THE EXPANDING ROLE OF LNG IN NORTH AMERICAN GAS SUPPLY - A CHALLENGE TO GAS SUPPLY MODELING

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JAMES T. JENSEN
Jensen Associates
49 Crescent Street; Weston, MA 02493 U.S.A.
Phone (781) 894 2362
Fax (781) 894 9130
E Mail JAI-Energy@Worldnet.ATT.Net
Website JAI-Energy.com

THE MODELING OF U.S. GAS SUPPLY OPERATES ON THREE UNWRITTEN ASSUMPTIONS

- First, For the Most Part, North American Gas Markets and North American Gas Supply Operate in Isolation From the Rest of the Gas World
- Second, Exploration and Development of Gas Reserves are Driven by Economics
- And Third, Competitive Commodity Behavior Governs the Supply Response to Market Price Signals

UNFORTUNATELY NONE OF THOSE THREE ASSUMPTIONS APPLY TO IMPORTED LNG SUPPLY

AND THEREIN LIES THE CHALLENGE TO THE TRADITIONAL NEMS APPROACH TO SUPPLY MODELING

- The First Assumption - the Focus on North America - Enables the Model to Match Supply and Demand in a Closed Regional Market System
- Exports to Japan are Small and are Defined by Long Term Contracts
- Exports to Mexico are also Comparatively Small and, as Bilateral Trades, Can be Estimated by Monitoring Mexican Analyses
- The Biggest Departure from a Closed Regional System Has Been Canada; While it is Possible to Model Canada and the U.S. Together - as Canada has Done for Years - The Use of Canadian Government Forecasts Makes it Possible to Treat Canadian Imports as an Exogenous Input to the U.S. Model With Limited Risk

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

- While Legal Constraints on Land Access and the Environment Must be Considered, These Are Usually Based on Public Regulations and Policies and Can be Factored into the Supply Model to Influence the Output

- The Importance of the Assumption is that it Enables the Modeler to Ignore the Complex Geopolitics that are So Important in Understanding Energy Investment Behavior in Many of the Less Developed 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

THIS EMPHASIS ON NORTH AMERICA HAS SOMETIMES TENDED TO CREATE A RATHER MYOPIC VIEW OF THE LNG INVESTMENT DECISION PROCESS

- It is Most Evident in the Focus on North American Terminal Siting as the Major Obstacle to Increased LNG Imports
- And in the Assumption That at Some "Trigger Price", LNG Will Flow into the U.S. to Put a "Cap" on U.S. Gas Prices
- In Both Cases, the Focus is on the U.S., Largely Ignoring the Rest of the World

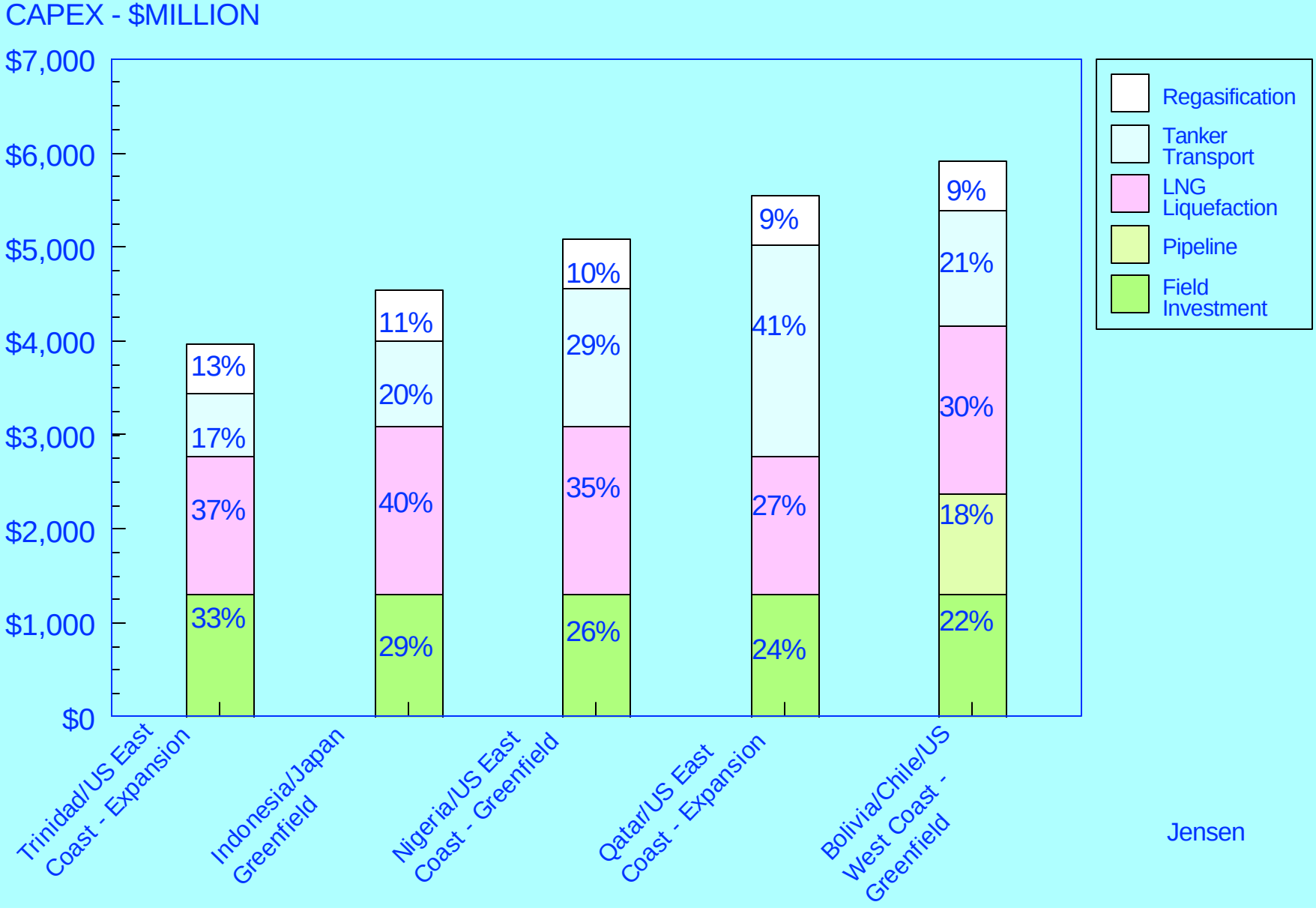
LNG SUPPLY INVOLVES A "CHAIN" OF CAPITAL INVESTMENTS

- And Despite All of the Attention Being Paid to the Terminal Siting Issue, Terminals Are a Comparatively Small Part of the Total LNG Chain - They are the "Tail" - The "Dog" Is Upstream
- Figure 1 Illustrates the Portion of the Capital Investment Required for Different Functions for Several LNG Trades
- In All Cases, Less Than 13% of the CAPEX is Located in the Receiving Country While At Least 50% is Located in the Producing Country

Figure 1

ILLUSTRATIVE CAPITAL EXPENDITURE PROFILES FOR SELECTED LNG PROJECTS

ASSUMING TWO 3.3 MMT TRAINS AND A FIELD INVESTMENT OF $3.85/ANNUAL MMBTU



NOT ONLY IS THE GREATEST SHARE OF LNG CHAIN CAPEX INVESTED OUTSIDE THE U.S., BUT

- Much of the LNG Demand Is Outside the U.S., as Well
- Since the Qatargas 1 Project in 1997 Initiated the Current Burst of Activity in International LNG, Approximately 150 Million Tons of LNG Have Been Committed on Long Term Contract
- The Regional Commitment Balance is as Follows:

U.S.	24%
Europe	38%
Asia	29%
System or Flexible	9%

- While New Terminals in the U.S Will Increase the U.S.'s Share of World LNG Markets, There is Still Substantial Demand Elsewhere

- Thus the Assumption of Regional Isolation for North America is Not Valid for LNG

IT IS A MYTH THAT THE TERMINAL SITING PROBLEM IS THE ONLY SIGNIFICANT OBSTACLE TO LNG IMPORTS

- It is Based on the Assumption That a Restructured International Gas Industry Will Always Maintain an Overhang of Freely-Available and Competitively-Priced Short Term Supply

- While That Appeared to be True During the Winter of 2000/2001, the Following Year Europe Outbid the U.S. for That Supply and U.S. Terminal Capacity Was Idled

- Then, In Late 2002, a Shutdown of 15 Nuclear Plants by Tokyo Electric and a 2003 Fire at Malaysia's Tiga Plant Upset World LNG Supply/Demand Balances and Tanker Availability Patterns to the Detriment of U.S. Markets

- The Effect on U.S. Terminal Capacity Operation is Shown in Figure 2

Figure 2

COMPARISON OF U.S. LNG TERMINAL IMPORTS WITH CAPACITY

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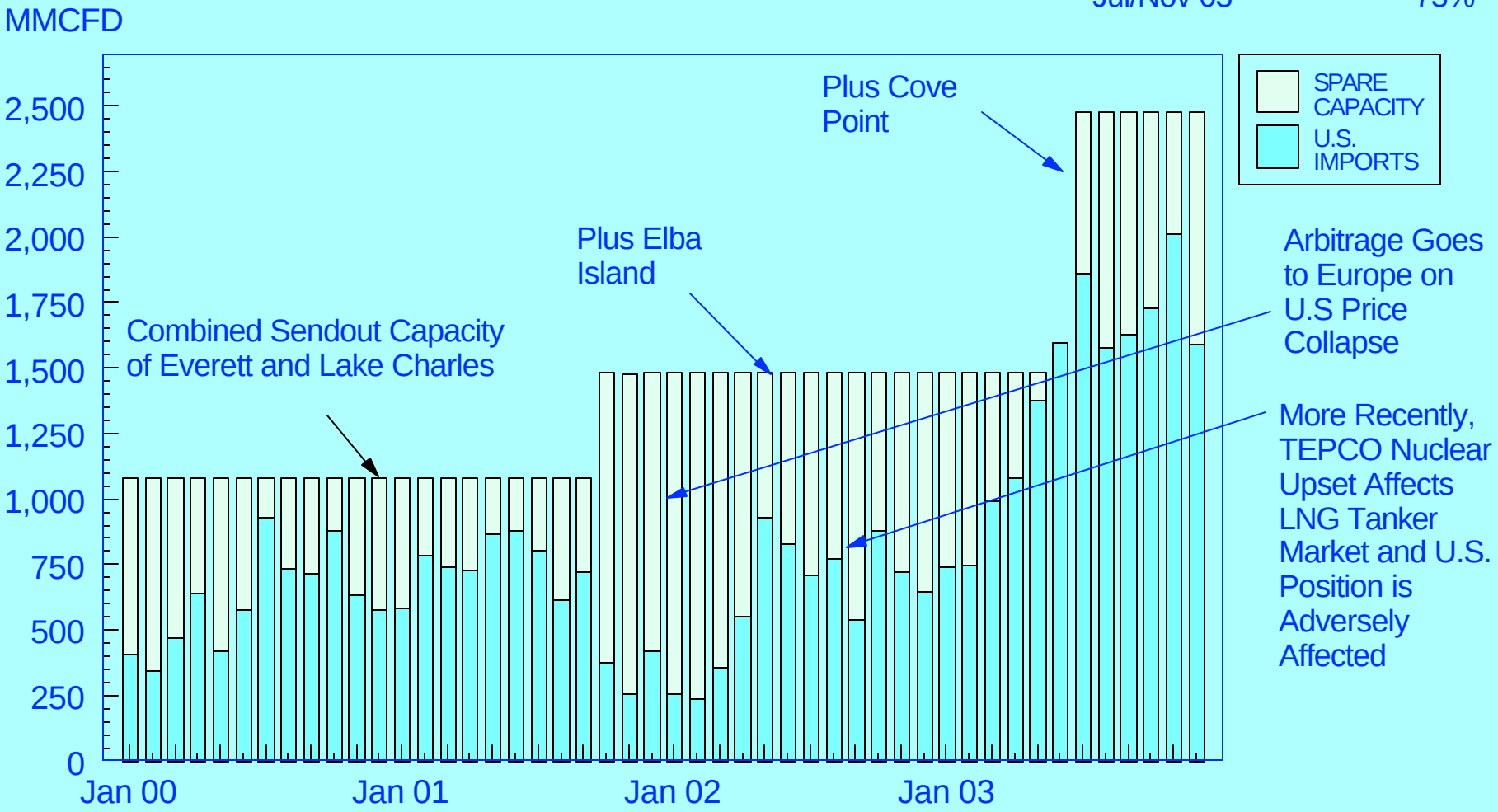
Effective Capacity Factor

Jul/Jun 00/01	- 70%
Jul/Jun 01/02	- 38%
Jul/Jun 02/03	- 57%
Jul/Nov 03	-73%



- Figures 3,4 and 5 Illustrate the Competitive Netbacks to Trinidad, Nigeria and Qatar During The Three Periods

- While it is Clear That the U.S. Cannot Import LNG If it Does Not Have the Necessary Terminal Capacity, the Converse - That Eliminating the Terminal Bottlenecks Guarantee LNG Supply - is Not Necessarily True

- Having Adequate Receipt Capacity Simply Gives the U.S. a Seat at the Table Enabling it to Compete With Europe and Asia for LNG Supplies

- And, Except for Trinidad, the Atlantic/Gulf U.S. is at a Transportation Disadvantage to Europe For Most Supply Sources

Figure 3

NETBACKS TO TRINIDAD, NIGERIA, AND QATAR LOADING PORTS FROM EUROPEAN, U.S. AND JAPANESE TERMINALS

SITUATION IN DECEMBER 2000 WHEN THE U.S. MARKET WAS VERY STRONG

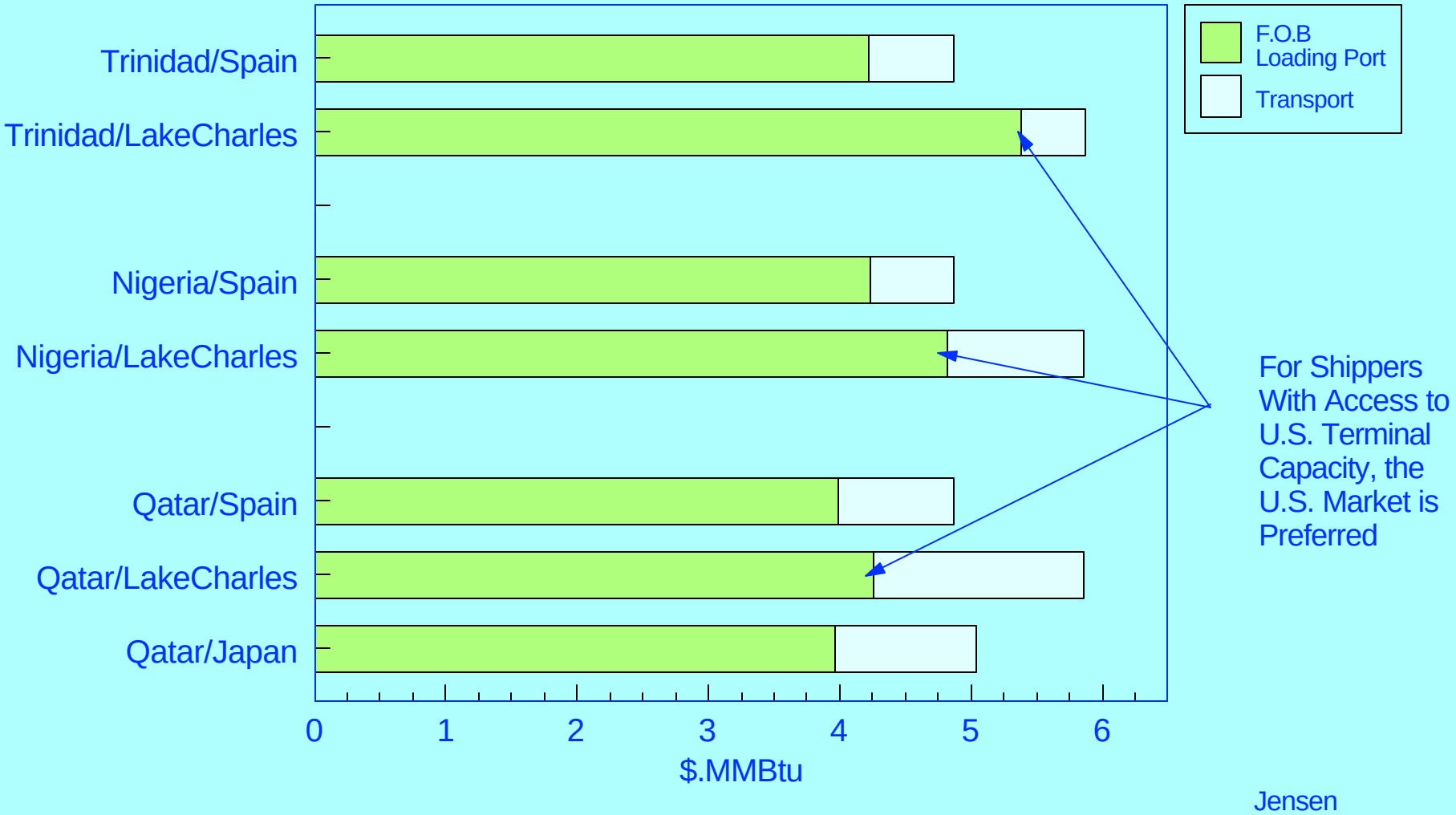


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Figure 4

NETBACKS TO TRINIDAD, NIGERIA, AND QATAR LOADING PORTS FROM EUROPEAN, U.S. AND JAPANESE TERMINALS

SITUATION IN SEPTEMBER 2001 WHEN THE U.S. MARKET WAS VERY WEAK

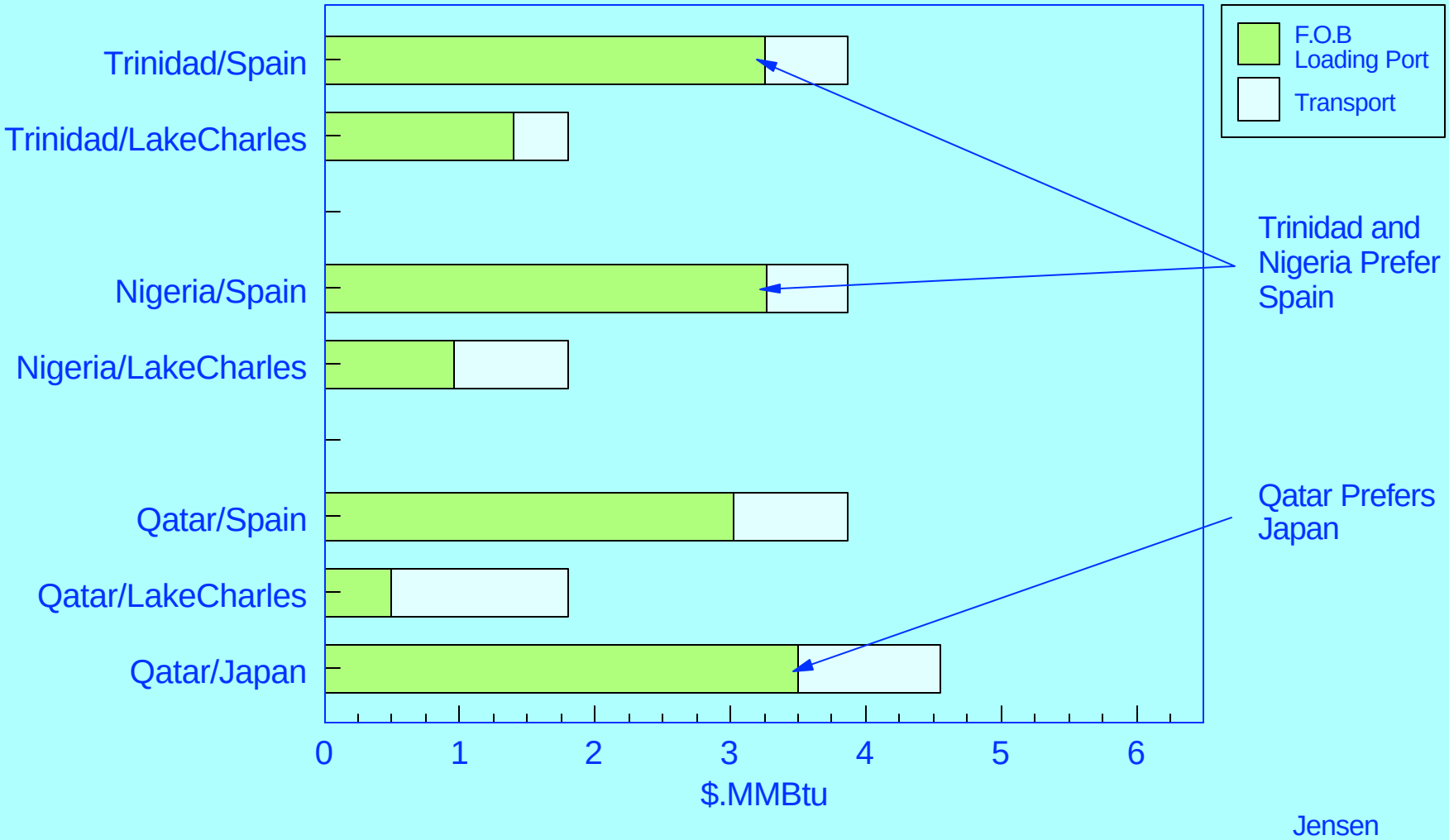

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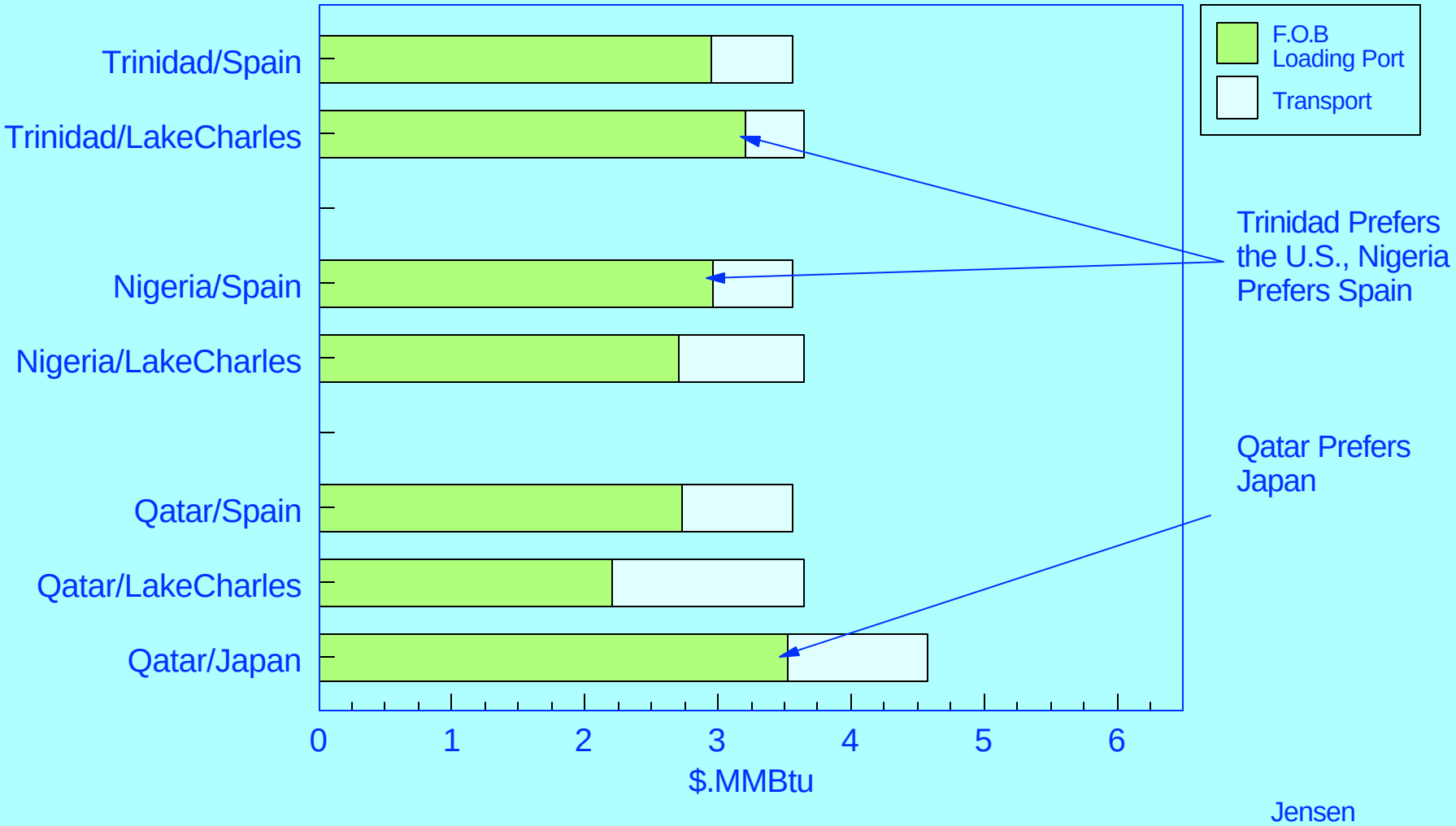
Figure 5

NETBACKS TO TRINIDAD, NIGERIA, AND QATAR LOADING PORTS FROM EUROPEAN, U.S. AND JAPANESE TERMINALS

SITUATION IN NOVEMBER 2002 WHEN ASIAN MARKETS WERE VERY STRONG



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THE 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 Stakeholders are the Producing Governments (Where At Least Half of the CAPEX are Concentrated) Raising Questions of Political Risk, Not Only About the Stability of the Governments, But the Stability of Their Fiscal Regimes, as Well

- Political Problems Have Been in the News this Past Year About Such Potential LNG Suppliers to the U.S. as:
  - Bolivia - Government Fell with LNG a Major Issue
  - Equatorial Guinea - Charges of a Possible Coup
  - Indonesia - Separatist Problems Affecting Arun, Bayu Undan and Sunrise LNG Projects
  - Nigeria - Workers Strikes Affecting Oil Production
  - Venezuela - Civil Unrest Affecting Oil Production

- 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; New Investment Decisions Finalized Today Will Probably Not be On Stream Until 2008

THE MYTH THAT THE AVAILABILITY OF LNG IMPORTS WILL "PUT A CAP" ON U.S. GAS PRICES IS ECONOMICALLY APPEALING

- Clearly, in a Market Economy the More LNG the U.S. Imports, the Greater the Supply of Gas and the Lower the Resulting Price

- And, By Most Estimates, Current U.S. Gas Prices Provide a Substantial Margin Over the Likely Costs of Most LNG Supply

- But the "Cap" Myth is Based on an Additional Premise - That LNG is an Energy Commmodity Whose Prices Will Be Driven to Cost-Based Levels by Competition

- Thus, in This Formulation, the Focus is on LNG Costs Since They Will Ultimately Set the "Cap" on U.S. Prices

- But This Myth Ignores the Fundamental Shift in U.S. Natural Gas Regulatory Policy Which Took Place in 1978 When Congress Rejected Cost-Based ("Cost-of-Service") Wellhead Price Controls in Favor of Market Pricing

- In So Doing, Congress Recognized the Difficulty of Trying to Apply Cost-of-Service Regulation to Individual Producers With Very Different Costs When Their Product Was a Fungible (Interchangeable) Commodity in the Marketplace

- It Substituted Instead the Concept that Competition in the Marketplace Would Determine Prices for the Commodity and Individual Producers Could "Net Back" Prices to the Wellhead Regardless of their Individual Cost Structures

- Although North American Gas Prices are Now Determined by "Netbacks" From the Marketplace, "Cost-of-Sevice" Pricing Logic Has Been Subtly Revived by the Way in Which Gas Supply Models are Designed

- By Assuming That Competitive Commodity Behaviour at the Wellhead Will Drive Prices to Cost-Based Levels, They are Able to Use the Costs of Drilling and Developing Gas Reserves in Individual Producing Basins as a Predictor of Market Prices

- And Because the Resulting Supply Response in Most Basins is Quite Elastic, Cost-Based Prices and Market Prices Tend to Converge

- The Idea That the Same Logic Can be Applied to LNG is Encouraged by the Fact That the Margins Required for Liquefaction, Tanker Transport and Regasification Appear to Fit the Classic Cost-of-Service Model

- Thus, if One Assumes that LNG Comes From Just Another Competitive "Basin", it is Not a Major Leap to Assume that Cost-Based Pricing Applies to the LNG Wellhead as Well; Or that Production Costs Will Ultimately Determine the Value at Which LNG Can be Imported into the U.S. to Set a "Cap" on U.S. Gas Prices

- Only That is Not the Way International LNG Pricing Works

- LNG Projects Have Always Been "Price Takers", Netting Back Prices to the Wellhead from a Reference Price That is Deemed to Represent the Market

- The Traditional Long Term Contract Typically Defined "Market Prices" in Terms of Other Fuels, Such as Oil; North American Industry Restructuring is Now Subsituting Gas-Linked Prices for U.S. Markets

- LNG Suppliers Operate on the Assumption that it is the U.S. Price Level That Will Determine Their Netbacks; Not That Their Costs Will Determine the U.S. Price Level

TWO REASONS WHY THE COMPETITIVE COMMODITY MODEL WITH CONVERGING COSTS AND PRICES DOES NOT FIT LNG

- LNG Competition is Among a Limited Number of Projects - "Project Supply" - Rather Than Among a Very Large Number of Competing Producers - "Commodity Supply"
- And There Are Very Large Disparities in Individual Costs Among Projects Making it Difficult for Costs and Prices to Converge on Some Price-Elastic "Bench" as Might be the Case in Individual North American Producing Basins

- The Sharp Difference in Transaction Activity Between Conventional U.S. Exploration and Development and LNG Projects is Illustrated by Figure 6

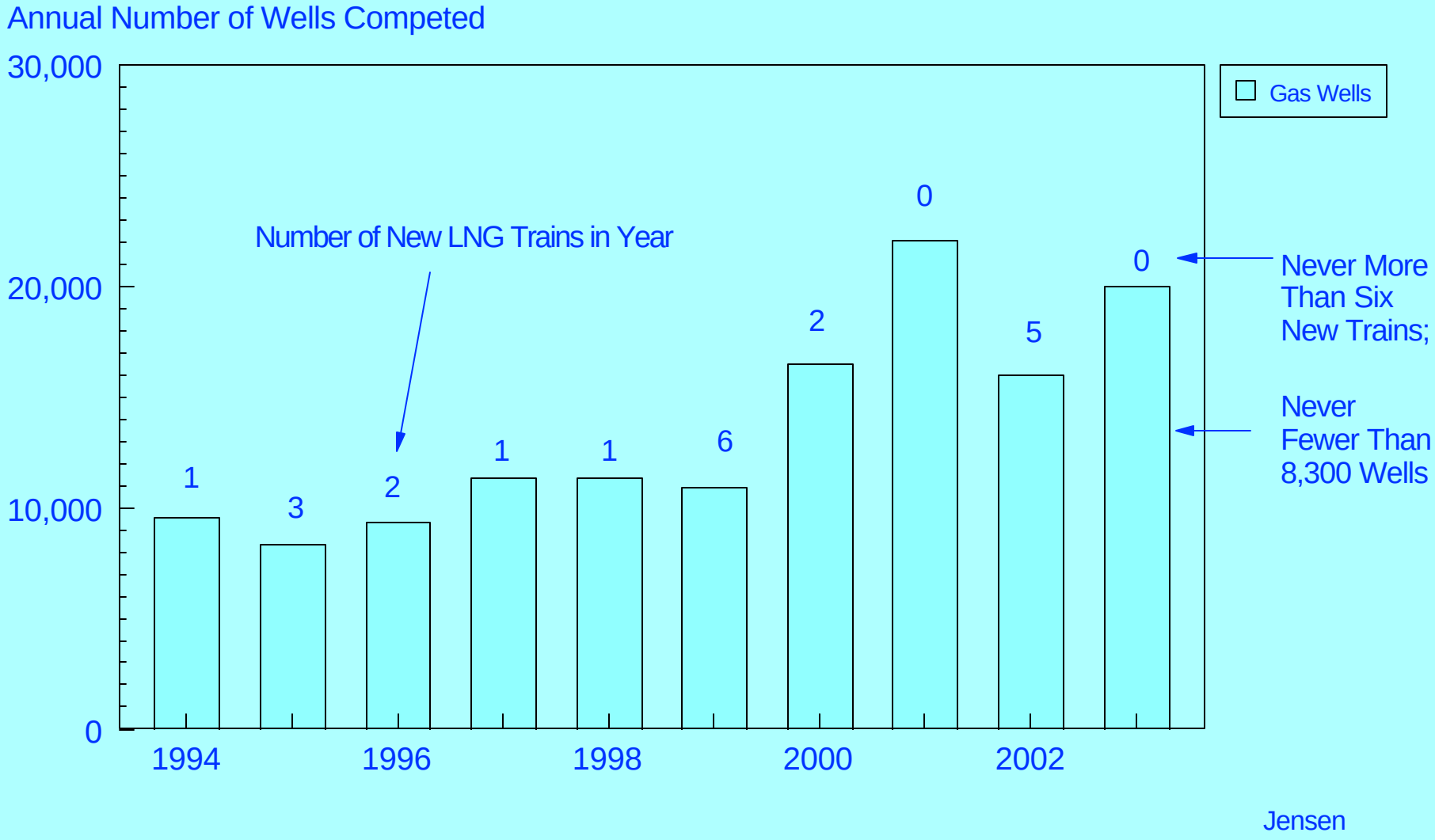
- Over the Past Decade, the Number of Completed U.S. Gas Wells Has Varied from 8,354 to 22,083; In Sharp Contrast, the Number of New LNG Trains Completed During the Same Period has Varied from zero to 6

- And While There are More LNG Projects Competing for Market Outlet at Any One Time, the Fact that LNG Projects Have Traditionally Marketed as a Unit (Rather than as Individual Joint Venture Partners), Means that the Transaction Activity is Very Low

- LNG Projects Thus Bear Greater Resemblance to Major Supply Projects Such as the Arctic Pipelines That They Do to Drilling in the Permian or Powder River Basins

Figure 6

THE NUMBER OF U.S. NATURAL GAS WELLS COMPLETED COMPARED WITH THE NUMBER OF LNG TRAINS COMPLETED FOR ALL WORLDWIDE MARKETS - 1994/2003



- LNG Costs Also Vary Significantly Among the Limited Number of Projects on the Market at Any One Time
- Liquefaction Costs Differ as Between Greenfield and Expansion Projects and Tanker Costs Vary With Distance
- But the Costs of Gas at the Wellhead are the Most Variable; This is Especially Important Since Most LNG Projects are Based on Non-Associated Gas Fields that are Very Rich in Gas Liquids
- Some Fields Actually Exhibit "Negative Opportunity Costs" - That is The Liquids Content Would Justify the Project Even if the Gas Were Flared

- If the Gas Must be Reinjected for Conservation Purposes, the Internal Transfer Value is Equivalent to the Avoided Cost of Reinjection

- Rigorous Enforcement of Anti-Flaring Rules for Associated Gas May Have Similar Cost Consequences

- Thus, the Idea that LNG Costs Will Converge on Some "Trigger Price" is Probably Unrealistic

- The Effect of LNG on U.S. Prices is Likely to be the Same as That of Any Other Gas Supply; It Will be Reflected in the Supply/Demand/Price Balance

- If Enough LNG Producers Compete for the U.S. Market, it Will Increase Supply and Weaken Prices; There is No Magic Cost-Based Price at Which LNG Takes Over the Responsibility for Price Determination

TOWARDS A POTENTIAL SOLUTION

- If LNG Supply:
  - Depends - Like Arctic Pipeline Supply - on Successsful Project Impementation
  - Is Influenced by Geopolitical Constraints as Well as Economics
  - And is Subject to Netback, Rather than Cost-of Service Pricing

- It Argues Strongly That the LNG Forecast be Treated as an Exogenous Input to the Model

- And it Also Suggests that the Domestic LNG Forecast be Integrated with the Work Being Done on the International Energy Outlook Analysis

- One Approach is to Classify Potential New Supply Projects According to the Likelihood of Their Becoming Commercial

- Figure 7 Shows One Such Classification Broken Down by Region, as Well as By "Firm", "Probable" and "Possible" Rankings; a "Remote" Category is Not Included

- Because Many Projects Reported in the Trade Press Fail to Meet Their Scheduled Startups or Are Abandoned Altogether, It is Necessary to Make Independent Judgments as to Which Projects Will Go and When

- The Best Way to Track the Likely Availability of Supply, Recognizing the Possibility of Schedule Slippage, is to Maintain a List of Contract Commitments

- Figure 8 is Such a List for the Atlantic Basin and the Middle East (the Pacific Basin is Not Shown)

- Figure 9 Compares the Contract Commitments for U.S. Markets With AEO's and NPC's Projections for the Year 2010

Figure 7

HISTORY AND FORECAST [1] OF FIRM, "PROBABLE" AND "POSSIBLE" LNG LIQUEFACTION CAPACITY BY REGION

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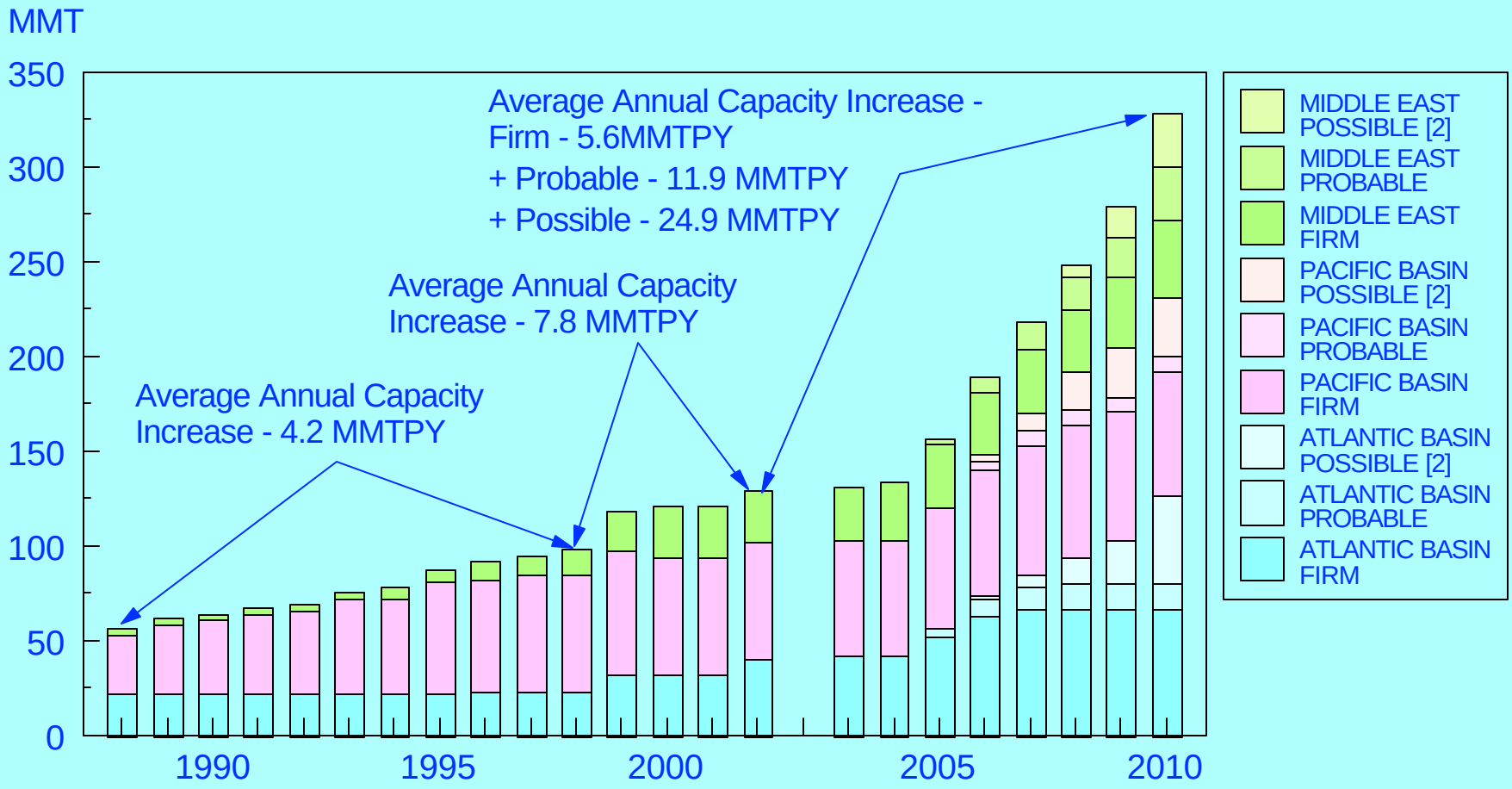

[1] Jensen Estimates
[2] Placing Unscheduled Possibles in 2010

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Figure 8

REGIONAL DESTINATION OF NEW (POST 2002) LNG CONTRACT SUPPLIES FROM OPERATING, "FIRM" AND "PROBABLE" [1] LIQUEFACTION PLANTS IN THE ATLANTIC BASIN AND THE MIDDLE EAST

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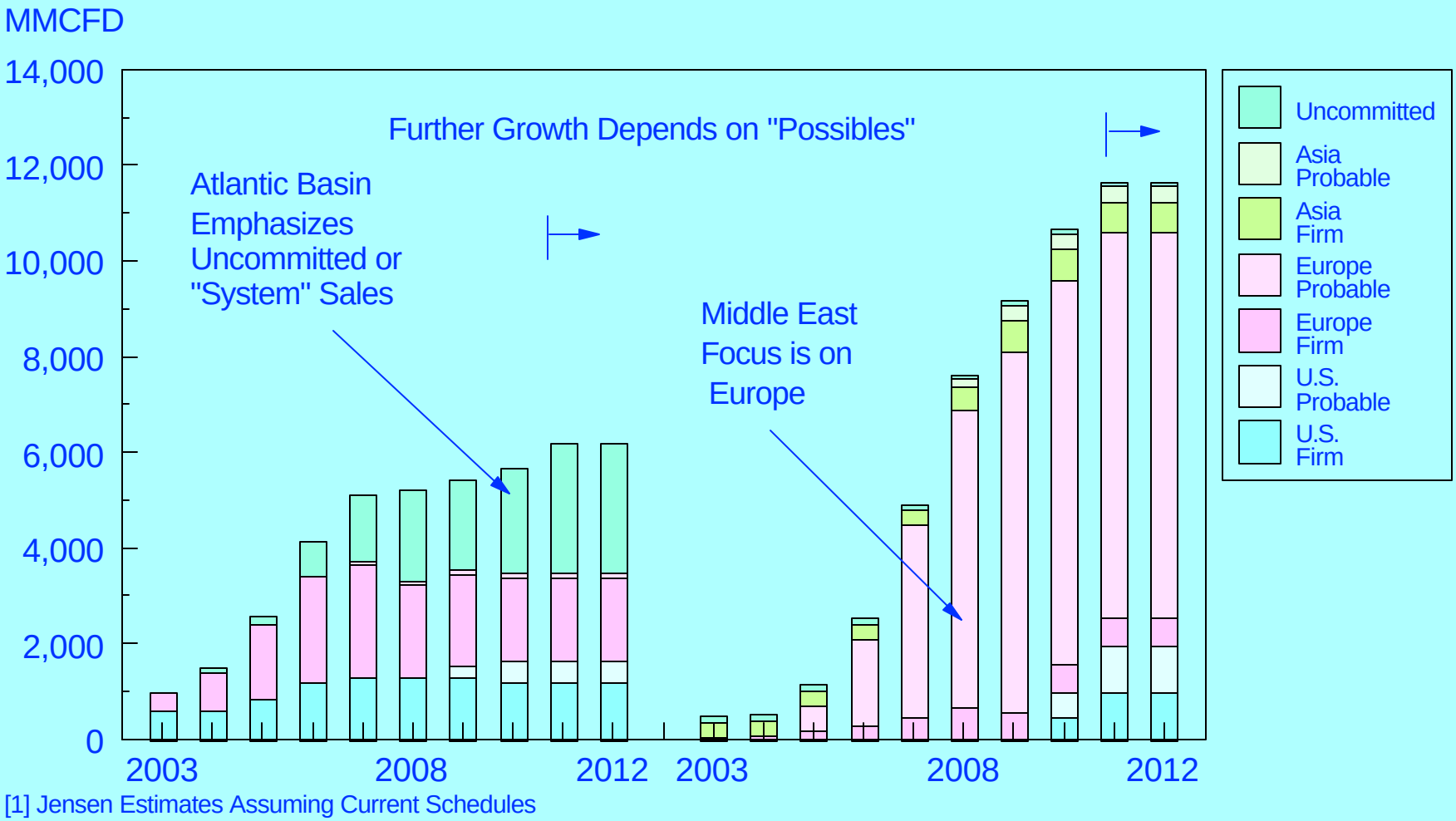

[1] Jensen Estimates Assuming Current Schedules

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Figure 9

CONTRACTUAL DEDICATION TO U.S. MARKETS FROM OPERATING, "FIRM" AND "PROBABLE" [1] LIQUEFACTION PLANTS COMPARED WITH ACTUAL AND FORECAST IMPORTS (INCLUDING ATLANTIC BASIN UNCOMMITTED VOLUMES BUT EXCLUDING "POSSIBLES")

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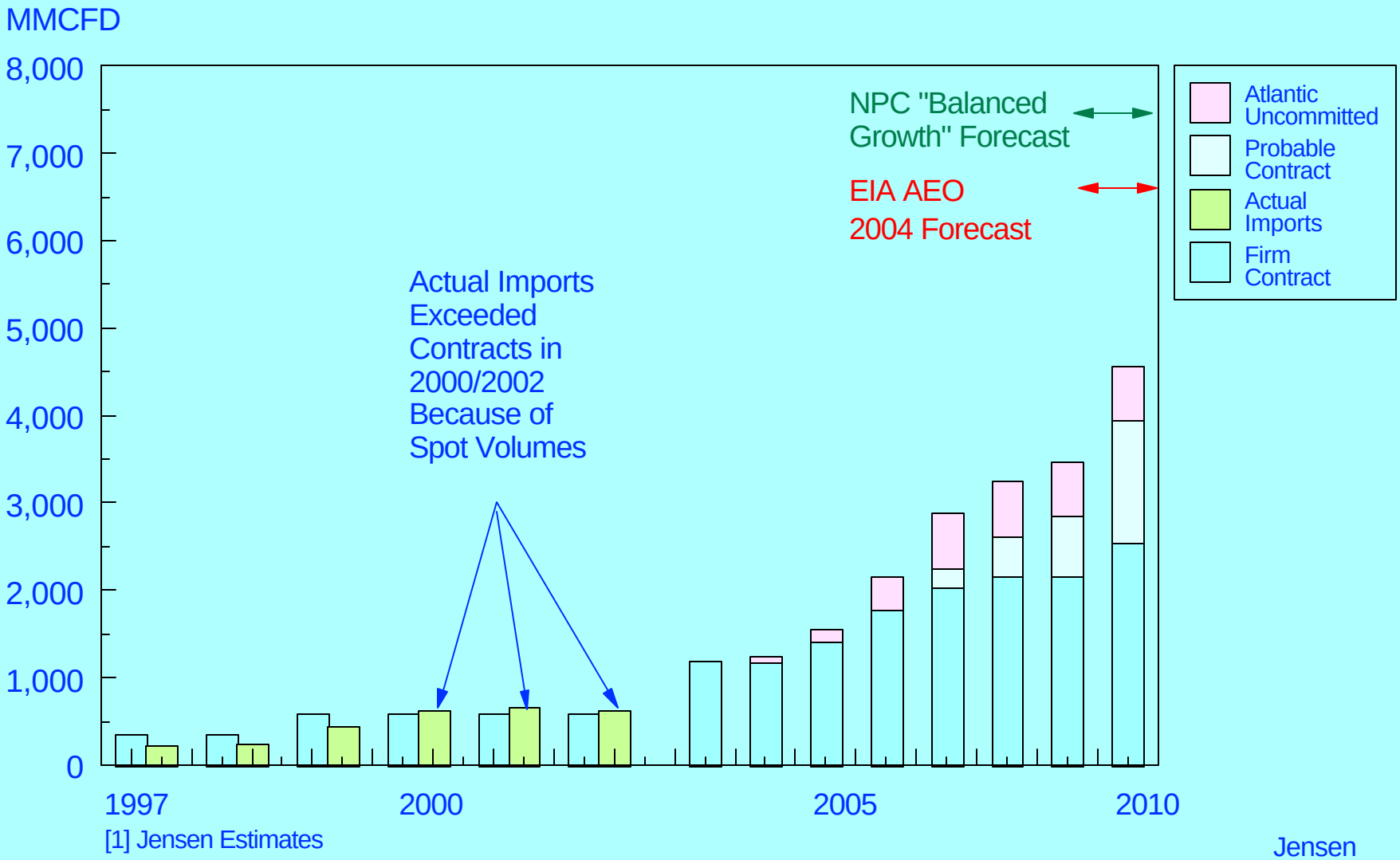

[1] Jensen Estimates

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- Figure 9 Suggests That it May Be Difficult to Meet the AEO and NPC Projections for the Year 2010 Without Accelerated Activity in the "Possibles" Category

- Contract Analysis Has Its Limitations, Both in its Limited Time Horizon and its Lack of an Independent View of Other Gas Markets

- For Example, Figures 8 and 9 Are Only Part of the Story; If the Appetite of Europe for the Middle East "Probable" Volumes is Less Than That Shown in Figure 8, Some of Those Volumes are Potentially Available for the U.S.

- All of Which Emphasizes the Importance of Integrating the NEMS Domestic Projections with an International View of Gas Supply and Demand From the International Energy Outlook Projections