geopolitical and environmental atmosphere, Nexant believes it is important to revisit and reanalyze the technical and economic viability of each of the developing gas-based fuel and chemical technologies, the benefits of their products, and the economic reality of world scale plants.
STRANDED GAS UTILIZATION: STEPS TO COMMERCIALIZATION

The new Nexant study on the utilization of remote natural gas, *Stranded Gas Utilization: Steps to Commercialization*, provides an in-depth quantitative and qualitative analysis of the various end uses and production processes for converting large, remote natural gas reserves to viable commodity products, both conventional fuels and fuel substitutes as well as commodity petrochemicals.

Nexant reviews the status of each of the gas-based technologies listed below. The expectations and hurdles for commercialization and the performance of those technologies are evaluated.

**Fuels**

**Conventional Fuels**
- Naphtha and Diesel fuel (GTL)
- Fuel grade methanol
  - For power
  - For fuel

**Alternate Fuels**
- DME (dimethyl ether)
  - For power
  - Diesel substitute
- MTG (methanol to gasoline)

**Fuel Cells**
- Vehicle applications
- Stationary applications

**Commodity Petrochemicals**
- Chemical grade methanol
- Methanol to olefins
  - MTO (Methanol to olefins)
  - MTP (Methanol to propylene)
- Ethylene from Fischer-Tropsch (F-T) liquids
  - Ethylene from F-T naphtha
  - Ethylene from F-T gas oil
- \(n\)-Paraffin (C\(_9\)C\(_{17}\)) from F-T Middle Distillates
- Ammonia and Fertilizers
Nexant compares the cost to produce each commodity fuel or petrochemical at a remote location as well as the costs to ship it to major consuming regions. Resulting delivered costs are compared to forecast domestic prices for these regions. Cost estimates are made for 2003, Quarter 3.

Economics are developed for our estimates of conceptual representative plants for each of the technology/product groups, such as diesel fuel from F-T synthesis, DME, etc., based on information provided by the various technology holders, supplemented by publicly available information and Nexant’s own engineering experience and expertise. Where appropriate, these costs of production are compared to conventional technology. These economic comparisons are made for those commodity fuels and chemicals whose processes lend themselves to comparison with conventional technology currently in place, most prominently the commodity chemicals. Economic comparisons of the fuel products compare the delivered costs of the product from the developing technology to domestic prices characteristic of the current market.

The study includes detailed technology, economic, and commercial evaluations:

- **Technology Evaluation** – A detailed review and status of the various process routes including: patent review and analysis, technology holders and offerers, licensor package analysis and cost of production development for what would be considered representative of the technology, and identification of the stage of process package commercial development with a listing of actual and announced projects.

  Due to the increased importance of emerging gas-to-liquids fuel technologies, for these technologies we also review patent activity for potential new processes or catalyst systems. For each of the GTL technologies, we analyze and compare qualitatively the important process design features and variables:

  - Syngas conditioning
  - Catalyst handling
  - F-T product synthesis and recovery (where appropriate)
  - Carbon efficiency
  - Crude product handling
  - Level of research and development
  - Potential for and implications of improvements

  In addition, we examine the key areas of the process designs, discuss how the various technologies differ and comment on the advantages and disadvantages of each:

  - Reactor type (e.g. slurry, tubular packed, etc.)
  - Catalyst system (e.g. precious vs. non-precious metal, supported vs. non-supported, heterogeneous vs. homogeneous, etc.)
  - Process design (process integration, operating aspects)
  - Product slate
Economic Evaluation – Local cost of production estimates are developed for each of the technologies for a stranded gas location with significant remote gas reserves. Costs are developed on an “ex-plant” and delivered basis, depending on the likely market destination for each product. Sensitivities are performed for gas cost and effect of capital cost and estimates are made as to potential improvements and their implications.

Commercial Evaluation – Nexant performs an analysis of the major fuel products included the technical evaluation. This analysis is performed on a global and regional basis, with attention to regional demand and logistical shipping issues. The commercial analysis also regards the limitations of existing infrastructure and delivery systems for the various products and the implications on product competitiveness.

The cost of the study is US$15,000 (fifteen thousand U.S. dollars).
Section 2  Scope

The objective of this study is to assess current and emerging state-of-the-art technologies for converting stranded gas to the following usable products:

Gas to Fuels

- Naphtha and Diesel Fuel (GTL)
- Fuel Grade Methanol
  - For power
  - For fuel
- DME
  - For power
  - Diesel substitute
- MTG
- Fuel Cells
  - Vehicle applications
  - Stationary applications

Gas to Chemicals

- Chemical Grade Methanol
- MTO
- MTP
- Ethylene from F-T (Fischer-Tropsch) liquids
  - Ethylene from F-T naphtha
  - Ethylene from F-T gas oil
- \textit{n}\textendash Paraffins (C_9\textendash C_{17}) from F-T Middle Distillates
- Ammonia and Fertilizers

Brief examples of some of the major issues that are addressed are discussed below.
Fuels

- Diesel substitutes: Diesel fuel is a large potential application for remote natural gas-derived products. DME has shown interesting promise as a substitute for crude oil-derived diesel fuel. Its properties exceed the most stringent and proposed engine emission regulations, while affording excellent diesel properties and high cetane number. In Nexant’s previous report, we evaluated and compared current technology, using methanol as the raw material, developing one-step processes from natural gas. This new report examines the latest developments in both the commercial and developing technology, along with the competitive implications.

- Fischer-Tropsch Middle Distillates (GTL): Nexant updates and analyzes technology advances in Fischer-Tropsch synthesis of natural gas to middle distillate liquid transportation fuels. This route can be an attractive alternative to direct liquefaction of natural gas or, in the case of remote gas, the high cost of transporting natural gas via pipeline. Nexant revisits the most advanced, technically viable, and competitive F-T processes, including BP, ConocoPhillips, ExxonMobil, Rentech, Sasol (SSPD II), Shell (SMDS II), Statoil/PetroSA, and Synthroleum. The evaluation includes the critical components of the process design, such as advanced reactor type and design, catalyst system, etc. Cost of production estimates are performed to ascertain the competitiveness of the technology versus crude oil-based technologies and products.

Chemical Products

- Light Olefins: The conversion of natural gas into short chain light olefins, e.g. ethylene and propylene via methanol, is a potentially viable means to add value to methane. The complication is the methanol intermediate, in itself a valuable commodity. In recent years, there have been several developments in methanol to olefins (MTO) technology based on alternate catalysts to ZSM-5 that exhibit a higher selectivity to light olefins and methanol to propylene (MTP) technology based on Lurgi’s process which is economically superior to propane dehydrogenation, the predominant dedicated propylene process. Commercially viable processes, most notably that developed by UOP and Norsk Hydro (the UOP Hydro MTO process), ExxonMobil (ExxonMobil MTO process), and Lurgi are evaluated and the technology compared economically to conventional olefin production technology.

- Ethylene from F-T Liquids: F-T diesel is a very good cracker feed and can produce a superior yield of ethylene per unit of feedstock. The combined yield of ethylene and propylene from F-T diesel can be superior to that from the conventional feedstocks at the equivalent operating severity. The paraffinic nature of the F-T naphtha also allows for a higher severity operation than might be normally considered when compared to conventional naphtha cracking. Thus, F-T liquids can be expected to be excellent steam cracker feedstocks for the production of ethylene. Steam cracking of F-T diesel and F-T naphtha is compared using Kellogg Brown & Root, Linde AG, ABB Lummus, and Stone & Webster process technologies.
- **n-Paraffins** (C₉-C₁₇): One of the major chemical derivatives potentially benefiting from GTL technology is *n*-paraffins, a key raw material for the production of linear alkyl benzene (LAB). LAB is one of the most important detergent intermediates and accounts for the majority of *n*-paraffin worldwide consumption. Traditionally, *n*-paraffins are obtained via extraction process from kerosene feedstock using proprietary technologies such as Molex (UOP), Isosiv (Union Carbide), or Enso (ExxonMobil) involving molecular sieves. The LAB industry has been negatively impacted during the last several years by either limited *n*-paraffin availability (e.g., when Shell's Bintulu plant suffered an explosion in 1999) or rising crude oil prices, exceeding $30/bbl, causing kerosene and *n*-paraffin prices to rise as well. The availability of cheaper stranded gas presents an opportunity to convert the middle distillates from GTL processes to higher value *n*-paraffins. The study evaluates the process of obtaining *n*-paraffins from GTL middle distillates.

**Fertilizers**

- Ammonia: Total nitrogen consumption (fertilizer and industrial) is forecast to grow to more than 130 million metric tons N by 2010. Fertilizer use accounts for approximately 87 percent of worldwide ammonia consumption. The study examines and evaluates advances in natural gas to ammonia technology with emphasis on the major licensors such as KBR, Haldor Topsoe, Linde, and Uhde.

**Power**

- There has been increasing interest in large-scale production technology of methanol from remote natural gas for use as fuel in some Combined Cycle Power Plants. Fuel grade methanol can be transported safely at low cost to distant markets for use as gas turbine fuel for electric power generation. This is especially beneficial for plants located in regions where pipeline natural gas is not available and where power demand is too small for LNG to be practical. Nexant reexamines the economics of the so-called “Well Head to Wire” technology and compare this process with alternative technologies.

Each of the process technologies (e.g. GTL, MTO, MTP, etc.) and product routes (e.g. F-T diesel fuel, DME, etc.) are evaluated from technical, economic and commercial perspectives, as follows:
Technology Evaluation – A detailed review and status of the various process routes including patent review and analysis, identification of technology holders and offerers, licensor package evaluation and cost of production development for what would be considered representative of the technology, and identification of the stage of process package commercial development with a listing of actual and announced projects.

Regional cost of production estimates are developed for conceptual plants representative of each of the technologies. Costs are developed on an “ex-plant” and delivered basis, depending on the likely market destination for each product. Sensitivities are performed for gas cost and capital cost and estimates are made as to potential improvements and their implications, and competing technologies are compared to conventional technology (e.g., MTO vs. steam cracking).

Economic Evaluation – The study assesses the remote gas price necessary for these processes to be viable at different crude oil price levels. Nexant performs this assessment based on our baseline outlook for Mideast marker crude (Dubai, FOB) as well as high and low boundary cases that will impact gas pricing. Economic assessments are made to determine well-head gas prices necessary to make the natural gas-based processes economically viable versus the range of crude prices.

Commercial Evaluation – Nexant performs an analysis of the major fuel products included in the technical evaluation. The analysis is performed on a global and regional basis, with attention to regional demand and logistical shipping issues.
Section 3 Approach

The evaluations of conventional technology are based on Nexant’s in-house and published information regarding process technology, augmented by contacts with licensors, engineering contractors and other experts in the industry. Stranded gas implementation technology evaluations are “built up” from a review of patents, public domain information, and discussions with the technology developing companies and engineering contractors.

Nexant uses proprietary and commercial state-of-the-art software tools to develop the technology and economic estimates. These are well established, state-of-the-art engineering tools in the process chemical industry and are used by major engineering contractors.

Commercial information and forecasts are developed from Nexant’s extensive in-house databases, augmented with selected regional fieldwork.

Market projections are developed with the aid of Nexant’s Supply/Demand computer modeling systems.
Section 4  Contact Information

Please visit www.nexant.com to authorize engagement of the study or return the following authorization form to one of the Nexant offices.

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1. The undersigned (hereafter "Client") hereby subscribes to purchase from Nexant, Inc. ("Nexant"), Nexant’s study, *Stranded Gas Utilization: Steps to Commercialization*, in accordance with the following terms and conditions.

Nexant will provide to Client the following information and services:

(a) Three (3) bound copies of the report

(b) Access to electronic downloads of the report via a password-protected area from www.nexant.com

2. While the information supplied by Nexant to Client will represent an original effort by Nexant, based on its own research, it is understood that portions of the report will involve the collection of information available from third parties, both published and unpublished. Nexant does not believe that such information will contain any confidential technical information of third parties but cannot provide any assurance that any third party may, from time to time, claim a confidential obligation to such information.

3. The information disclosed in this report will be retained by Client for the sole and confidential use of Client and its 51 percent or greater owned affiliates in their own research and commercial activities, including loaning the reports on a confidential basis to third parties for temporary and specific use for the sole benefit of Client.

4. Client further agrees that it will use reasonable efforts to keep the information in the reports for its sole use; however, this restriction shall not apply to information which is or becomes generally available to the public in a printed publication, which is already in the possession of Client, or which is received by Client in good faith from a third party without an obligation of confidentiality.

5. Client shall not republish any of the report except within its own organization or that of its 51 percent or greater owned affiliates. Client further agrees to refrain from any general publication of the reports, either directly or through its affiliates, so as to constitute passage of title into the public domain or otherwise jeopardize common law or statutory copyright in said report.

6. Upon authorization, Client will be billed by and shall pay Nexant a total of US$15,000. Client shall have the option of being invoiced the total amount upon authorization or in two equal installments, one upon authorization and the second upon delivery of the study. Amounts are due upon receipt of invoice and payable within thirty (30) days. Late payments shall accrue interest at the rate of 1.5 percent per month. Fees quoted do not include any applicable sales tax, or use or value added tax, all of which are for the account of Client.

7. Additional copies of the report are available at US$500 each. The complete report will also be available electronically on CD-ROM at a cost of US$1,000.

8. The obligations of paragraphs 3 and 4 shall terminate five (5) years from receipt of reports.

9. Unless specified otherwise, there are no warranties of any kind for reports and consulting services provided under this Agreement. Nexant’s total liability under this Agreement is limited to the total amount paid to Nexant for the reports.

10. This Agreement will be governed by the laws of the State of New York.
AUTHORIZATION FORM

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CLIENT: ___________________________    NEXANT, INC.

Name: ___________________________    Name: ___________________________

Signature: ___________________________    Signature: ___________________________

Title: ___________________________    Title: ___________________________

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Section 6

6.1 GENERAL

Nexant uses multidisciplinary project teams drawn from the ranks of our international staff of engineers, chemists, economists and financial professionals, and from other Nexant groups to respond to the requirements of each assignment. Most of the staff of consultants possess credentials in both scientific and commercial disciplines plus substantial industrial experience. The collective talents of our staff, strategically located and closely linked throughout the world, result in valuable insights gained through a variety of perspectives.

ChemSystems is an international consultancy that is now part of Nexant, Inc., and is dedicated to assisting businesses within the global energy, chemical, plastics and process industries by providing incisive, objective, results-oriented management consulting. Over three decades of significant activity translate into an effective base of knowledge and resources for addressing the complex dynamics of specialized marketplaces. By assisting companies in developing and reviewing their business strategies, in planning and implementing new projects and products, diversification and divestiture endeavors and other management initiatives, Nexant helps clients increase the value of their businesses. Additionally we advise financial firms, vendors, utilities, government agencies and others interested in issues and trends affecting industry segments and individual companies. Whether identifying opportunities, managing change or confronting competitive challenges, we adhere to the highest ethical and professional standards.

ChemSystems, founded in 1965, was originally an independent, management owned consultancy. IBM acquired it in 1998, and from early 1998 until August, 2001 ChemSystems was a part of the IBM Global Services and IBM’s Chemical and Petroleum groups. Effective September 1, 2001, the ChemSystems unit of IBM was acquired by Nexant, Inc. Nexant, Inc. is an independent industry-expert consulting firm, that was spun off from Bechtel three years ago, that provides technology solutions and experienced-based technical and management consulting services to electric utilities, energy producers, chemical companies, oil and gas companies, governments, and energy end-users worldwide. All of the staff and intellectual capital of ChemSystems was acquired by Nexant, Inc. Thus, Nexant, Inc., with ChemSystems as part of its Chemicals and Petroleum Division, continues to maintain fully-integrated operations in White Plains, New York; London, England; San Francisco, California; and Washington, D.C. Other business unit offices are located in Boulder, CO and Phoenix, AZ, and satellite business or project offices are located in Tokyo, Bangkok, Cairo, New Delhi, Moscow, and Houston. We also work with representatives throughout the world.

From major multinationals to locally-based firms and governmental entities, our clients look to us for expert judgment in solving compelling business and technical problems and in making critical decisions. The acquisition of ChemSystems by Nexant, Inc., has enhanced ChemSystems’ ability to successfully serve its clients. This merger’s success arises from complementary methodologies and technologies, which are used to provide services to clients and allow us to provide more complete and effective consulting.
Nexant’s clients include most of the world’s leading oil and chemical companies, financial institutions, and many national and regional governments. Nexant, Inc./ChemSystems is active in most of the industrialized countries of the world, as well as in most of the developing areas including the Middle East, Africa, and East and Southeast Asia.

Major annual programs are:

- Process Evaluation/Research Planning (PERP)
- Petroleum and Petrochemical Economics (PPE) – United States, Western Europe and Asia

The PERP service covers technology, commercial trends, and economics applicable to the chemical industry. The program has more than 50 subscribers, including most of the major international chemical companies. Many of the processes to be analyzed in this multiclient have been assessed in the PERP program.

PPE covers the market and manufacturing economics for major petrochemicals. The program has approximately 100 clients.
6.2 SPECIFIC SINGLE-CLIENT EXPERIENCE RELEVANT TO STRANDED GAS UTILIZATION

Nexant is exceptionally qualified to perform this comprehensive analysis based on our multidisciplinary business approach and has been carrying out studies of this type throughout our more than 35 year history.

Nexant has extensive experience in the areas of natural gas technology and commercial utilization. Projects based on natural gas feedstocks have involved the full range of services including strategic assessments of energy options, market analysis and forecasts, process selection, cost estimating, financial analysis, preparation of bid documents, contractor selection and project management through to plant operation.

A partial list of projects includes:

- **GAS-TO-LIQUIDS HIGH VALUE PRODUCTS** -- For a potential new project, Nexant reviewed and forecast the market for products from a Fischer-Tropsch GTL plant, including naphtha, n-paraffins, and synthetic drilling fluid, and synthetic lubricants. The study included historical and forecast prices, supply/demand, cost structures of competing products and a discussion of typical end-uses.

- **ULTRA CLEAN FUELS MARKET STUDY** - Nexant completed a project jointly funded by U.S. Department of Energy and a major international petroleum company involving comprehensive life cycle analyses and assessment of the potential markets through 2015 for ultra clean transportation fuels produced from natural gas via both state-of-the-art and emerging technologies. The ultra clean fuels encompass F-T diesel, F-T naphtha, F-T jet, (i.e., the major product slates from GTL technologies) and methanol. Comparative global economics, including cost of production, transportation to market, tariff, etc., for key GTL and methanol technologies were developed. Rates of return on capital investment were compared among the new technologies and against the conventional refining operations.

- **TECHNOECONOMIC EVALUATION** -- For a major U.S. chemical company seeking to identify and evaluate viable chemical outlets that could consume significant quantities of remote gas resources in world-scale facilities, Nexant screened a broad group of major chemicals that were first or second derivatives of methane. For the selected chemicals, market related information and production economics and technology evaluation were provided.

- **TECHNOECONOMIC EVALUATION** -- Nexant was retained by a Japanese energy-related agency to evaluate the status and trends of natural gas conversion to liquid fuels technologies. Processes already commercial (Sasol, Mobil, Shell), ready for commercialization (Exxon, Haldor Topsoe), as well as under development (Syntroleum, Statoil), were assessed and comparisons made with competitive processes. For each of the processes, detailed descriptions of the investment required, the feedstocks and chemistry of the processes, and the costs of production were provided.

- **PRODUCTION ECONOMICS** -- Nexant developed the cost of producing dimethyl ether (DME) via a recently announced process in large scale natural gas plants and delivering it as a substitute for conventional diesel fuel. The client was also interested in comparing DME
production costs with other alternative processes for converting remote natural gas to a fuel product.

- **MARKET POTENTIAL** -- The natural gas division of an international petroleum company authorized Nexant to determine the market potential for natural gas based chemicals including: ammonia, urea, methanol, acetic acid and for novel conversion technologies. Nexant provided the global market size, growth factors, cost of production (ammonia, methanol, acetic acid) and an overview of primary technology licensors or contractors who are candidates as partners.

- **OPPORTUNITY ANALYSIS** -- A major U.S. chemical producer interested in developing and producing hydrocarbons in Asia engaged Nexant to ascertain the market opportunities for available methane in selected regions in China for petrochemical or related products. We provided a general overview of the Chinese energy market and the role of natural gas in energy, industrial and chemical applications; infrastructure overview in the target regions/locations; focused assessment of natural gas opportunities for chemicals and for energy/industrial applications in the selected regions.

- **NATURAL GAS UTILIZATION** -- An Australian client interested in developing natural gas fields that contained undesirable amounts of inert gases for industrial gas customers engaged Nexant to assess the suitability of these resources as chemical feedstocks or as fuel in a variety of applications: direct reduction of iron; steel making; methanol; ammonia/urea; chloralkali and ethane based petrochemicals. In each case, gas consumption, specifications, cost of gas treatment, if any, problems or benefits from impurities and the cost benefit of several levels of treatment were determined.
6.3 MULTICLIENT EXPERIENCE INVOLVING NATURAL GAS

- **STRANDED GAS UTILIZATION: METHANE REFINERIES OF THE FUTURE** -- A study analyzing and comparing the technologies and markets that can utilize natural gas from remote locations.

- **STATIONARY FUEL CELLS** – An analysis of the status and prospects of the technology for stationary fuel cells with particular emphasis on its impact on the chemical industry (now in progress).

- **FUEL CELLS FOR AUTOMOBILES** – An analysis of the status and prospects of the technology of mobile fuel cells intended for automobile and truck application with particular emphasis on infrastructure requirements and barriers (now in progress).

- **PETROCHEMICALS FROM REFINERIES** -- This in-depth business assessment evaluates opportunities to produce high value petrochemicals from lower value refinery streams. The analysis examined the operational and capital costs benefits of integrated operations versus stand-alone petrochemical facility construction. The study also evaluated the global market outlook for over twenty petrochemical products. The profitability of producing these products from pro forma refineries located in the world’s three major refining centers (USGC, Singapore, Rotterdam) was evaluated.

- **THE LATIN AMERICAN ENERGY, REFINING AND PETROCHEMICAL INDUSTRIES IN TRANSITION** -- A geographically-focused business assessment that evaluates the key issues facing the energy and refining industries in all major Latin American countries. Industry competitiveness is assessed and energy and major petroleum product supply/demand trends analyzed for each country and the region.

- **PROCESS EVALUATION/RESEARCH PLANNING (PERP)** – Nexant’s premier technology evaluation service prepared several reports in the last few years on gas to liquids: Developments in Natural Gas to Liquid Fuels Conversion; Advances in Fischer-Tropsch Technology; Methane Conversion to Olefins and Liquids, Methanol to Olefins.

- **GAS-BASED CHEMICALS AND FUELS: GLOBAL PROSPECTS TO THE YEAR 2000** -- An industry analysis that quantified the likely scale of gas/gas liquids-based investments in the 1990s and assessed the potential impacts upon industry structure and pricing. The major focus was on the economics of gas and gas liquids conversion and the implications for current project planning. The study addressed the following: the potential for gas and gas liquids conversion projects based on an overall market/economic assessment of the possible products; the likely capacity of new gas and gas liquids projects and their competitiveness; and the likely impact of gas and gas liquids based developments on the supply and pricing of the relevant products. Key issues covered included: resource base (gas and gas liquids), market potential (potential products), technology (new versus improved), production and shipping economics (competitiveness and profitability), investment Intention (countries and capacity development) and strategic assessment (impact, opportunities and threats).
- **LPG AVAILABILITY AND PRICING** -- A global analysis of LPG availability from a variety of sources, LPG pricing and the demand for LPG in all significant end-use markets. Forecast supply/demand balances provided the basis for projecting prices, after having also considered various political/economic factors including how LPG was priced by overseas producers and how U.S. governmental policies and programs affect global LPG market.

- **AMMONIA BUSINESS** – Nexant evaluated the impact of changing economics and markets on the global ammonia business, especially the effect on U.S., West European and Japanese industry of trends towards fertilizer self-sufficiency in the developing world. The study also covered export-oriented production of ammonia, urea and other fertilizers by the gas-rich countries. Detailed production economics were produced for all types of feedstocks, as applicable for various parts of the world.