

A DIFFERENT WAY OF LOOKING AT THE FUTURE OF WORLD LNG TRADE

A Presentation Prepared for the
Department of Energy
Washington
September 2014

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THE BASIC TOOL THAT ECONOMISTS USE TO PROJECT INTERNATIONAL GAS TRADE IS A WORLD GAS MODEL

- But Despite Their Great Value, Economic Models Have Certain Shortcomings
- They Assume That Fuel Choice Decisions are Driven by Economics
 - How Does One Account for the Fact That the Chinese are Willing to Override Favorable Coal Economics in Favor of More Expensive Gas Because of Air Pollution?
- They Assume That Investment Decisions are Also Economic Decisions
 - How Does One Account for the Fact That the Former Command-and-Control Economies - Russia, China and the Caspian States - Build Pipelines That Would Probably be Uneconomic by Western Standards?

- Models Have Trouble Dealing With Geopolitical Considerations in Major Gas Investment Decisions
 - How Does One Explain the Russians Building Redundant Pipeline Capacity to Europe - Nordstream and Possibly Southstream - to Bypass the Ukraine?
 - Why Can't the Iran-Pakistan-India Pipeline Get Done?
 - And Why Have the Chinese Built Costly Pipeline Capacity to the Caspian When an East Siberian Source Should be More Economic?
- And the Models Assume That International Gas is a Traded Commodity When Most Gas Transportation Decisions are "Lumpy" Projects That Often Have Oil-Linked Contract Pricing Clauses That are Not Market-Responsive
 - Why Was the 2013 Price for Japanese LNG (as Liquid) 54% Higher Than the European Price for Gas When the Distance From the Middle East is Similar?

THESE ISSUES ARE PARTICULARLY IMPORTANT IN TODAY'S GAS MARKETS

- China's Gas Demand, if Driven by Environmental Considerations, is Potentially Very Large
- Its Diversification Efforts to Achieve Supply Security and Create Supplier Price Competition Raise Uncertainties About Which Projects Get the Market
- The EU's Ongoing Tensions with Russia Affect How Much Europe Wants to Rely on Russian Supply Despite That Country's Very Large Gas Resources
- And the Issue of Contract Pricing Clauses is in Flux
- These Non-Economic Considerations are an Important Driver of Future Gas Trade

SINCE MUCH OF THE GROWTH OF WORLD GAS TRADE DEPENDS ON LARGE PIPELINE OR LNG PROJECTS, ONE WAY TO DEAL WITH THESE ISSUES IS TO FOCUS ON THE PROJECTS THEMSELVES

- This Enables the Analyst to Judge How These Non-Economic Factors Will Influence Project Implementation and Thus Future Trading Patterns
- And They Can Readily be the Basis for Scenario Analysis if These Factors Develop Differently From Expectations
- In Appraising the Outlook for the Securities They Follow, Oil Analysts Commonly Use the Project Approach in Order to Judge Where the Projects They Analyze Stand in the Hierarchy of Potential "Winners"

- While There are a Large Number of Such Supply Projects Relative to What the Market Can Absorb, They are Well-Reported in the Trade Press Providing a Basis for Judgments About Their Potential
- And Since Pipelines and the Traditional Destination LNG Contracts Commonly Specify the Sources and the Markets They May Serve, Many of the Future Trade Patterns Are Already Locked In
- However, the Growth of Portfolio LNG Contracts, Where Major Company Buyers Assemble Supplies from Multiple Suppliers, and the Increasing Need to Rely on Projects That do not Yet Have Contracts, Means That a Growing Portion of LNG Trade Will Have Destination Flexibility in the Out Years

THIS ANALYSIS FOCUSES ON INDIVIDUAL PROJECTS TO DEVELOP TRADE PATTERNS FOR THE YEARS 2020, 2025, AND 2030

- It is Not a Substitute for Economic Model Analysis; In Fact it Utilizes Model-Derived Projections as a "Control" Within Which the Various Projects can be Assembled
- The Control is a Composite of Model Projections - EIA for U.S., China's CNPC for China and the IEA for the Rest
- The Focus of the Analysis is on Trade; It Determines the Net Import Requirements for Five Major Importing Regions - Europe, Northeast Asia, China, India and Other Importing Asia - By Deducting Local Supply From Expected Demand

- For These Regions, it Determines the Regional LNG Import Requirement by Then Subtracting Projected Pipeline Flows at 90% of Contract
- Although LNG Imports Into Exporting Regions Would Net Out, They Still Add to LNG Trade Requirements
- Thus LNG Imports Into Six Exporting Regions - Atlantic North America, Atlantic Latin America, Middle East, Exporting Asia, Pacific North America and Pacific Latin America are Projected Separately and Added to the Total; LNG Trade is Deemed to be Satisfied if LNG Supplies Fall Between 84% and 86% of Contracts (or Capacity)
- This Approach - Focusing on LNG Import Trade - Does Not Explicitly Project Total Production in Exporting Regions Since That is a Product of Production for Domestic Requirements Plus Exports But it Can Easily be Derived

- Because the Selected Projects are Region-Specific, it is Possible to Assign Them to Twelve Exporting Regions - North Africa, West Africa, East Africa, Europe, Pacific Latin America, Atlantic North America, Middle East, Australia, Southeast Asia, Russian Far East and Pacific North America; the Analysis Also Breaks Out Portfolio Trade and Uncommitted Volumes
- The Analysis Assumes That Iranian Sanctions are Ultimately Lifted Enabling India and Pakistan to Import by Pipeline and Iranian LNG Projects to Compete; But One Scenario Illustrates What Happens if That Does Not Occur
- Each Year Has a Supply/Demand Matrix as Do Each of Seven Scenarios
- The Following Slide Shows What a Matrix Looks Like

FORECAST - SCENARIO 1 MATRIX

Increase Chinese Demand by 20%

	IMPORTERS	IMPORTERS	IMPORTERS	IMPORTERS	IMPORTERS	IMPORTERS	EXPORTERS	EXPORTERS	EXPORTERS	EXPORTERS	EXPORTERS	EXPORTERS	DESTINATION	DESTINATION	
	[1]	NORTHEAST	CHINA	INDIA	OTHER	TOTAL	ATLANTIC	ATLANTIC	MIDDLE	EXPORTING	PACIFIC	PACIFIC	FLEXIBLE	FLEXIBLE	
	EUROPE	ASIA	CHINA	INDIA	ASIA	TOTAL	NORTH	LATIN	EAST	ASIA	NORTH	LATIN	PORTFOLIO	UNCOMMITTED	WORLD
	Bcfd	Bcfd	Bcfd	Bcfd	Bcfd	Bcfd	AMERICA	AMERICA	Bcfd	Bcfd	AMERICA	AMERICA	Bcfd	Bcfd	Bcfd
2020															
Net Imports Required															
Demand	58.14	16.13	40.80	8.63	14.68	138.39									
Supply	22.15	0.00	19.11	5.94	8.24	55.44									
Net Imports Required	36.00	16.13	21.69	2.69	6.44	82.95									
Less Pipeline Imports															
Russia/Europe	19.21					19.21									
Russia/China (East Siberia)			0.55			0.55									
Russia/China (West Siberia)															
Caspian/Europe	0.65					0.65									
Caspian/China (Turkmenistan)			4.21			4.21									
Caspian/China (Kazakhstan)			0.72			0.72									
Caspian/China (Uzbekistan)			0.58			0.58									
North Africa/Europe	4.05					4.05									
Middle East/Europe	0.84					0.84									
Middle East/India				0.24		0.24									
Middle East/Pakistan					0.24	0.24									
Southeast Asia/Other Asia					1.72	1.72									
Southeast Asia/China			0.87			0.87									
Total Pipeline	24.75	0.00	6.93	0.24	1.96	33.88									
LNG															
North Africa	0.50					0.50							0.54	1.56	2.59
West Africa	1.20					1.20							2.99	0.10	4.28
East Africa	0.00													1.71	1.71
Europe	0.42		0.34			0.76							0.66	0.13	1.54
Pacific Latin America											0.23			0.27	0.50
Atlantic North America	0.40	1.57		0.53	0.02	2.52							1.81	2.58	6.91
Atlantic Latin America	0.37					0.37		0.09					0.03	0.44	0.93
Middle East	1.14	3.02	0.57	0.85	0.63	6.21			0.17				3.06	2.33	11.77
Australia		3.52	2.25			5.77							2.39	3.35	11.51
Southeast Asia		2.38	0.87		0.41	3.66						0.07	0.00	2.86	6.59
Russia (East)		0.81				0.81							0.87	1.13	2.80
Pacific North America														2.04	2.04
Secondary Portfolio Contracts [2]	0.16	1.31	1.28	0.63		3.38						0.23		(3.61)	(0.00)
Uncommitted (Destination Flexible)	7.07	3.53	9.45	0.44	3.42	23.91	0.33	0.23	0.19	2.50		0.02	(12.34)	(14.85)	(0.00)
Total LNG	11.25	16.13	14.76	2.45	4.48	49.07	0.33	0.32	0.36	2.50	0.23	0.32	(0.00)	0.00	53.15

- The Seven Scenarios are:
 - Chinese Demand Plus 20%
 - Chinese Supply Minus 20%
 - Eliminate Iranian Exports
 - Reduce Capacity Factors on Russian and Caspian Pipelines to China From 90% to 70%
 - Reduce European Reliance on Russia by 50% in Ten Years
 - Increase European Supply by 10%
 - Do not Restart Japanese Nukes

- With the Exception of the Increased European Supply Scenario, the Scenarios Largely Focus on Issues That Would Increase LNG Demand - and Put Upside Pressure on U.S. Projects; A Surplus Situation Can More Easily be Accomodated by the Market

THE ANALYSIS UTILIZES A DATABASE THAT LISTS LNG PROJECTS THAT HAVE BEEN REPORTED IN THE TRADE PRESS

- It Classifies Them as to the Likelihood That They Will Go Forward and Judges When They May Start Up
- They are Classified as:
 - Operating
 - Firm - They Have a Final Investment Decision (FID)
 - Probable - We Believe Their FIDs are Likely
 - Possible (Scheduled) - Far Enough Advanced That They Have a Site and a Proposed Startup Date
 - Possible (Unscheduled) - Much Less Far Along and Frequently Quite Speculative
 - Remote - Forget It

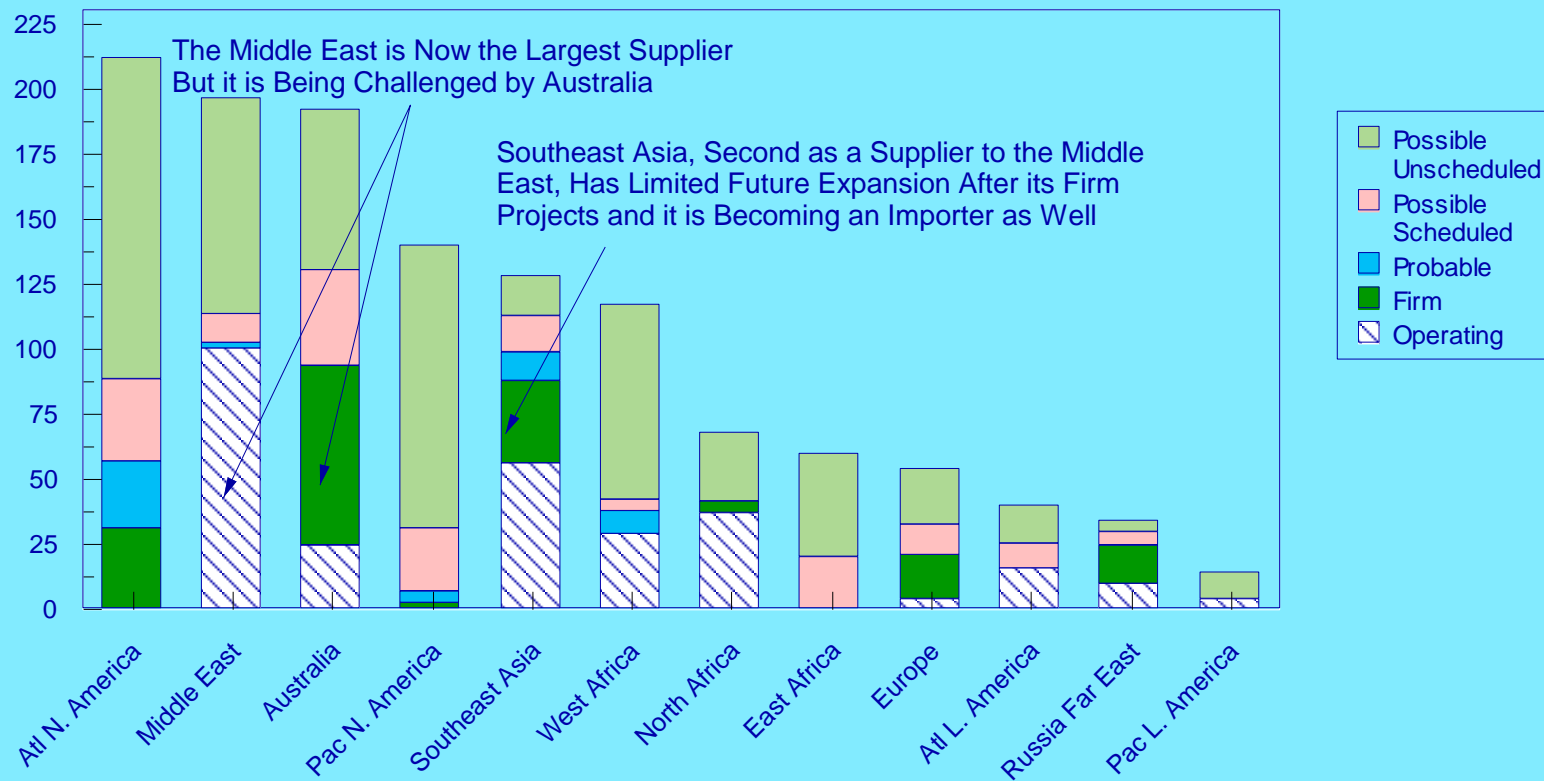
- By Those Definitions, the Total Capacity Classed as Probable and Possible was 2.9 Times the Capacity in Operation at the End of 2013
- The Middle East Accounted for 38% of the 2013 Capacity, 30% from Qatar Alone, But Aside from Iran, the Middle East Has Very Little More on Offer
- Southeast Asia Has Been the Second Largest Regional Supplier but After Current Expansions it, Too, Has Limited Upside Potential; And Exporters, Such as Indonesia and Malaysia Have Selectively Become Importers
- North America, Principally the U.S. Gulf Coast and British Columbia, Have the Most Possible Project Capacity

THE CURRENT SOURCES OF LNG AND WHAT IS POSSIBLE

CAPACITY OF OPERATING AND FIRM LIQUEFACTION PLANTS RELATIVE TO PROPOSED PROBABLE AND POSSIBLE PLANTS BY COUNTRY

(ESTIMATES FROM A JENSEN DATABASE CLASSIFICATION SYSTEM)

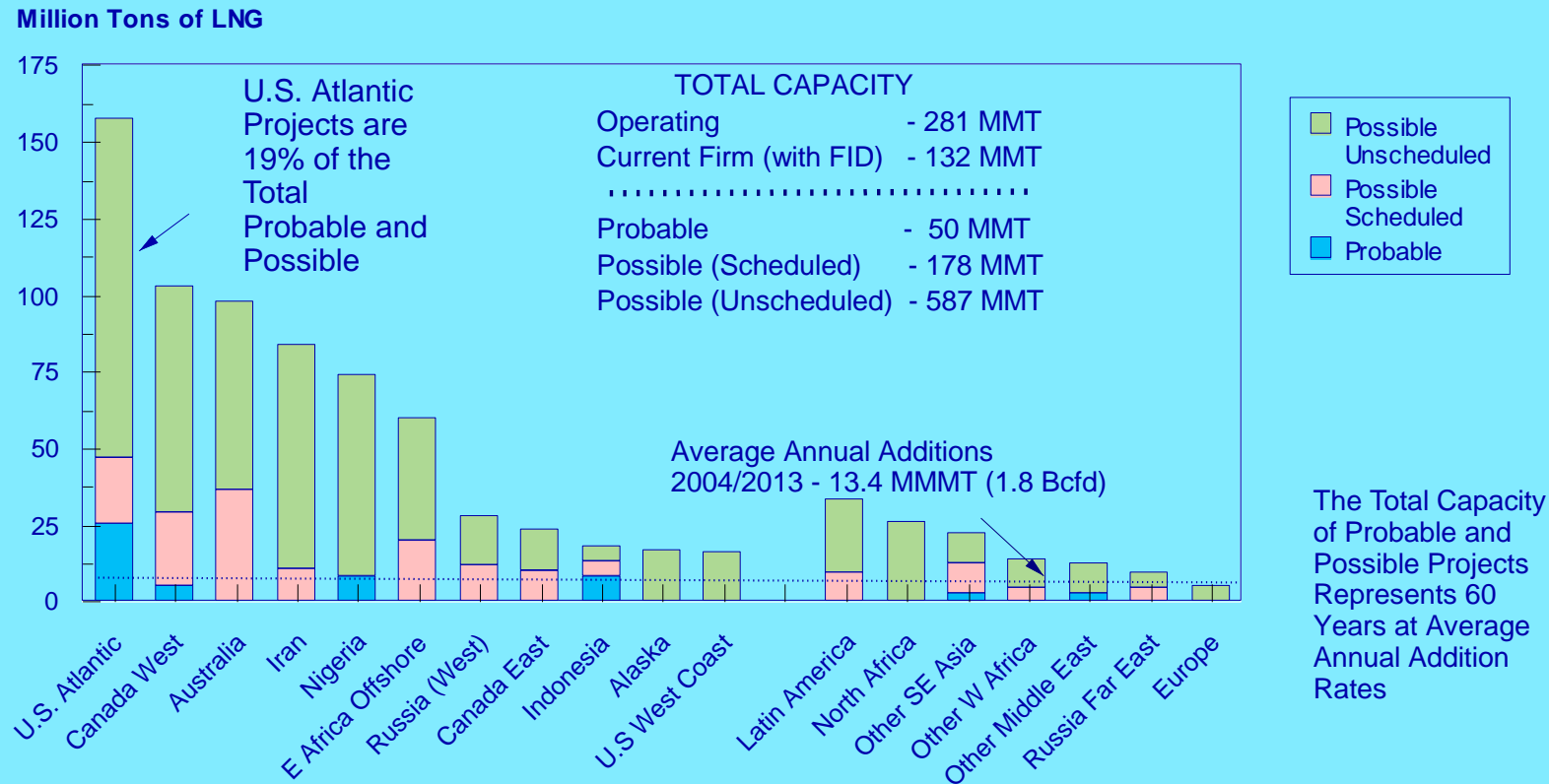
Million Tons of LNG



- The Top Six Regions with Probable and Possible Capacity on Offer - U.S. Atlantic, Western Canada, Australia, Iran and Nigeria - Account for 64% of the Total; But Each of Them Have Issues That Raise Serious Questions About How Realistic the Totals Are
- The U.S. Atlantic is Unique in That its Projects are Tolling Projects Based on Commodity Supply; They Require a Much Smaller Capital Commitment Than Traditional Projects But Their Low Barrier to Application Invites Speculative Entries That are Probably Unrealistic
- The British Columbia Projects, Like the U.S. West Coast Projects, Benefit from a Sympathetic Investment Climate; But They Probably Require Costly Pipeline Supply Commitments and May Need the Kinds of Long-Term Contracts that are Currently Out of Favor in Asia

- The Australian Projects Dominate Current Expansion, But Their Costs are Very High, Making Them Vulnerable to Price Weakness; Already Some Projects Have Pulled Back; Interest in Floating Liquefaction Projects (FLNG) May Provide Some Relief
- Iran's Large List of Projects Has Suffered In Part Because of Sanctions (One Project Being Built by the Revolutionary Guards Has Stalled); But the Necessary Supply Has Been Preempted, Both by the Rapid Growth of Subsidized Domestic Demand and the Need for Reinjection in its Complex Oil Fields
- And Nigeria's Government Instability with Tax Uncertainty Together with Rebel Activities in the North and in the Oil Fields Has Created Serious Investment Risks for That Country

CAPACITY OF PROPOSED PROBABLE, POSSIBLE (SCHEDULED) AND POSSIBLE (UNSCHEDULED) LIQUEFACTION PLANTS BY COUNTRY (ESTIMATES FROM A JENSEN DATABASE CLASSIFICATION SYSTEM)

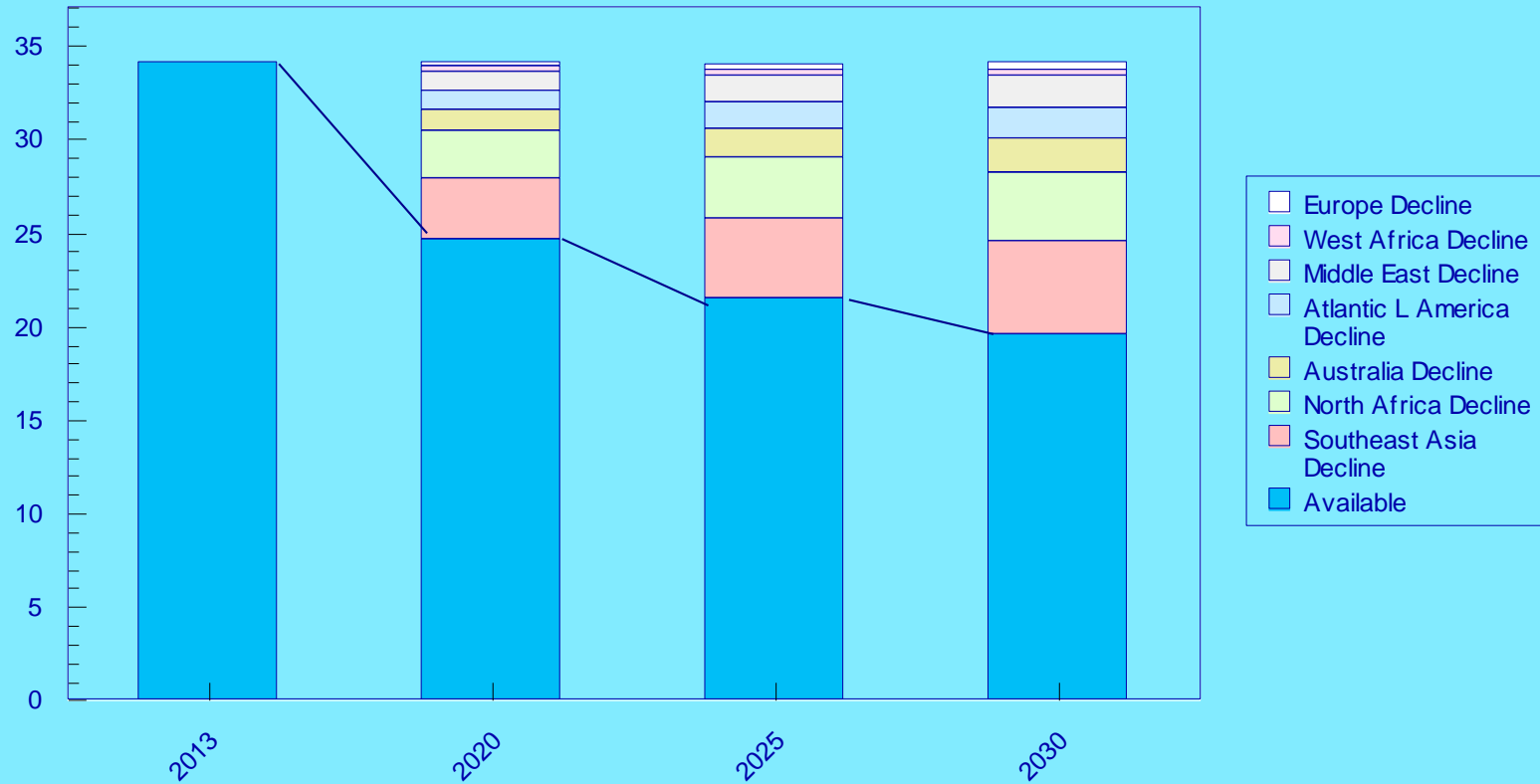


THE DECLINE OF EXISTING CAPACITY CREATES AN ADDITIONAL DEMAND FOR NEW LNG

- Field Depletion of the Dedicated Reserves for Some of the Older Plants is now Forcing Reduced Operation or Even Retirement for These Plants
- Southeast Asia and North Africa, Which Were Among the Earliest Suppliers, are Particularly Vulnerable
- An Estimated 43% of Year End 2013 Capacity Will be Retired by 2030

DECLINE OF YEAR END 2013 CAPACITY BY REGION

Capacity Available After Decline - Bcfd



PICKING WINNERS

- The Act of Putting the Project Database Together Involves Judgments About the Relative Merits of the Various Projects and Their Possible Timing
- But it is Made in the Absence of Constraints About How Much the Market Can Accomodate in Any Given Year
- Thus, Not Surprisingly, There are Usually Too Many Projects for the Constrained Market in the Early Years and the Analyst Must Choose Among Them; And Then He May Have to Select Among Unscheduled Projects in the Out Years When Many Projects Have Not Yet Jelled
- The Process Might be Described as "Picking Winners"

- Before the LNG Selection Process Begins, it is Necessary to Estimate Pipeline Flows

- This is Important in Four Areas:
 - We Have Assumed That Existing Flows, For the Most Part, Will be Retained
 - But the EU's Concern for Russian Supply Requires an Estimate of Forward European Takes From Russia;
 - We Have Assumed That the Eastern European Reliance on Russia Will be Gradually Reduced by Backflow Interconnections
 - Since China has Created Competitive Pipeline/LNG Options, We Have Had to Assume How Much of the Market the Pipelines Capture
 - And We Have Assumed in Some Chinese Scenarios, That the Russian Link to West Siberia is Implemented

- The LNG Database Carries a Forward Estimate for Operating and Firm Capacity by Year of Startup
- Projects are Added as Needed According to a Judgmental Ranking - Probables First, Then From the Lists of Possible Schedules and Possible Unschedules
- But Some Projects do Not Fit That Mold (Alaska, for Example, Which Has Been Included in 2026)
- The U.S. Projects, Requiring DOE and FERC Approval, are Slow to Reach FID; But We Grant High Probability to Projects That Have Contracted With Destination Buyers, Such as Korea or India, Despite the Lack of FIDs
- U.S. Portfolio Projects are Somewhat Less Certain, Since the Buyers May Have Second Thoughts Before Reaching FID if Market Conditions Weaken

- We Give a Much Lower Ranking to U.S. Projects that Have Been Slow to Secure Contract Commitments
- East Africa Offshore Presents Another and Different Kind of Issue Since it Might Grow Rapidly Despite its Early Stages of Development
- Mozambique is Intriguing Since its Preliminary Economics are Very Attractive; But, While the Discoveries are Very Large, it is Still Developing Its Oil Laws and Has Limited Infrastructure
- It is Thus Very Vulnerable to Tax Issues and to the Cost Overruns That Have Plagued Australia
- And Israeli and Other Eastern Mediterranean Discoveries are Geopolitically Complex; We Have Assumed That Much of the Supply Will Go to Local and Pipeline Markets

THE FIVE MAJOR IMPORTING REGIONS DIFFER IN THE WAY THEY ARE SUPPLIED

- Europe is in Transition from Oil-Linked Contract Supply to Competitive Commodity Supply Based on North Sea Producer Competition and Atlantic Basin LNG Arbitrage
- It is Difficult to do a Traditional Destination Contract that Would Satisfy the Bankers: Thus it Will Primarily be a Portfolio Market Where Suppliers Take the Risks and Can Hedge Them With Destination Flexibility
- But Despite the Fact That LNG Demand Will Grow, Partially From Declining Local Production, Its Prices are Volatile and the Price Risks are Real
- China's Growth in Imports is Very Rapid but it Has Pipeline Alternatives to LNG

- While it Lacks Europe's Commodity Price Competition, it Has Been Able to Play Off Pipeline Supply, Primarily from Russia and the Caspian, Against LNG's Traditional Oil-Linked Contracts
- And While it Does Contract Directly with Some LNG Suppliers, It Seems to Have Been Reluctant to do So With the U.S.; Thus China Has Some Appeal for U.S. Portfolio Suppliers Who Can Provide Diversification for Chinese Concerns About Geopolitical Risks in Direct Contracting
- Northeast Asia Has Been a Traditional Destination Contract Buyer and it Lacks Europe's Commodity Price Competition and China's Pipeline Competition
- Thus it Remains Vulnerable to the Rigid and High Price Structure of the Traditional Asian Oil-Linked Contract

- Much of the Appeal to Northeast Asia of U.S. Contracting is That it Introduces a Much More Flexible - and at the Moment Cheaper - Alternative to its Traditional Contracts
- But the Region's Projected Slow Growth Limits How Much it Can Buy Until Contract Expirations Kick in the 2020s
- India Has Found it Difficult to Get Competitive LNG Prices and is Thus a Good Candidate for U.S. Contracts: But at Some Point a Successful Iran-Pakistan-India Pipeline (Negotiated Unsuccessfully for Years) Would Blunt That Market
- Other Importing Asia - Now Taiwan, Thailand and Singapore - is a Mixed Bag of LNG and in Some Cases, Pipeline Options; The Region May Benefit From Singapore's Efforts to Create an LNG Trading Hub

THE VARIOUS SCENARIOS AFFECT THE RELATIVE OUTLOOK FOR SOME SUPPLIERS

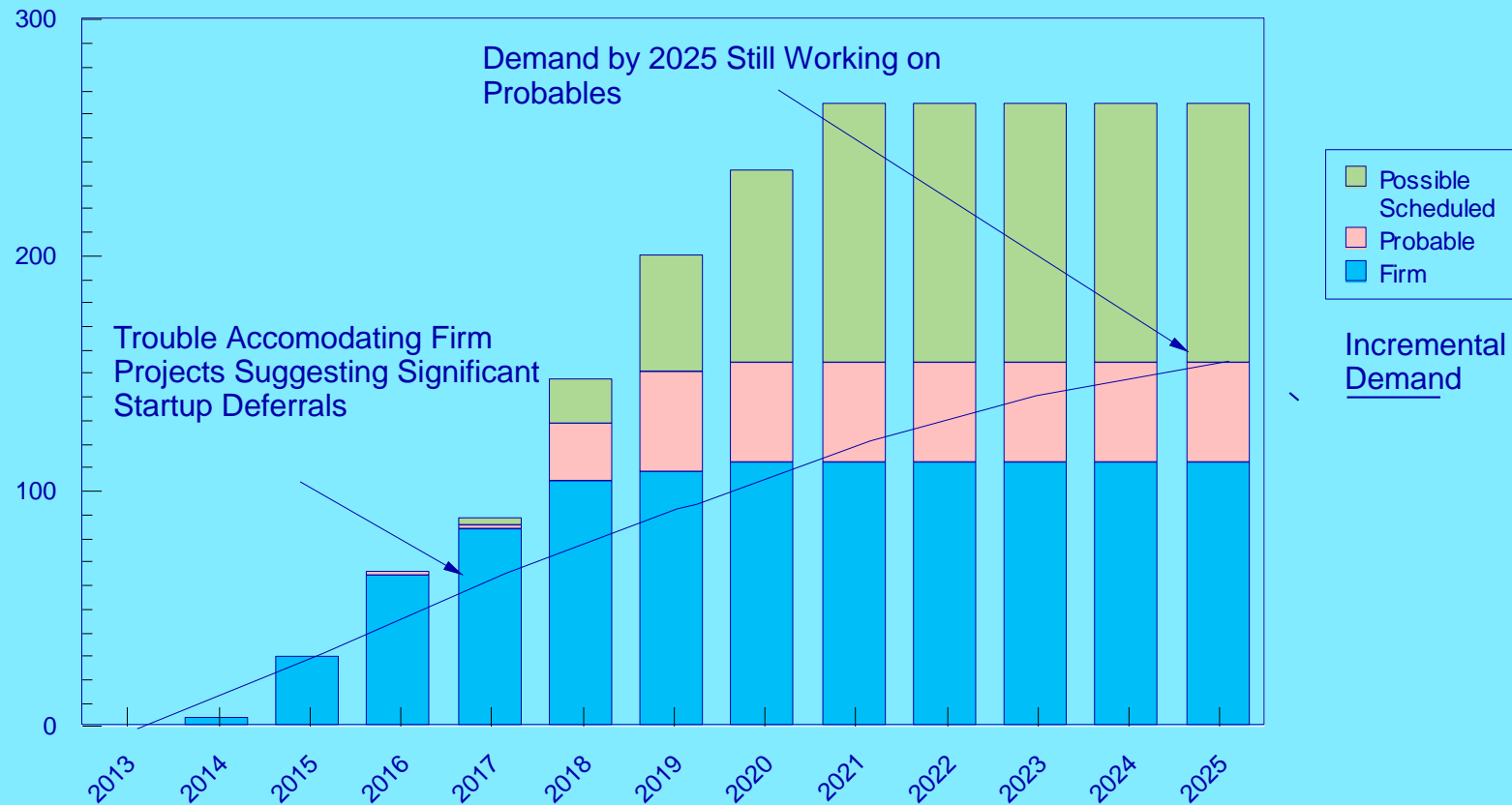
- Scenarios Involving Increased Atlantic Basin Takes, Such as for Europe, Tend to Improve the Outlook for West African and U.S Atlantic Portfolio Suppliers
- Those Involving Increased Chinese LNG Imports Tend to Favor Pacific North America (Particularly BC), the Middle East (Iran), East Africa and U.S. Atlantic Portfolio Sellers
- If They Strengthen the Price Outlook, They Help Australia
- A Scenario That Increases Northeast Asian LNG Imports, Either Through Nuclear or Carbon Policy, is a Plus for U.S. Direct Contracting
- And if Iran Does Not Become a Significant Exporter, Asian Suppliers and U.S. Direct Contracts Should Benefit

SOME CONCLUSIONS

- Early in the Analysis, it Became Apparent That - Given the Study's Underlying Assumptions - the LNG Market was Likely to Be Oversupplied in the Near Future
- There was Simply Too Little Demand Growth to Accomodate Both an Expected Surge in LNG Supply and the Many Other Projects With Proposed Startup Dates
- This Conclusion Has Some Very Important Implications
 - It Suggests a Significant Market Limitation on the Growth of U.S. LNG Exports
 - It Also Suggests LNG Price Weakness and a Potential Threat to the "Asian Premium"
 - And it Gives Unusual Influence Over LNG Growth Both to the Chinese, Whose Diversification Options Enable it to Play Off Pipeline Markets Against LNG and to Europe in its Efforts to Diversify Supply

INCREMENTAL GROWTH OF LNG DEMAND FROM A 2013 BASE COMPARED WITH SCHEDULED FIRM, PROBABLE, AND SCHEDULED POSSIBLE CAPACITY FROM THE JENSEN DATABASE(CAPACITIES AT 85% CAPACITY FACTOR)

MMT Incremental Increase Over 2013 (Capacity @ 85% CF)



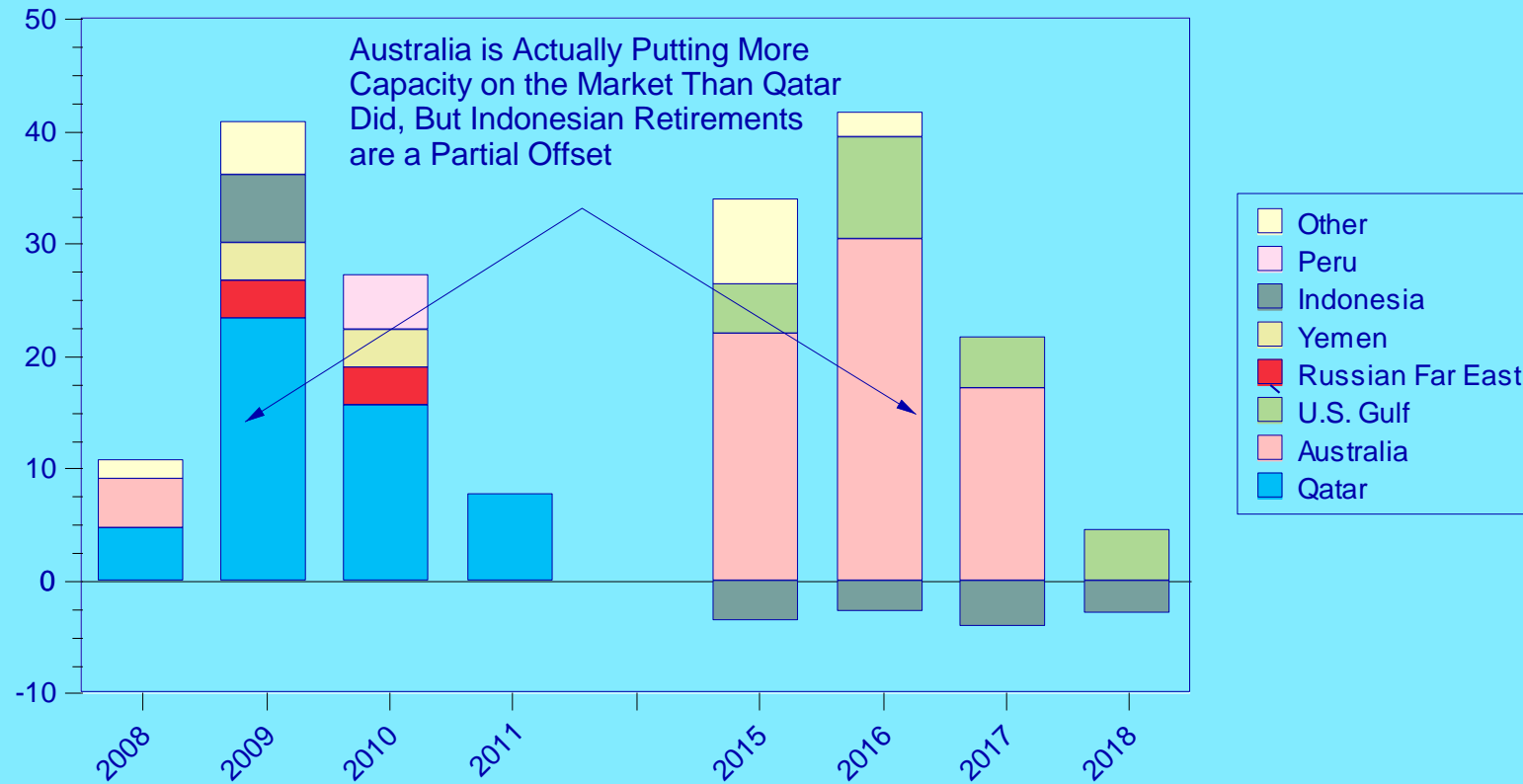
- The Supply Surge is Reminiscent of the Surge in 2008 to 2011, Which Sharply Weakened Prices as Qatar Put Some 52 MMT of New Capacity on a 2007 Market of 226 MMT
- The Market Surplus was Intensified by the Worldwide Recession and by the Loss of the U.S. Market Which Was Expected to Be a Major Contributor to Growth
- But the Declines Were Cushioned in Part by an Incremental 23 MMT of LNG Carved Out of a Declining European Market; Much of This Came at the Expense of Russian Pipeline Gas Trying to Defend Oil-Linked Pricing
- And They Were Also Cushioned by About 15 MMT Which Partly Replaced the Japanese Nukes Post Fukushima

- Looking Forward to the Next Four Years, Australia is Expected to Place 35% More Capacity on Line Than Qatar Did During its Surge - and the Period Will Also See the Startup of Some of the New Gulf Coast Capacity
- Shutdowns in Indonesia Will Absorb Some of the Supply Pressure
- But Where Low-Priced LNG Could Carve Out an Added Market in Europe by Undercutting Oil-Linked Pipeline Supply, the Asian Pipeline Competition is Largely in China, Where Pipeline Prices Have the Potential to Undercut LNG With its "Asian Premium" Price Structure
- And the Nukes are Coming Back on, Not Being Shut Down

A TALE OF TWO SURGES

NEW CAPACITY SUPPLIED IN THE 2008/2011 SURGE AND THAT POTENTIALLY TO BE SUPPLIED DURING 2015/2019

Capacity Added - MMT LNG

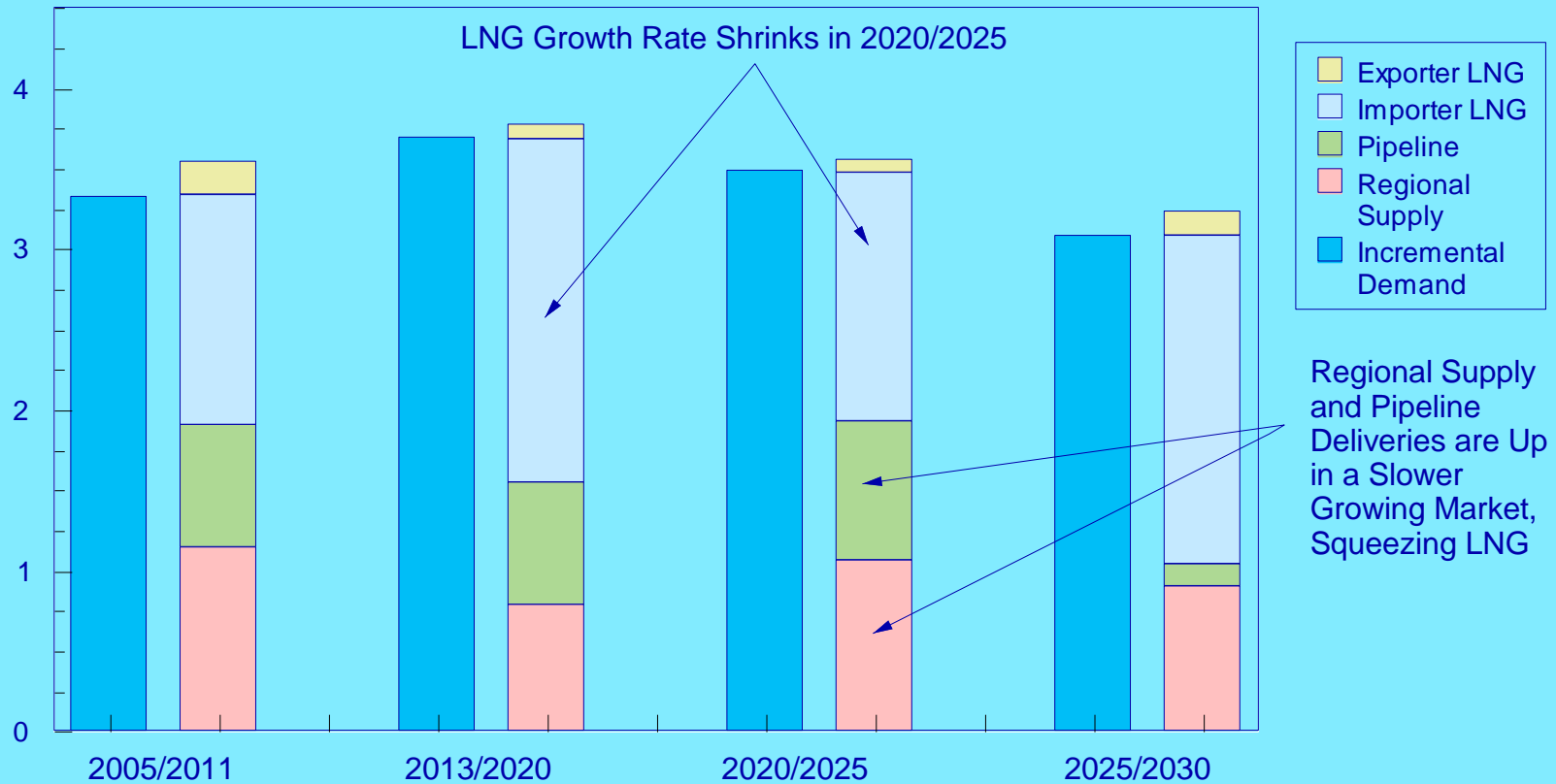


FROM NOW TO 2020

- Overall Growth in Import Requirements by Importers Will Accomodate Some Increased LNG as Supply Declines and Pipeline Imports are Static
- But in the 2020/2025 Period, LNG Growth is Squeezed by Greater Supply and Increased Pipeline Trade (Both Largely in China)
- And in the 2025/2030 Period, LNG Imports Again Increase Their Growth Rates Assuming That Neither China nor Europe Substantially Increase Their Pipeline Commitments to Russia, the Caspian or the Middle East

HOW IMPORTING REGIONS INCREMENTAL DEMAND IS SUPPLIED (INCLUDING IMPORTS INTO NET EXPORTING REGIONS) 2005/2011, 2013/2020, 2020/2025 AND 2025/2030

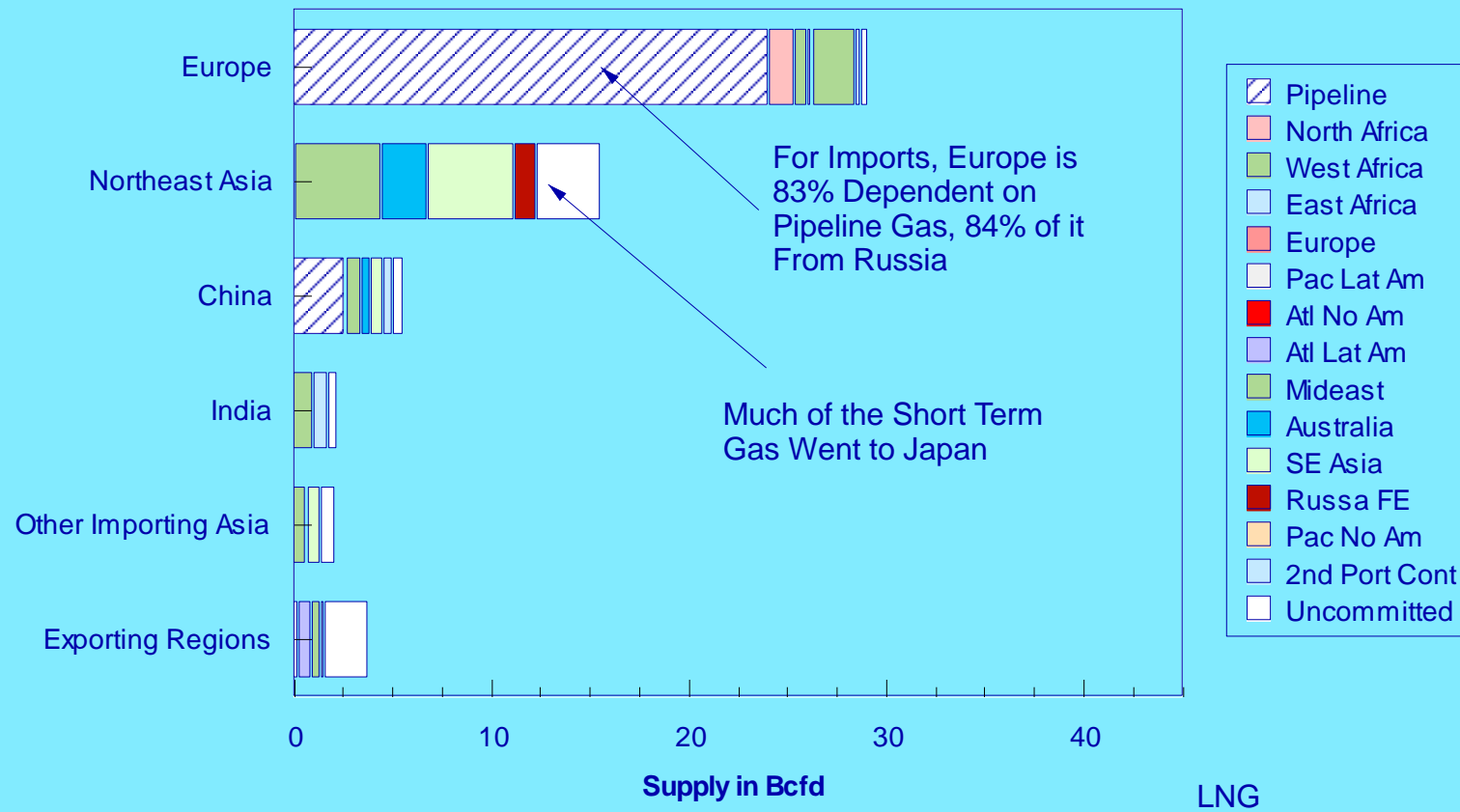
Average Annual Change - Bcfd



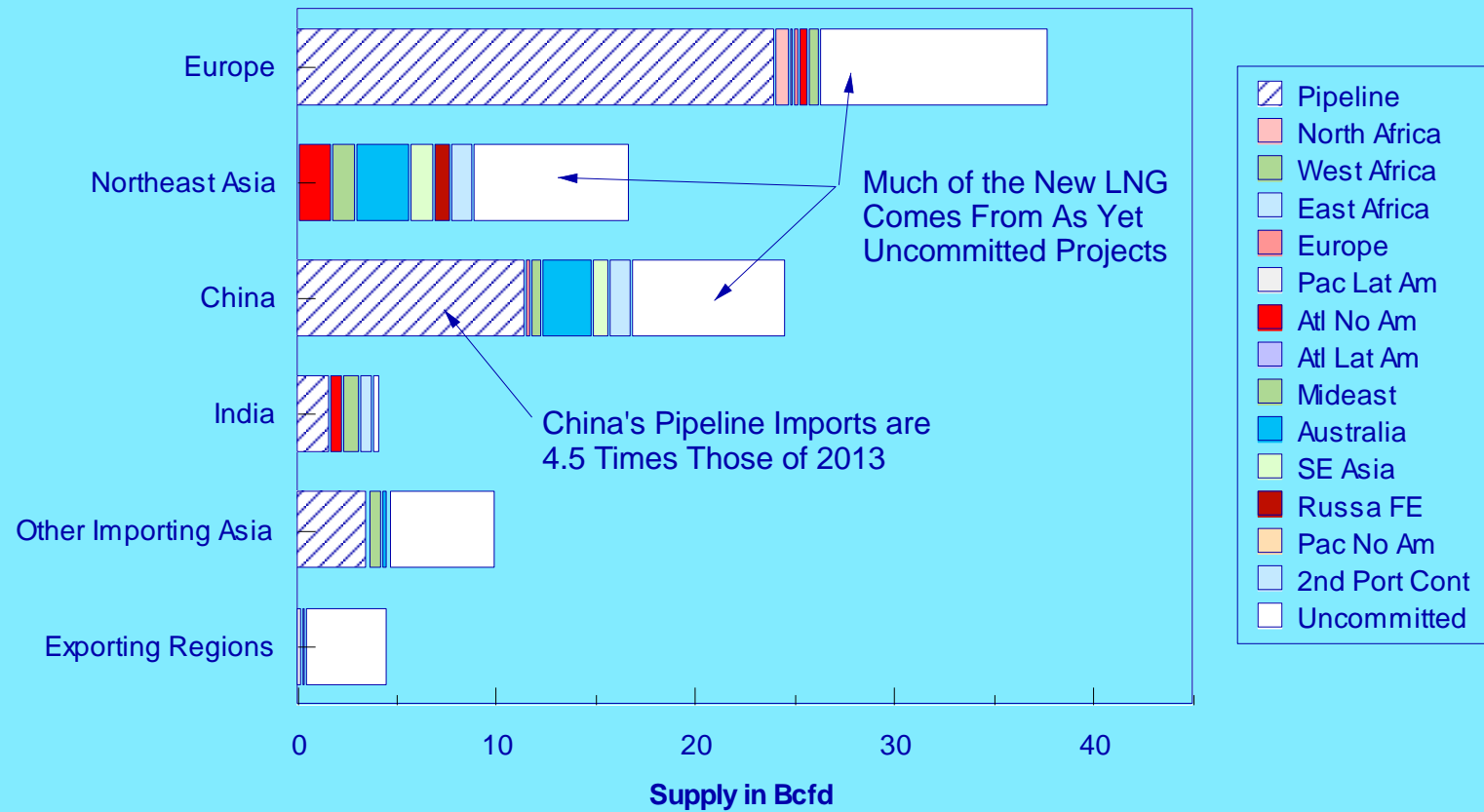
ROUGHLY HALF OF THE INTERREGIONAL TRADE IN 2013 WAS BY PIPELINE WITH EUROPE 83% DEPENDENT ON PIPELINE GAS

- And 84% of Europe's Pipeline Supply Came From Russia
- Of the Short-Term Trade, 41% Went to Northeast Asia, Much of it to Offset the Loss of the Japanese Nukes
- Looking Forward to 2025, European Pipeline Imports Will be Static, But Chinese Pipeline Imports Should be 4.5 Times Those of 2013 as the Chinese Absorb Their Contract Commitments From Russia, Turkmenistan, Kazakhstan and Uzbekistan
- This Will Take a Big Bite Out of Potential LNG Growth

REGIONAL SUPPLY PATTERNS FOR IMPORTING REGIONS 2013



REGIONAL SUPPLY PATTERNS FOR IMPORTING REGIONS 2025

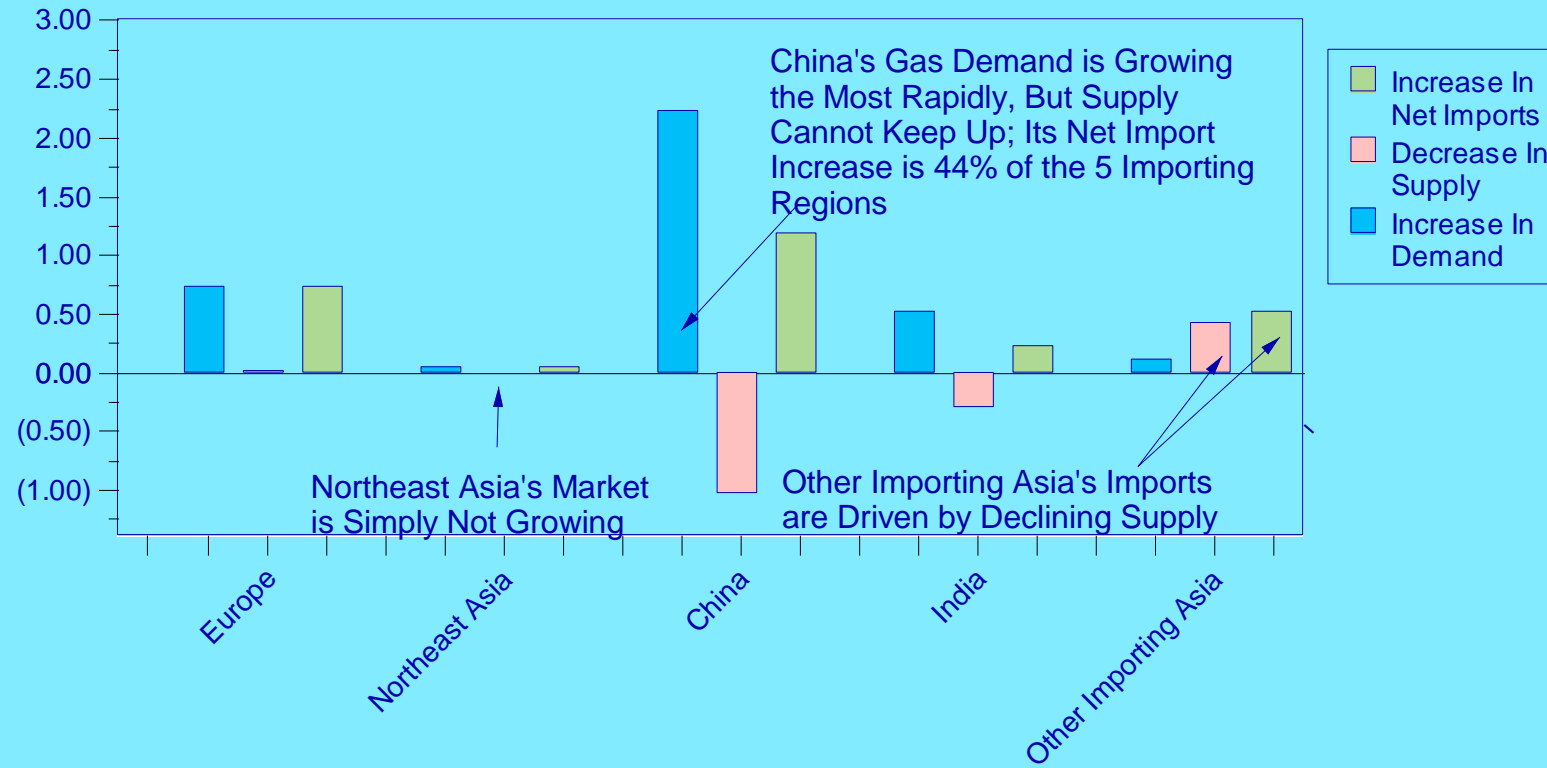


BETWEEN 2013 AND 2025, CHINA EXHIBITS THE LARGEST GROWTH IN IMPORTS

- While Supply is Also Expected to Grow, It Cannot Keep Pace With Demand
- Northeast Asian Imports are Essentially Flat; New Import Commitments Will Come From Expiring Contracts
- Despite an Early Falloff in Supply Coverage, Europe Recovers Enough to Hold Supply Constant; Import Growth Will Come From Demand
- While the Other Asian Importers are Replacing Falling Regional Supply

THE AVERAGE ANNUAL INCREASE IN NET GAS IMPORTS AMONG THE FIVE IMPORTING REGIONS BETWEEN 2013 AND 2025 BCFD

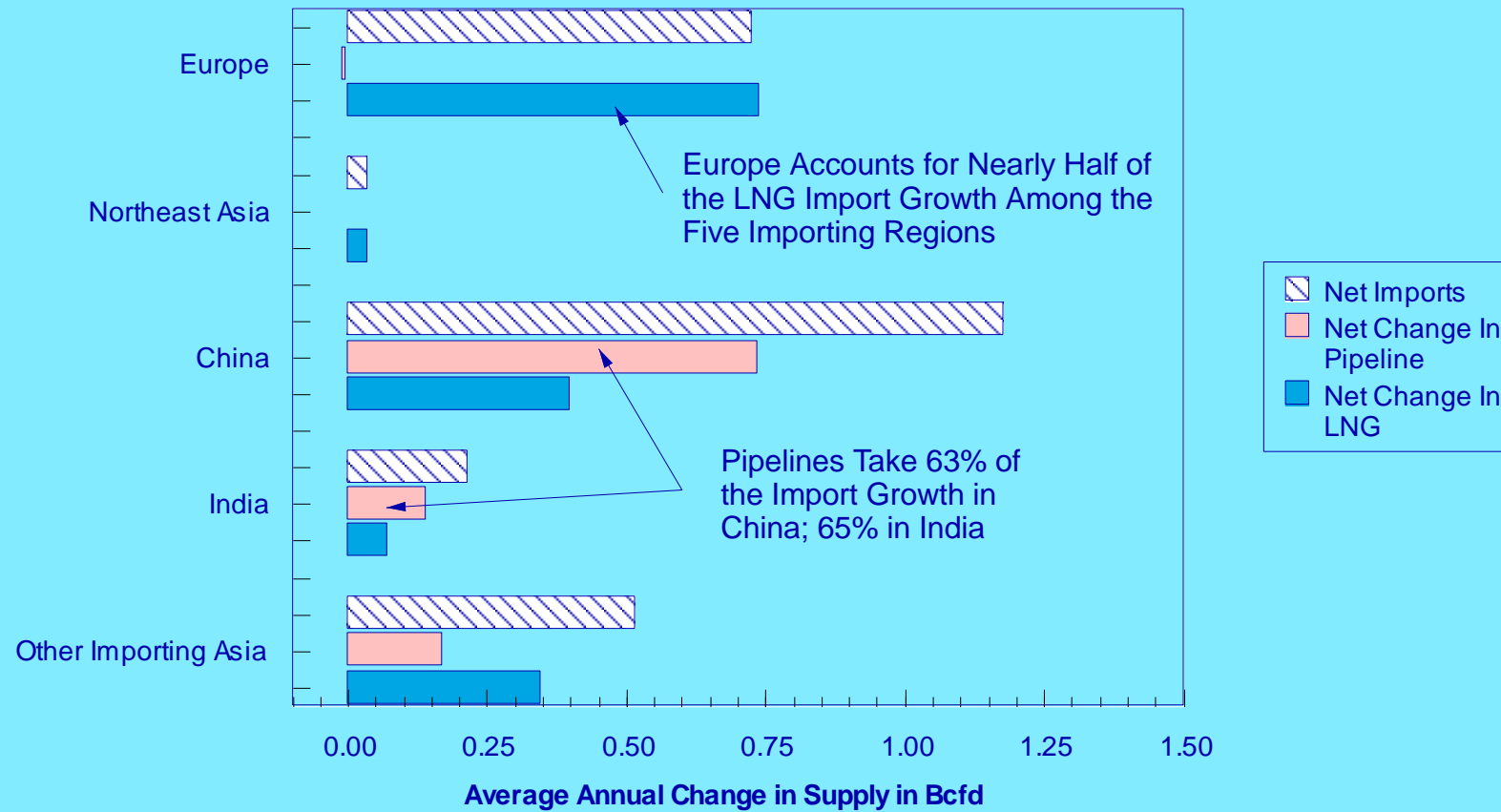
Average Annual Change in Bcfd



PIPELINE COMPETITION IN CHINA AND INDIA PRESENTS A PROBLEM FOR LNG

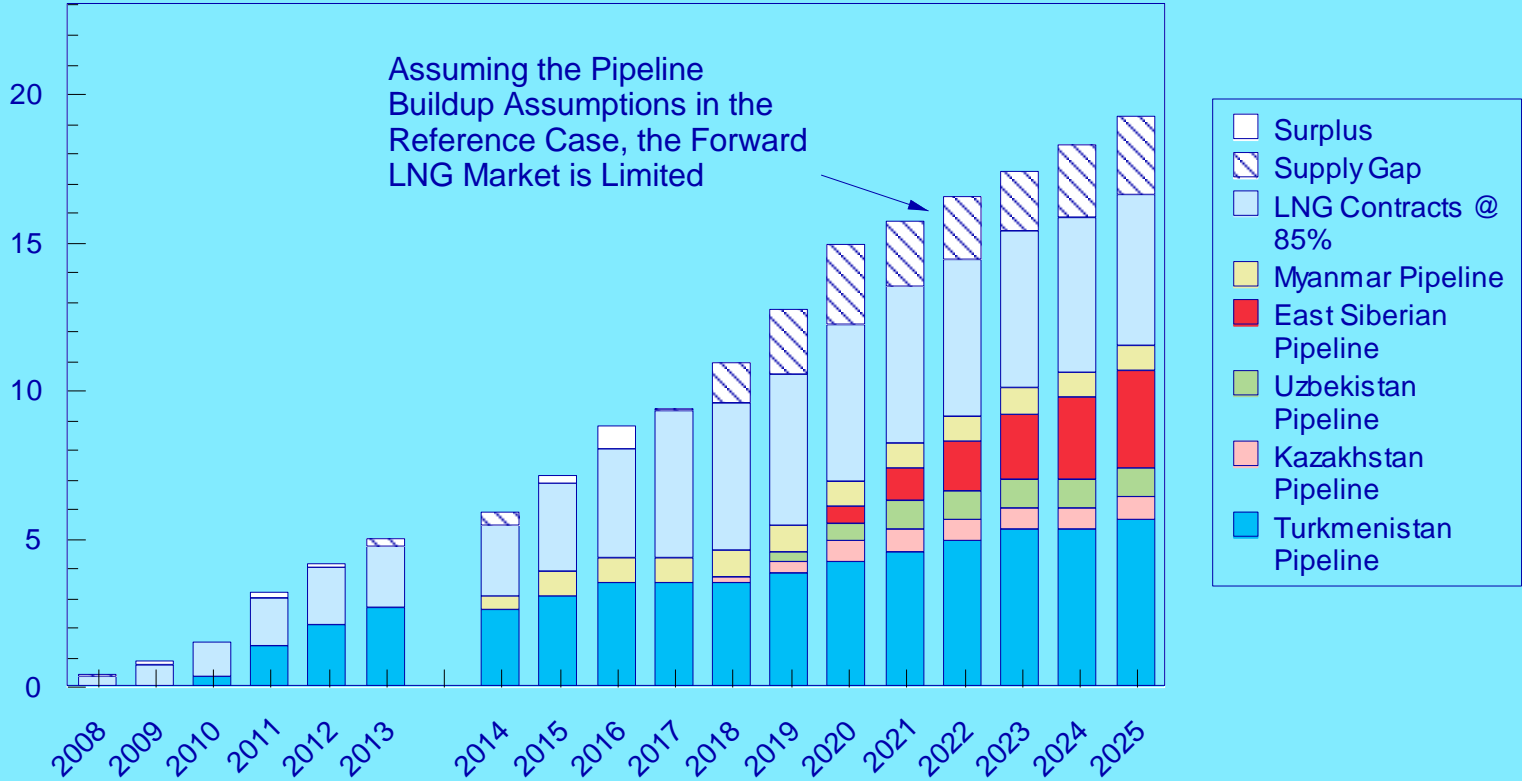
- If China Proceeds to Utilize the Contract Commitments That it Has Signed in Russia, Turkmenistan, Kazakhstan and Uzbekistan, They Potentially Take 63% of China's Import Growth to 2025
- And Some of the Potential LNG Market Has Already Been Contracted For
- While One Might Question the Economics of These Supplies, the Caspian Pipelines are Well Under Way and Chinese Companies Have Upstream Equity Positions
- And if the Long Discussed Iran-Pakistan-India Pipeline Finally Gets Done, it Would Take 65% of India's Import Growth

HOW THE NET IMPORTS ARE SUPPLIED - PIPELINES VERSUS LNG FOR THE FIVE IMPORTING REGIONS



PROJECTED CHINESE NATURAL GAS IMPORTS AND THEIR POTENTIAL CONTRACT COVERAGE BCFD

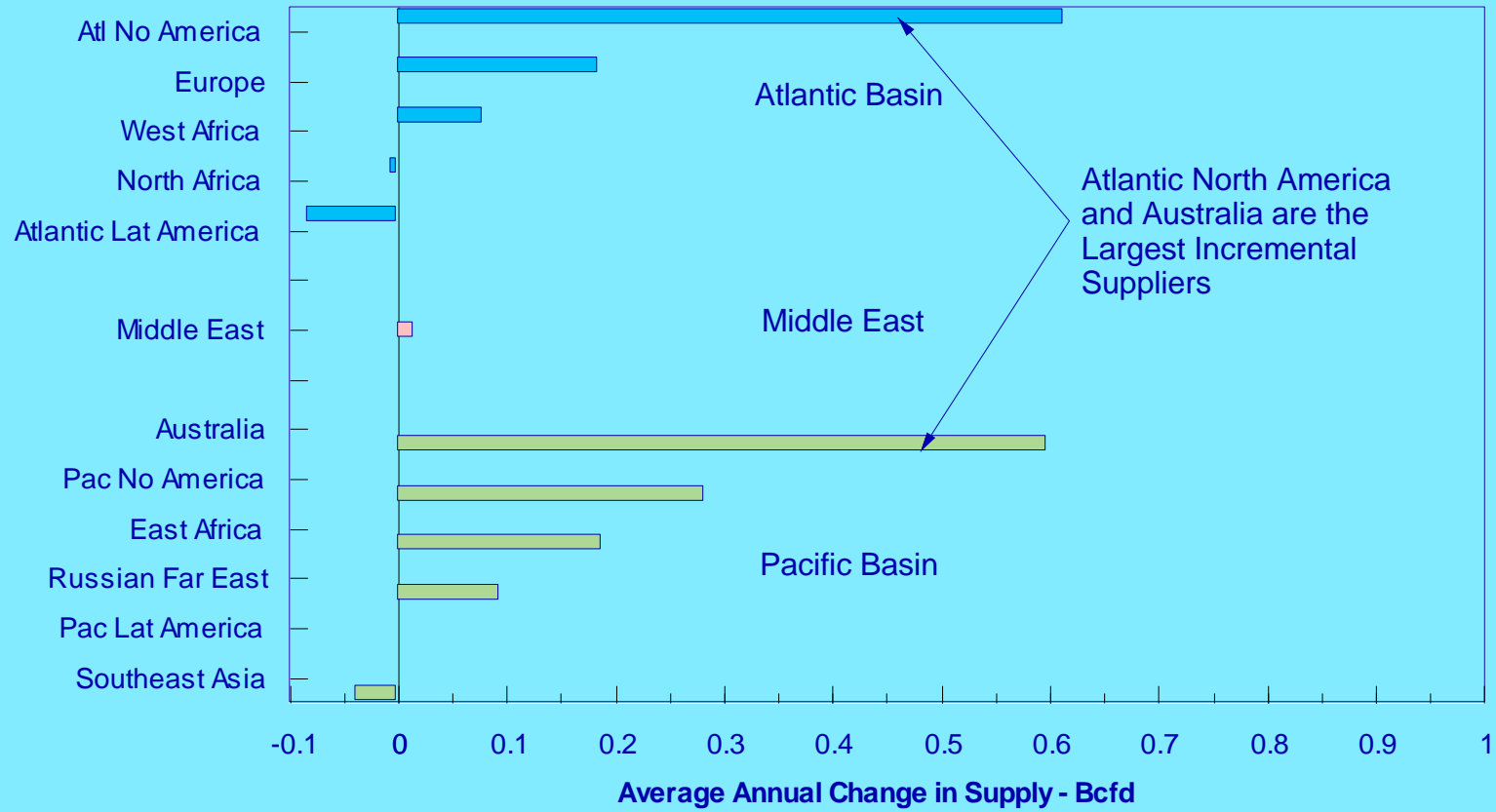
Commitments in Bcfd



WHERE WILL THE SUPPLY COME FROM?

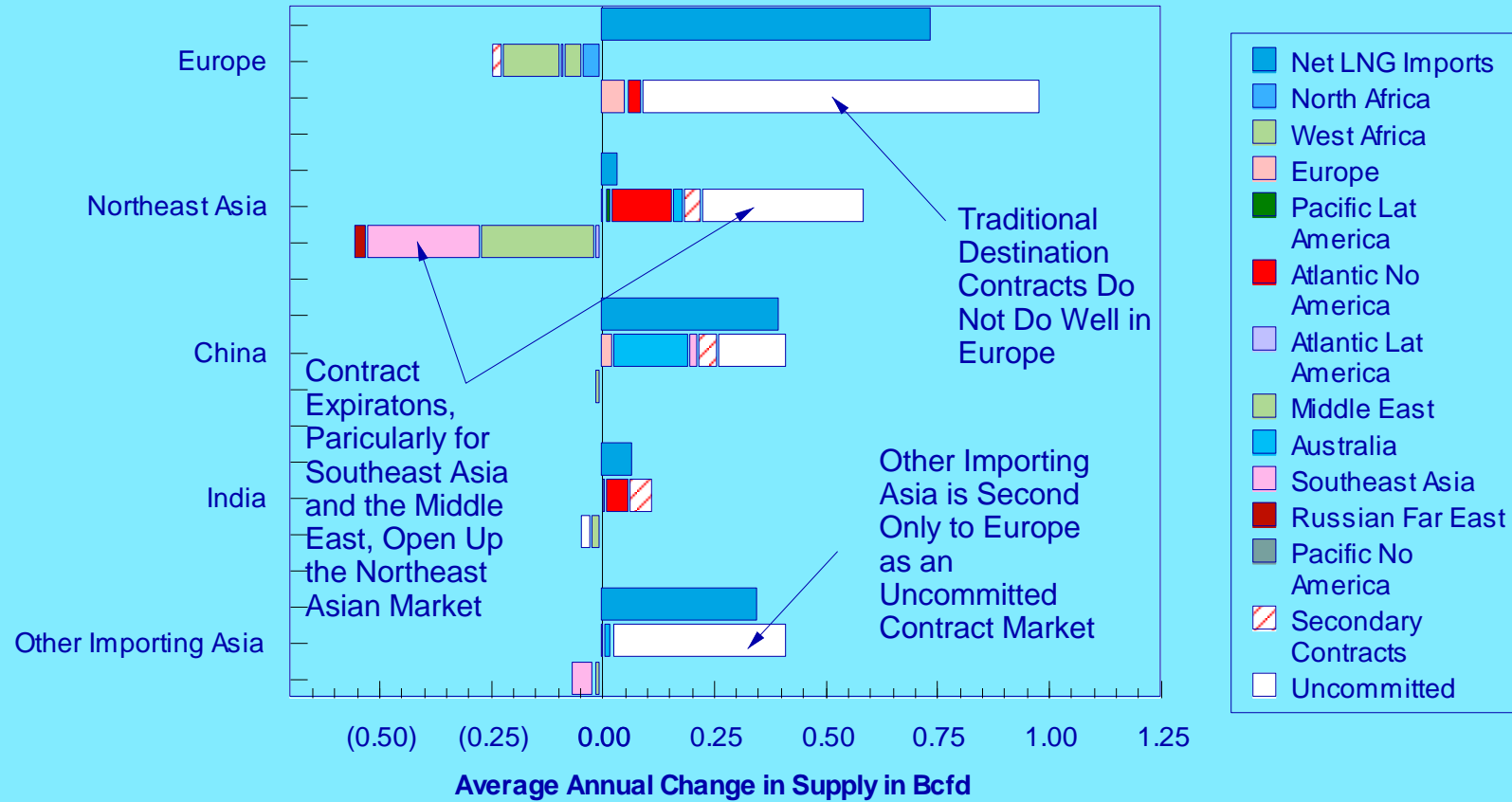
- In 2013, the Middle East with 42% of the World's Supply (32% From Qatar Alone) and Southeast Asia with 20% Were the World's Largest Suppliers
- But Between Now and 2025, Supply Positions Will Substantially Change; the Role of the Middle East Will be Limited While Southeast Asian Supply Will Actually Decline
- Atlantic North America (Largely the U.S. Gulf) Should Emerge as the Largest Incremental Supplier With Australia, Having Only 9% of 2013 Supply, a Close Second
- Pacific North America Should Also be an Important Contributor

**WHERE WILL THE TOTAL LNG SUPPLY COME FROM?
 SUPPLY BY REGION OF ORIGIN
 AVERAGE ANNUAL CHANGE 2013 TO 2025**



- Looking Forward, Contracts Will Play an Important Role in Competitive Opportunities
- Europe, With its Semi-Deregulated Market and Price Volatility, is a Difficult Market for Traditional Destination Contracts
- Northeast Asia is a Classic Destination Market, But its Lack of Growth Limits the Opportunities to Expiring Contracts
- The Other Asian Import Market is Growing Rapidly and Much of its Forward Requirements are as Yet Uncommitted

WHERE WILL SUPPLY FOR THE FIVE REGIONS COME FROM? IMPORTING REGION SUPPLY BY CONTRACT STATUS AVERAGE ANNUAL CHANGE 2013 TO 2025

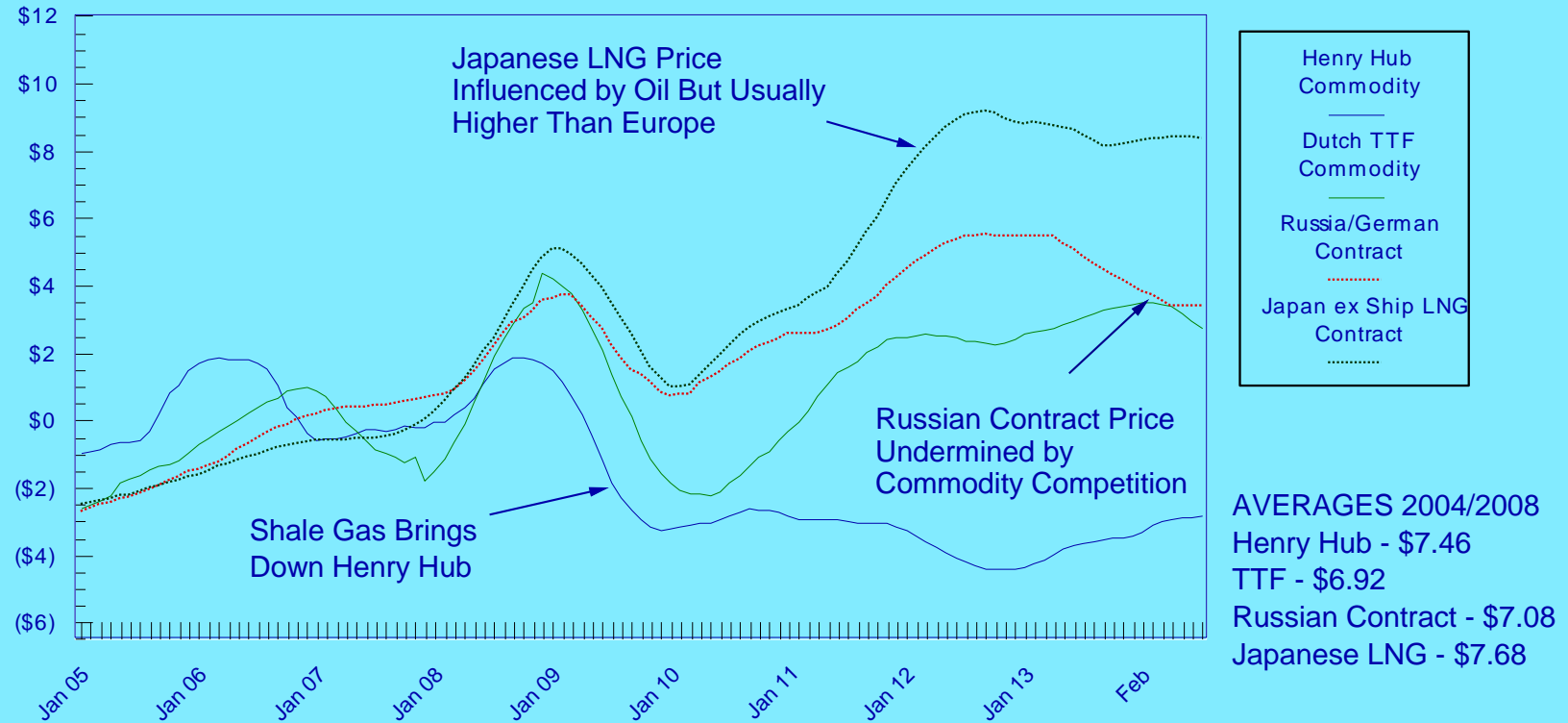


THE CHALLENGE THAT THEORETICAL ECONOMIC MODELS FACE IS ILLUSTRATED BY PRICE BEHAVIOR SINCE 2008

- Henry Hub Prices Fell with the Shale Gas Surpluses
- The North Sea Area Commodity Prices Also Initially Fell Influenced by Atlantic LNG Arbitrage; They Rose Again Towards Continental Oil-Linked Price Levels as Markets Tightened
- Now, With European Markets Again in Surplus, Commodity Prices Have Undermined Oil-Linked Contract Prices Forcing Russian Price Concessions; The Result is a Semi-Competitive Continental Commodity Market
- But Asian Prices Were Largely Unaffected by the LNG Surplus, Rising and Falling with Oil Prices

THE EMERGENCE OF REGIONAL PRICE DIVERGENCE FOLLOWING THE GAS MARKET SURPLUS OF 2009/2010 (12 MONTH MOVING AVERAGES) THE DEPARTURE OF REGIONAL GAS PRICES FROM THEIR AVERAGES FROM 2004 THROUGH 2008

Price Relative to 2004/2008 Average

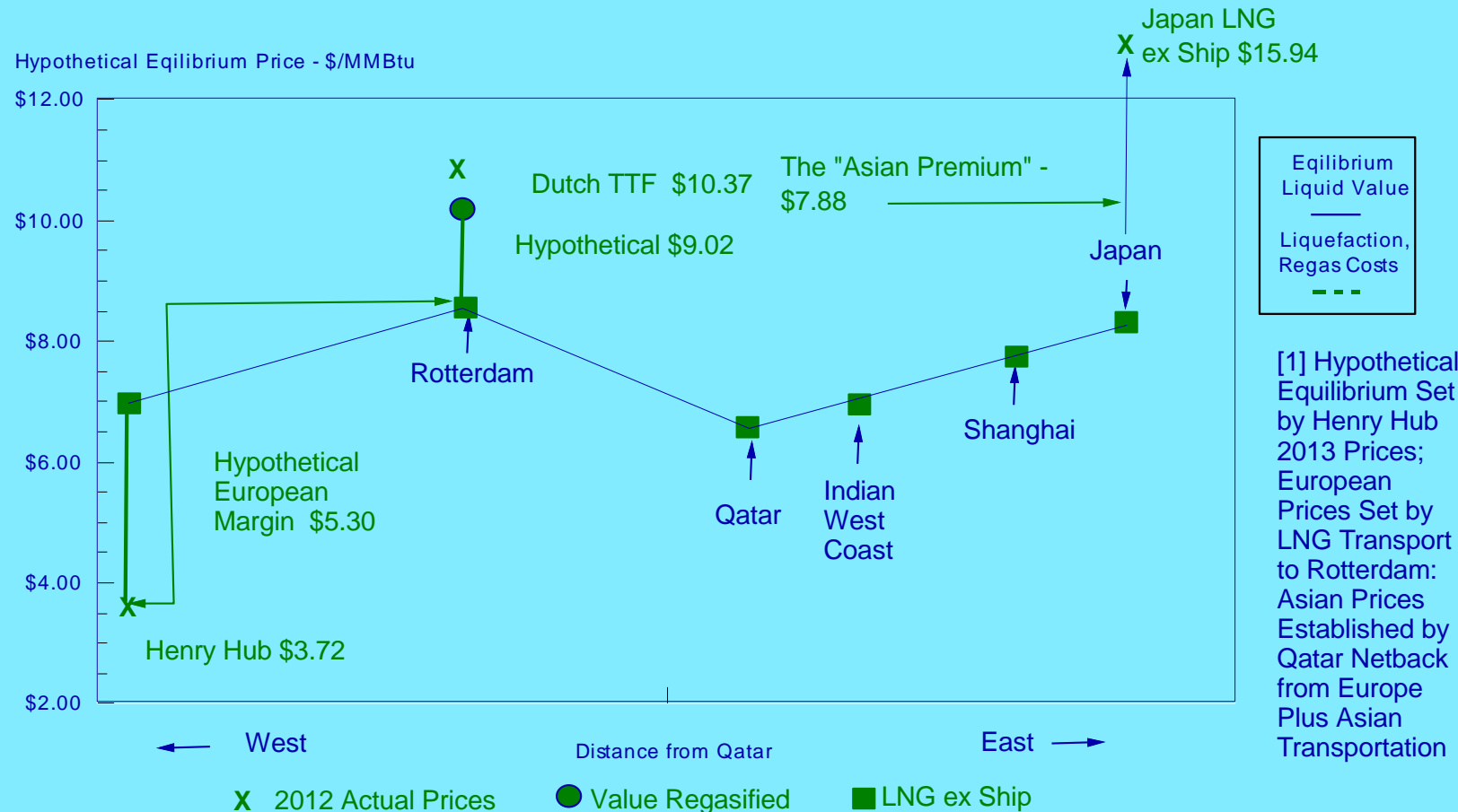


A LEGITIMATE QUESTION - "WHAT MIGHT A THEORETICAL WORLD COMPETITIVE COMMODITY GAS MARKET LOOK LIKE?"

- One Can Devise an "Equilibrium" Set of Basis Differentials Between Markets by Assuming That Transportation Alone Sets the Regional Price Differences for the Commodity
- Alone Among the Major LNG Trading Partners, North America Has a Truly Gas-to-Gas Competitive Commodity Market; While the U.K Also Has a Competitive Commodity Market, It Tends to be Influenced by Continental Oil-Linkage When LNG Markets are Tight
- The "Equilibrium" Commodity Pricing System Thus Might be Based on Henry Hub Pricing

- And Although it Lacks the Liquidity and Transparency of Henry Hub, Qatar Plays a Similar "Hub" Role in LNG, Since it Can Arbitrage Atlantic Basin and Pacific Basin Prices
- In Such a Theoretical System, the European Gas Value Might be Based on U.S. Prices Plus the Cost of Transportation From the U.S. Gulf Coast to Europe; Then Those Prices Might be Netted Back to Qatar Where They Would in Turn Establish Asian "Equilibrium" Prices
- The Following Figure is Just Such an Estimate; The Equilibrium Transportation Differential Between U.S. and Europe For 2013 is \$5.30 and Between U.S. and Japan \$4.34 ex Ship (Before Regasification)

HYPOTHETICAL WORLD LNG PRICE STRUCTURE [1] ASSUMING MARKETS ARE IN EQUILIBRIUM WITH U.S. 2013 COMMODITY PRICES, TRANSPORT COSTS TO EUROPE SET EUROPEAN PRICES AND EUROPEAN NETBACKS FROM EUROPE TO QATAR SET ASIAN PRICES



A COMMON MISCONCEPTION IS THAT OIL-LINKED PRICING IS OIL-PARITY PRICING IT IS NOT

- The Relationship Between Oil and LNG Prices is Set by the Price Clause; In 2013 the Japanese ex Ship LNG Liquid Price Averaged 84% of Brent Crude; the Russian Gas Price to Germany Averaged Only 59% of Brent
- The European and Asian Price Clauses are Very Different; European Price Clauses Typically Link the Price to a Mix of Oil Products
- One Set of Terms are Known as "Pass Through Factors" Which Divide the Price Changes Between Buyer and Seller; Discounting is Usually Done by Reducing the Pass Through Factors; The European Clauses Have Proved to be Fairly Flexible in Adapting to Competition

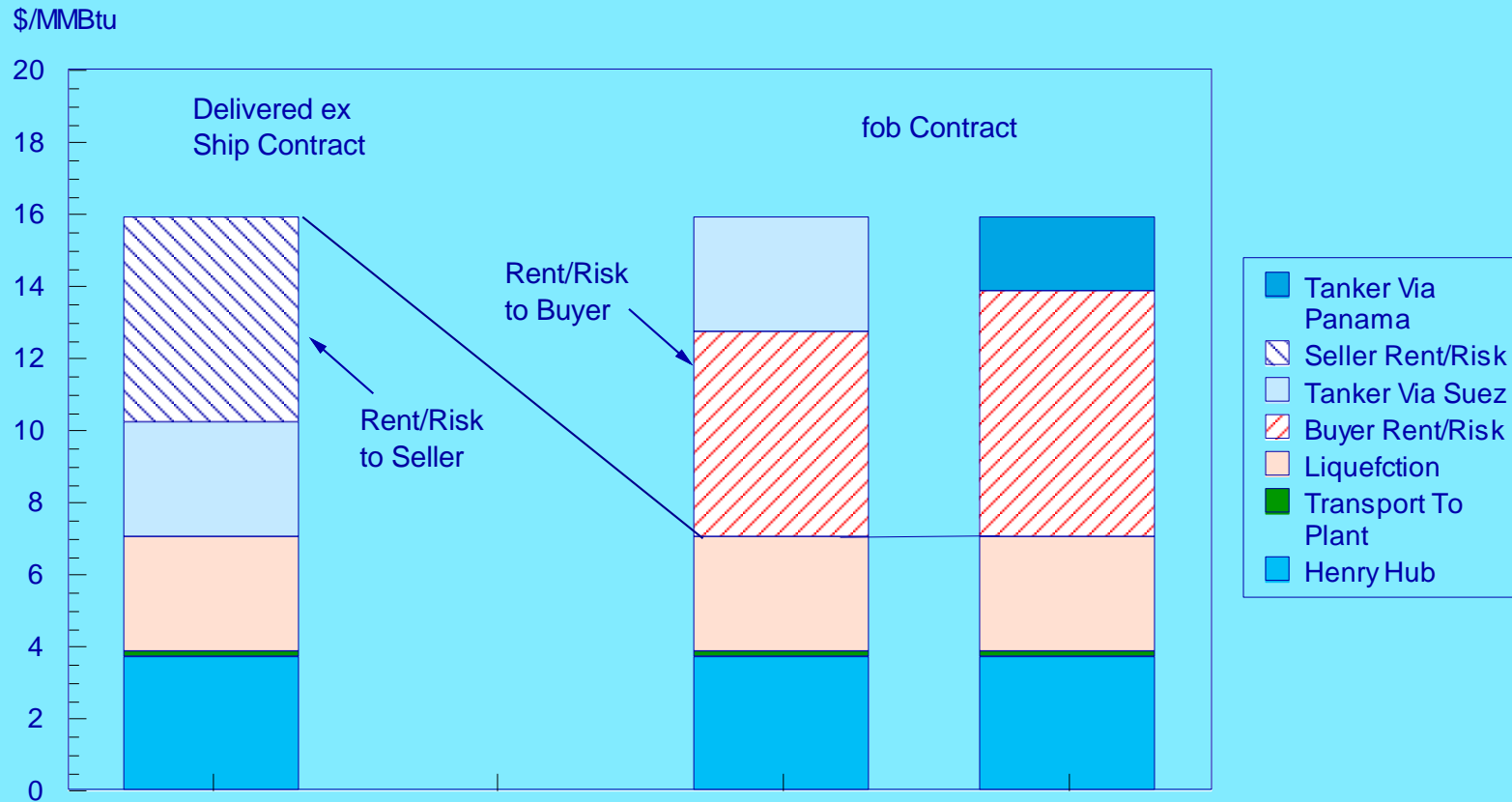
THE TYPICAL JAPANESE PRICING CLAUSE IS BASED ON A SIMPLE FORMULA

- It is Linked to the Japanese Customs Cleared Price for Crude Oil - JCC or the "Japanese Crude Cocktail"
- "It is in the Form of:
$$P=C+S*JCC$$
- Where P is the Price in \$/MMBtu, C is a Constant Expressed in \$/MMBtu and S is the "Slope", a Dimensionless Number
- Discounting is Most Often Done by Changing the Slope and Sometimes the Constant; But its Simplicity Limits the Contract Options for Competitive Discounting and, Once Negotiated, the Only Thing That Changes is the Oil Price

- Northwest Europe Has Benefitted from the Price Competition That Was Unleashed by the LNG Surge in 2009/2010
- There LNG Arbitrage Together With North Sea Commodity Competition Exported Weak North American Prices to the Continent Through the Open Access EU Pipeline System and Undermined Oil-Linkage
- No Similar Price Competition Has Been Possible in Asia Because There Is No Access to Commodity Gas; This Has Been a Powerful Driving Force Behind the Asian Interest in U.S. Exports Since it Gives Asia a Source of Gas-to-Gas Competitive Commodity Supply Similar to That Which Has Already Benefitted Europe

- The Most Common Type of LNG Contract is the Delivered ex Ship (DES) Contract in Which the Seller Delivers to the Buyer's Receipt Terminal; The Price Clause is Based on Destination Market Conditions
- Less Common is the fob Contract in Which the Delivery is Made at the Outlet of the Liquefaction Plant; But the Pricing is Commonly Based on Destination Pricing and Adjusted for Tanker Transportation
- All of the U.S. Export Contracts so Far are Also fob Contracts, But They are Unique in That Their Pricing Clauses are Based on Origin Pricing - Keyed to the North American Commodity Price at Henry Hub
- Thus Unlike Traditional Clauses, the Economic Rent - and the Price Risk - Go to the Buyer, Not the Seller
- That is Their Appeal to Oil-Linked Contract Buyers

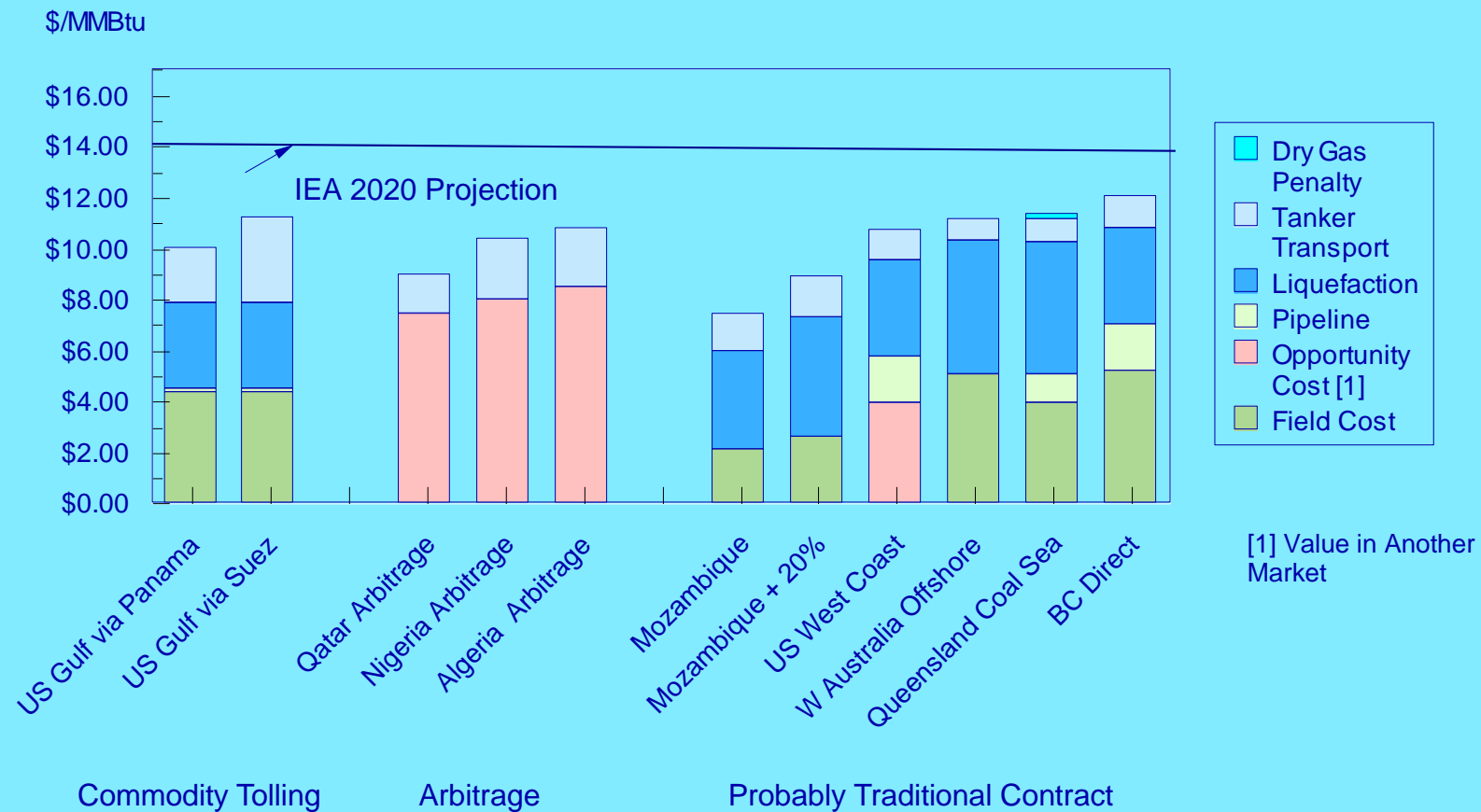
WHO GETS THE RENT AND TAKES THE RISK BETWEEN THE 2013 JAPANESE PRICE AND HENRY HUB PRICE (INCLUDES THE 2014 PANAMA OPTION)



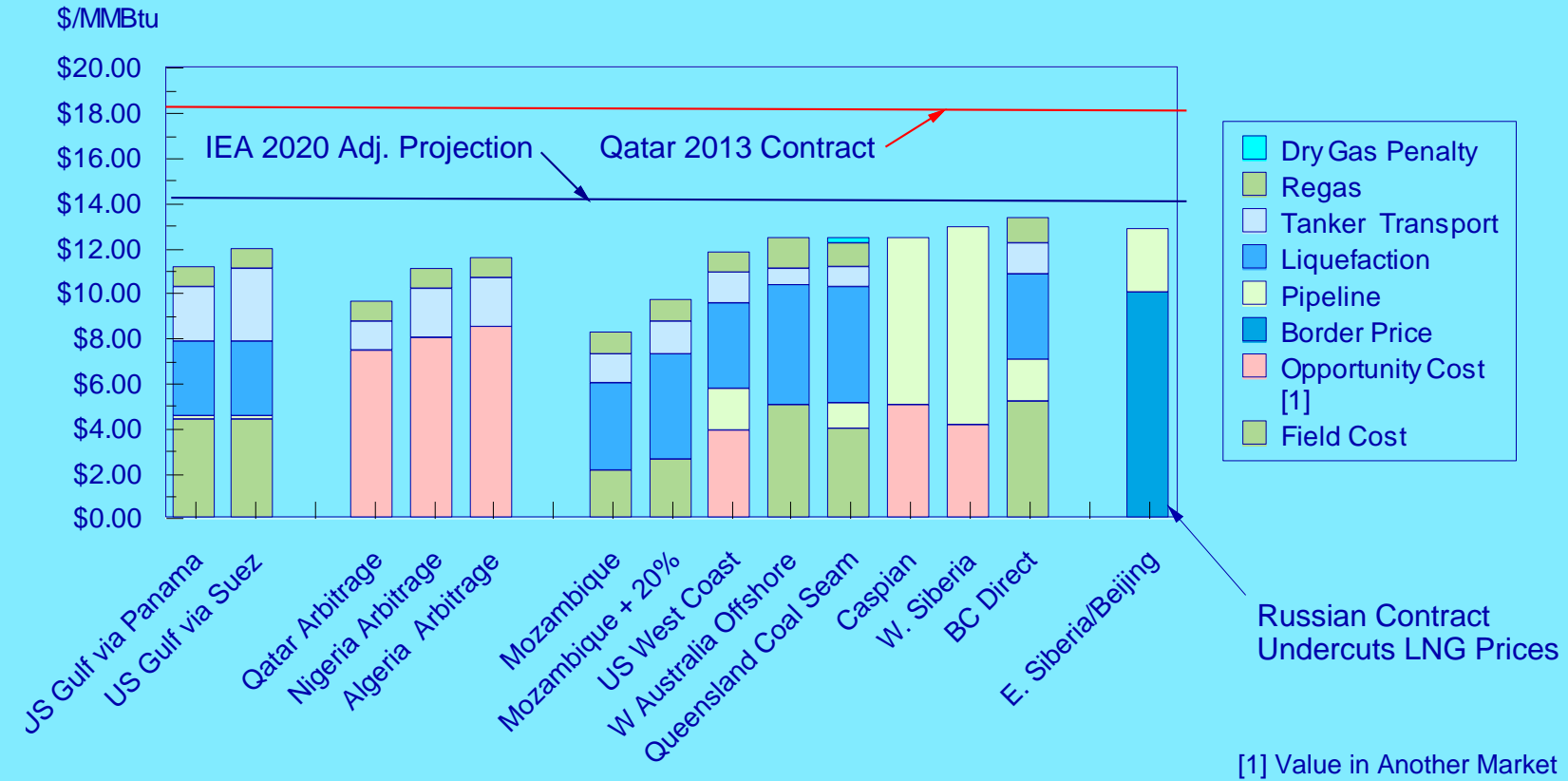
BECAUSE ASIAN LNG COMPETITORS "SHADE" CONTRACT PRICES ONLY SLIGHTLY, LNG PRICING IS VERY SLOW TO RESPOND, EVEN IN VERY WEAK MARKETS

- That is the Essence of Northeast Asia's Problem in Dealing With the Asian Premium
- In Theory, Destination-Flexible Supplies Should be Able to Undermine the Price Structure by Arbitraging Much Cheaper Atlantic Basin Prices
- But the Potential Arbitragers Often Have a Stake in High Asian Prices and So That Does Not Work Quickly Either
- The Chinese Have an Advantage Since They Can Play Off Pipeline Supply Against LNG; An Earlier Turkmen Contract Helped, But the New East Siberian Contract Should Have a Significant Effect

ILLUSTRATIVE COSTS OF DELIVERING NATURAL GAS TO JAPAN IN 2020 ASSUMING CURRENT COSTS AND PROJECTED 2020 PRICES (IEA WEO 2013 FOR JAPAN AND EUROPE, EIA AEO 2014 FOR U.S.)



ILLUSTRATIVE COSTS OF DELIVERING NATURAL GAS TO SHANGHAI IN 2020 ASSUMING CURRENT COSTS AND PROJECTED 2020 PRICES (IEA WEO 2013 FOR JAPAN AND EUROPE, EIA AEO 2014 FOR U.S.)



Commodity Tolling Arbitrage Probably Traditional Contract

THIS ANALYSIS HAS CONSIDERED SEVEN ADDITIONAL SCENARIOS

- Scenarios 1 and 2
 - Chinese Demand Plus 20%
 - Chinese Supply Minus 20%
- These Scenarios Place Great Stress on the LNG System; They Favor Pacific LNG Sources as Well as Iran, East Africa and North American Portfolio Supply
- Scenario 3
 - Eliminate Iranian Exports
- This Scenario, Whose Effects are Slow to Build, Opens Up the Indian and Pakistani Markets and Favors East Africa and North American Contract Supply

- Scenario 4
 - Reduce Russian and Caspian Pipeline Capacity Factors From 90% to 70%

- Pipelines Like to Operate at High Capacity Factors; But it is Difficult to Sustain Them When Serving Power Generation Loads; This Scenario's Response is Similar to Chinese Scenarios 1 and 2

- Scenario 5
 - Reduce European Reliance on Russia to 50% in Ten Years

- This Has the Greatest Effect on Atlantic Basin Supplies Including North American Portfolio Suppliers

- Scenario 6
Increase European Supply by 10%

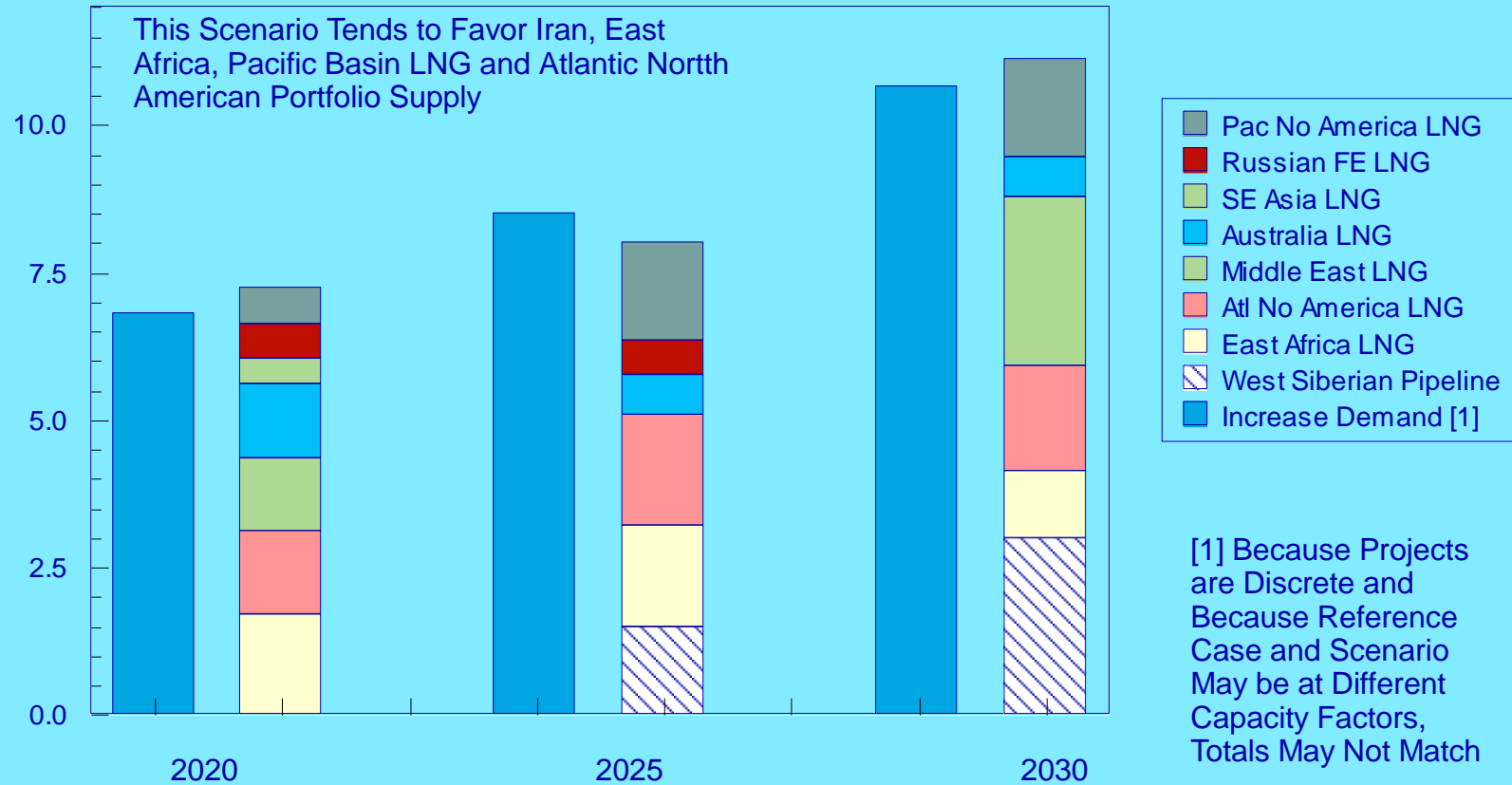
- This Scenario is the Only One of the Group That Reduces the Need for Additional LNG; It Assumes That Russian Pipeline Supply Absorbs Half and That West African and North American LNG Absorbs the Rest

- Scenario 7
Do Not Restart Japanese Nukes

- Since Northeast Asia Favors Diversification to Deal With Traditional Formula Contract Pricing, This Scenario Favors East Africa and North American Contract Supply

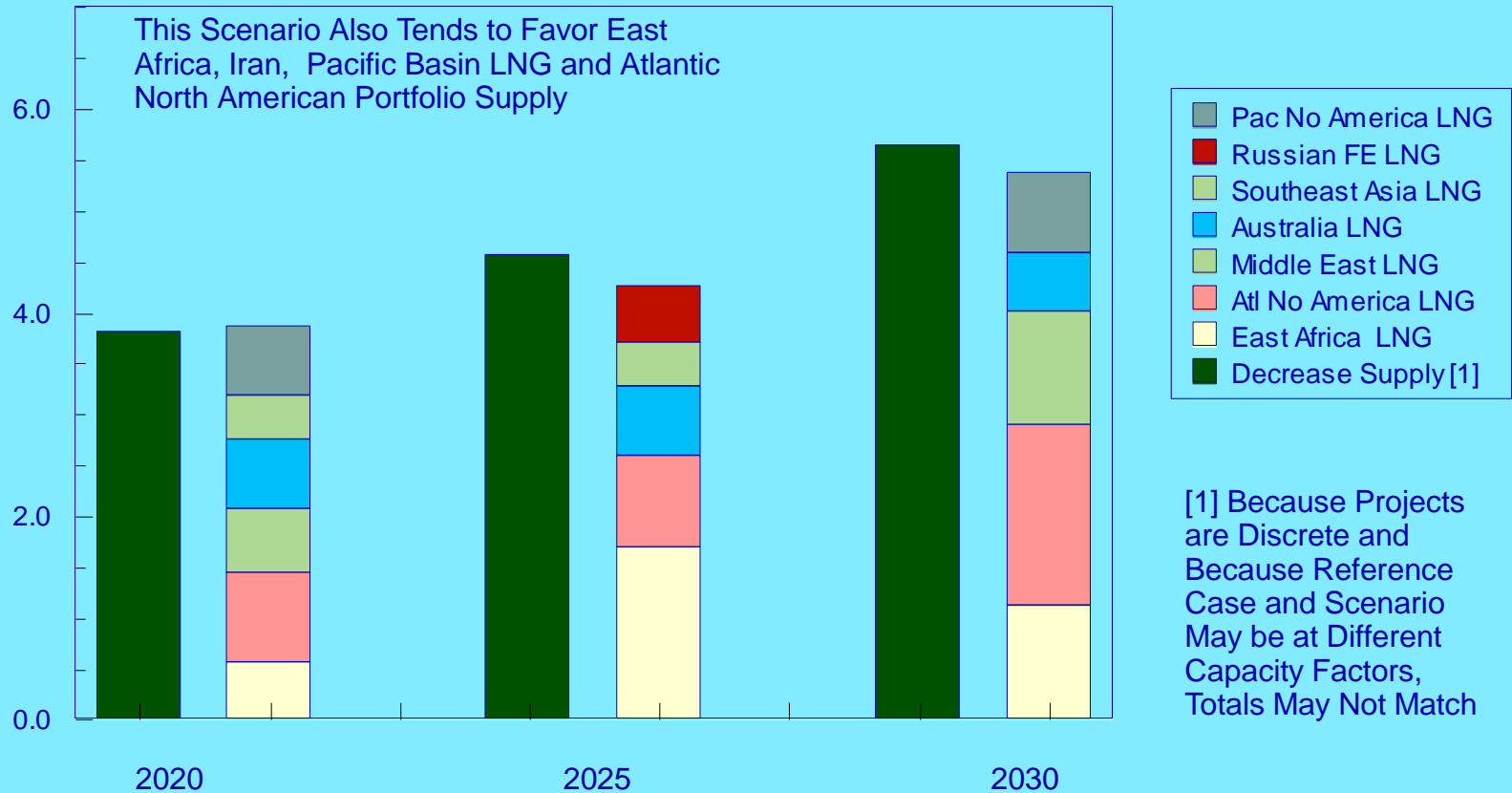
SCENARIO 1 INCREASE CHINESE DEMAND BY 20% CHANGES FROM REFERENCE CASE BALANCES BCFD

Changes in Supply and Demand - Bcfd



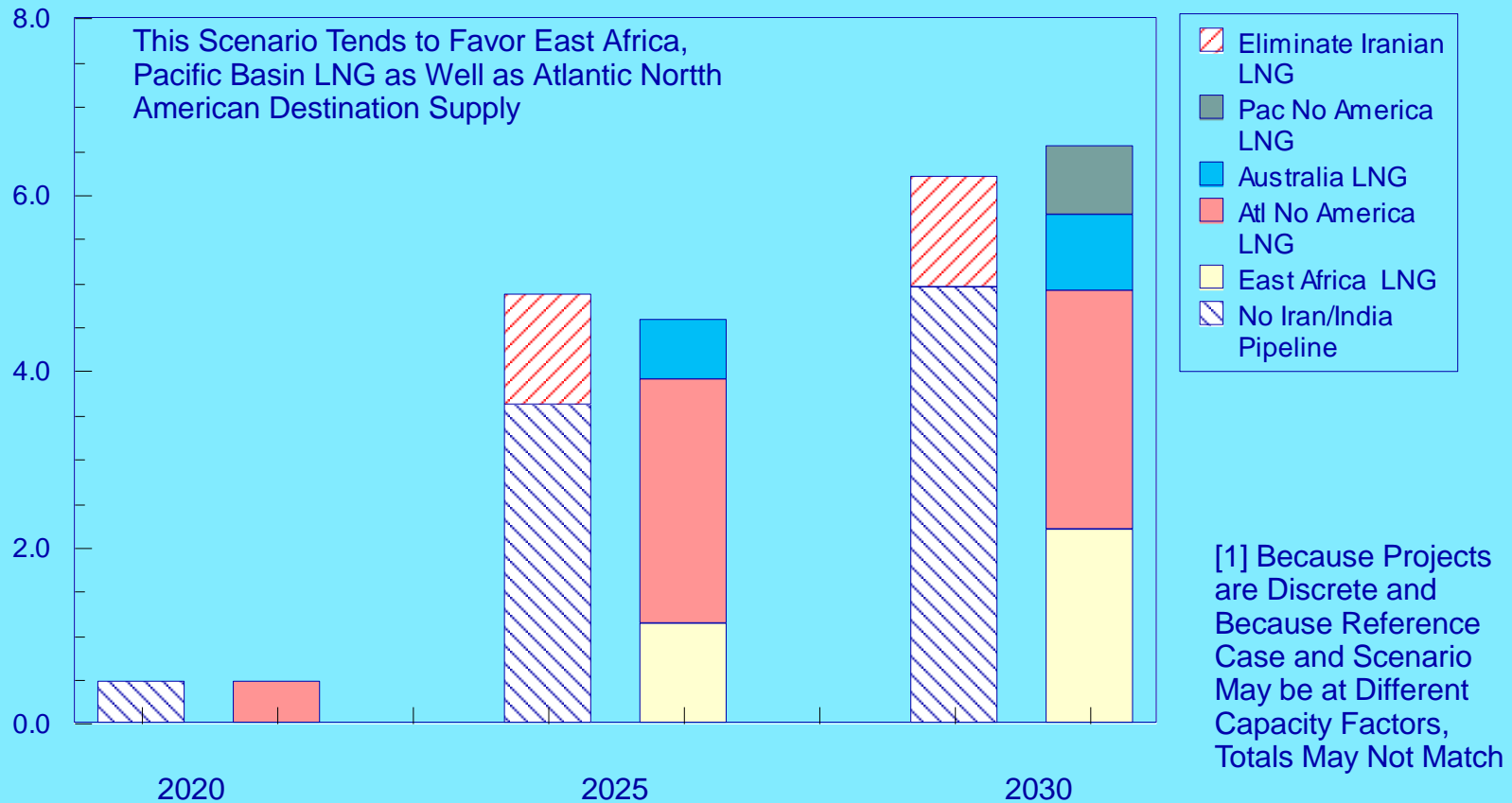
SCENARIO 2 DECREASE CHINESE SUPPLY BY 20% CHANGES FROM REFERENCE CASE BALANCES BCFD

Changes in Supply and Demand - Bcfd



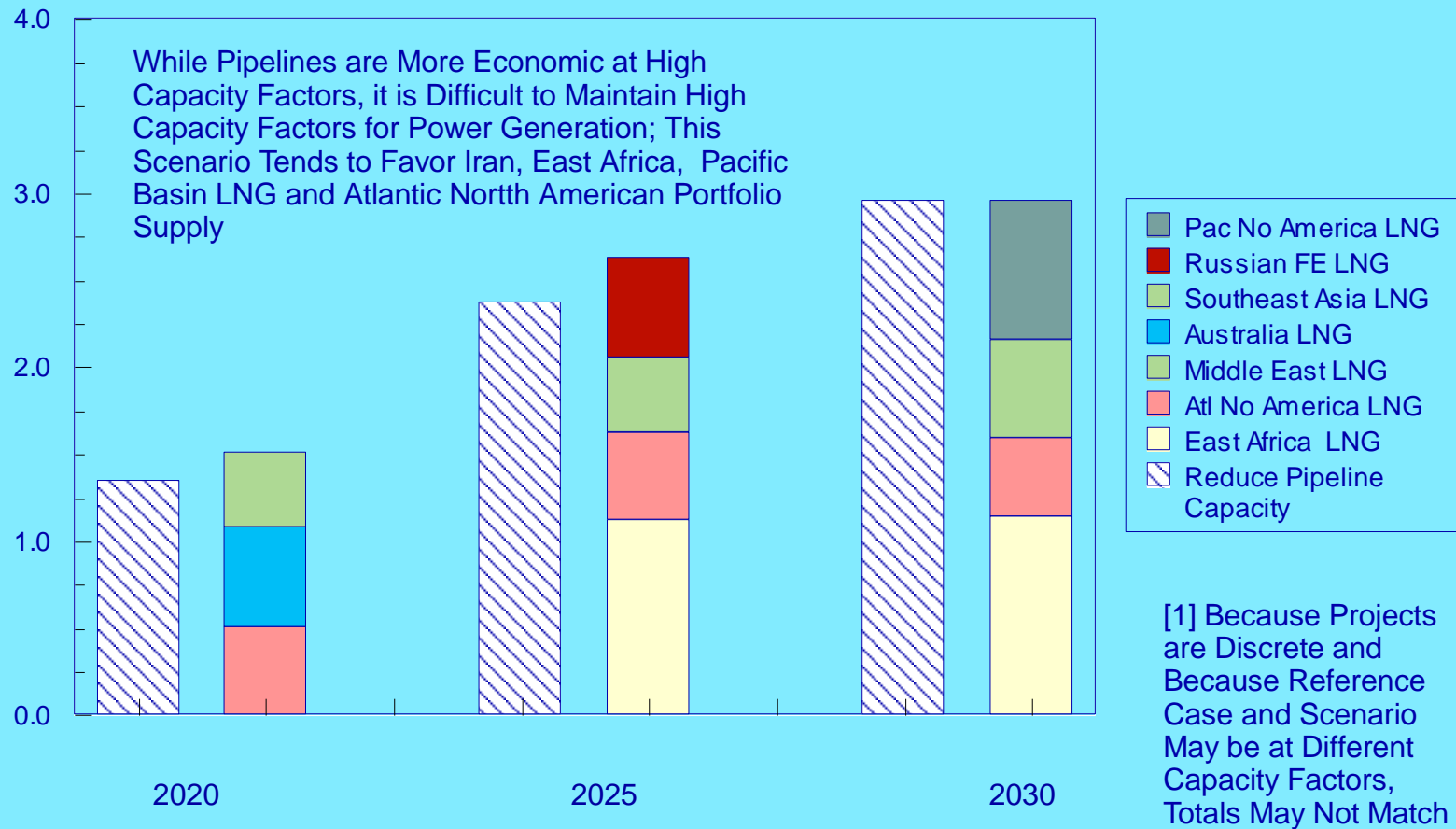
SCENARIO 3 ELIMINATE IRANIAN EXPORTS CHANGES FROM REFERENCE CASE BALANCES BCFD

Changes in Supply and Demand - Bcfd



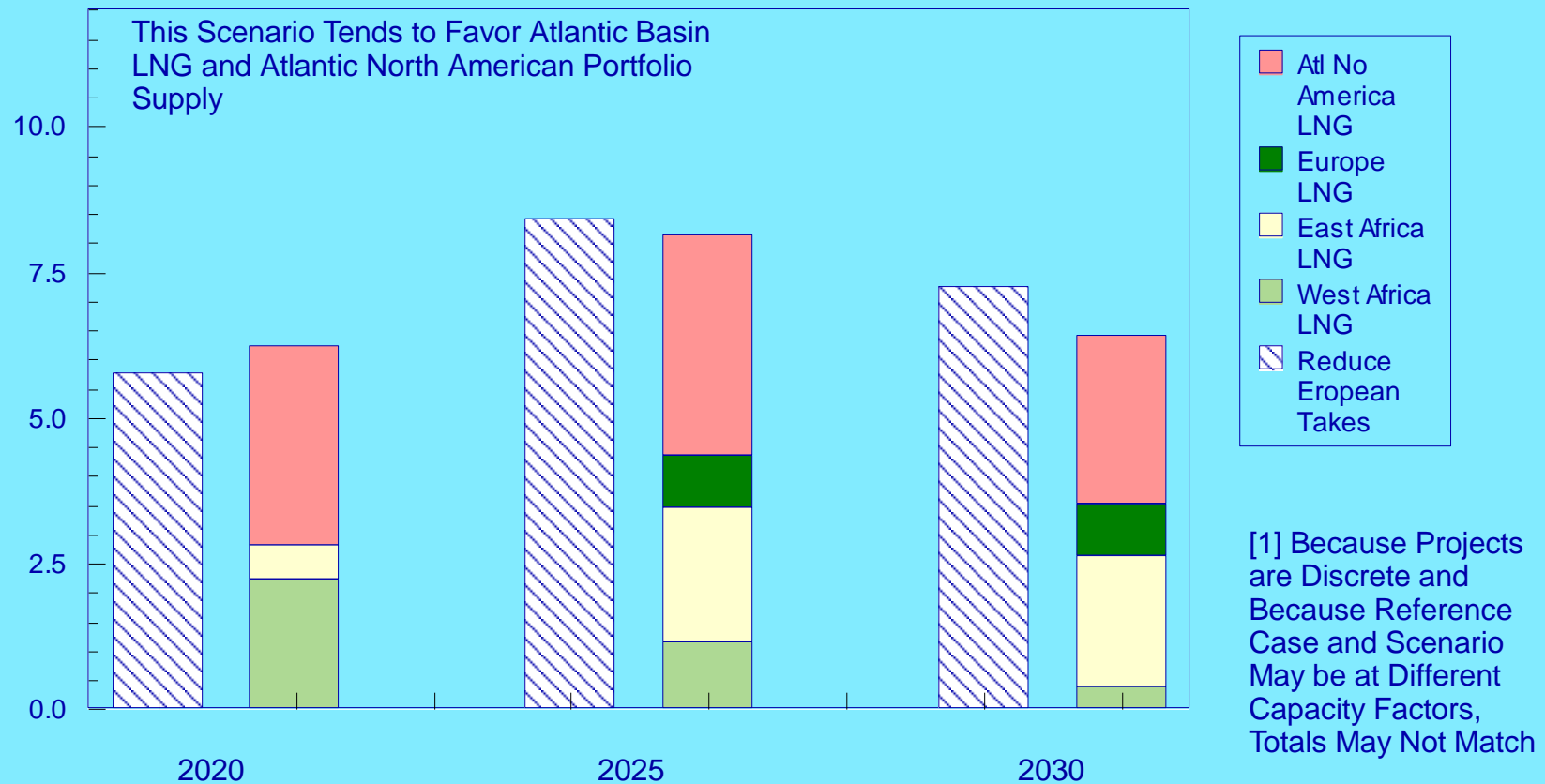
SCENARIO 4 REDUCE CAPACITY FACTORS ON RUSSIAN AND CASPIAN PIPELINES TO CHINA FROM 90% TO 70% CHANGES FROM REFERENCE CASE BALANCES BCFD

Changes in Supply and Demand - Bcfd



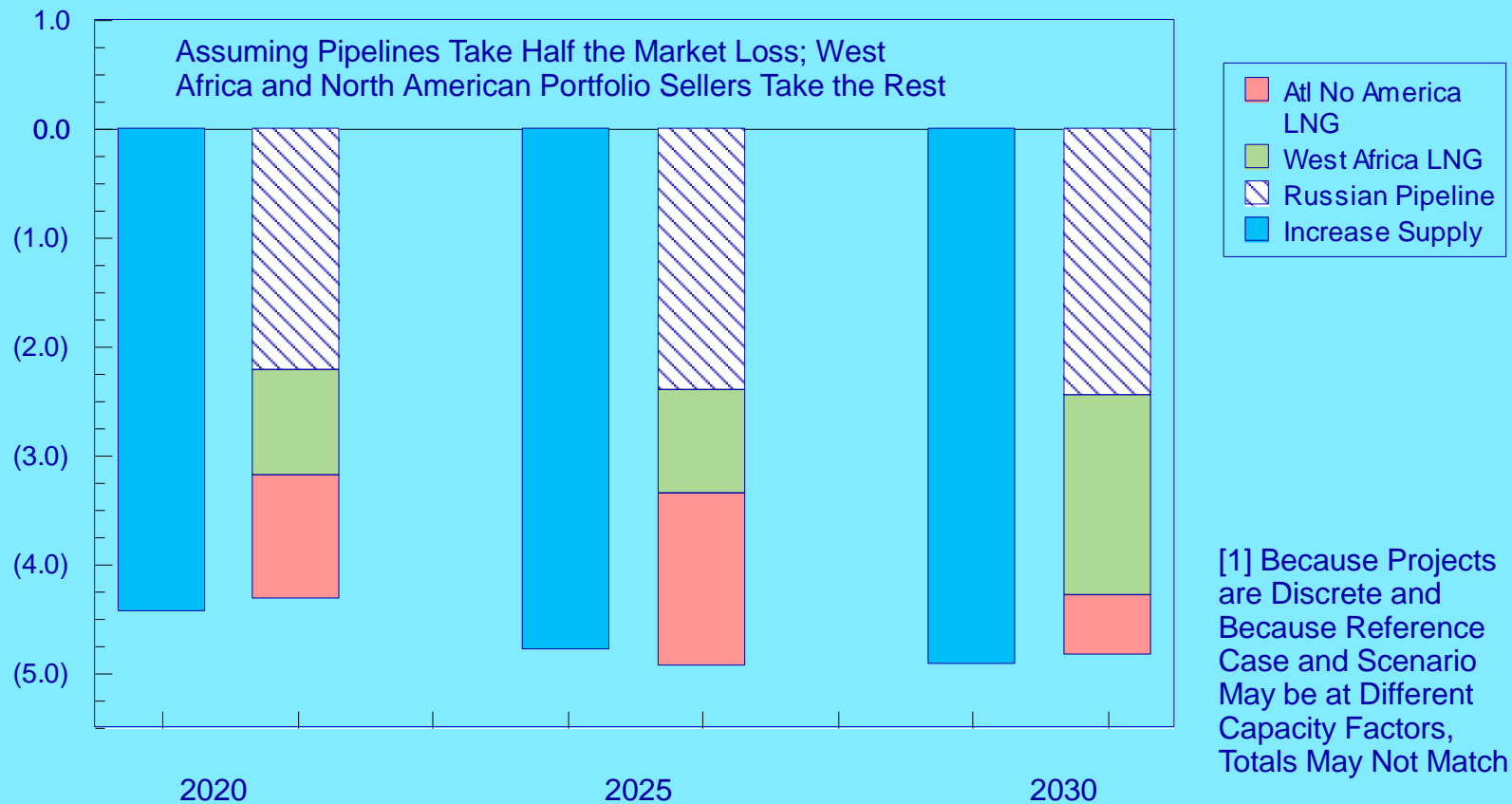
SCENARIO 5 REDUCE EUROPEAN RELIANCE ON RUSSIA BY 50% IN TEN YEARS CHANGES FROM REFERENCE CASE BALANCES BCFD

Changes in Supply and Demand - Bcfd



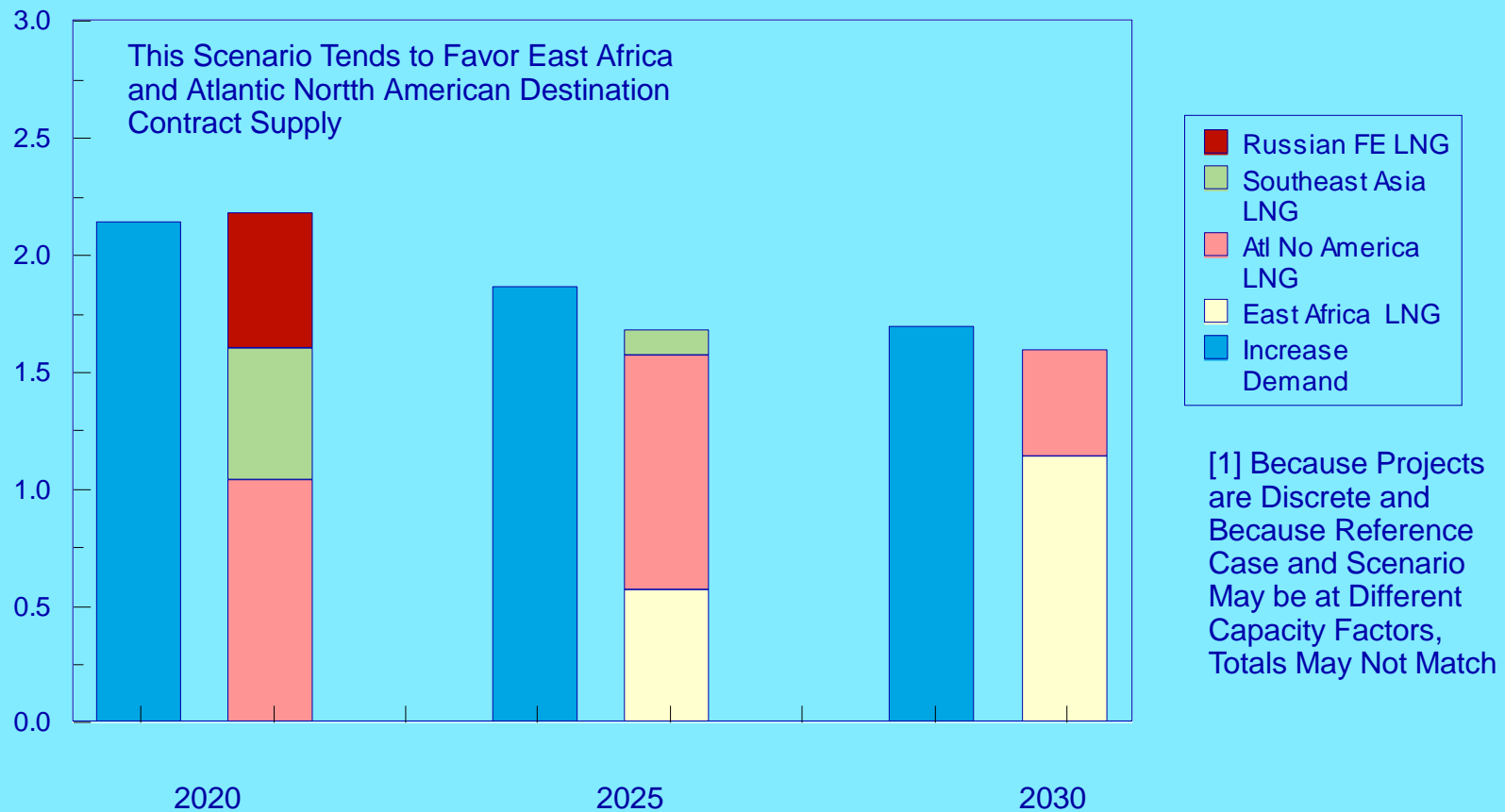
SCENARIO 6 INCREASE EUROPEAN SUPPLY BY 10% CHANGES FROM REFERENCE CASE BALANCES BCFD

Changes in Supply and Demand - Bcfd



SCENARIO 7 DO NOT RESTART JAPANESE NUKES CHANGES FROM REFERENCE CASE BALANCES BCFD

Changes in Supply and Demand - Bcfd

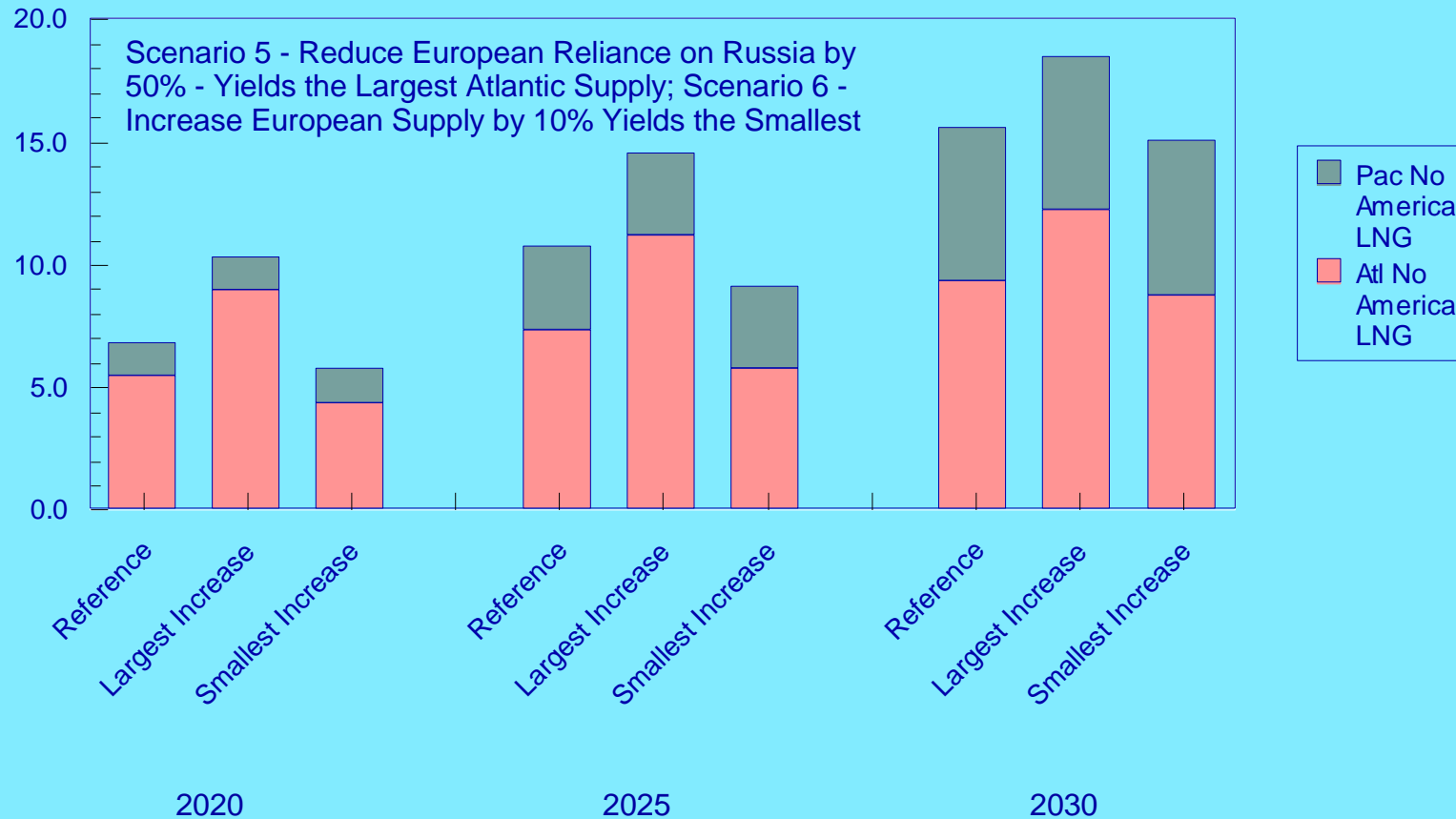


THE CALL ON NORTH AMERICAN SUPPLY VARIES WITH THE SCENARIOS

- The Reference Case Projects 5.5 Bcfd, 7.3 Bcfd and 9.3 Bcfd for Atlantic North America in 2020, 2025 and 2030; For Pacific North America 1.4, 3.4 and 6.3 Bcfd
- The Highest Case is Reduced European Reliance on Russia; There the Atlantic Estimates are 8.9, 11.2 and 12.2 Bcfd
- The Lowest Case is Increased European Supply Where the Estimates are 4.4, 5.8, and 8.8 Bcfd
- Since Both the Highest and Lowest Cases are Atlantic Basin Scenarios, Pacific North American Estimates do Not Change

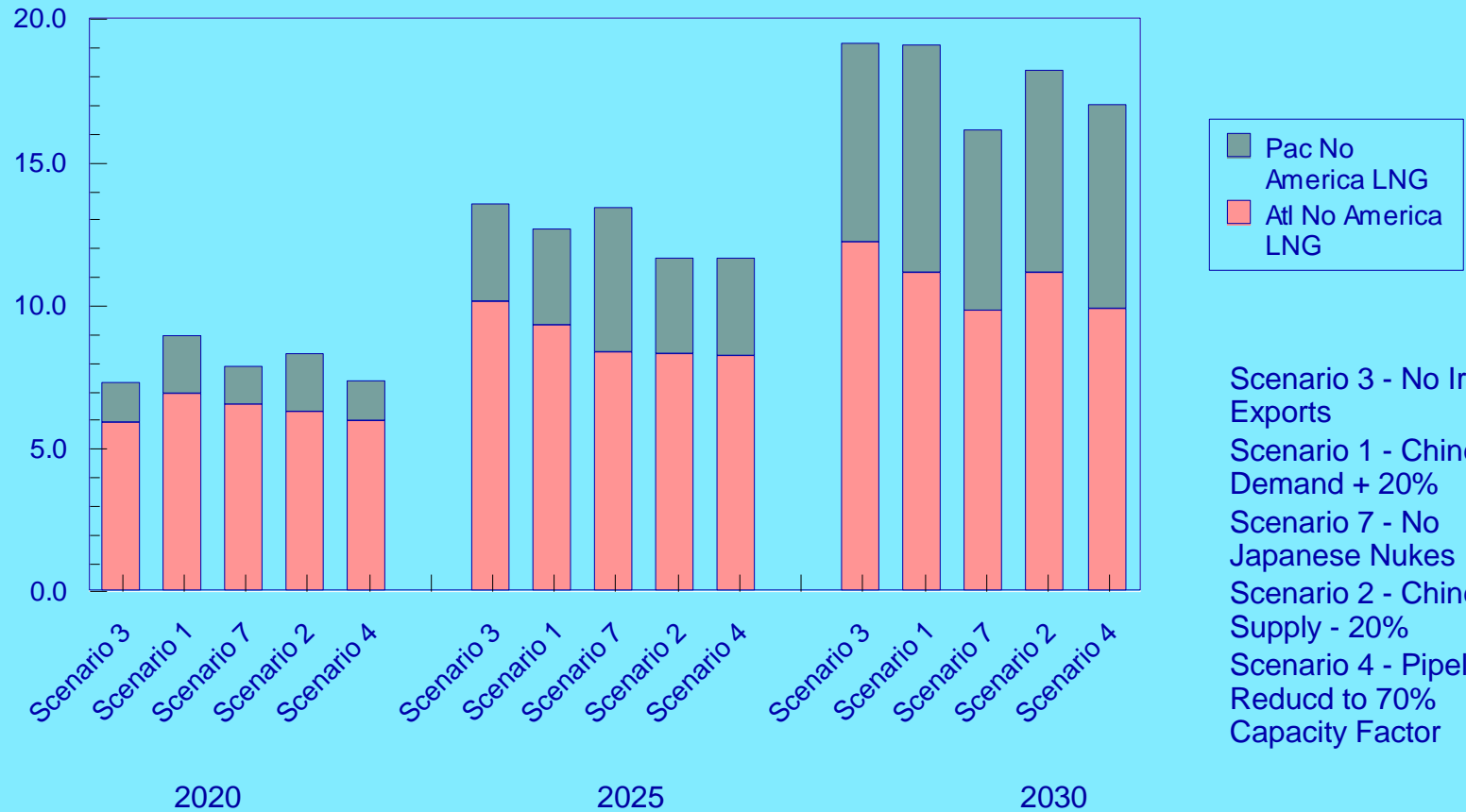
A COMPARISON OF NORTH AMERICAN SUPPLY UNDER VARIOUS SCENARIOS REFERENCE CASE COMPARED WITH SCENARIO 5 AND SCENARIO 6 BCFD

Supply - Bcfd



A COMPARISON OF NORTH AMERICAN SUPPLY UNDER SCENARIOS 1, 2, 3, 4, & 7 BCFD

Supply - Bcfd



- Scenario 3 - No Iranian Exports
- Scenario 1 - Chinese Demand + 20%
- Scenario 7 - No Japanese Nukes
- Scenario 2 - Chinese Supply - 20%
- Scenario 4 - Pipelines Reduct to 70% Capacity Factor

TO CONCLUDE

- This Analysis Foresees a Distinctly Weakening LNG Market as the Full Impact of Australian Expansion and North American Startups Begins to Make Itself Felt
- This Suggests a Distinct Market Limit on U.S. LNG Exports; Buyers Importing for Their Own Markets Will be Preferred; Portfolio Buyers May Have Second Thoughts Before Reaching FID; Late Comers Will Have Problems
- China's Ultimate Import Demand, as Well as its Choice of Pipeline Versus LNG Supply, Will Have a Strong Impact on LNG Markets
- The Analysis Also Suggests Price Weakness in Asia, Where the "Asian Premium" Will be Under Attack

- Under the Pricing Theory Advanced in This Analysis, U.S. Prices Will be Dependent on the U.S Supply/Demand Balance as Influenced by Exports
- Since Europe and the U.S Should be in Rough Price Equilibrium, Prices There, Though Volatile, Should Reflect LNG Transportation Costs From the U.S Gulf - Say Henry Hub Plus \$5.30
- The Asian Premium Should be Reduced, Though Probably Not Eliminated; If We Had to Hazard a Guess, the Asian Price in 2020 Would be Half Way Between the IEA's European and Japanese Projections or About \$13.10 in Constant Dollars
- The IEA Expects the Asian Premium to Shrink; It Foresees a Japanese Price Relative to Crude of 73% in 2020 and 69% in 2030 Compared With 84% in 2013

- The Scenarios Clearly Affect the Price Levels
- Under the Most Extreme Chinese Demand Scenario (Number 1), it is Difficult to See Much Decline in the LNG/Oil Price Relationship; That Implies a 2020 Price of \$16.35
- At the Other Extreme Scenario 6 with Increased European Supply, the Surplus is Concentrated in the Atlantic Basin and There Might be Little Further Decline From the \$13.10 Level

