LNG - THE CHALLENGE OF INCLUDING AN INTERNATIONALLY TRADED COMMODITY IN A NORTH AMERICAN NATURAL GAS FORECAST

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JAMES T. JENSEN
Jensen Associates
49 Crescent Street; Weston, MA 02493 U.S.A.
Website  JAI-Energy.com

Phone (781) 894 2362
Fax (781) 894 9130
E Mail JAI-Energy@Comcast.Net
U.S. NATURAL GAS SUPPLY FORECASTS HAVE TENDED TO OPERATE ON FOUR UNWRITTEN ASSUMPTIONS

- First, North American Gas Demand and the Supply Required to Meet it Are Effectively Isolated From Gas Markets in the Rest of the World

- Second, Economic Considerations Drive the Exploration and Development of Gas Reserves

- Third, Competitive Commodity Behavior Governs the Supply Response to Market Price Signals

- And Finally, the Adjustment of Supply to Price Changes is Instantaneous
UNFORTUNATELY NONE OF THOSE FOUR ASSUMPTIONS APPLY TO IMPORTED LNG

AND THEREIN LIES THE CHALLENGE TO TRADITIONAL NORTH AMERICAN SUPPLY FORECASTING
The First Assumption - the Focus on North America - Enables the Forecaster to Match Supply and Demand in a Closed Regional Market System

The Second Assumption - That Exploration and Development are Driven by Economics - is Ideally Suited to a Market-Oriented Economy, Such as the U.S.

But it Ignores the Complex Geopolitics and Joint Venture Negotiations That Are a Powerful Influence on Energy Investment Behavior in Many of the Developing Countries
The Third Assumption - That Price Response is Governed by Competitive Commodity Behavior - Enables the Model to Focus on Costs as the Determinant of Supply Prices

It Thus Operates on the Premise That in a Competitive Commodity Market, No Supplier Can Retain Scarcity Rents and There is No Inherent Difference Between "Cost-Based" Pricing and "Market" Pricing

And the Fourth Assumption - That the Response of Supply to Price is Instantaneous - Enables the Forecaster to Ignore the Complex Contract Negotiation Process and the Long Lead Times that Take Place Between the Decision to Proceed with a Major LNG Project and its Final Startup
THE TRADITIONAL FOCUS ON NORTH AMERICAN GAS SUPPLY HAS MADE IT DIFFICULT FOR SOME TO ADJUST TO A WORLD IN WHICH NORTH AMERICA MUST COMPETE WITH EUROPE AND ASIA FOR LNG

- It is Most Evident in the Common View that North American Terminal Siting is the Only Significant Obstacle to Increased LNG Imports

- LNG Delivery Systems Involve a "Chain" of Capital Investments in Which Terminals Are a Comparatively Small Part - 10% to 15% - of the Total LNG Chain

- Terminals are the "Tail" - The "Dog" Is Upstream
Much of the LNG Demand Is Outside the U.S., as Well

In 2004, the U.S. Imports Were Only 10% of World LNG Trade

And, Since the Qatargas 1 Project in 1997 Initiated the Current Burst of Activity in International LNG, Approximately 160 Million Tons of LNG Have Been Committed on Long Term Contracts

The Regional Commitment Balance is as Follows:
- U.S. 14%
- Europe 25%
- Asia 38%
- Destination Flexible 23%
BECAUSE OF THE STRONG DEMAND FOR LNG IN OTHER MARKETS, IT IS INEVITABLE THAT U.S. IS EXPOSED TO EVENTS IN WORLD GAS MARKETS THAT AFFECT THE SUPPLY, DEMAND AND PRICE OF LNG

During the Past Three Years, There Have Been a Number of Disruptions that Have Affected World LNG Supply
- A 2003 Fire at Malaysia's Tiga Liquefaction Plant
- An Explosion that Destroyed Three Liquefaction Trains at Algeria's Skikda Plant in 2004
- Guerilla Activity in Nigeria in 2005 that Shut Down Some Liquefaction for a Period
- Gas Supply Problems at Both Indonesia's Arun and Bontang Facilities, the Former Compounded by Insurrectionist Activity
- And Mechanical Problems that Have Temporarily Reduced Supply in:
  - Australia
  - Egypt
  - Qatar
  - Trinidad
Events that Have Put Unanticipated Demand on World LNG Supply During the Same Period Include:
A Nuclear Upset at Tokyo Electric that Forced the Shutdown of Seventeen Nuclear Plants in 2003, Some for as Much as Two Years
A Recent Severe Drought in Spain that Has Boosted Gas-Fired Generation to Offset Reduced Hydropower
This Last Winter's Reversal of the U.K.'s Historic Position as a Net Gas Exporter to a Net Gas Importer
And Cold Temperatures in Europe this Last Winter

It is Important to Note that When Competing with Europe for Tight Supplies, the U.S. is at a Transportation Disadvantage for All Sources Except Trinidad

The Competitive Effect on U.S. LNG Supply is Evident in the Comparative Low Utilization Rate for the U.S.'s Growing Receipt Terminal Capacity
Figure 1
COMPARISON OF U.S. LNG TERMINAL IMPORTS WITH CAPACITY
MILLION CUBIC FEET PER DAY

Effective Capacity Factor
Jul/Jun 00/01 - 71%
Jul/Jun 01/02 - 34%
Jul/Jun 02/03 - 48%
Jul/Jun 03/04 - 51%
Jul/Jun 04/05 - 50%

Competition with Europe and Asia for Cargoes Has Shifted Atlantic Basin Volumes to One Side of the Atlantic or the Other
THE SECOND ASSUMPTION - THAT ECONOMICS ARE THE SOLE DRIVING FORCE FOR LNG SUPPLY FAILS TO RECOGNIZE THE COMPLEXITY OF THE INVESTMENT DECISION PROCESS

- Upstream LNG Projects Are Characterized by Large Up Front Investments, Long Lead Times, "Lumpy" Supply Additions and Complex Negotiations Among the Various Stakeholders in the Project

- Because They Are Usually Joint Ventures and Because They Are Large Compared to the Partners' Capital Budgets, it is Often Difficult to Get a Final Agreement Among Partners to Proceed with a Project

- Prominent Among the Project Stakeholders are the Producing Governments (Where At Least Half of the CAPEX are Concentrated)
The Project Approval Process Can be Likened to a Decision by Committee to Place a Multi-Billion Dollar Bet on an Investment

And in Those Cases Where the National Oil Company is a Partner, One Committee Member Often Has an Inherent Conflict of Interest

As an Agent of the Government's Tax Regime, it Wants to Maximize Government Revenues; With its Oil Company Hat on it Wants to Maximize Project Return

The Involvement of Governments in the Decision Process Also Raises Questions of Political Risk, Not Only About the Stability of the Governments, But the Stability of Their Fiscal Regimes, as Well
Political Problems Have Recently Been in the News About Such Potential LNG Suppliers to the U.S. as:

Bolivia - Election as President of a Populist Who Had Led the Fight Against an Earlier LNG Proposal

Equatorial Guinea - Charges of a Possible Coup

Indonesia - Separatist Problems Affecting the Arun Project; Independence of East Timor Affecting Bayu Undan and Sunrise LNG Projects

Nigeria - Workers Strikes and Guerilla Activity Curtailing LNG Output and Shutting in Oil Production

Venezuela - Civil Unrest Shutting in Oil Production
THE THIRD ASSUMPTION - THAT PRICE RESPONSE IS GOVERNED BY COMPETITIVE COMMODITY BEHAVIOR FAILS TO RECOGNIZE THE PROFOUND DIFFERENCE BETWEEN LNG AND ONSHORE GAS COMPETITION

- LNG Competition is Among a Limited Number of Projects - "Project Supply" - Rather Than Among a Very Large Number of Competing Producers - "Commodity Supply"

- The Sharp Difference in Transaction Activity Between Conventional U.S. Exploration and Development and LNG Projects is Illustrated by Figure 2

- Since 1994, the Number of Completed U.S. Gas Wells Has Varied from 8,354 to 27,335; In Sharp Contrast, the Number of New LNG Trains Completed Worldwide During the Same Period has Varied from Zero to Six
Figure 2

Annual Number of Wells Competed

Number of New LNG Trains in Year

0 10,000 20,000 30,000

1 3 2 1 1 6 2 0 5 1 2 6


Jensen

Never More Than Six New Trains;
Never Fewer Than 8,300 Wells
LNG Projects Thus Bear Greater Resemblance to Major Supply Projects Such as the Arctic Pipelines Than They Do to Drilling in the Anadarko or Powder River Basins

These Projects Have Traditionally Been Price Takers, Suppliers Assuming that Prices in the Marketplace Will Determine their Netbacks, not that Their Costs Will Determine Prices

While LNG Prices Will Clearly Weaken in the Face of Plentiful Supply Offerings, LNG is Rarely the Marginal Source of Supply that Sets the Market Price

Netbacks to the Wellhead Commonly Provide Economic Rents; These are Shared Between Investors and Host Governments According to the Terms of the Tax Regime
The LNG Supplies That Will Come on Line This Year for the Most Part Were Initiated Under the Market Conditions that Prevailed in the Year 2002 or Even Earlier; New Investment Decisions Finalized Today Will Probably Not be On Stream Until 2010.

In Addition, the Fact That Projects That are Expected to be a Part of Future Supply are Often Delayed or Even Cancelled, Makes an Orderly Balancing of LNG Supply and Demand Difficult.

Thus LNG Projects Do Not Smoothly Respond to Short Term - and Volatile - Price Signals When Demand Calls for New Supply.

THE FOURTH ASSUMPTION - THAT SUPPLY, DEMAND AND PRICE READJUST INSTANTANEOUSLY TO REBALANCE INTERNATIONAL MARKETS IGNORES THE LONG INVESTMENT LEAD TIMES IN LNG PROJECTS
LNG PROJECTS CONSIST OF A "CHAIN" OF INTERLINKED INVESTMENTS WHICH TRADITIONALLY HAVE BEEN HELD TOGETHER BY LONG TERM CONTRACTS

- While This Traditional Structure Has Been Under Fire, No New LNG Facility Has Been Launched Without a Long Term "Anchor" Contract

- Thus Industry Reliance on Long Term Contracting is Likely to Remain, Acting as a "Filter" to Determine the Flow of New Projects into the Market

- But Despite the Reliance on Long Term Contracts, the LNG Market is Becoming Increasingly Flexible

- This New Flexibility has Created the Possibility of Shifting LNG Cargoes to Those Markets With the Highest Netbacks, Thus Introducing International Price Competition and Regional Price Arbitrage into LNG Trade
THE TRADITIONAL CONTRACT WAS A RELATIVELY INFLEXIBLE "DESTINATION CONTRACT"

- It Linked Specific Liquefaction Facilities with the Receipt and Regasification Facilities of Specific Customers, Usually with Dedicated Tankers

- The New Contracting Patterns are Much More Destination-Flexible and Permit Shifting Cargoes Among Markets as a Price Arbitraging Mechanism

- The New Flexibility Has Come About in Two Ways
  (1) A Small, But Growing, Short Term Market, and
  (2) A Trend by Suppliers Towards "Self Contracting" with Their Own Downstream Marketing Affiliates
Figure 3
LNG TRADE SHOWING THE GROWING ROLE OF SHORT TERM SALES
MILLION TONS OF LNG

Million Tons

Short Term Volumes, While Growing Rapidly, Are Still Small


1.4% 2.5% 5.5% 7.7%

11.6%

Short Term Volumes
Contract Volumes
SELF-CONTRACTING GIVES THE SUPPLIERS DESTINATION FLEXIBILITY THAT WAS NOT AVAILABLE UNDER THE TRADITIONAL CONTRACTING SYSTEM

- The Ultimate Market Destinations are Defined, Not by the Terms of the Contract, But by the Best Netbacks Available to the Supplier, Given His Portfolio of Liquefaction and Regasification Assets

- Some Idea of the Importance of these New Flexible Volumes is the Proportion of the Estimated Firm and Probable Capacity for the Year 2010 That is Still Committed to Destination Contracts Versus That Which Remains Flexible - Either as Uncommitted or Self-Contracted Volumes
Figure 4
ESTIMATED [1] CONTRACTUAL STATUS OF FIRM AND PROBABLE LNG CAPACITY IN PLACE BY 2010
MILLION TONS OF LNG

- The Atlantic Basin Has Become the Major LNG Arbitrage Market, with Cargoes Being Shifted Among Nigeria and Trinidad on the one Hand and the U.S. and Spain on the Other; the U.K.'s Growing LNG Imports Will Make it an Important Arbitrage Partner in the Future

- The Middle East Remains the Most Dependent on the Traditional Long Term Contract, But Much of its Focus Has Switched from the Pacific Basin Market to the Atlantic Basin Market

- The Pacific Basin also Shows a Large Flexible Volume in 2010

- It is a Product of Competitive Expansion of New Greenfield Facilities Coupled with Major Contract Expiration Later in the Decade
The greater volatility of the U.S. netbacks is largely attributable to the fact that the U.S. Henry Hub price is a spot market price; Spanish border prices average spot prices with those of more stable contract volumes.

Thus Figure 5 does not really tell us the prices at which Spain has competed for spot volumes.

Broadly speaking, Trinidad and Nigeria have similar netbacks from Spain, but Trinidad has a transportation advantage to the Gulf Coast.
Trinidad and Nigeria Have Similar Netbacks From Spain But Trinidad Does Better Against the U.S. Gulf Coast

[I] U.S. Prices are Market Prices; Spanish Prices Are Import Prices and Include Imports With Relatively Stable Contract Terms
THE CENTRAL LOCATION OF THE MIDDLE EAST BETWEEN ATLANTIC BASIN AND PACIFIC BASIN MARKETS ENABLES IT TO SHIP EITHER EAST OR WEST AS MARKETS DICTATE

- Thus it is in a Position to Play the Price Arbitraging Role Between Northeast Asia and the Atlantic Basin
- And it Can Also Play a Role in the Atlantic Basin Arbitrage by Favoring Either European or North American Destinations
ILLUSTRATIVE NETBACKS [1] FROM THE U.S. GULF COAST, SPAIN AND JAPAN TO THE MIDDLE EAST SHOWING ARBITRAGE PATTERNS

Figure 6

U.S. Gulf Coast is an Attractive Market When U.S. Prices are Strong

Japan Has Usually Provided Better Netbacks Than Spain But is Commonly Less Active in Short Term Markets

[1] U.S. Prices are Market Prices; Spanish and Japanese Prices Are Import Prices and Include Imports With Relatively Stable Contract Terms (Including LNG as Liquid)
THIS PAST YEAR HAS RAISED SERIOUS QUESTIONS ABOUT FUTURE LNG PRICE FORMATION

- In the Midst of a Growing Debate About the Value of Oil-Linked Pricing Clauses in Long Term Contracts, LNG Has Experienced Several Patterns of Disruptive Market Behavior
  - Sharply Higher Oil Prices
  - Liquefaction Supply Problems and Tight LNG Markets
  - The U.S. Katrina Disruptions
  - The U.K.'s Role Reversal from Exporter to Importer
  - Adverse Weather in Europe

- Not Only Have These Confused the Pricing Issue, but the Market Does Not Seem to Have Functioned as Smoothly in Allocating Gas Supply as One Might Have Expected

- One Source of Friction Has Been the Difference in the Response of the Restructured Gas Markets and the Contract-Dependent Markets to Higher Oil Prices
OIL AND GAS PRICE RELATIONSHIPS DIFFER IN THE FOUR MAJOR LNG IMPORT MARKETS - NORTHEAST ASIA, NORTH AMERICA, THE U.K., AND THE CONTINENT - AND THUS THEIR RESPONSE TO HIGH OIL PRICES MIGHT BE EXPECTED TO DIFFER

- Traditional Long Term Contracting Still Dominates Northeast Asian LNG Trade

- The Traditional Contract Commonly Tied LNG Prices to The Japanese Customs Clearing Price for Crude Oil - JCC or the "Japanese Crude Cocktail"

- To Protect Buyers from Oil Price Shocks, Price Caps and "S Curves" Were Common

- These Price-Limiting Clauses Have Served to Insulate Japanese Import Volumes from Much of the Recent Surge in Oil Prices
Ordinarily, LNG Prices Roughly Track Oil Prices

But Now, Oil Prices Are Rising Much More Rapidly Than LNG Prices

Price Caps and "S Curves" in Contracts are Holding Down LNG Prices

[1] As Liquid
The Price-Limiting Clauses Have Also Created a Substantial Difference Between Buyers' and Sellers' Negotiating Positions on Prices in New Contracts

Sellers Argue That the High Prices in the U.S. and Europe Represent the New World Market Price for Gas

But Buyers Do Not See Any Cost Justification for Such a Significant Increase from Traditional Price Levels

This Has Been Partly Responsible for a Stalemate in Contract Negotiations

It Has Also Raised Serious Questions About What Will Ultimately Determine LNG Price Levels

An Interesting Question - "Does the Insulation of Japan From Full Oil Price Tracking Give It the Ability to Cross Subsidize Spot Market LNG Purchases to the Disadvantage of the Liberalized Gas Markets?"
IN SHARP CONTRAST TO JAPAN, THE U.S. HAS COMPLETELY RESTRUCTURED ITS GAS INDUSTRY

- Few Long Term Contracts Remain and the Contractual Linkage to Oil Has Completely Disappeared

- While the Working Assumption for a Time was That "Gas-to-Gas Competition" Made Oil Prices Irrelevant, an Indirect Linkage has Been Restored in Tight Markets Through Switching to Oil in Dual-Fired Boilers

- Weaker Markets Tend to Move Prices Towards Residual Fuel Parity; Stronger Markets Towards Distillate Parity

- The Start of 2006 Has Seen the Return of Gas-to-Gas Competition - Decoupled From Oil Prices - for the First Time in Four Years

- Another Question - "Is U.S. Oil Price Decoupling Only Temporary?"
Recent Prices Have Tended to Fluctuate Between Resid Parity in Weak Markets and Towards Distillate Parity in Tighter Markets

The Start of 2006 Has Seen an Unusual Decoupling of Gas and Oil Prices

■ Thus, One Would Expect U.K. Price Behavior to Resemble that of the U.S. While the Continent Might Look More Like Japan

■ But the U.K. - Previously in Surplus - Has Had No Reason to Develop an Indirect Link to Oil Prices as Has the U.S. and the Lack of a Liquid and Transparent Continental Market Makes it Difficult to See How Continental and U.K. Prices Interact at This Point

■ Thus, What Will Happen to U.K. Price Formation Now that It Has Become a Net Importer is Far From Clear

■ Spain, the Major LNG Arbitrage Partner to the U.S. Also Has Some Contract-Protected Prices - Does it Have a Competitive Advantage Over the U.S. and the U.K.?
While Gas Prices Fluctuate About Oil Prices, They Tend to Follow Them Upwards.
Figure 11
BRENT CRUDE OIL PRICE COMPARED WITH SPANISH BORDER PRICES IN $/MMBTU

Price in $/MMBtu

- Spanish Border Prices Include Some Contract Volumes With Price Caps or "S Curves" That Do Not Track Rising Oil Prices
- And Somewhat Similar to Japan, Prices for LNG are Diverging from Oil Prices; Less Restructured Continental Markets Such as Germany Show Even Greater Divergence
WHAT DOES ALL THIS MEAN?

- North America is Moving from a Largely Self-Contained Gas Market to Reliance on LNG Imports at a Time of Great Uncertainty About the Outlook for Demand, Supply and Price of Internationally-Traded LNG

- The Principal Uncertainties in Developing an LNG Import Schedule Lie in How Rapidly Upstream Projects are Likely to Come on Line in the Face of Geopolitical Constraints and How Much Price Competition There Will Be for Those Supplies

- The Cost Structure for LNG and the Adequacy of U.S. Terminal Capacity - Assuming it Does Not Constrain the Upstream Supply Schedule - Are Probably Secondary Issues

- All of This Suggests the Importance of Developing a World Gas Model, Difficult Though That May Prove to Be