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Welcome

7TH ANNUAL CONFERENCE

Global Energy:
The New Frontier

May 23, 2012



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Global Energy: The New Frontier

Shale Gas Issues and Mitigating Risk

◆ **David Blackmon**
El Paso Corporation

◆ **Obie O'Brien**
Apache Corporation

◆ **David Cunningham**
*Tudor, Pickering,
Holt & Co.*

◆ **Jed Shreve**
Deloitte

◆ **Bill Moss (Moderator)**
Mayer Brown LLP

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Networking Break

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Mozambique

Overview on Oil & Gas Exploration & Production

Mário Marques
Ministry of Mineral Resources

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**Global Energy:
The New Frontier**
May 23, 2012



Mozambique

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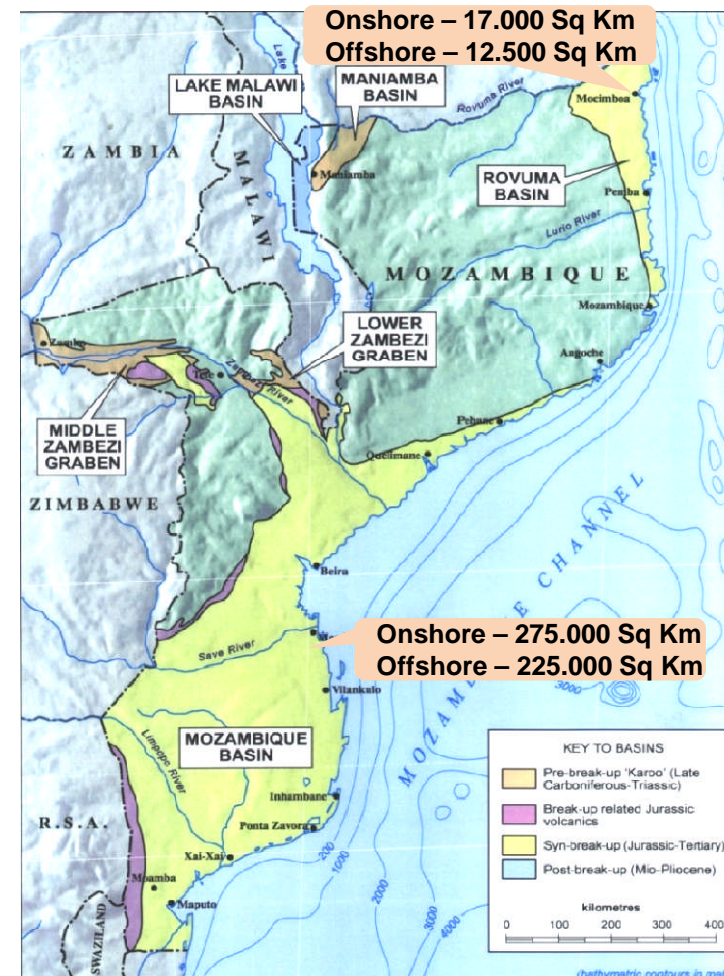
General information

- Independence – July 25, 1975
- Comprehensive *Peace Agreement* – October 4, 1992
- Capital – Maputo
- Official language – Portuguese
- Population – 21,284,701 (Estimated)
- Currency – Metical (US\$1 = 27.00Mt)

Mozambique Sedimentary Basins

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- 1/3 of continental territory covered by sediments
- 2/3 covered by igneous and metamorphic rocks.
- Passive Continental Margin basins:
 - Rovuma Basin – 29.500 Sq Km
 - Mozambique Basin – 500.000Sq.km
- Graben and Rift basins
 - Maniamba Basin
 - Lake Niassa Basin
 - Lower Zambeze Graben
 - Middle Zambeze Basin



Main Historical Facts

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- **1948 - 1974** – Concession granted to GULF, AMOCO, SUNRAY, HUNT and AQUITAINE
- **1961 - 1967** – Discoveries of Natural Gas in Pande (1961), Buzi (1962) and Temane (1967)
- **1975** – Independence
- **1981** – Enactment of post-independence Petroleum Law – Incorporation of ENH (*Empresa Nacional de Hidrocarbonetos*) – Mozambique National Oil Company
- **1992** – End of the Civil War
- **2001** – New Petroleum Law

Main Historical Facts

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- **2003** – Natural Gas Discoveries in Inhassoro
- **2005** – 2nd Bidding round of concessions
- **2007** – 3rd Bidding round of concessions
- **2008** – Natural Gas Discoveries in blocks 16 and 19
- **2010** – 4th Bidding round for concessions
- **2010** – First major Natural Gas discoveries in the Rovuma Basin

Total of 146 wells drilled (onshore/offshore):

- 84 wells – wildcat
- 24 wells – production **Until 2011**
- 36 wells – appraisal
- 2 wells - Injection

Legal Framework Petroleum Operations

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- Petroleum Law 3/2001.
- Regulation for Petroleum Operation , Decree No.24/2004.
- New Model Exploration and Production Concession Contract (EPCC) – 2005.
- Strategy for Concession Areas for the Petroleum Operations, Resolution No. 27/2009.
- Strategy of Development of Natural Gas Market in Mozambique, Resolution No. 64/2009
- Regulation for licensing Petroleum installation and activities, Ministerial Diploma No. 27/2009.
- Environmental Regulation Specific for Petroleum Activity
- Fiscal Law on Petroleum activities: Law 12/2007.
- Mining and Petroleum Tax Incentives: Law 13/2007

Main Institutional Players

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- **Counsel of Ministers** – Approves the Concession Contracts
- **Ministry of Mineral Resources** – Represents the Government under E&P Contracts
- **National Institute of Petroleum** – Regulates E&P activities and manages the country's petroleum resources (launches and manages bidding rounds)
- **ENH**– Empresa Nacional de Hidrocarbonetos – National Oil Company, party to all E&P Concession Contracts – carried interests

Petroleum Law n.3/2001

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Petroleum Law

- Applies to petroleum Operations and exclude refining of petroleum
- Establishes the regime for granting of rights for the conduct of Petroleum Operations Onshore and Offshore of Mozambique

Ownership and control of petroleum resources

- All petroleum resources in situ as natural resources in the soil and the subsoil, in interior waters and in the territorial sea, on the continental shelf and in the exclusive economic zone are the property of the State

State participation

- The State reserves to itself the right to participate in petroleum operations in which any legal person is involved. The participation of ENH ("carry" during exploration varies up to 15%)

Award of rights

- Typically through competitive Public Tender

Types of Concession Contracts

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Reconnaissance Contract

- 2 years
- Survey studies, with wells up to 100 meters

Exploration and Production Concession Contract

- Exclusive right to conduct petroleum exploration and production as well as a non-exclusive right to construct and operate oil or gas pipeline systems
- The exclusive exploration rights shall not exceed 8 years (minimum work obligation negotiable), and shall be subject to provisions concerning abandonment. The exclusive right to develop and produce shall not exceed 30 years, dating from the date of approval of PDO
- Oil sharing plus taxes

Oil and Gas Pipeline Concession Contract

- Grants the right to construct and operate an oil or gas pipeline for the purpose of transporting hydrocarbons

Some terms and conditions under the E&P Contracts

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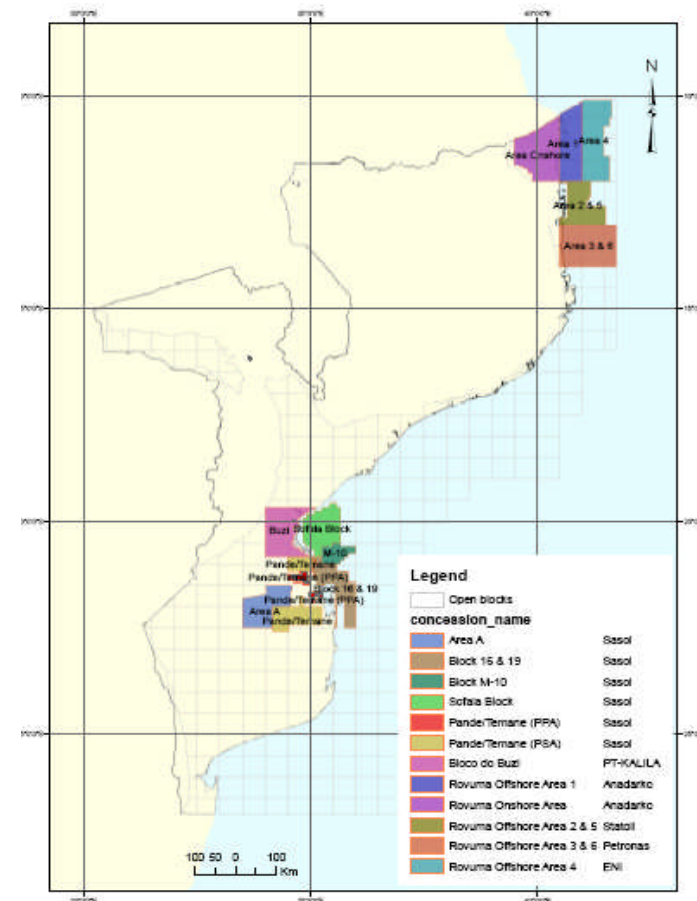
- Petroleum Production Tax (royalty in cash or in kind): 10% for oil; 6% for natural gas
- Corporate Income Tax: 32%
- Concessionary is allowed to transfer its participating interest in the concession to third parties, provided Ministry of Mineral Resources consent
- Foreign Exchange
 - Concessionaires are allowed to open bank accounts in Mozambique (Meticais or foreign currency) and abroad
 - Offshore bank accounts could be used to process all payments related with the E&P operations
 - Capital exportation – the right to repatriate profits, dividends, interests, invested capital, salaries – is typically granted through the concession agreement
- Subject to Mozambique Law
- Anti-corruption Clause

Petroleum Exploration and Production Contracts

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12 Concession Areas:

- 5 in Rovuma Basin
- 7 in Mozambique Basin

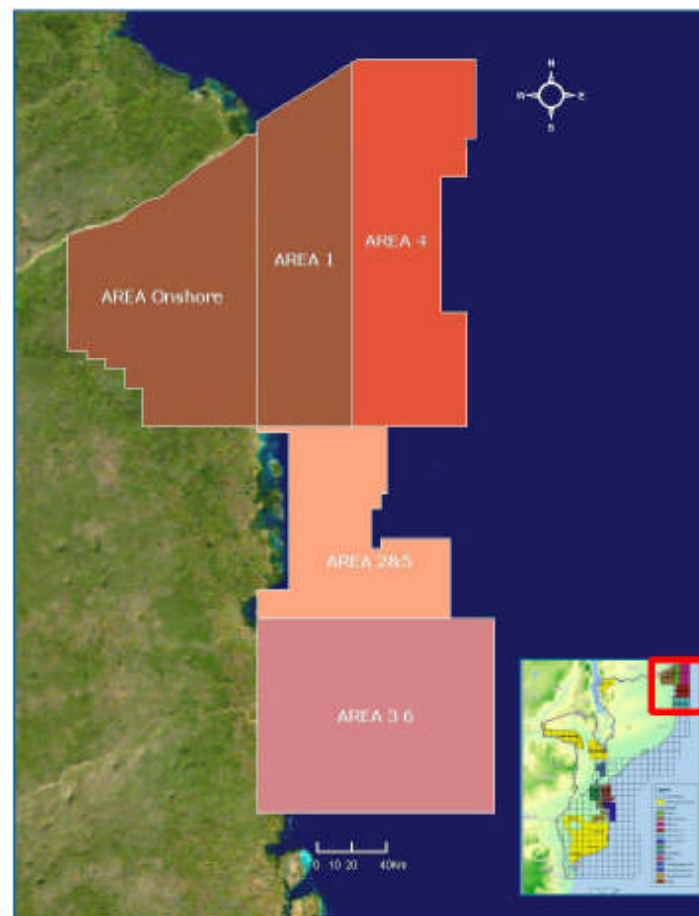


Petroleum Exploration and Production Contracts

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Rovuma Basin

Concessions	Partner
Area Onshore	Anadarko (35.7%), Artumas (15.3%) Maurel & Pron (24%), ENH (15%) & Cove Energy (10%)
Area 1	Anadarko (36.5%), Mitsui (20%), ENH (15%), BPRL (10%), Videocon (10%) & Cove Energy (8.5%)
Area 4	ENI (70%), ENH (10%), KOGAS (10%) & Galp Energia (10%)
Area 2 & 5	Statoil (90%) & ENH (10%)
Area 3 & 6	Petronas (90%) & ENH (10%)



Mozambique High Potential for Natural Gas

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Mozambique Basin

- ✓ 1961 - 1st Discovery – **Pande**
- ✓ 1962 - 2nd Discovery – **Buzi**
- ✓ 1967 - 3rd Discovery – **Temane**
- ✓ 2003 - 4th Discovery – **Temane East**
- 5th Discovery – **Inhassoro**
- ✓ 2008/2009 - 6th Discovery – **Block 16&19**

Rovuma Basin

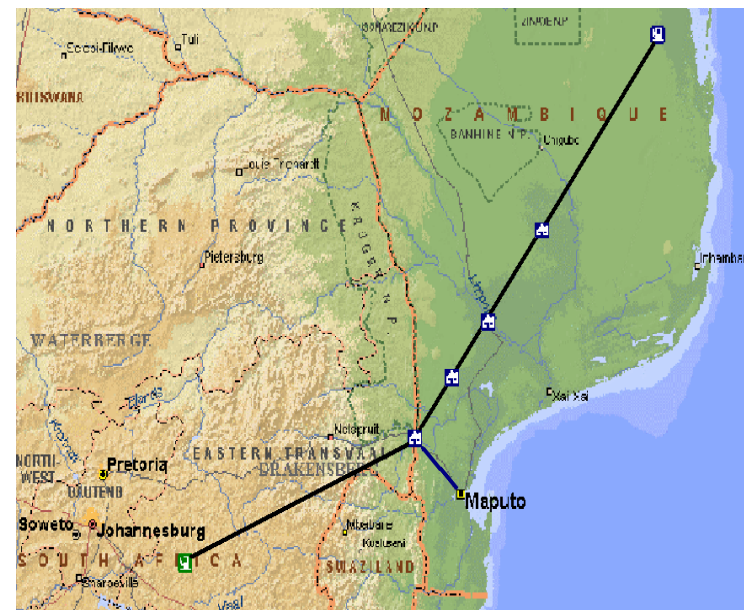
- 2009 – One Gas shows - **Onshore Area**
- 2010 – One Oil Shows - **Ironclad**
- 2010 – 1st Discovery in February – **Windjammer**
- 2nd Discovery in October – **Barquintine**
- 3rd Discovery in November – **Lagosta**
- 4th Discovery in December – **Tubarão**
- 2011 – 5th Discovery in September – **Camarão**
- 6th Discovery in September – **Mamba South**



Natural Gas in Mozambique

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- The country has been producing natural gas and condensate since 2004 from Pande and Temane gas fields
- 147 million gigajoules per annum is being exported to South Africa through a 865km high pressure gas pipeline
- A middle pressure gas pipeline supplies gas for domestic supply to the Matola's Industrial Zone close to Maputo
- Recent Major Discoveries in the Rovuma Basin may place Mozambique among one of the world's largest exporter of natural gas
- The construction of of LNG plants are under discussion



End



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Thank you

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The Increasing Energy Activity in Africa

Mozambique / Anadarko – A Strong
Partnership with a Clear Vision

Ramsey Fahel

Vice President and General Manager – Mozambique Commercial

Ramsey.Fahel@anadarko.com

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Cautionary Language

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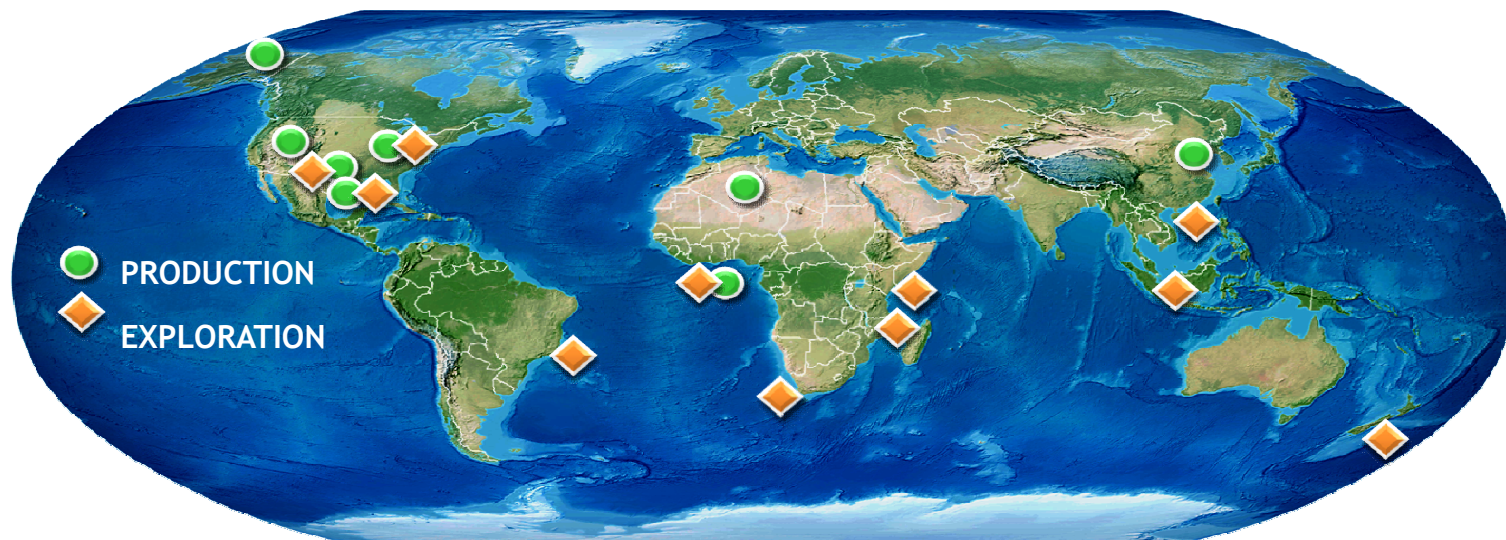
◆ Regarding Forward-Looking Statements and Other Matters

- ◆ This presentation contains forward-looking statements within the meaning of Section 27A of the Securities Act of 1933 and Section 21E of the Securities Exchange Act of 1934. While Anadarko believes that its expectations are based on reasonable assumptions as and when made, no assurance can be given that such expectations will prove to have been correct. A number of factors could cause actual results to differ materially from the projections, anticipated results or other expectations expressed in this presentation, including the following: Anadarko's ability to meet financial and operating guidance; to achieve its production targets, successfully manage its capital expenditures and to complete, test and produce the wells and prospects identified in this presentation; to successfully plan, secure necessary government approvals, finance, build and operate the necessary infrastructure and LNG plant; to achieve its production and budget expectations on its mega projects; to successfully defend itself against any remaining claims relating to the Deep-water Horizon event (including, but not limited to, fines, penalties and punitive damages) and BP's ability to fulfill its indemnification obligations to Anadarko; and the legislative and regulatory changes, such as the delays in processing and approval of drilling permits, exploration plans and oil response plans that may impact the Company's Gulf of Mexico and International offshore operations resulting from the Deep-water Horizon events. Other factors that could impact any forward-looking statements are described in "Risk Factors" in the company's 2011 Annual Report on Form 10-K, Quarterly Reports on Form 10-Q, and other public filings and press releases. Readers are cautioned not to place undue reliance on forward-looking statements, which speak only as of the date hereof. Anadarko undertakes no obligation to publicly update or revise any forward-looking statements.
- ◆ Please also see our website at www.anadarko.com under "Investor Relations" for reconciliations of the differences between any non-GAAP measures used in this presentation and the most directly comparable GAAP financial measures.
- ◆ Cautionary Note to U.S. Investors —The U.S. Securities and Exchange Commission (SEC) permits oil and gas companies, in their filings with the SEC, to disclose only proved, probable and possible reserves that meet the SEC's definitions for such terms. We may use terms in this presentation, such as "resources," "net resources," "net discovered resources," "net risked resources," "resource opportunity," "estimated ultimate recovery," "resource potential," "resource estimate," "gross recoverable resources," "net resource estimate," "gross recoverable resource," "net resource estimate," "discovered resources," "resource potential," and similar terms that the SEC's guidelines strictly prohibit us from including in filings with the SEC. U.S. Investors are urged to consider closely the oil and gas disclosures in our Form 10-K for the year ended December 31, 2011, File No. 001-08968, available from us at www.anadarko.com or by writing us at: Anadarko Petroleum Corporation, 1201 Lake Robbins Drive, The Woodlands, Texas 77380 Attn: Investor Relations. You can also obtain this form from the SEC by calling 1-800-SEC-0330.

Anadarko Petroleum Corporation

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- One of the world's largest independent exploration and production companies
- Third largest natural gas producer in North America
- Second most experienced driller in the ultra deep-water
- 2.54 BBOE of proved reserves at year-end 2011
- 4,900 employees worldwide
- Total assets of ~\$52 Billion at year-end 2011



A Global Leader in the Deep-water

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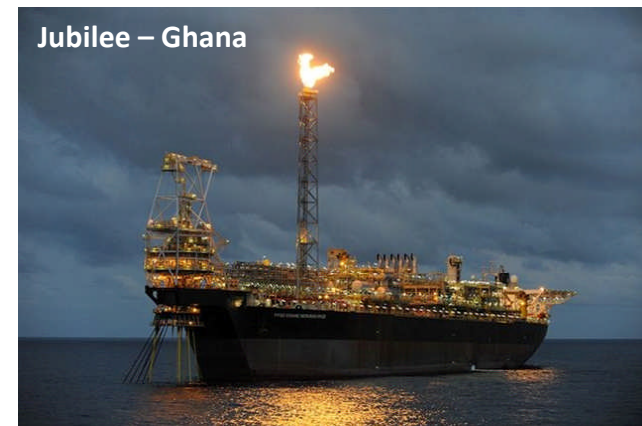
- Anadarko is one of the industry's safest and most successful deep-water explorers
 - 70% success rate in exploration and appraisal drilling in the last five years (industry average of 47%)
- In 1947 the company drilled the first oil discovery out-of-sight-of-land in Block 32, Gulf of Mexico
- Continue with world's firsts
 - Deepest platform - 2,450 m
 - Deepest subsea production tree - 2,750 m
 - Deepest export pipeline and Steel Catenary Riser
 - First production Spar – Neptune 1996



Experienced Project Manager of Mega-Projects in Africa

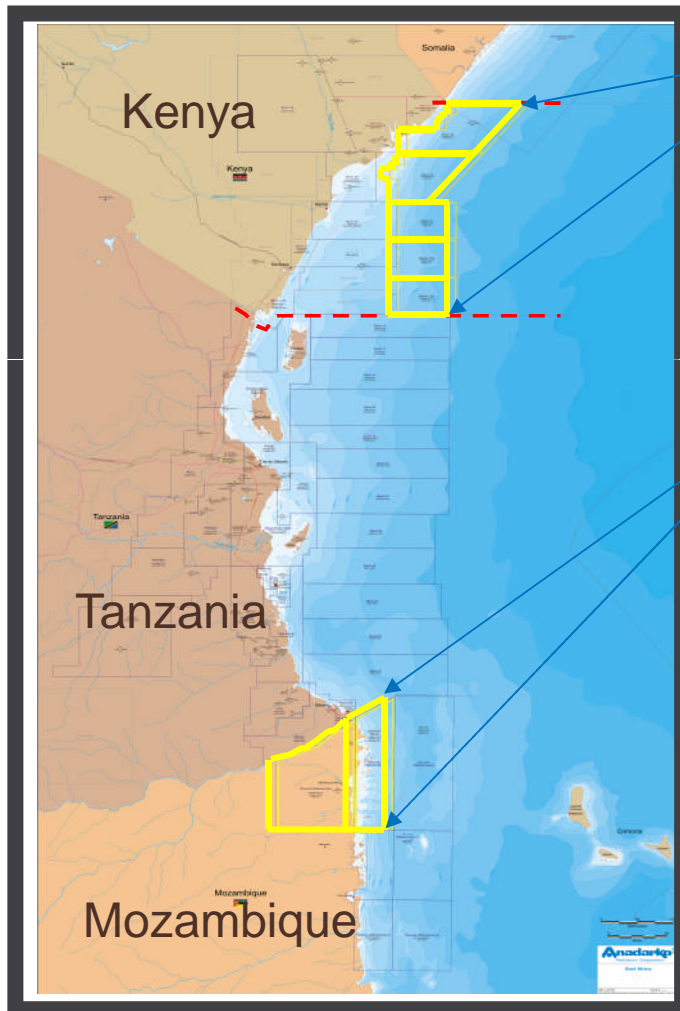
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- Our reputation for project execution is acknowledged by industry
- Several huge projects
 - Safely and responsibly
 - On time
 - On budget



A Leader in East African Exploration - Anadarko Opened a New Basin

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● Kenya

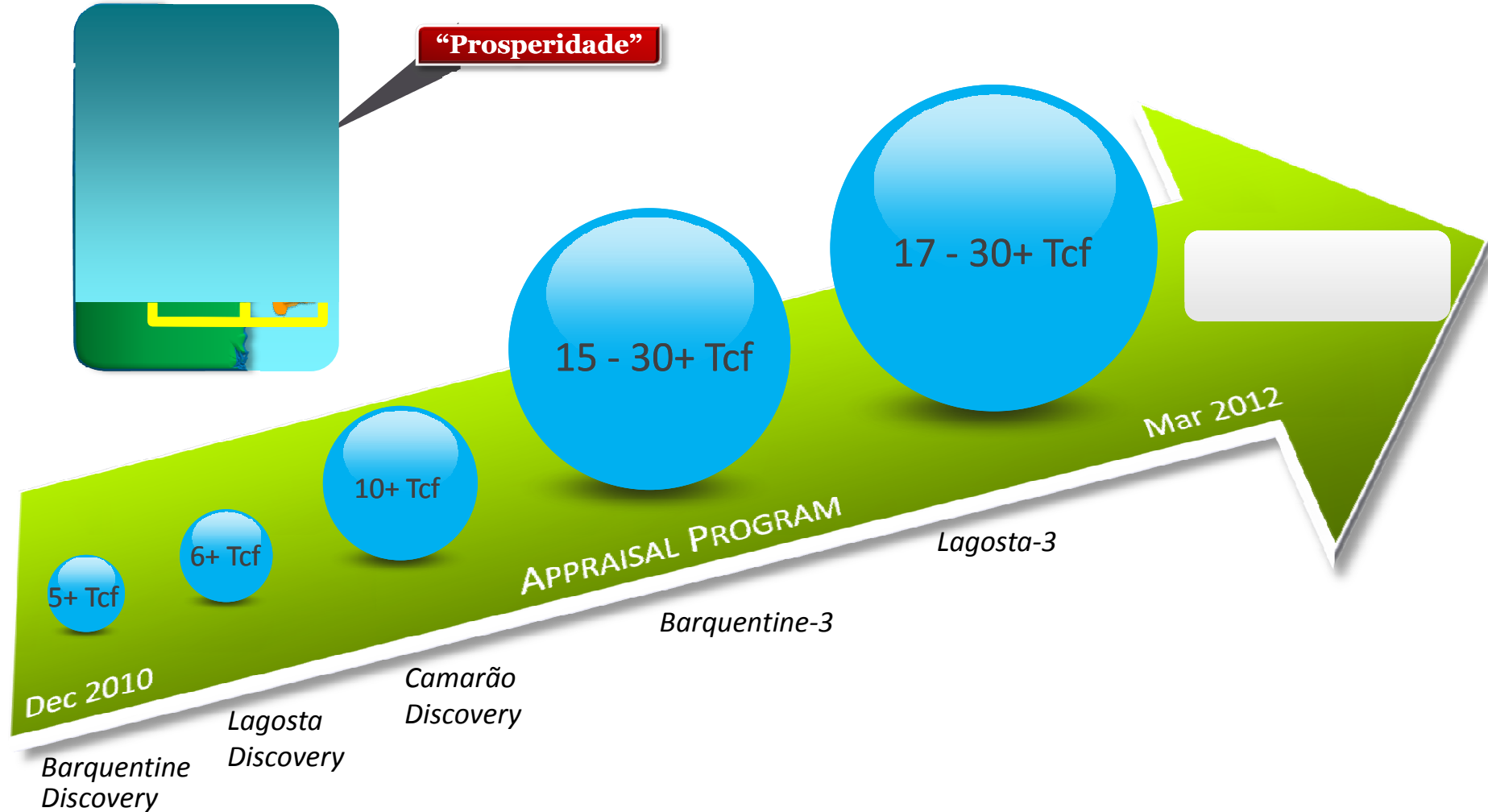
- Five deep-water blocks - 30,350 sq. km
- APC operator
- Partners: Cove and Total

● Mozambique

- Onshore and offshore
- Area 1 Rovuma blocks 26,300 sq. km
- APC operator of both blocks
 - Onshore partners: Cove, ENH, Maurel & Prom and Wentworth
 - Area 1 partners: Bharat, Cove, ENH, Mitsui, and Videocon
- Areas first deep-water discovery

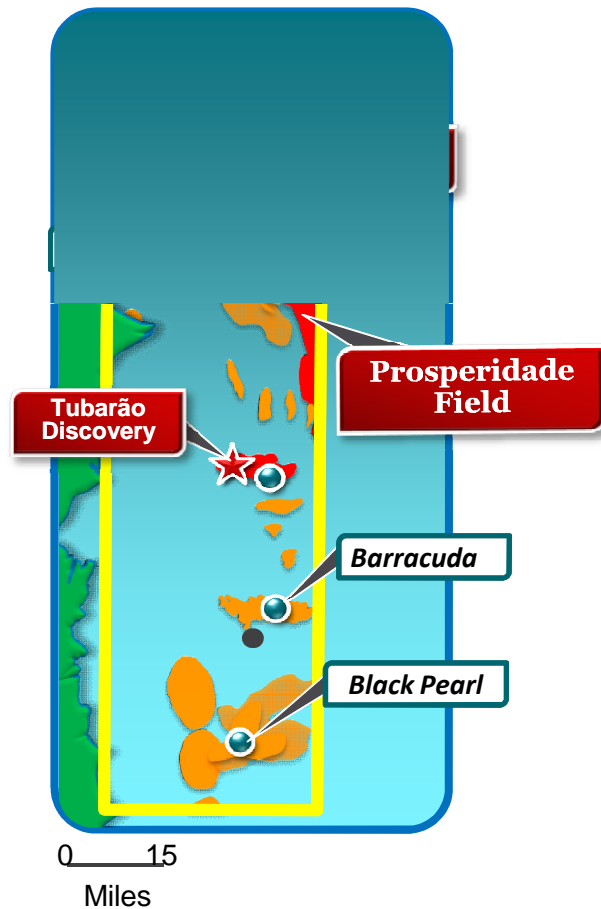
Giant Discoveries and a Growing Resource

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Giant Discoveries and a Growing Resource

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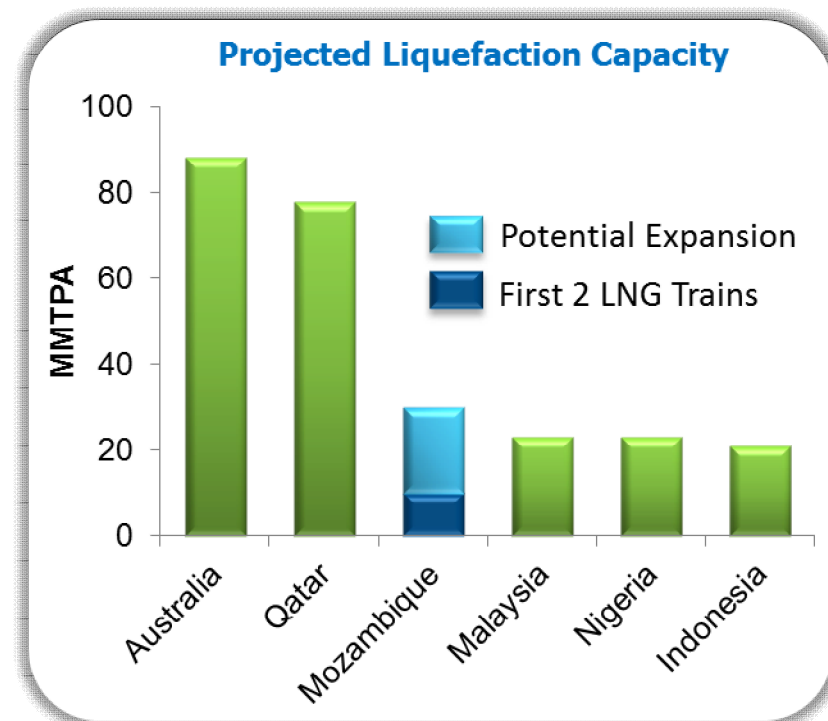


- **Golfinho Discovery**
 - 7 - 20+ Tcf Gross Recoverable Resources
 - 2012 Planned Appraisal Program
 - Cost-Effective Development Option
- **Significant Additional Resource Potential**
 - 20+ Prospects and Leads
- **Planned 2012 Exploration Activity**
 - Atum Drilling
 - Black Pearl
 - Barracuda

A Resource Can Transform Mozambique

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- Mozambique could become the world's third largest LNG producer by liquefaction capacity
- Generate annual revenue similar to the GDP of Mozambique
- Become one of the top ten exporting nations in Africa by value



Source: Wood Mackenzie

An Integrated Path to Commercialization

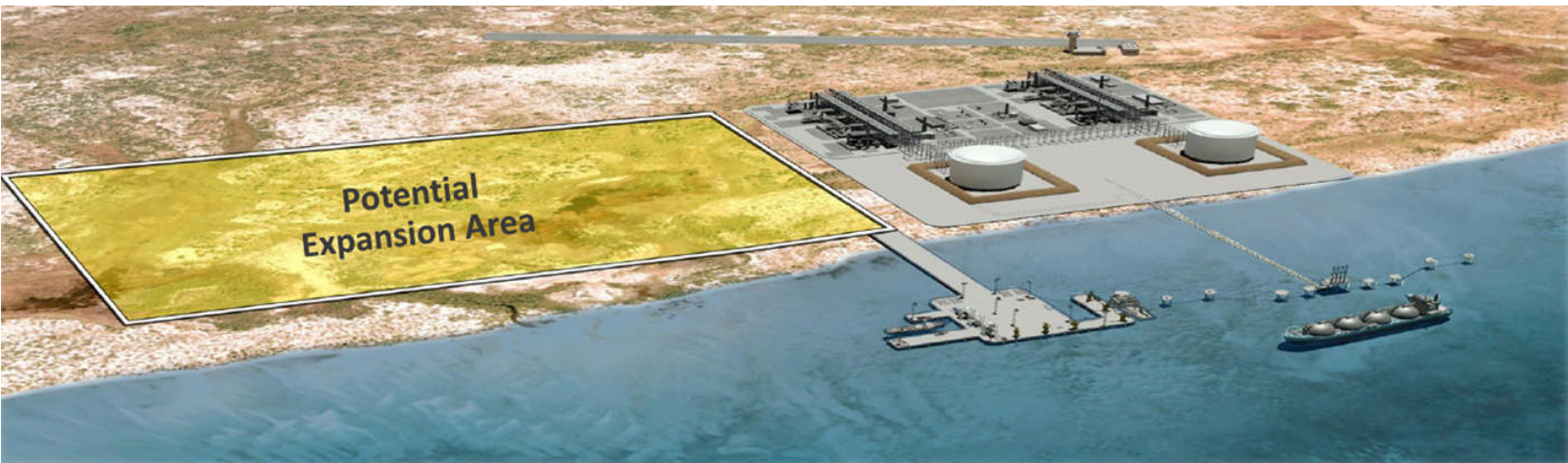
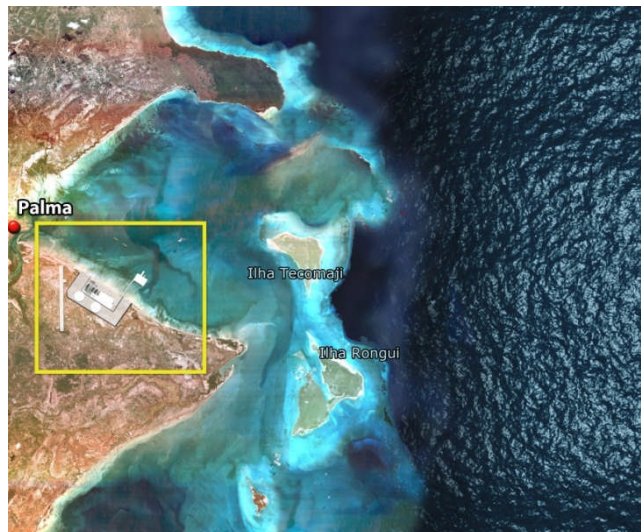
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- Build the foundation - initial 2 LNG trains - 10mmtpa - premium buyers
- LNG foundation is key to unlocking the real long-term value
 - Dependability
 - Reliability
 - Long-term partner
- Potential for future domestic gas-based industries



Rapidly Progressing an Initial 2 Train Development

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Shared Vision with Mozambique

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- Achieve social and economic benefits for the country and its citizens
- Build an international reputation for Mozambique as a great place to invest and do business
- Civil society support for Mozambique business
- Anadarko to be viewed as a welcome guest in Mozambique and a valued long-term partner
 - Honor our commitments
 - Be upfront and clear with our proposed plans
 - Do what we say, and say what we do
- LNG project is a key foundation for Mozambique's continued economic expansion

Summary

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- Mozambique possesses a great hydrocarbon resource
- Natural resource projects can be transformational for the country
 - Expand internal capacity
 - Train Mozambicans and provide new direct and indirect jobs
 - Revise and move forward with long term vision
- Timing is critical due to competition with other countries
 - Strong early interest, but Buyers may not wait for Mozambique
- Goal - make Mozambique a strategic global energy provider
 - Create a legal and contractual framework that provides long-term stability
 - Demonstrate to the world that we can execute on time and on budget

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US LNG Exports

◆ **Bill Hederman**
Deloitte

◆ **Stuart McAlpine**
Mayer Brown LLP

◆ **Daryl Houghton**
Poten & Partners

◆ **Jose Valera (*Moderator*)**
Mayer Brown LLP

◆ **Bill Wince**
*Chesapeake Energy
Marketing, Inc.*



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Forward-Looking Statements

- » This presentation includes “forward-looking statements” within the meaning of Section 27A of the Securities Act of 1933 and Section 21E of the Securities Exchange Act of 1934. Forward-looking statements give our current expectations or forecasts of future events. They include estimates of our natural gas and oil reserves and resources, expected natural gas and oil production and future expenses, assumptions regarding future natural gas and oil prices, planned asset sales, budgeted capital expenditures for drilling and other anticipated cash outflows, as well as statements concerning anticipated cash flow and liquidity, business strategy and other plans and objectives for future operations. Disclosures concerning the estimated contribution of derivative contracts to our future results of operations are based upon market information as of a specific date. These market prices are subject to significant volatility. Although we believe the expectations and forecasts reflected in forward-looking statements are reasonable, we can give no assurance they will prove to have been correct. They can be affected by inaccurate assumptions or by known or unknown risks and uncertainties.
- » Factors that could cause actual results to differ materially from expected results are described under "Risks Related to our Business" in our Prospectus Supplement filed with the U.S. Securities and Exchange Commission on February 8, 2011. These risk factors include the volatility of natural gas and oil prices; the limitations our level of indebtedness may have on our financial flexibility; declines in the values of our natural gas and oil properties resulting in ceiling test write-downs; the availability of capital on an economic basis, including through planned asset monetization transactions, to fund reserve replacement costs; our ability to replace reserves and sustain production; uncertainties inherent in estimating quantities of natural gas and oil reserves and projecting future rates of production and the amount and timing of development expenditures; inability to generate profits or achieve targeted results in drilling and well operations; leasehold terms expiring before production can be established; hedging activities resulting in lower prices realized on natural gas and oil sales, the need to secure hedging liabilities and the inability of hedging counterparties to satisfy their obligations; a reduced ability to borrow or raise additional capital as a result of lower natural gas and oil prices; drilling and operating risks, including potential environmental liabilities; legislative and regulatory changes adversely affecting our industry and our business; general economic conditions negatively impacting us and our business counterparties; transportation capacity constraints and interruptions that could adversely affect our cash flow; and losses possible from pending or future litigation.
- » We caution you not to place undue reliance on our forward-looking statements, which speak only as of the date of this presentation, and we undertake no obligation to update this information.

Agenda

- I. Chesapeake Overview
- II. LNG Exports & North American Gas Markets
- III. Shale Gas Environmental Considerations
- IV. Summary



Chesapeake Overview



Industry Leadership

» Leader in production

- ▶ Second-largest producer of U.S. natural gas and #11 producer of U.S. liquids
- ▶ 4Q'11 gas production of ~2.9 bcf/d; liquids production of ~106 mbbbls/d; total production of 3.6 bcfe/d
- ▶ Overall production up 23% YOY, liquids production up 76% YOY

» Leader in drilling

- ▶ #1 driller in the world of horizontal wells and horizontal shale wells
- ▶ Most active driller in the U.S.; 161 operated rigs currently and ~90 non-operated rigs; collector of >15% of all daily drilling information generated in the U.S.

» Leader in identifying and capturing world-class unconventional natural gas and liquids resources

- ▶ In past 4 years, discovered 5 of America's best unconventional plays: Granite Wash, Mississippi Lime, Haynesville Shale, Tonkawa Tight Sand and Utica Shale

» Leader in technological innovations in unconventional reservoirs

- ▶ #1 inventory of shale core rock data and built industry's only proprietary core analysis facility

» Leader in vertical integration into midstream and oilfield service operations

- ▶ Provides a hedge against higher service costs and enhances CHK profitability
- ▶ Ensures access to critical services, enables greater operational efficiencies and increases safety
- ▶ Provides confidence to JV partners in CHK's ability to accelerate drilling and enhance returns

» Leader in asset monetizations

- ▶ Seven joint ventures, two complete play sales and 10 VPPs for proceeds of ~\$29 billion

» Leader in risk management

- ▶ #1 hedging track record in the industry; \$8.4 billion in realized gains since 1/1/06, or \$1.59 per mcfe

CHK's track record of leadership and achievements during the past 22 years has been unique and has positioned the company for superior performance for years to come

Top 20 U.S. Natural Gas Producers

Daily U.S. Natural Gas Production⁽¹⁾⁽²⁾

Company	Ticker	4Q'11	3Q'11	4Q'10	4Q'11	4Q'11	2011 Reported	RP	2011 Reported	U.S.	U.S.	U.S. Gas Rigs	
					vs. 3Q'11	vs. 4Q'10	U.S. Net		Proved U.S.	Gas Rigs	Gas Rigs	% Drilling	
					% Change	% Change	Proved Natural Gas Reserves (BCFE)	Ratio ⁽³⁾	Natural Gas Reserves Ranking	Drilling on 04/13/12 ⁽⁴⁾	Drilling on 1/1/10 ⁽⁴⁾	Change Since 1/1/10	
1	ExxonMobil	XOM	4,005	3,917	3,869	2.2%	3.5%	26,366	18	1	47	52	(10%)
2	Chesapeake	CHK	2,957	2,763	2,558	7.0%	15.6%	15,515	14	2	30	110	(73%)
3	Anadarko	APC	2,328	2,271	2,139	2.5%	8.8%	8,365	10	7	25	24	4%
4	Devon	DVN	2,085	2,028	1,963	2.8%	6.2%	9,513	13	5	33	34	(3%)
5	EnCana	ECA	1,944	1,905	1,835	2.0%	5.9%	8,432	12	6	14	40	(65%)
6	BP	BP	1,817	1,819	2,085	(0.1%)	(12.9%)	13,552	20	3	10	12	(17%)
7	ConocoPhillips	COP	1,606	1,617	1,669	(0.7%)	(3.8%)	10,148	17	4	13	10	30%
8	Southwestern	SWN	1,480	1,399	1,209	5.8%	22.4%	5,893	11	9	15	16	(6%)
9	Chevron	CVX	1,290	1,260	1,307	2.4%	(1.3%)	3,646	8	12	8	1	700%
10	WPX	WPX	1,163	1,272	1,180	(8.6%)	(1.4%)	3,983	9	11	8	14	(43%)
11	EOG	EOG	1,085	1,122	1,241	(3.3%)	(12.6%)	6,046	15	8	16	31	(48%)
12	Shell	RDS	1,032	928	1,199	11.2%	(13.9%)	3,196	8	14	18	14	29%
13	Apache	APA	863	858	838	0.5%	2.9%	2,976	9	15	7	8	(13%)
14	BHP	BHP	833	857	708	(2.8%)	17.7%	2,730	9	18	34	19	79%
15	Occidental	OXY	833	799	699	4.3%	19.2%	3,365	11	13	5	1	400%
16	Ultra	UPL	702	664	600	5.8%	17.1%	4,779	19	10	2	11	(82%)
17	QEP	QEP	702	650	593	8.0%	18.3%	2,749	11	17	13	15	(13%)
18	El Paso	EP	675	652	648	3.5%	4.2%	2,566	10	19	3	8	(63%)
19	EXCO	XCO	587	528	338	11.1%	73.5%	1,291	6	20	13	13	0%
20	Cabot	COG	561	404	318	38.7%	76.6%	2,910	14	16	5	12	(58%)
Totals / Average			28,547	27,713	26,996	3.0%	5.7%	138,021			319	445	(28%)
Other Producers											289	359	(19%)
Total											608	804	(24%)

(1) Based on 4Q'11 company reports

(2) In mmcf/day

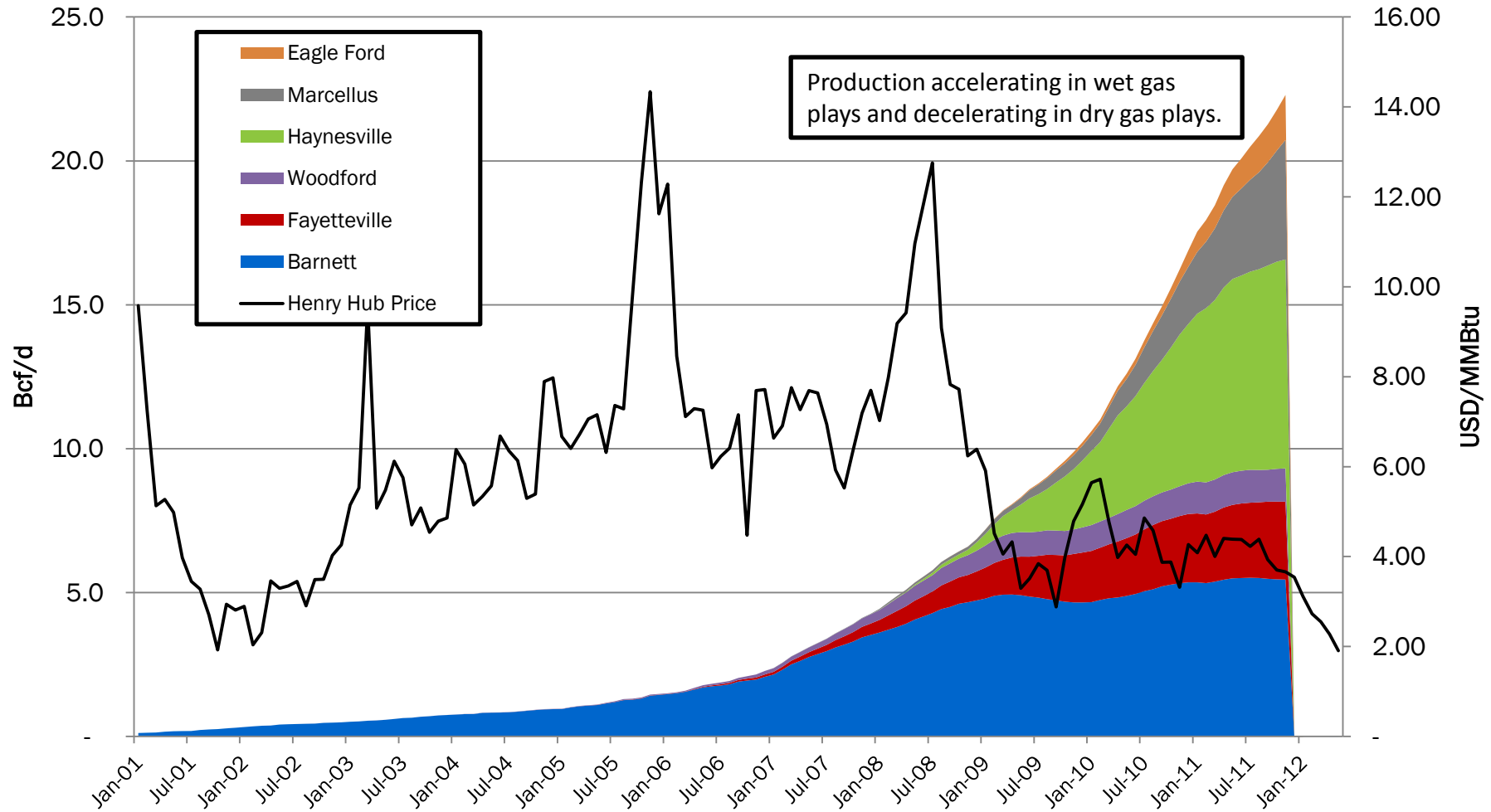
(3) Based on annualized production

(4) Source: Smith Bits, a Schlumberger Company; the total and CHK's rig counts have been adjusted for internal count of allocation to liquids-rich plays



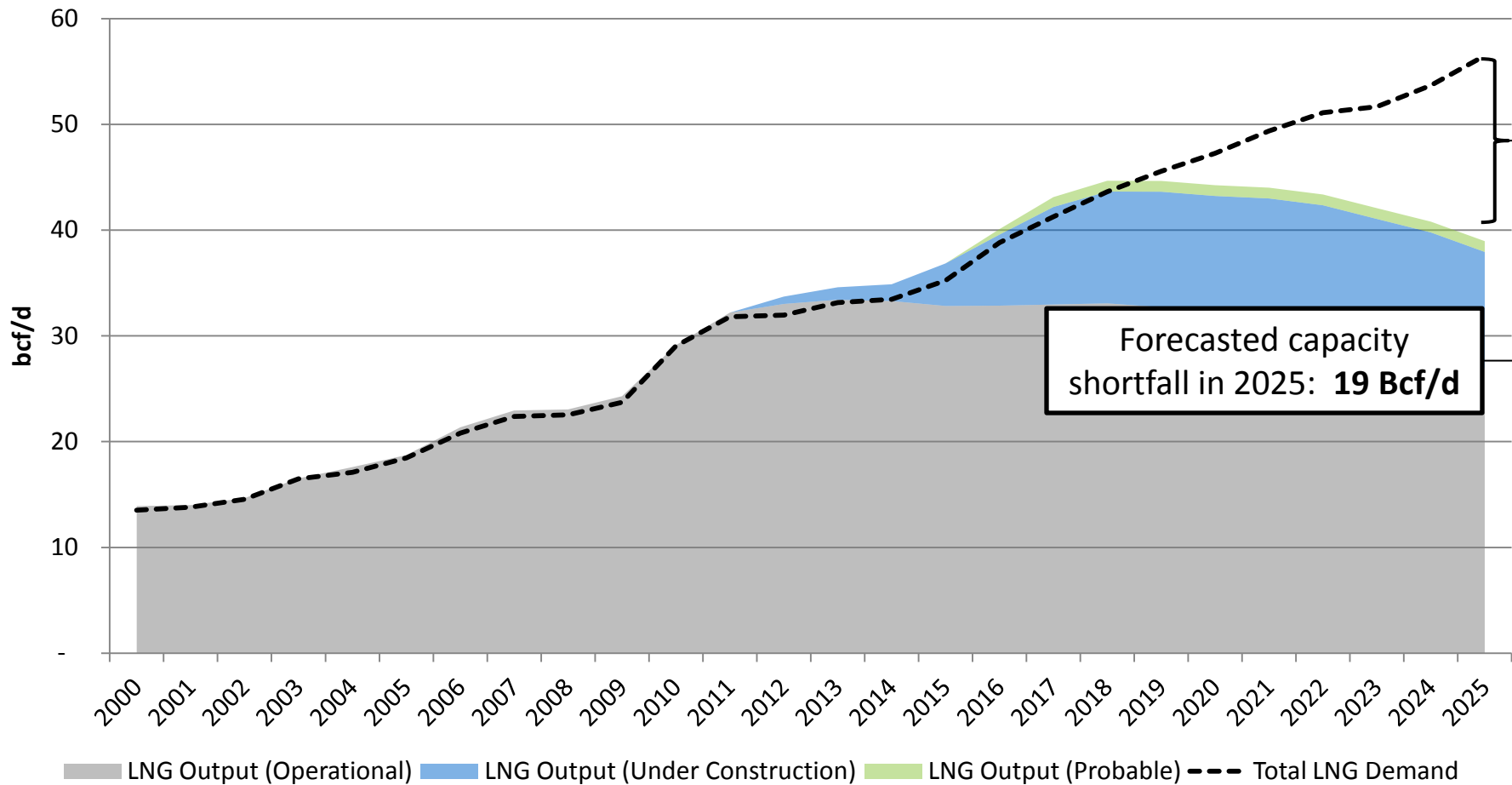
LNG Exports and North American Gas Markets

Relentless Production Growth Has Outpaced Demand & Depressed Price



CHK's gross operated shale gas production is ~6.3 bcf/d.

U.S. Shale Gas Can Fill the Global LNG Supply Shortfall...

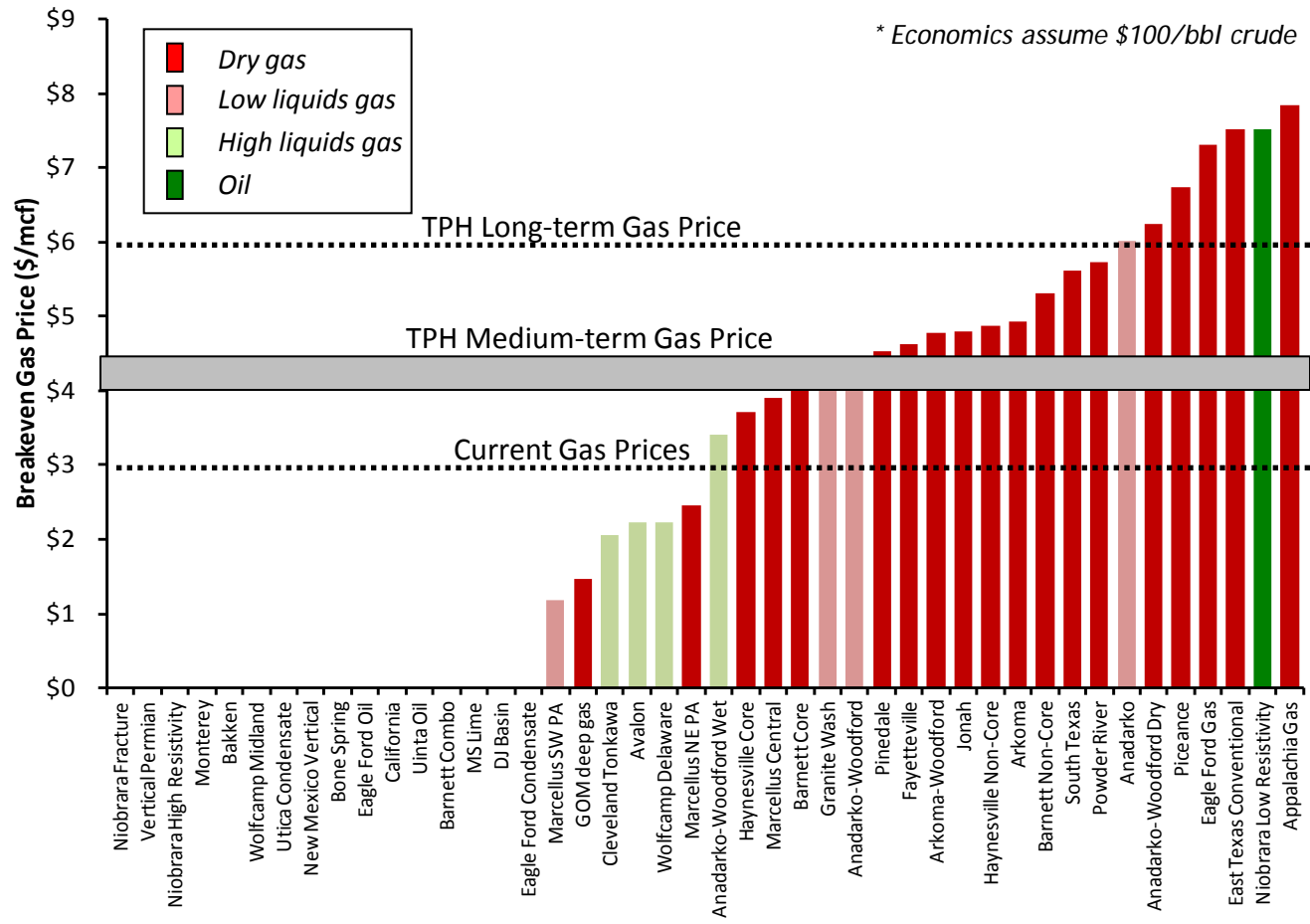


Forecasted capacity shortfall in 2025: **19 Bcf/d**

...But Producers Will Not Continue to Drill Dry Gas at Current Prices



Tudor Pickering Holt Basin Economics Analysis – Gas Price Required for 10% ATROR

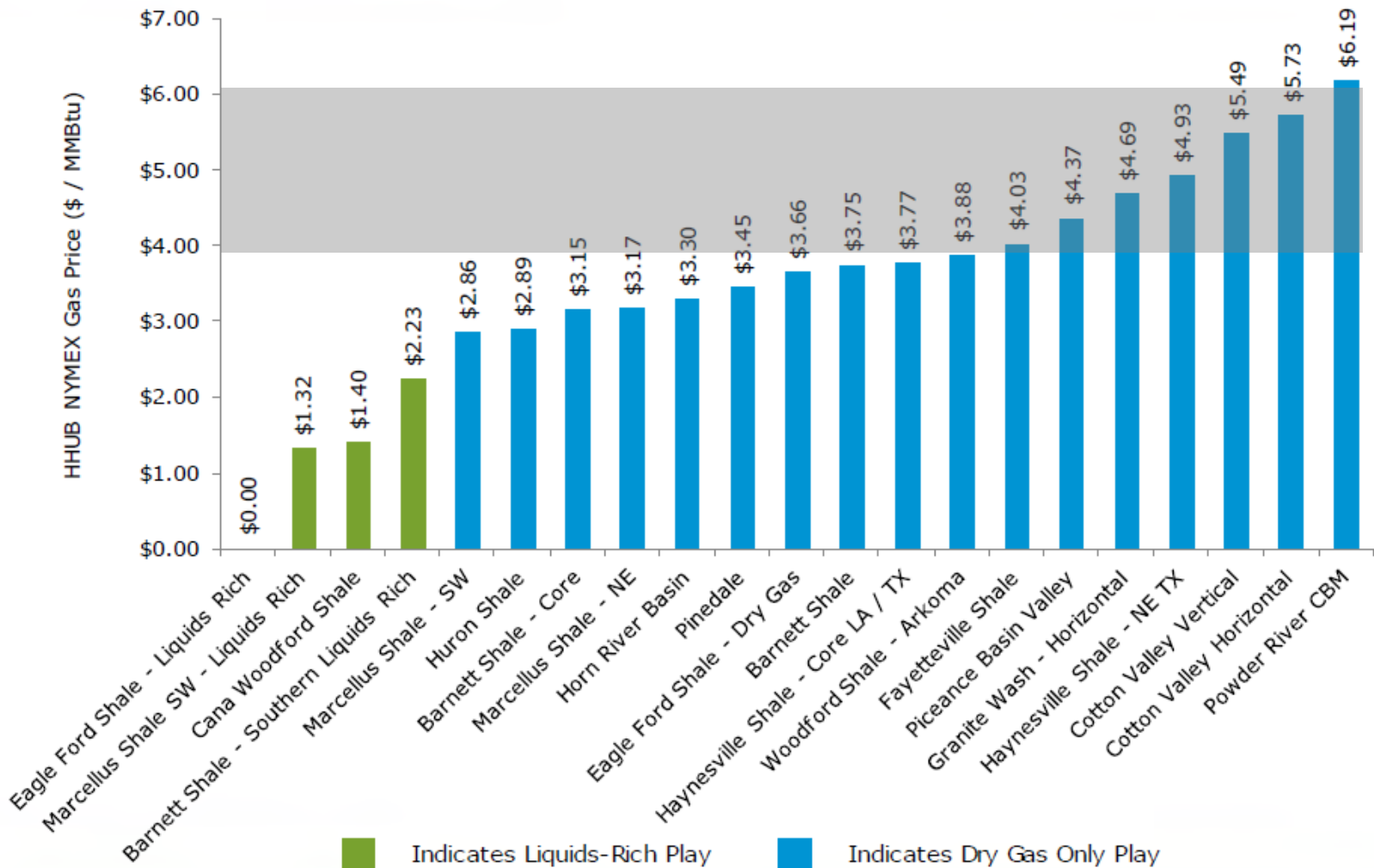


- Gas prices aren't sustainable below \$3/mcf gas. Marcellus is the only onshore gas play that truly works.
- Most basins fall below \$6/mcf gas, therefore, demand growth is needed to support our long-term gas price.
- Oil and liquids-rich plays lower the marginal cost of supply.
- Lower oil prices (we're assuming \$100/bbl) would increase the marginal cost

Marginal Dry Gas Plays Require \$4 - 6 Gas Prices

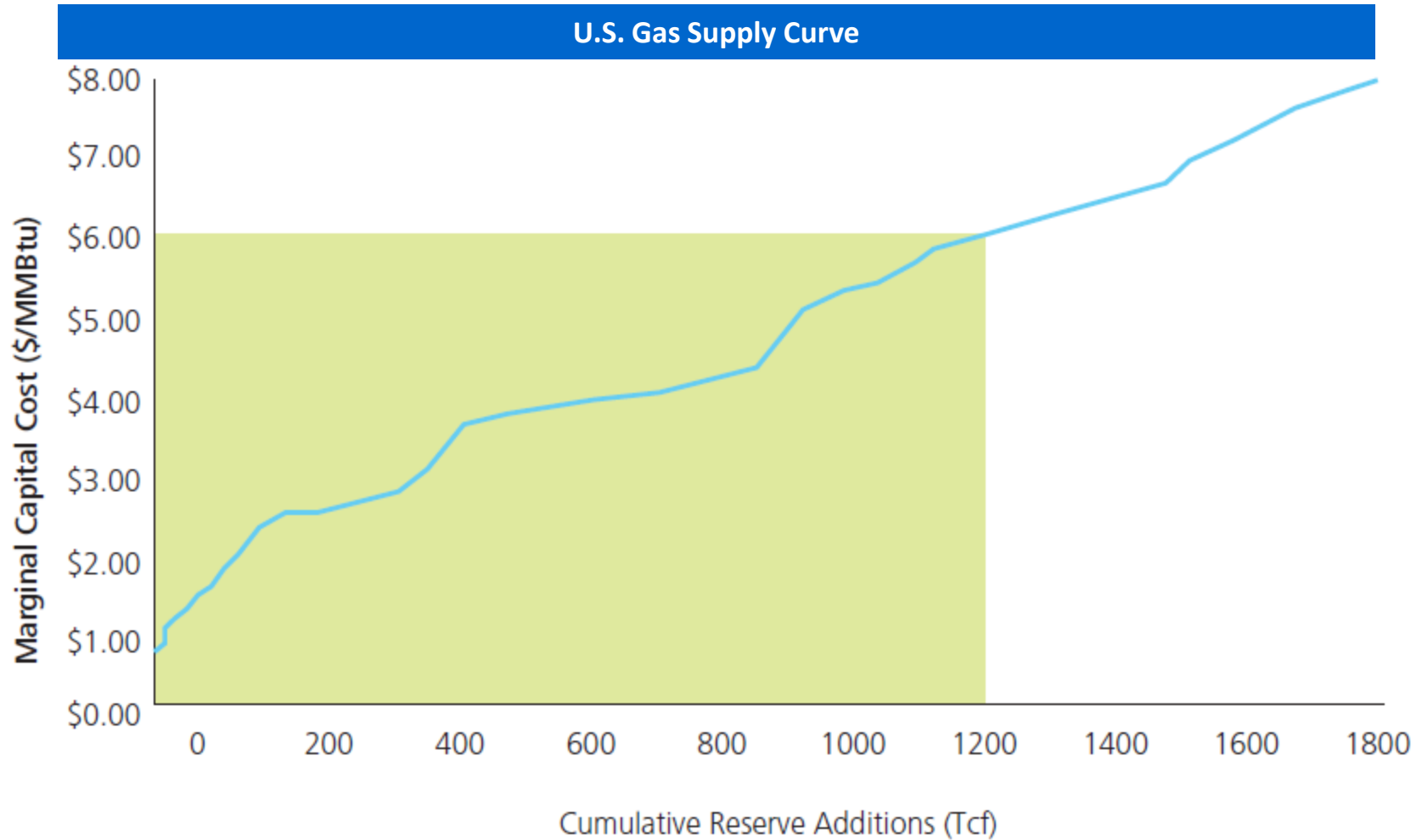


- Gas Price Necessary to Achieve a 10% After-Tax IRR



Source: Credit Suisse.

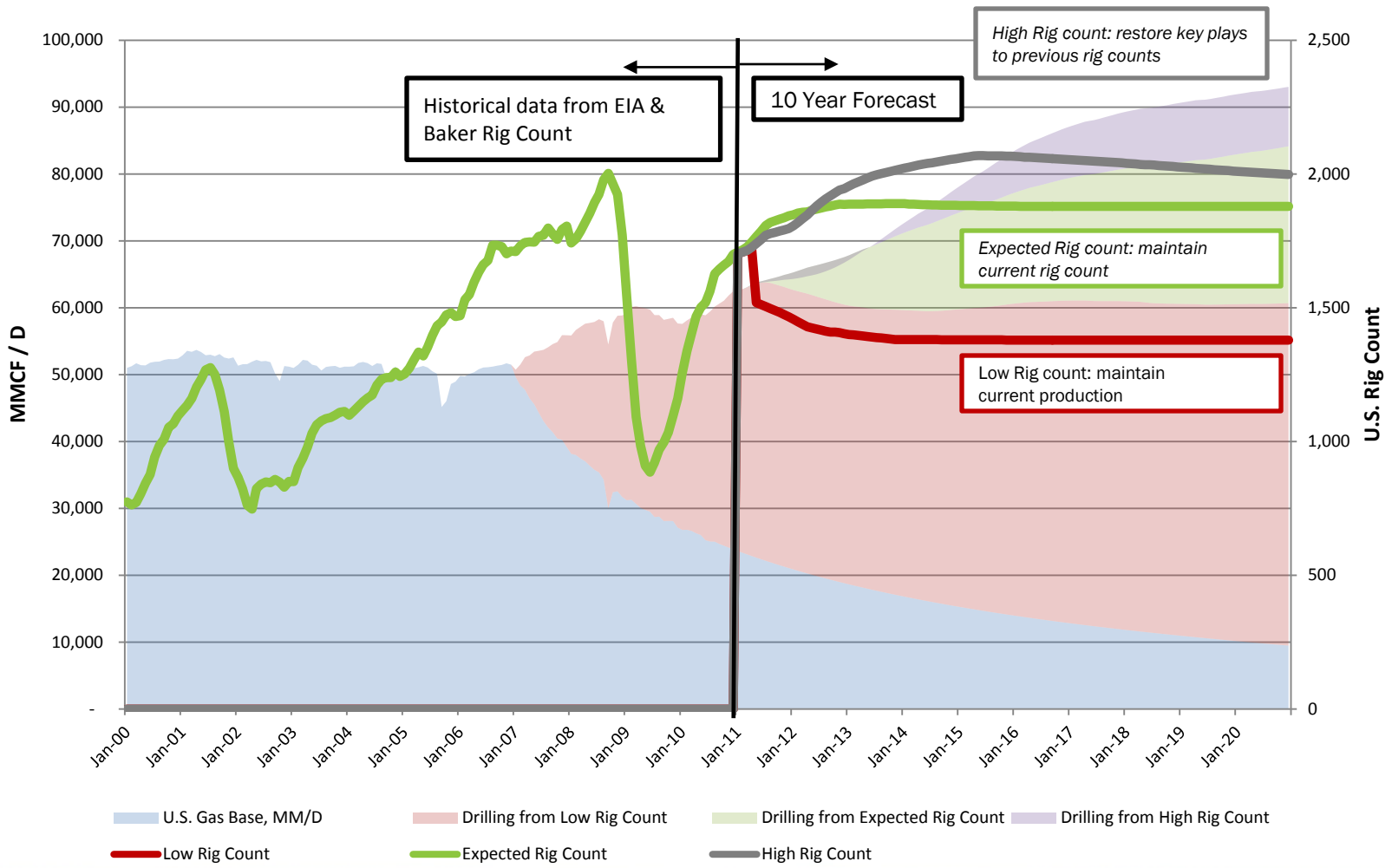
The Good News: Decades of Gas for Domestic Market & Exports at \$6



CHK's 2011 Projected US Gas Potential

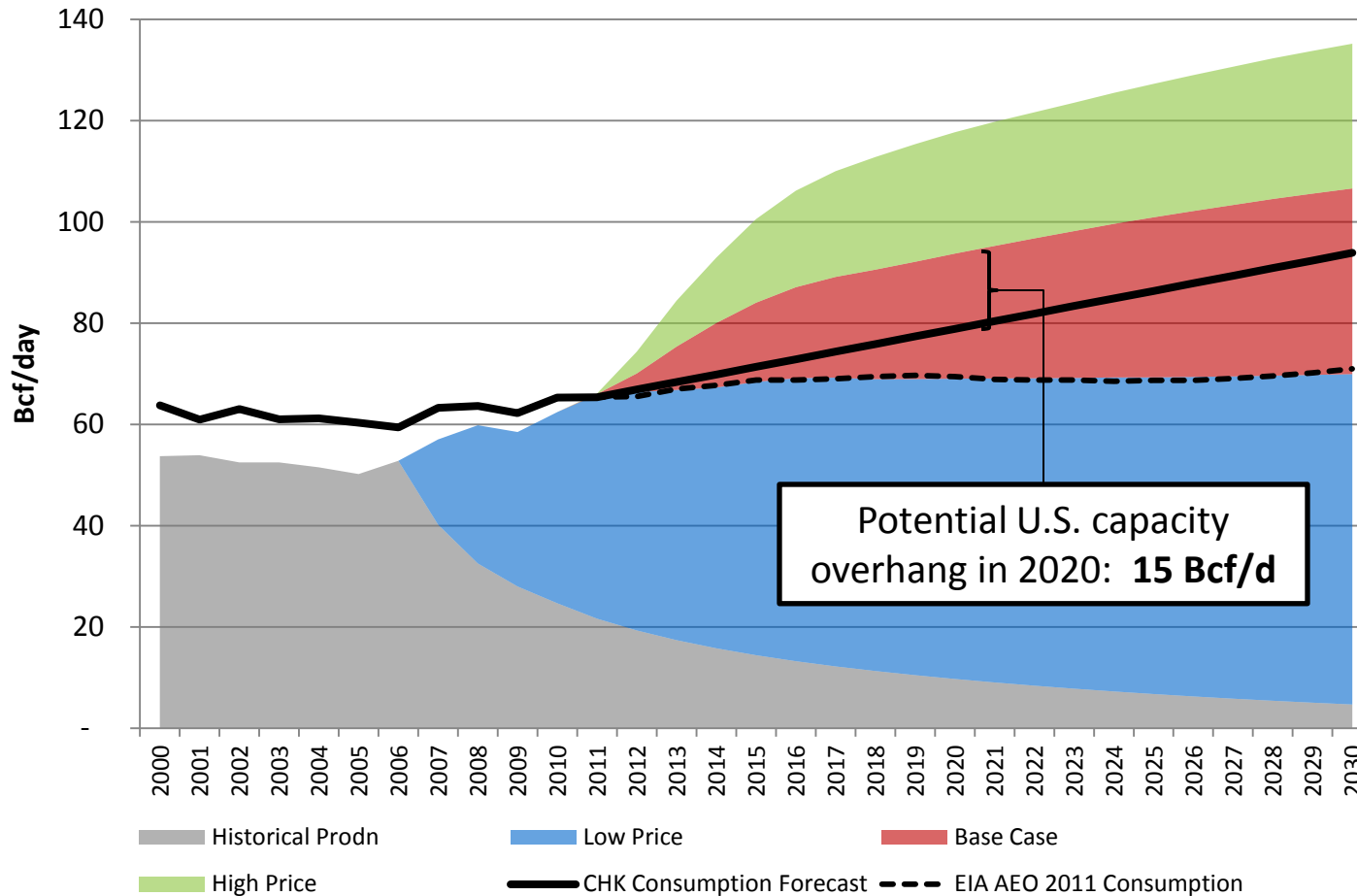


U.S. Gas Potential



Source: 2011 CHK estimates of total industry development, excluding potential transportation constraints. (Risk factors are CHK estimates of industry standards.)

What a Difference a Year Makes: CHK 2012 Projected Gas Potential



- From December 2011 to December 2012, US production increased **5.5 Bcf/d⁽¹⁾**, or 157 million cm/d.
- This increase equates to 17% of **total** 2011 global LNG output⁽²⁾.
- U.S. produced volumes could fully fill the forecasted LNG supply shortfall in 2020.

CHK currently operating 30 gas rigs, down from 110 a year ago⁽³⁾.

CHK estimates of total industry development, excluding potential transportation constraints. (Risk factors are CHK estimates of industry standards.)

(1) U.S. Energy Information Administration

(2) Wood Mackenzie

(3) CHK Investor Presentation April 2012



Shale Gas Environmental Considerations

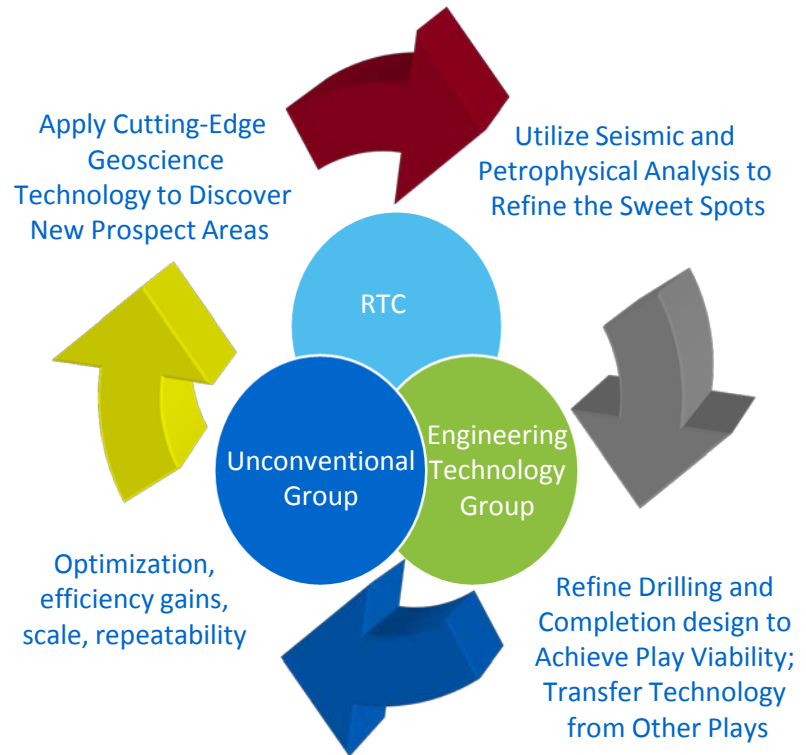
Implementing Leading Edge Technology

» Horizontal drilling and enhanced completion technologies enabled new unconventional plays

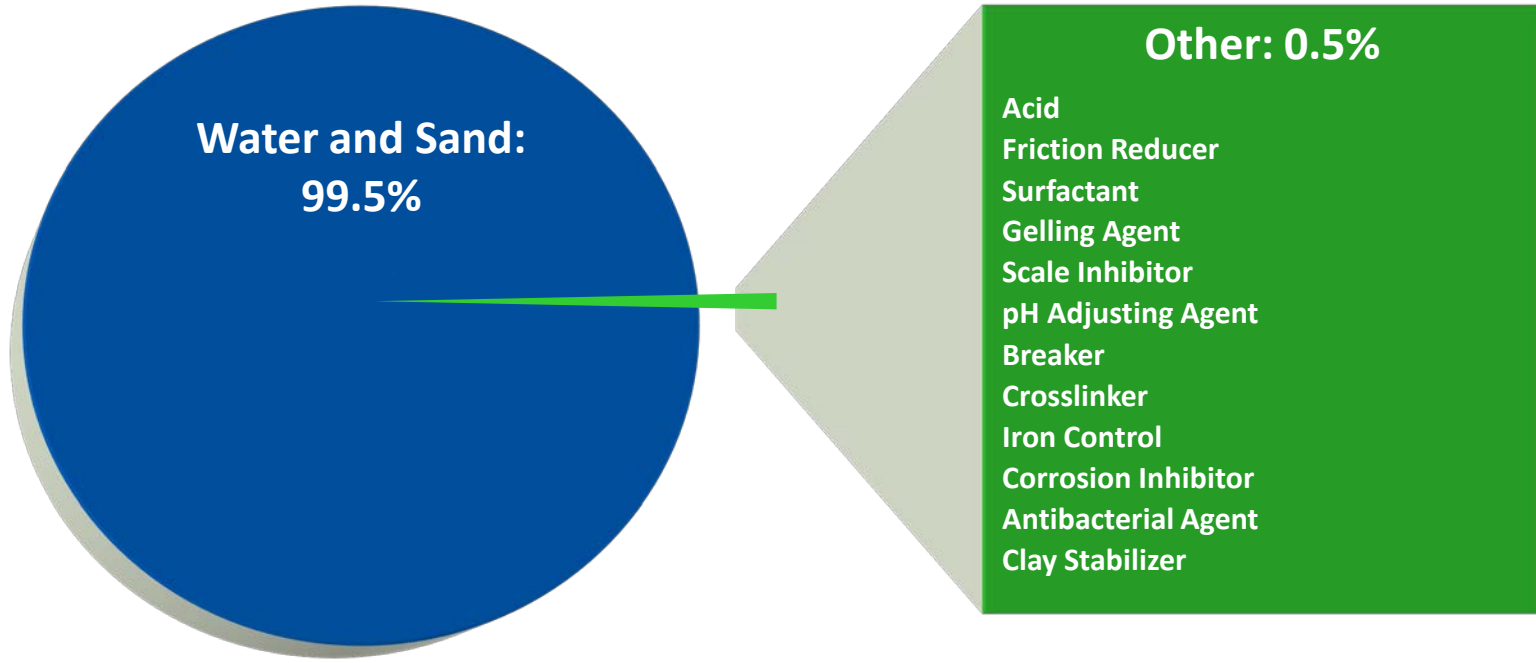
» Integrated technology solutions are driving improved performance

- ▶ Automated, fit-for-purpose drilling rigs
- ▶ PAD drilling
- ▶ Extended laterals
- ▶ Geosteering
- ▶ Reservoir characterization
- ▶ Seismic Inversion
- ▶ Green completions
- ▶ Advanced fracturing fluids
- ▶ Water recycling
- ▶ Refracs and frac diversion
- ▶ Real time microseismic
- ▶ Artificial lift

» Advanced analytical methods are being developed to identify value drivers from technology

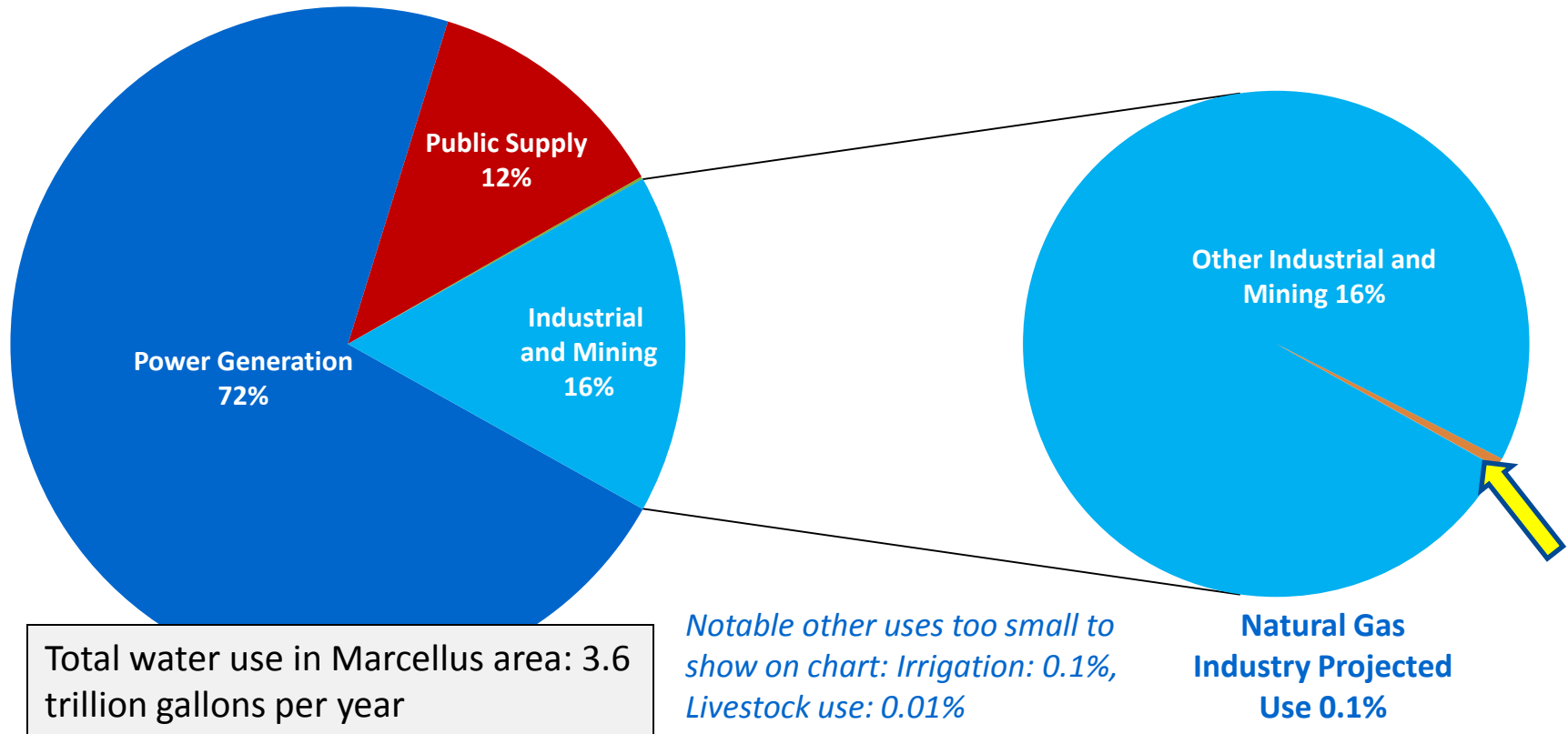


Composition of the Fracture Stimulation Mix – Dispelling the Myths, Presenting the Facts



Water Use in Marcellus Shale Area

Marcellus Shale water usage pales in comparison to other industries





Summary

Production Takeaways

» Scale of our gas resource is enormous

- ▶ Merely maintaining the Summer 2011 rig count would allow U.S. production to grow from 67 bcf/d (1,914 Mcm/d) today to around 95 bcf/d (2,721 Mcm/d) in 2020.
- ▶ If gas producers are incentivized by higher gas prices to increase drilling activity, U.S. production could grow significantly more.
- ▶ If not producers will manage supply by cutting rig utilization.
- ▶ The US gas resource can support domestic demand growth and LNG export while maintaining moderate pricing.

Things for the LNG Community to Think About



- » Dry gas economics will ultimately set the marginal price of U.S. gas
- » U.S. producers have not traditionally entered into twenty year agreements (regardless of the pricing mechanism)
- » There are LNG purchasers interested in either HHub or oil indexed pricing for gas feedstock
- » There is a second tier of purchaser that has interest in US LNG....
- » If you desire a twenty year agreement, you are not alone...
 - ▶ Ammonia/fertilizer producers
 - ▶ Methanol producers
 - ▶ Petrochemical industry
 - ▶ Steel manufacturers
- » You will see someone from this group take an economic interest in reserves to support their gas supply and infrastructure development needs

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LNG US Exports

Europe

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*Global Energy:
The New Frontier*

May 2012

World LNG Estimated May 2012 Landed Prices

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Source: Waterborne Energy, Inc. Data in US\$/MMBtu
April 2012

The European Gas Market: *What are the Dynamics?*

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- ◆ Gas supplies in Europe are expected to tighten and prices rise by 30 to 40% between now and 2014.
- ◆ Between now and 2020, the partial switch from nuclear to gas in Europe's power sector is expected to lead to an increase in annual gas consumption of 20 to 40 bcm.
- ◆ Declining domestic production, mainly in the United Kingdom and the Netherlands, will lead to a 27% increase in gas imports—climbing from the current 327 bcm to an expected 413 bcm in 2020.
- ◆ A conservative assessment of import infrastructure projects either under construction or in the planning stages reveals a 65% increase in pipeline capacity and more than double the LNG import capacity by 2020.
- ◆ In Europe, unconventional gas potential has been identified in Poland, Germany, France, The Netherlands, Sweden, Denmark, Hungary, Ukraine, Romania, Turkey and the UK.
- ◆ In the 27 European Union countries (EU27) gas is second to oil, representing 25.6% gross energy consumption (compared with 4% in China).
- ◆ Russia plans to boost its gas supplies to the European Union through its new Nord Stream (55 billion cubic meters per year) and the proposed South Stream (63 bcm per year) pipelines.

The European Gas Market : *What are the Dynamics?*

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- ◆ European gas hubs have grown steadily and have emerged to be liquid, with National Balancing Point (NBP) being the most liquid in Europe. Further gas hubs in continental Europe—such as the Title Transfer Facility (TTF) in The Netherlands and others in Germany, Iberia, Italy, France, and Austria—increased their traded volumes by an annual rate of 85% over the past five years.
- ◆ Europe imported 15% more LNG year on the year in H1 2011.
- ◆ The European Gas Regulatory Forum has endorsed the ‘Gas Target Model’ of the Council of European Energy Regulators (CEER). This means that the EU and its member states are about to transform the European gas market to integrate the various national markets into a single liberalised market.
- ◆ Dozens of cargoes destined for European Union countries have been diverted to Japan, enticed there by higher spot prices for gas.
- ◆ Qatar, Britain's main LNG supplier, is planning to continue to reduce exports to the UK in the coming months.
- ◆ BG Group said that of the 53 cargoes it delivered in the quarter, 34 went to Asia, 12 to South America, and two to Europe.
- ◆ North Sea Gas output has been falling 6-7% a year on average since 2000, and plunged 20.8% last year.
- ◆ LNG have increased, last year they accounted for about 30% of total UK supplies - up from 2% in 2008.
- ◆ European Re-Exports

Current Suppliers to Europe

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- ◆ Europe's major suppliers of gas/LNG include Gazprom, European majors (Statoil, Shell, Exxon Mobil), Qatar and Algeria.
- ◆ Europe produces 35% of its gas requirements, however Russia has 22% and Norway 19% market share in the EU-27, according to data from industry group Eurogas.
- ◆ Last year Gazprom controlled 27% of Europe's gas market and intends to increase that to 30% by 2020. It also plans to boost exports to the EU this year and raise prices by about 8%.
- ◆ In 2010 Gazprom struck a three-year deal with some of its biggest customers, including Eon Ruhrgas, agreeing to link up to 15% of its sales to spot prices. It has also negotiated a net price reduction of 10% for clients including GDF Suez, Wingas and OMV of Austria.
- ◆ Eon, RWE and Poland's PGNiG have all launched international arbitration proceedings against Gazprom to lower the prices in its gas contracts.
- ◆ *"The Europeans, on the other hand, have been attempting to bluff Gazprom and the LNG exporters with the tale of a vast potential shale industry able to pound Russian, Arab, and African prices down to American levels. Sadly, unlike eurocrats and commentators, the Russians know the European onshore exploration and production industry lacks the required developed geology, equipment, labour force, and lead time necessary to turn their talk into large amounts of actual gas."* John Dizard, Financial Times, May 7 2012
- ◆ *"Trotsky dreamt that the Russian Revolution would spread to the rest of the world, including the US. Fortunately for world civilisation, it didn't."* Guy Chazan, Financial Times, 24 April 2012

Opportunities for US Exporters

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- ◆ LNG from Qatar, Algeria, Nigeria and Trinidad and Tobago made substantial inroads to the European gas market in recent years.
- ◆ Existing European LNG terminals can annually bring 95 bcm and six new terminals that are being built could raise this yearly import capacity by 70 bcm.
- ◆ Construction at the first LNG export facility to be built in the US for more than 40 years is set to start within three months.
- ◆ Cheniere Energy, which is developing the project, has already signed deals with BG Group of the UK, Gas Natural Fenosa of Spain, Gail of India and Kogas of Korea to take a total of 16m tonnes of LNG per year, equivalent to about 89% of Sabine Pass's planned maximum capacity.
- ◆ Delivery of Cheniere Energy's first LNG cargo, to BG, is expected to be in late 2015.
- ◆ Exceleerate Energy plans to develop the country's first floating LNG export plant off the Gulf Coast. Exceleerate is the eighth company awaiting approval from the Department of Energy to ship cheap US natural gas to higher-priced markets across the globe. The plans, if approved, could export about 16% percent of US daily production.
- ◆ Despite the weakness in Europe's economies, gas and LNG is likely to play a bigger role in the energy mix in the next 5 – 10 years. US exporters have opportunities to sell into Europe but Asia is currently a far more lucrative market, despite the additional transport costs.
- ◆ New Eastern Mediterranean find could be a game changer in Europe.

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Asian LNG markets seek US gas exports

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23 May 2012

Global LNG demand surpasses 450 MMt by 2030

Driven by strong growth in Asia

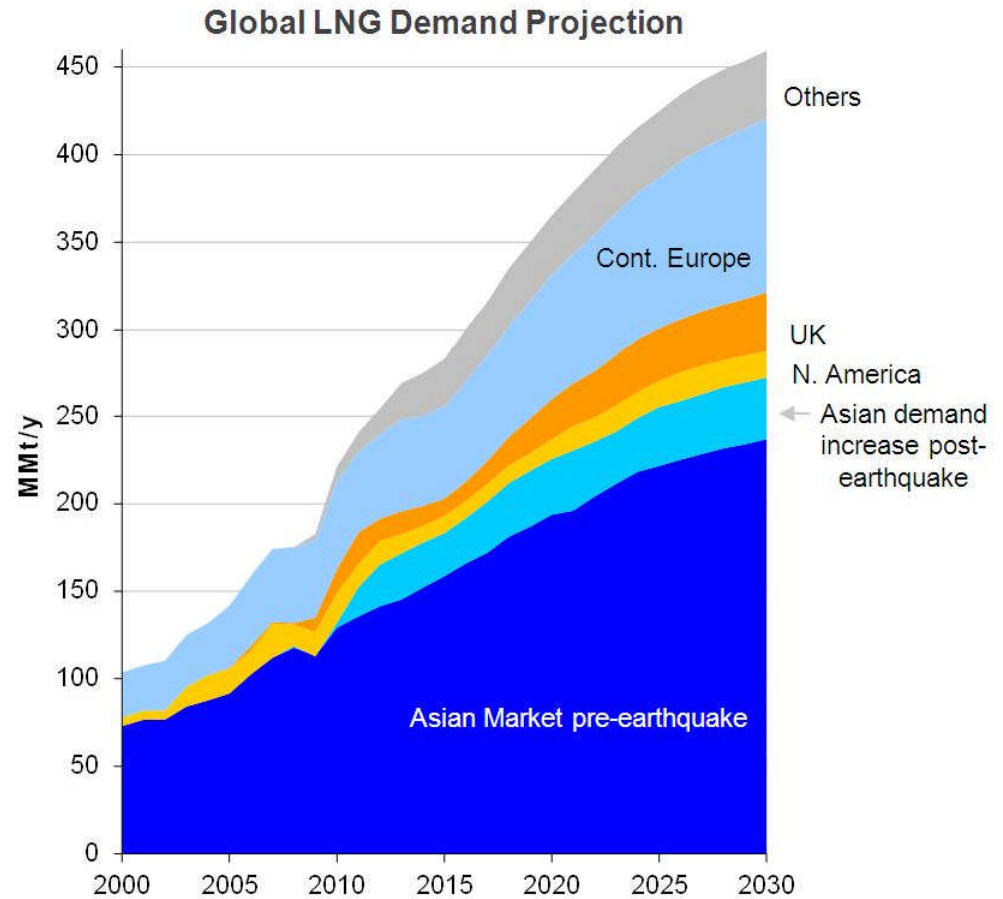
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Strong long-term LNG growth driven by growing use in power generation

- Strong needs in Japan post Fukushima
- CCGT often the technology of choice for future power plant developments

Growth anticipated in every major region, with the exception of North America

- Two thirds of all growth will be in Asia



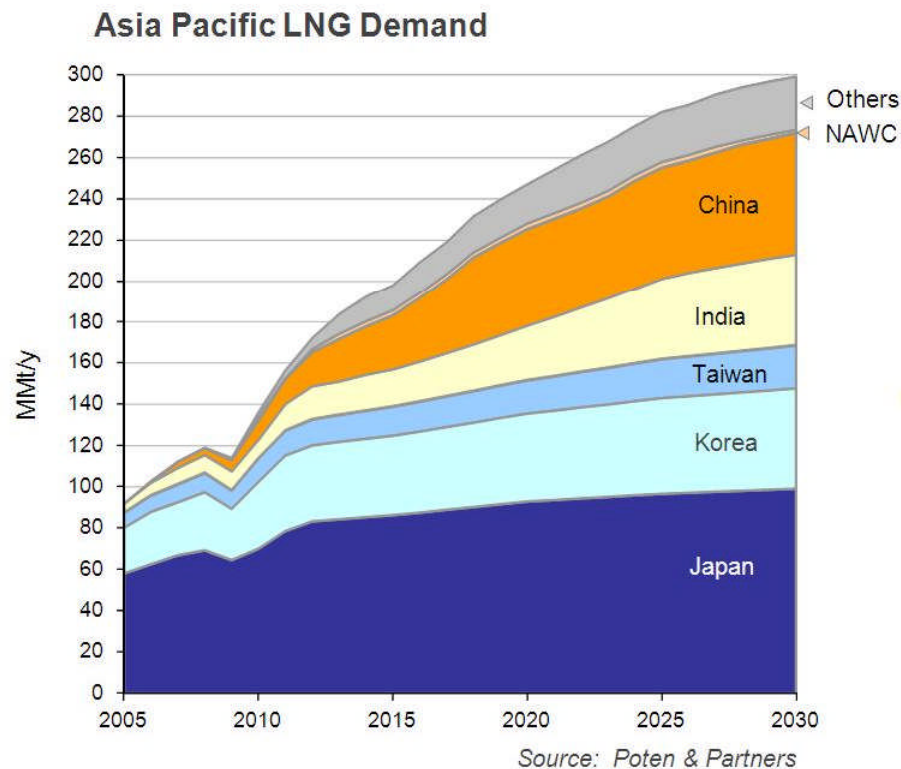
Source: Poten & Partners

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Asia Pacific demand to reach 300 MMt/y by 2030

China and India the major source of growth

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Traditional Asian markets - Japan, Korea and Taiwan - are isolated gas markets with limited access to alternative domestic or pipeline import supply

China has a mixed energy market that needs LNG

- Traditionally dominated by coal
- Growing domestic production, including significant CBM and shale gas potential, as well as pipeline imports
- Fast growing gas demand will be difficult to satisfy, lack of infrastructure will be a constraint, LNG required to fill the balance

India has fast growing gas demand and limited alternatives

- KG Basin domestic production has lagged, and LNG is set to make up the difference

Strong LNG demand from niche Asian markets

- Thailand, Malaysia, Indonesia, Singapore and others

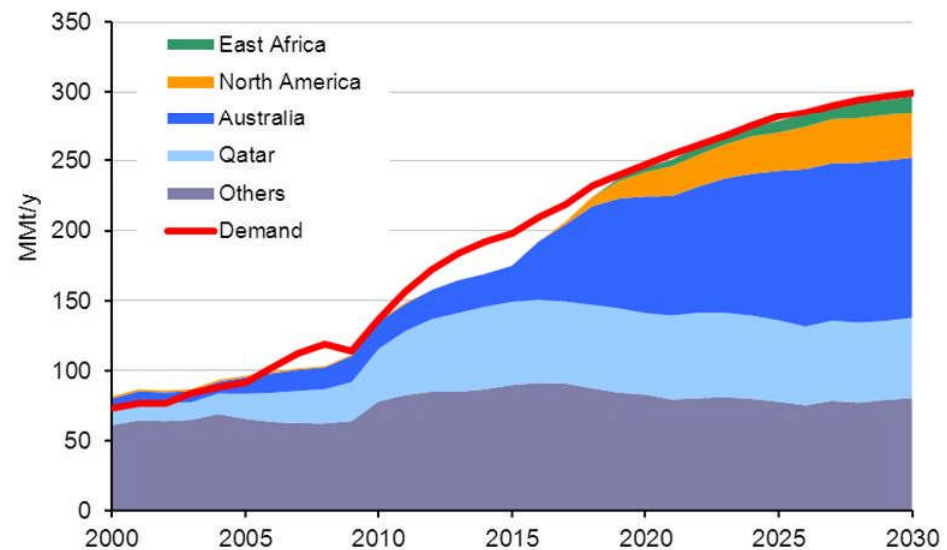
A supply race to meet premium Asian demand

North America and East Africa emerging

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- Historically, Asia has been supplied from South East Asia and the Middle East
- From the mid 1990s, Qatar became an important supplier to Asia, today being by far the single largest supplier
- Strong growth in LNG export developments will see Australia take over the position of leading supplier to Asia once the current wave of projects start-up
- Longer term, emerging supply regions will become important
 - Particularly North America and East Africa
- Competition between Australia, the US, Mozambique and potentially Qatar will increase towards the end of the decade

Australia takes leading position in supplying Pacific



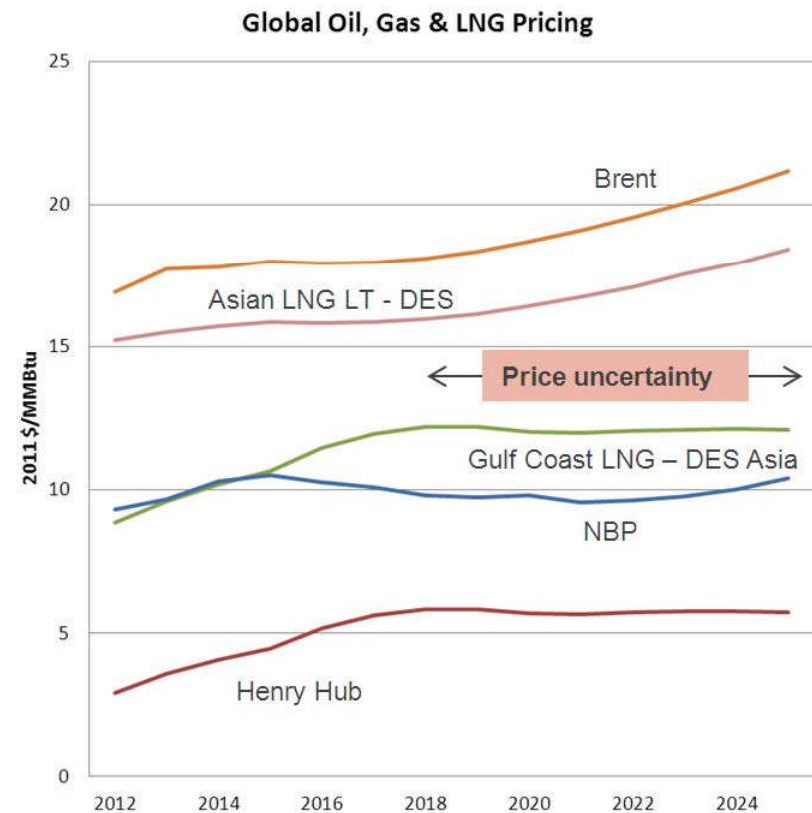
Source: Poten & Partners

Global natural gas markets to remain segregated

Growing supply and US exports will pressure Asian LNG prices

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- Asian LNG prices to remain at a premium in the medium term
 - Slopes for Asian LNG contracts are expected to remain linked to oil and slightly below oil parity around 14 to 14.5%
- Long-term Henry Hub should be set by marginal cost of unconventional gas in the US
 - Growing to around \$6.00/MMBtu by 2018
 - Remains de-linked from oil and regional natural gas benchmarks worldwide
- The Sabine Pass Ex-Ship FOB formulae can be used to calculate an indicator of US Gulf Coast LNG prices delivered to Asia
 - US Gulf Coast LNG should be competitive in Asia
- Growing supply at competitive prices will create uncertainty and exert pressure on Asian prices late in the decade



Source: Poten & Partners

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Made in America LNG exports from the United States



William F. Hederman, Deloitte & Touche LLP
Tom Choi, Deloitte MarketPoint LLC

Mayer Brown Global Energy Conference
Houston, TX
May 2012

Deloitte Center for Energy Solutions and Deloitte MarketPoint LLC

Study analyzed key questions and concerns

Based on the assumptions and data included in the Deloitte MarketPoint model:

- What would be the impact of 6 Bcfd of LNG exports on U.S. natural gas prices?
- Are the assumed LNG export volumes sufficient to erode competitiveness of U.S. industries and raise security issues?

Key findings

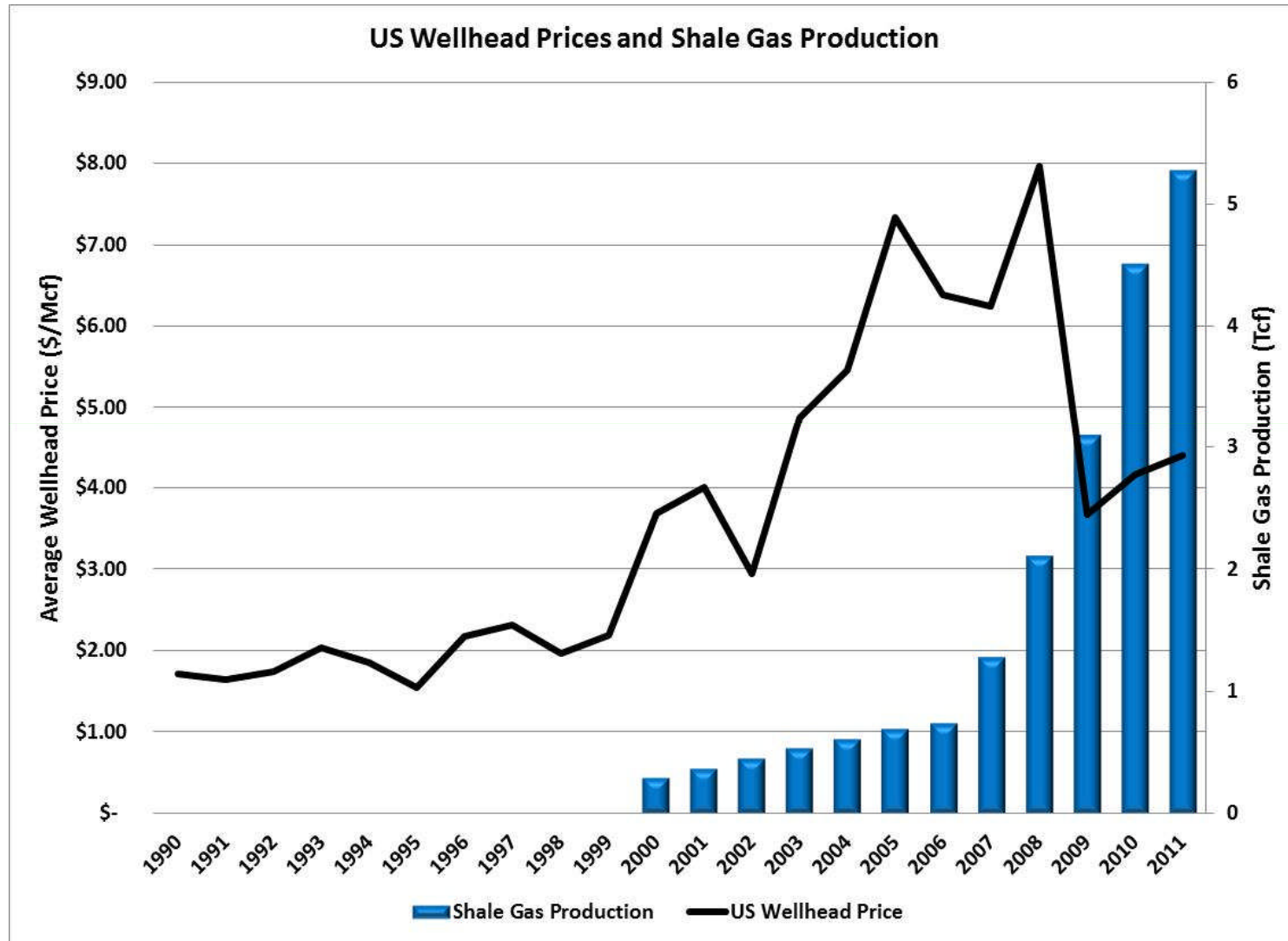
- Price impact is projected to be modest and dissipate with distance from the Gulf.
 - Average impact at US prices is about \$0.12/MMBtu
 - Average impact at Henry Hub is about \$0.22/MMBtu
 - Average impact is less than \$0.10/MMBtu in distant market areas such as Midwest and Mid-Atlantic regions
- Economic stimulation due to exports is substantial
- Large domestic resource base and highly interconnected North American energy market helps mitigate the price impact.
 - The shape of the supply curve, rather than the absolute price, and supply dynamics determine the price impact of LNG exports.
- Some of the objections raised related to LNG exports are inconsistent with findings

What triggered the “Shale Gas Revolution”?



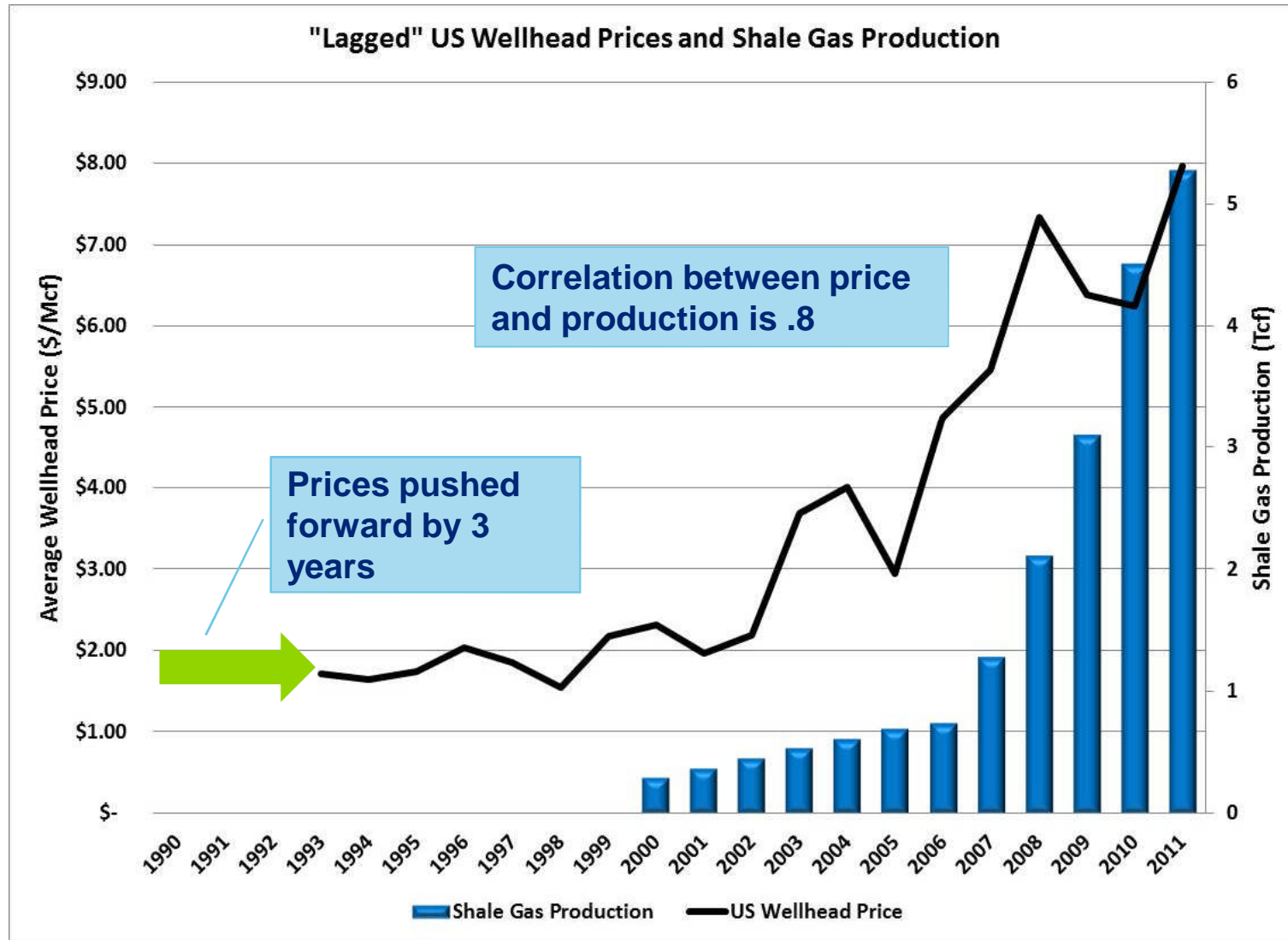
Source: Energy Information Administration based on data from various published studies
Updated: May 9, 2011

Historical wellhead prices and shale gas production



Source: U.S. Energy Information Administration (October 28, 2011).

Shale gas production compared to “lagged” price

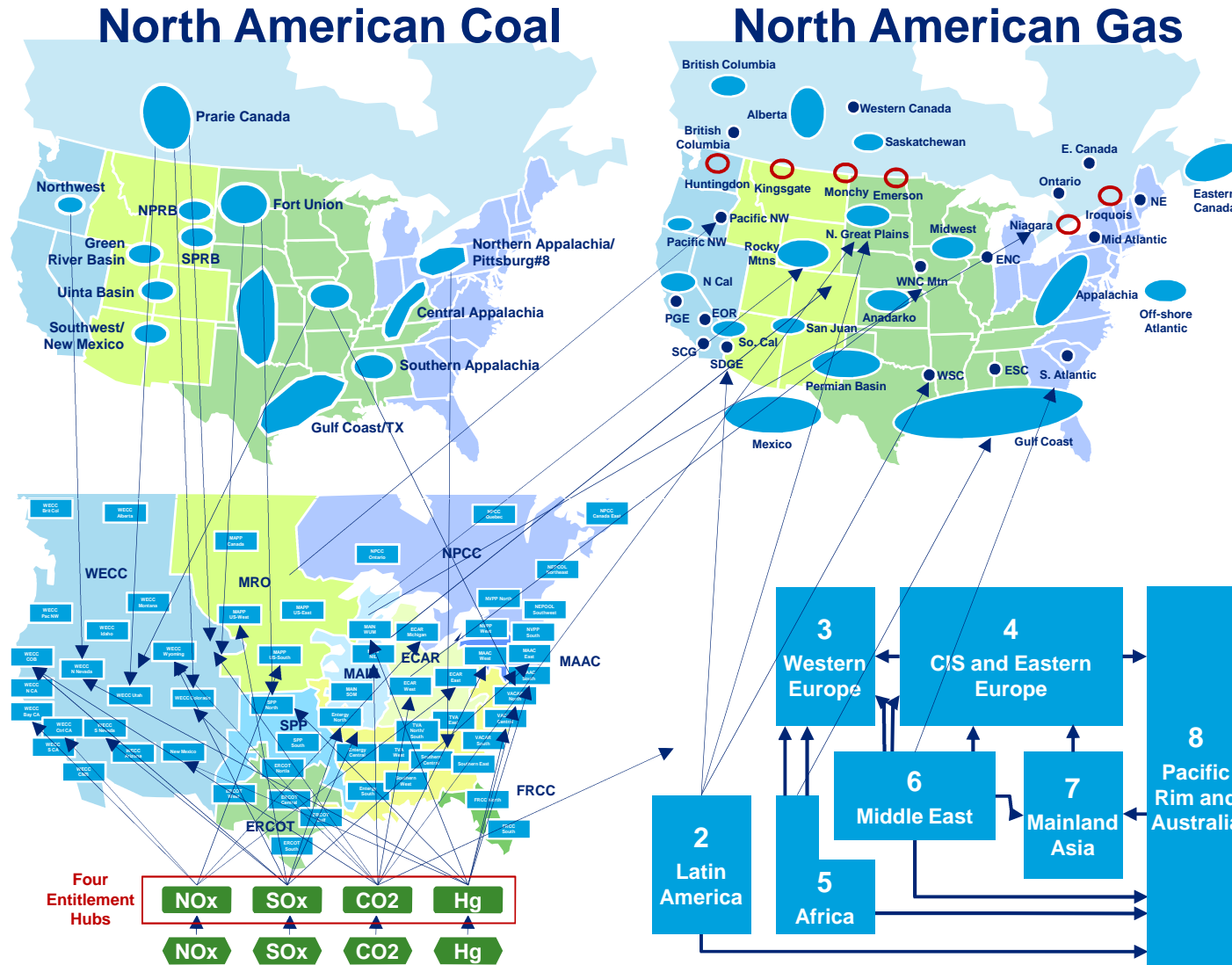


Source: U.S. Energy Information Administration (October 28, 2011).

Key lesson: North American natural gas market is highly dynamic

- Producers and consumers respond to price signals and anticipated market events to mitigate their price impacts.
- Strong market feedback.
 - What is the best thing for high prices?
 - What is the best thing for low prices?
- How might the market react to LNG exports?
 - Producers (supply elasticity)
 - Consumers (demand elasticity)

Integrated models for power, world gas, coal and emissions



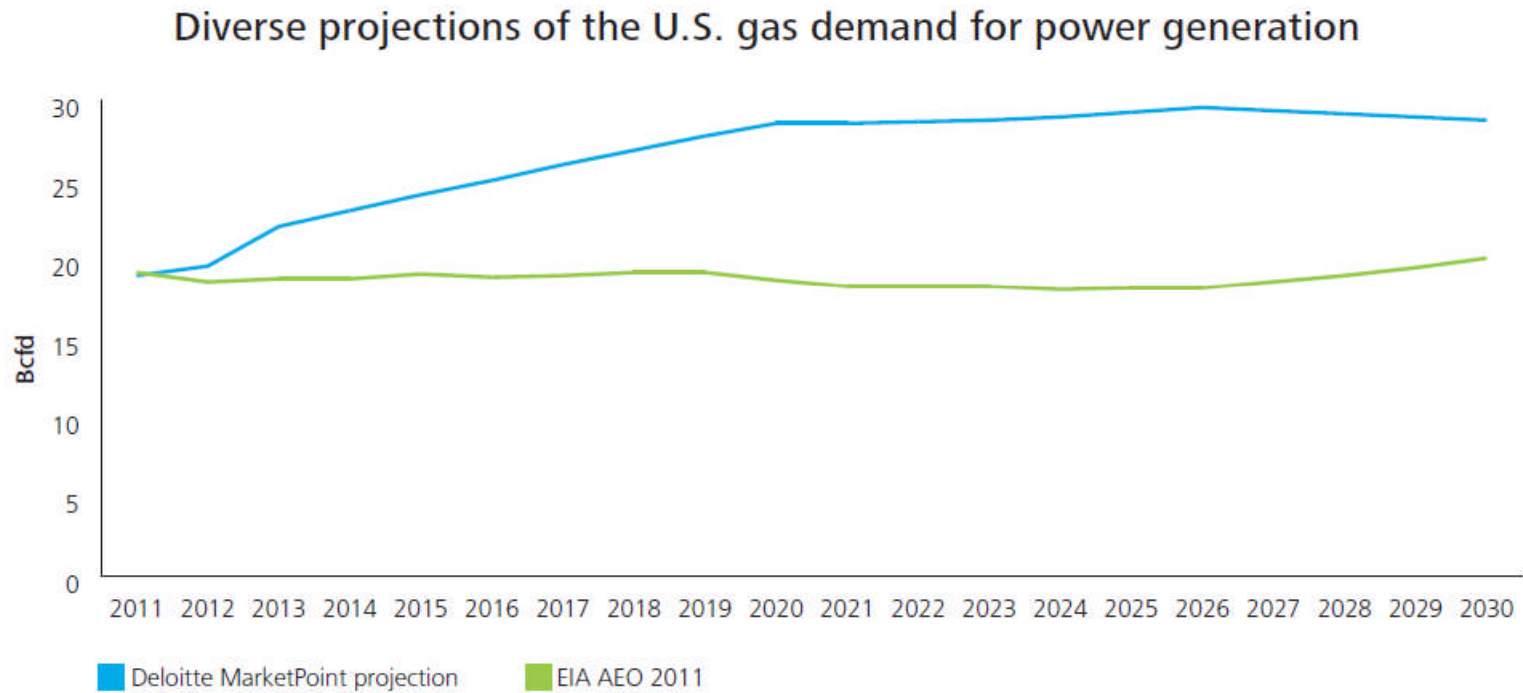
Source: Deloitte MarketPoint LLC

North American Electricity & Emissions

World Gas Model

Reference case includes high gas demand growth

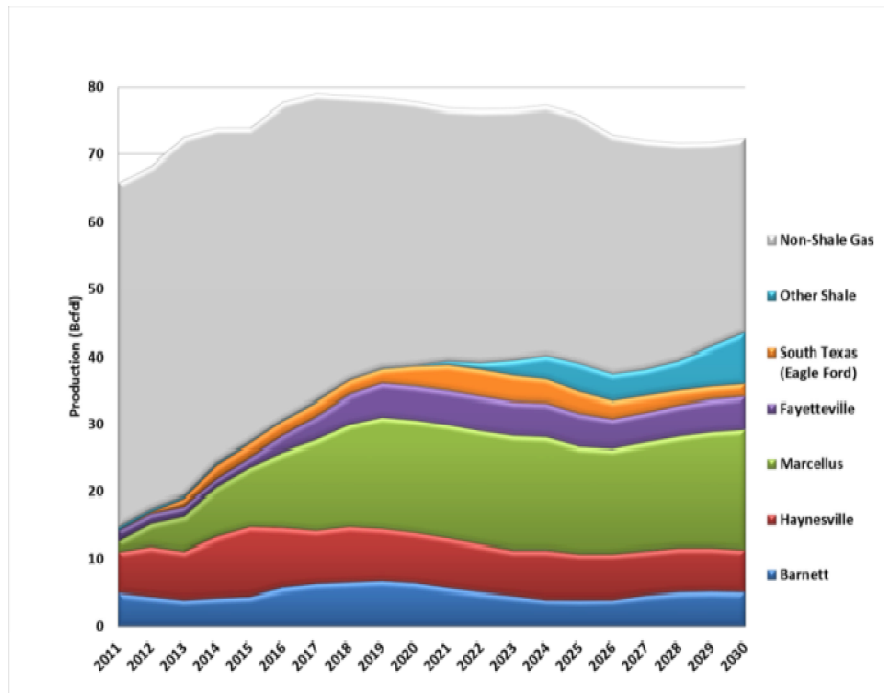
It represents a rather conservative case in terms of assessing the impact of exports



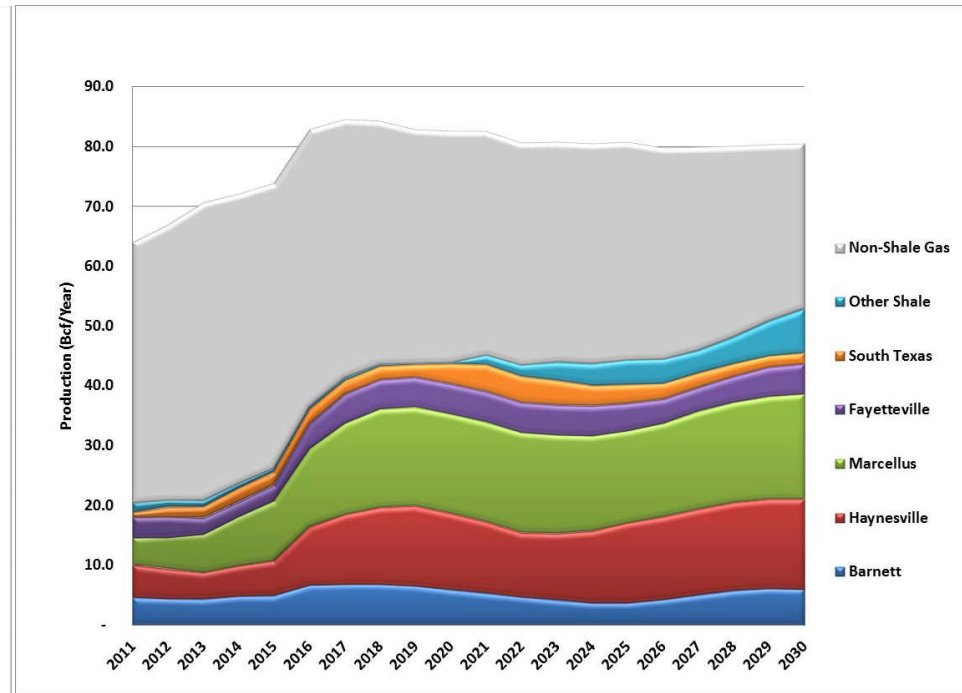
Source: Deloitte MarketPoint; Energy Information Administration

Projected continued rapid growth in shale gas production

U.S. Production (Reference Case)

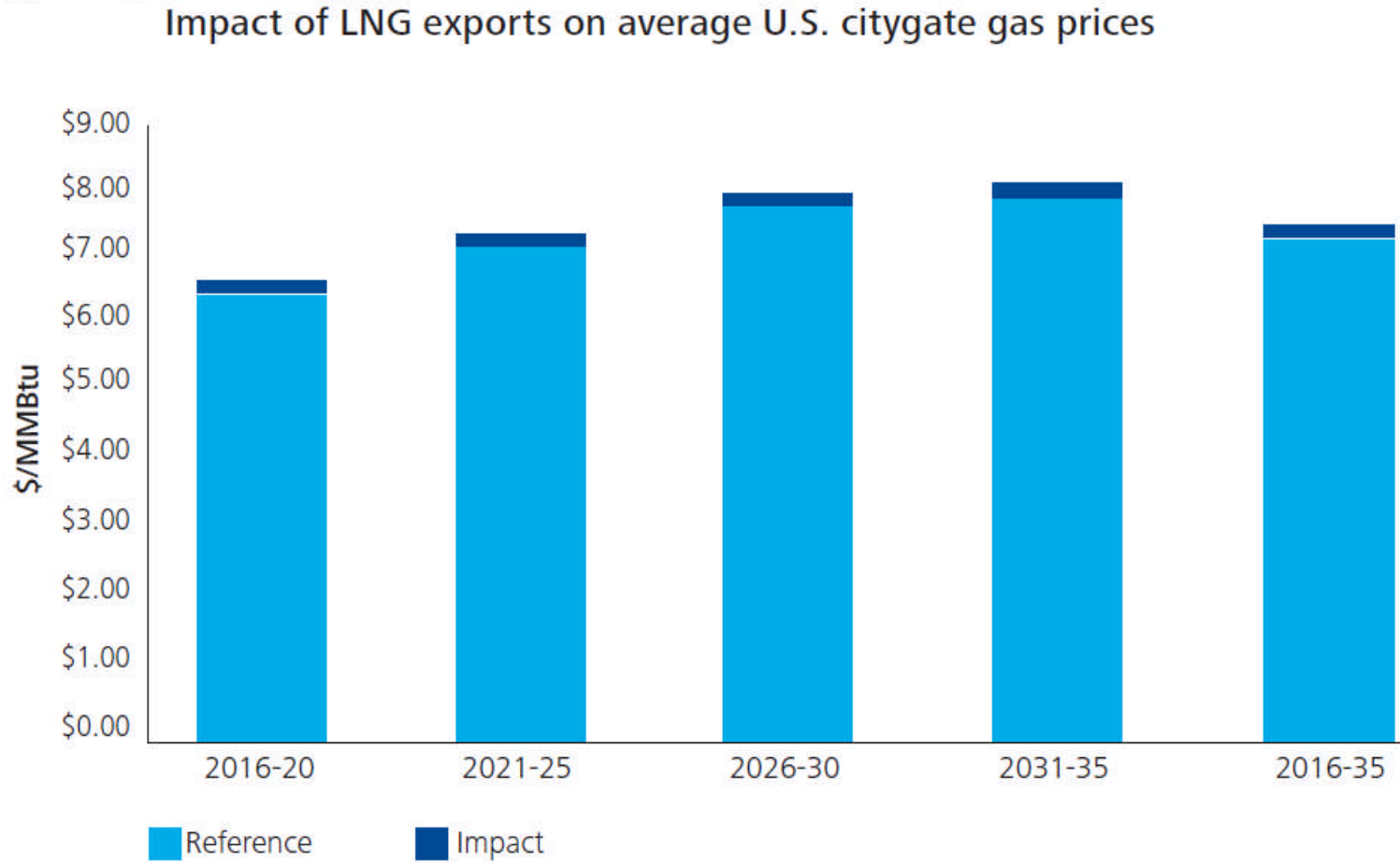


U.S. Production (LNG Export Case)



Source: Deloitte MarketPoint LLC

Projected price impact of LNG exports (Real 2011 \$)

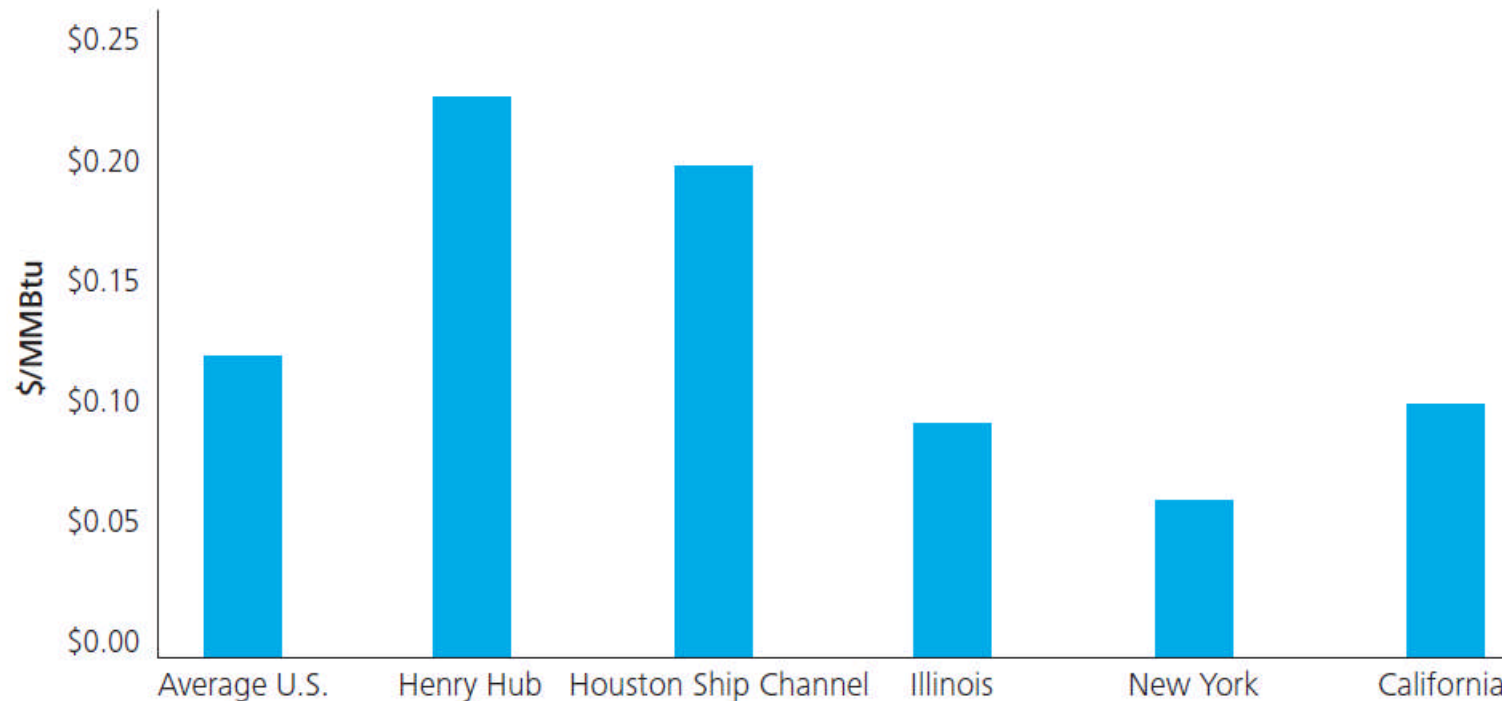


Source: Deloitte MarketPoint LLC

Projected impact is highly locational

Focus on Henry Hub or Gulf supply prices will greatly overstate the impact

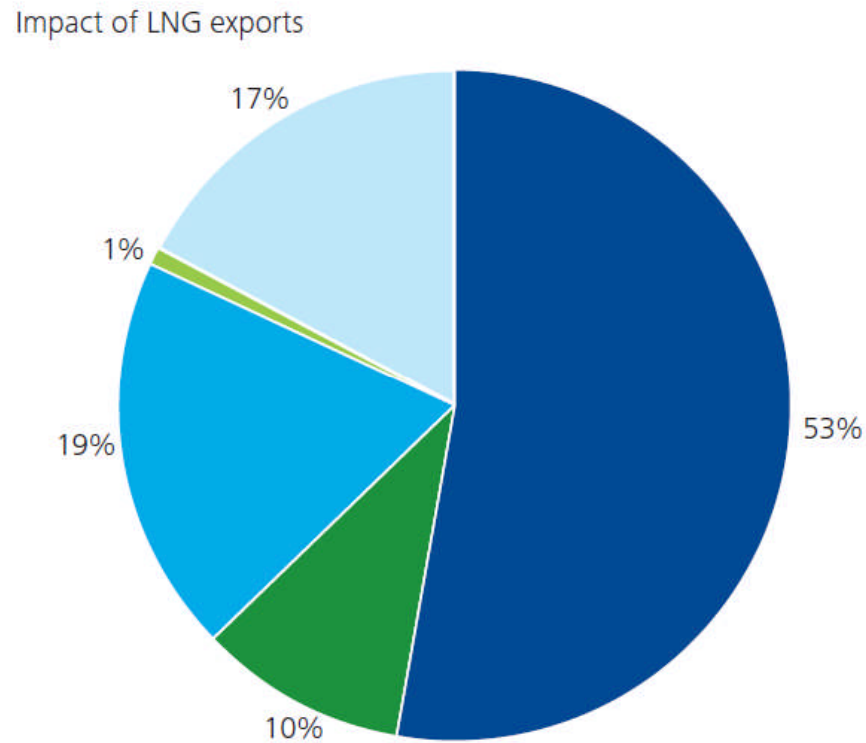
Price impact varies by location (average 2016-35)



Source: Deloitte MarketPoint LLC

Market dynamics and interconnectivity work to mitigate price impact

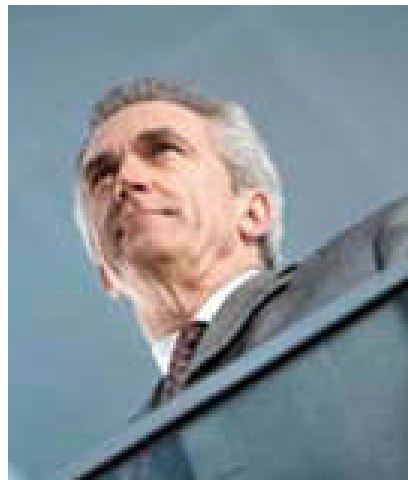
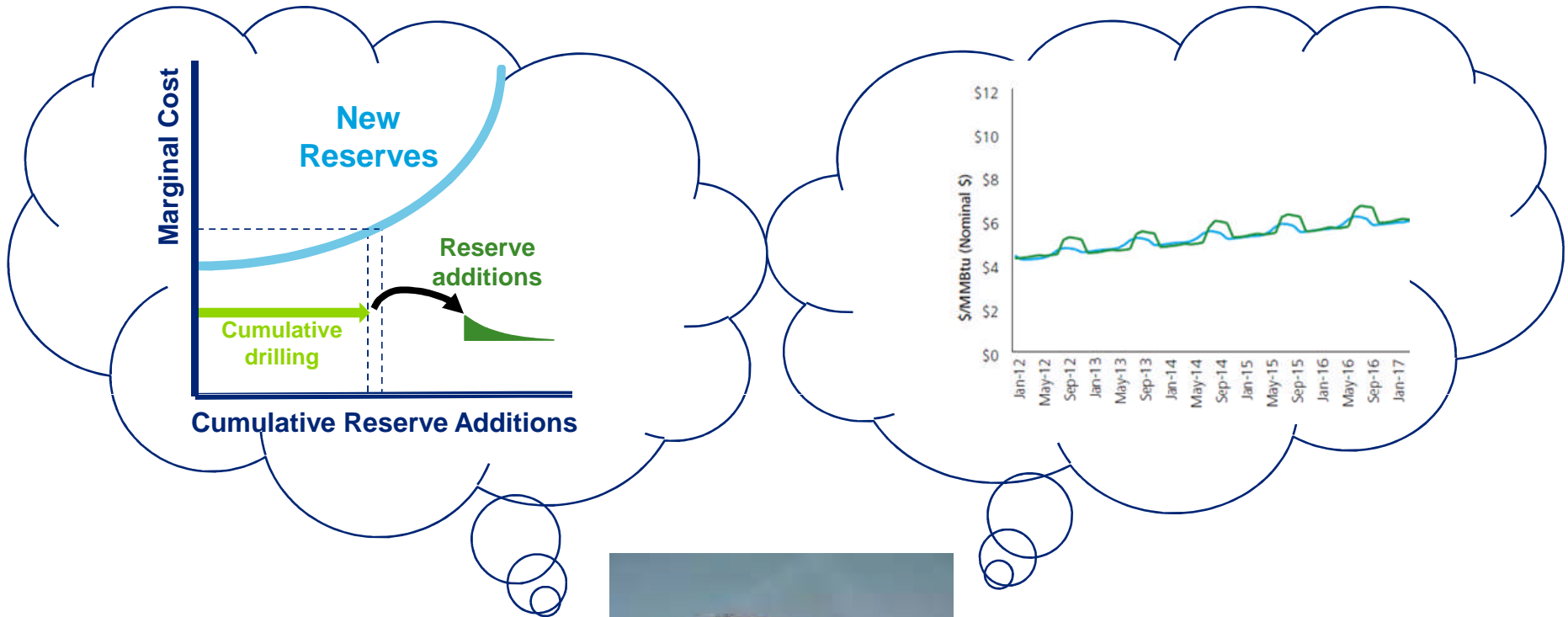
Projected sources of incremental volume



- Shale production
- Non-shale production
- Net pipeline imports
- LNG imports
- Demand elasticity

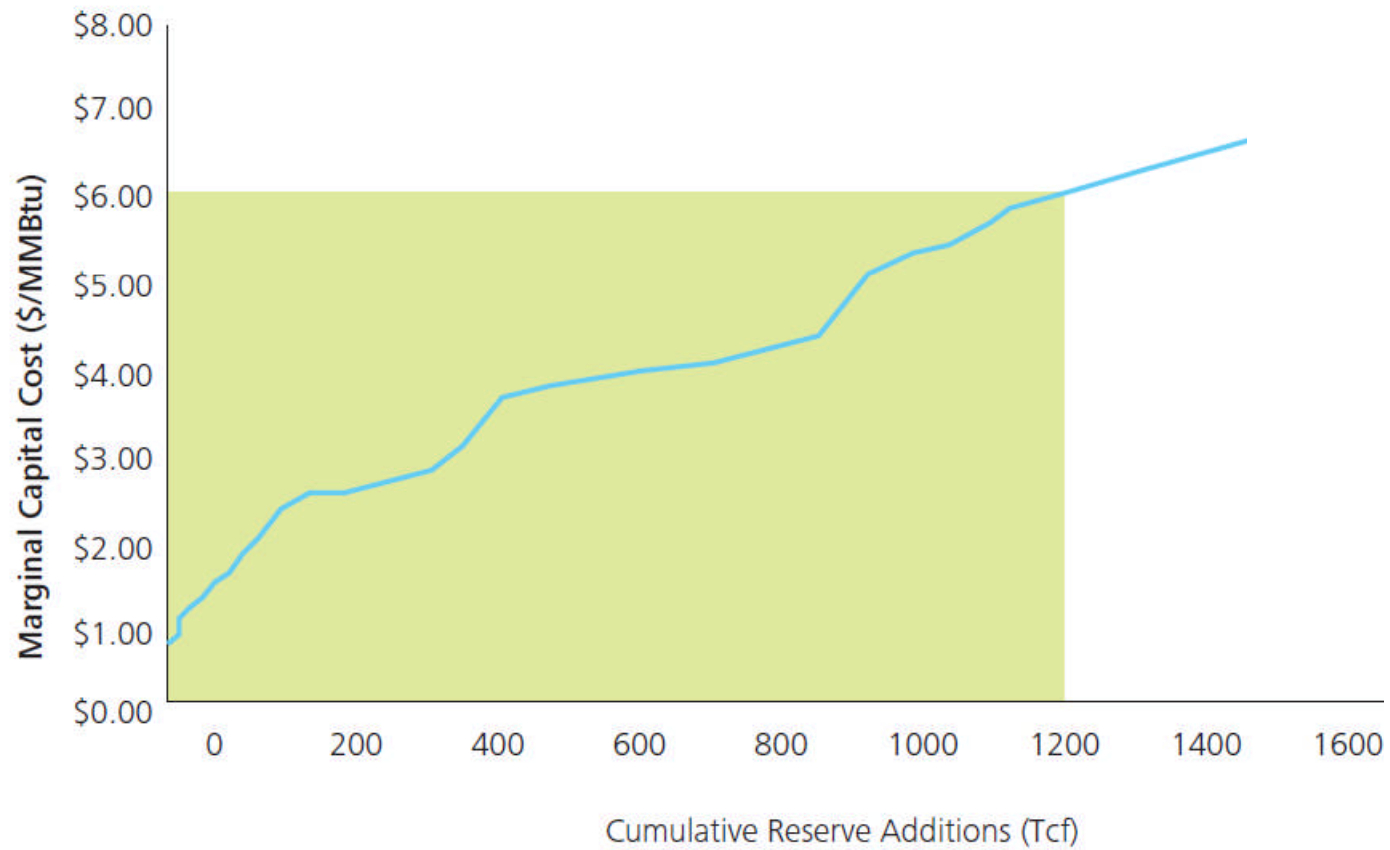
Source: Deloitte MarketPoint LLC

Fundamental model of producer decisions



Aggregate U.S. gas supply curve

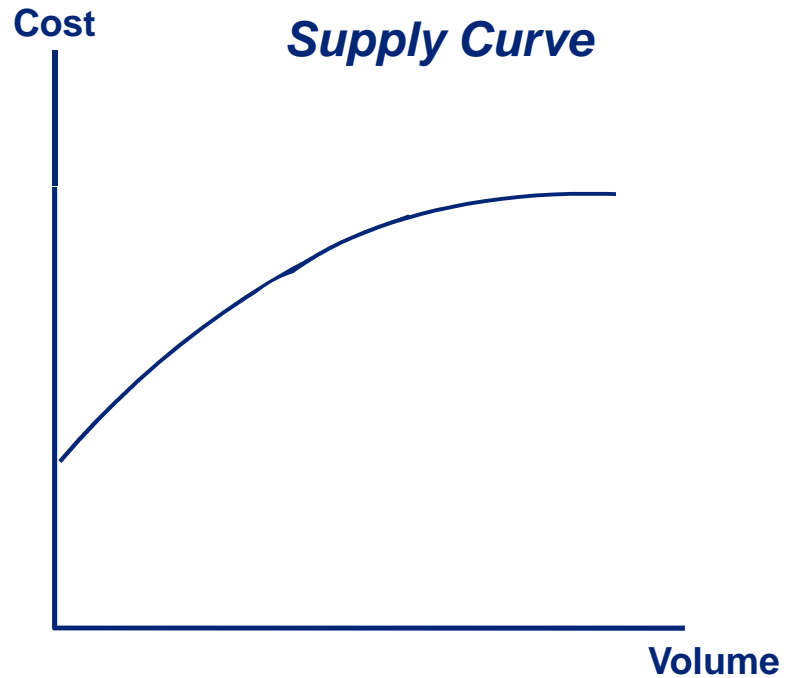
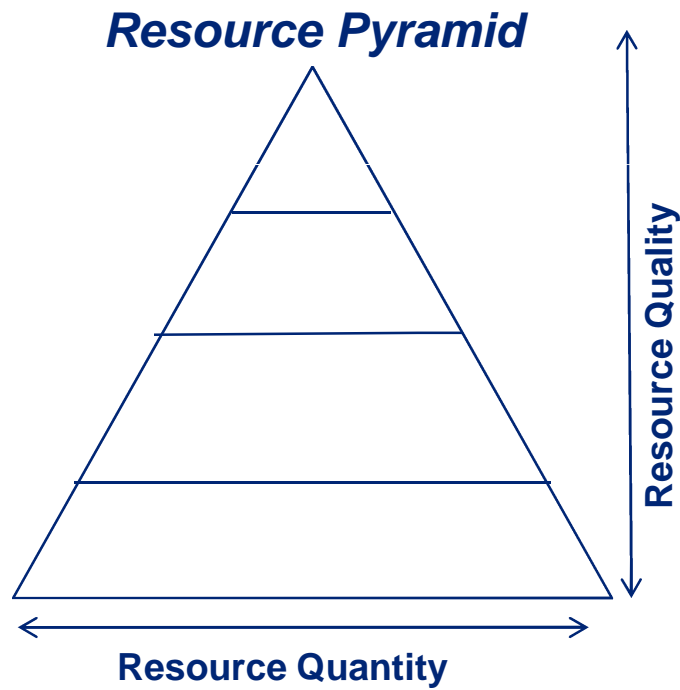
Aggregate U.S. natural gas supply curve



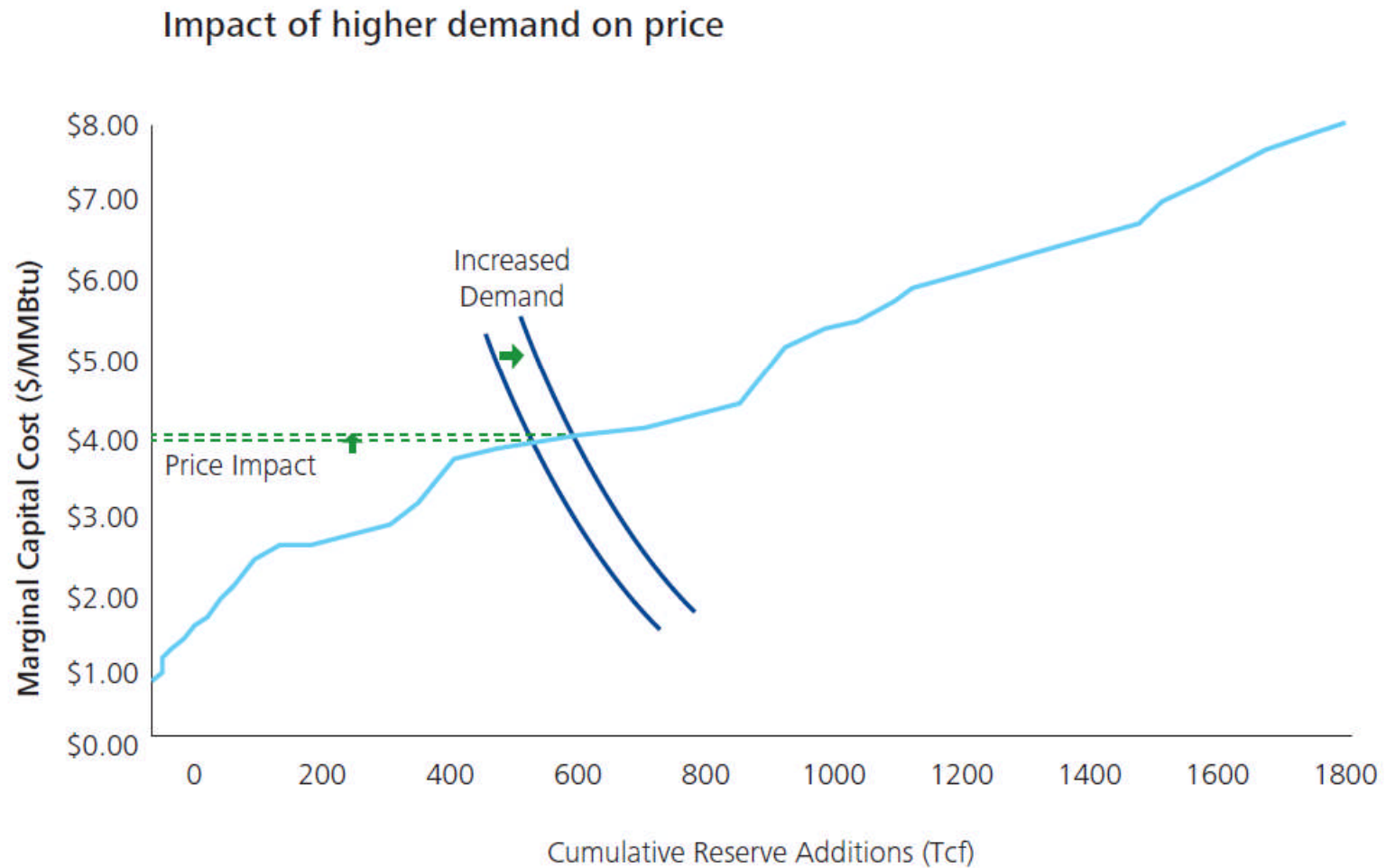
Source: Deloitte MarketPoint

Do we really know how the supply curve looks?

Resource pyramid implies a flat supply curve at higher costs

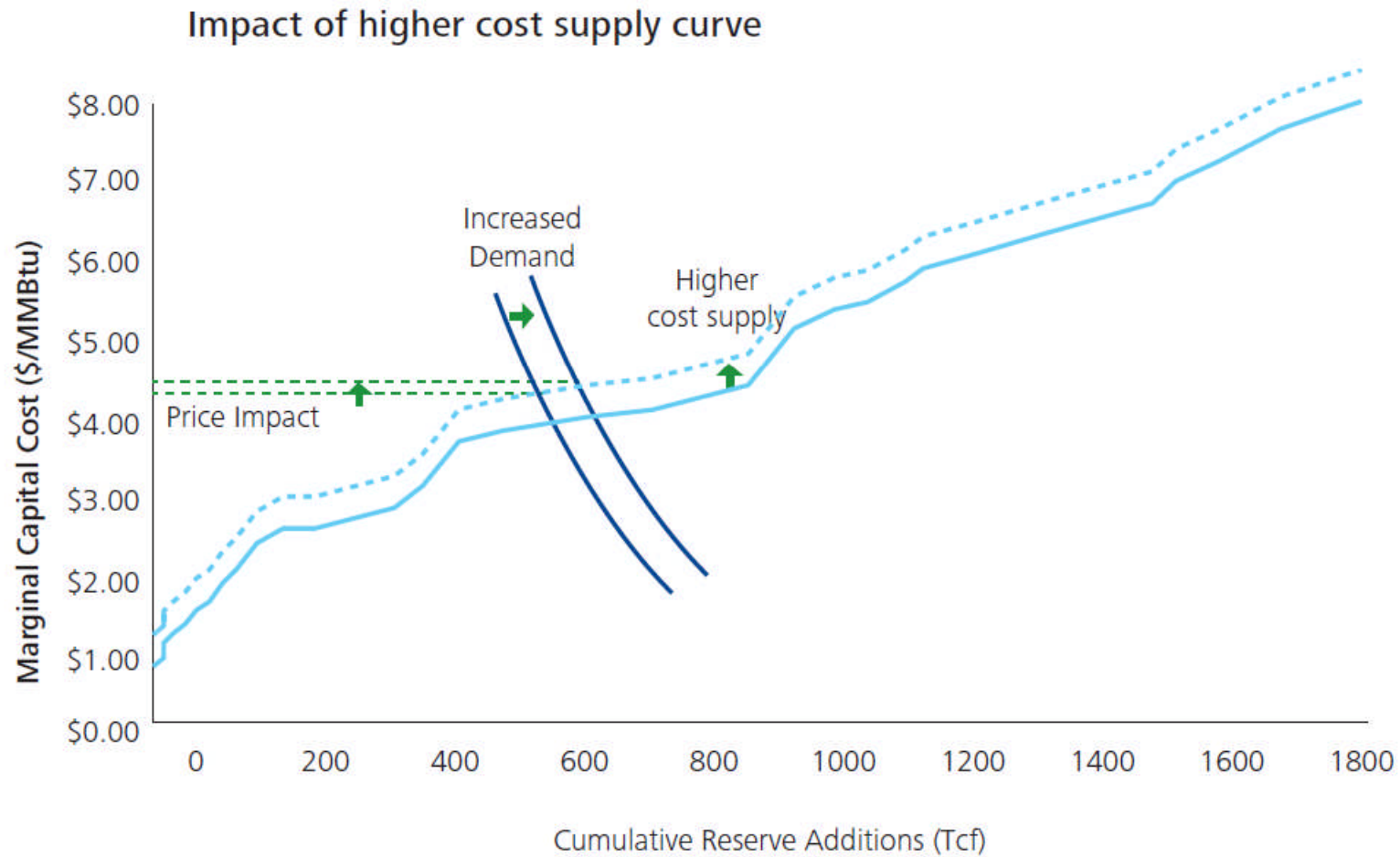


Potential impact of demand change depends on the shape of the supply curve



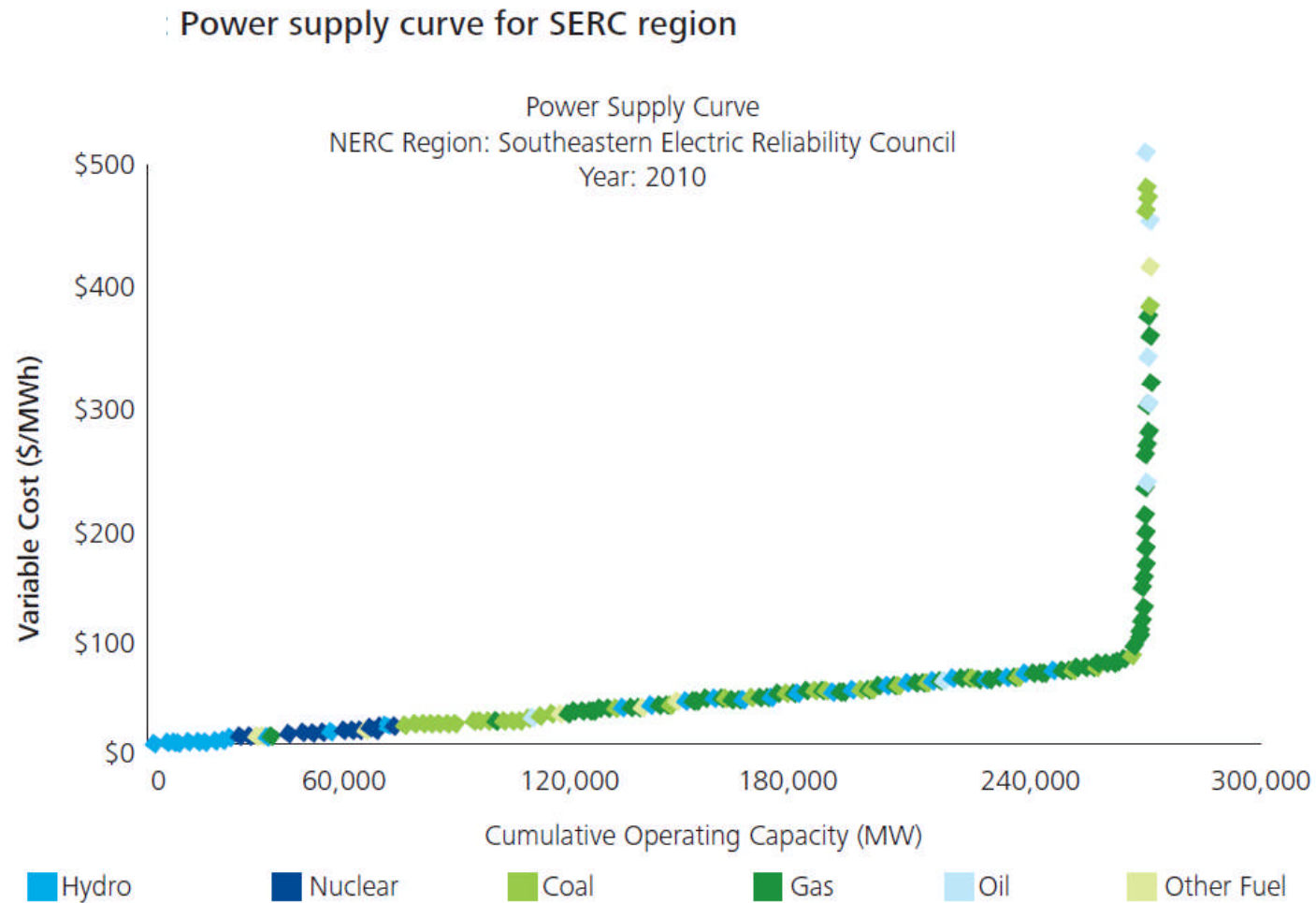
Source: Deloitte MarketPoint LLC

Less optimistic supply assumptions will not necessarily change the impact



Source: Deloitte MarketPoint LLC

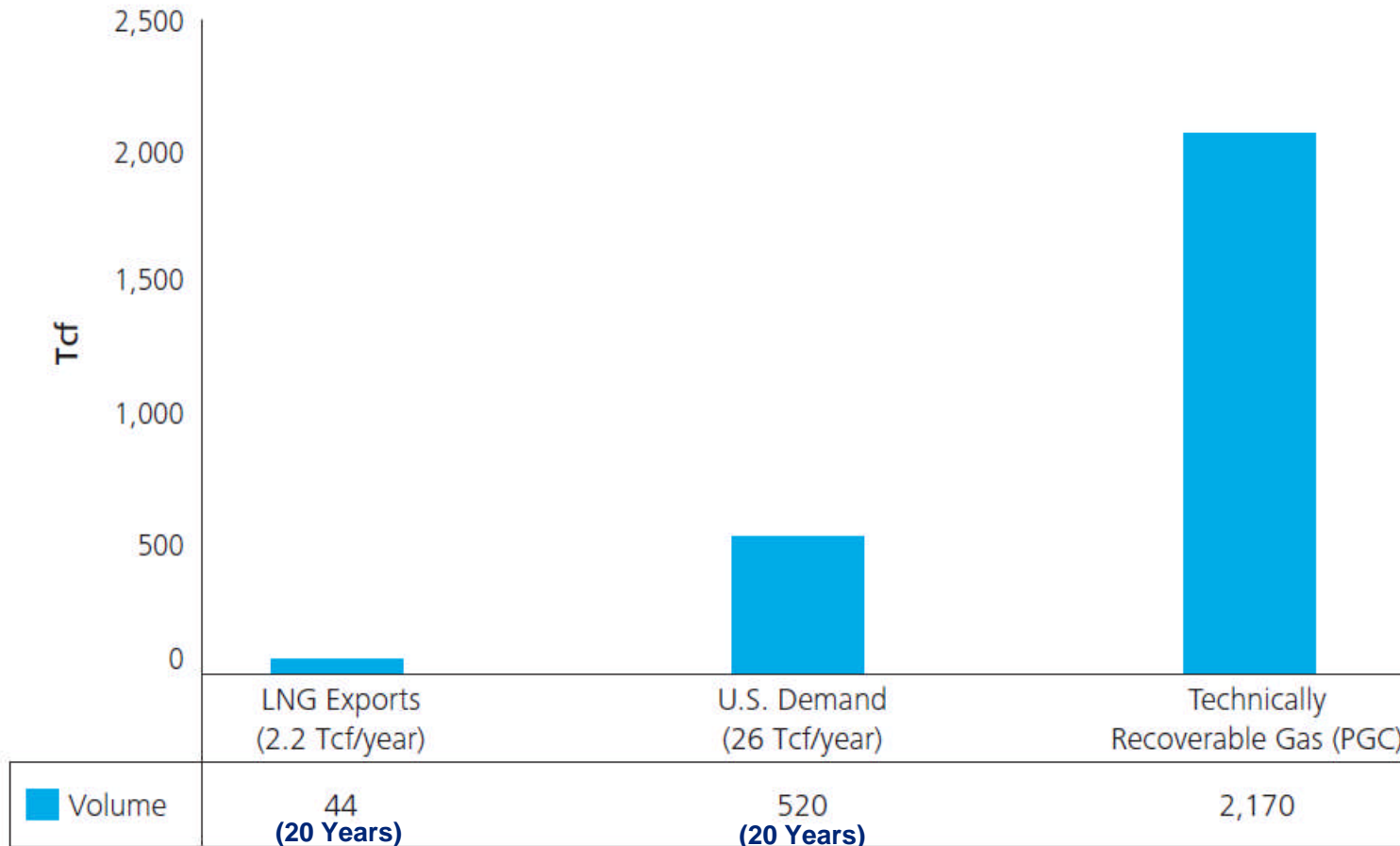
Just as in gas, the supply curve determines the electricity price impact



The volume of exports are small relative to total supply

Exports are unlikely to have an energy security impact

Comparison of volumes



Source: Deloitte MarketPoint; Potential Gas Committee

Issues raised related to LNG exports

- Supply sufficiency
 - Supply is inadequate for both domestic consumption and exports
- Price impact
 - Exports will raise prices and harm competitiveness of U.S. industries
 - Connection with foreign markets will raise price volatility in the U.S.
- Security implications
 - Domestic production of natural gas should be used domestically to offset dependence on foreign supplies

U.S. LNG exports will operate in a global market

Federal Energy Regulatory Commission • Market Oversight • www.ferc.gov/oversight

World LNG Estimated April 2012 Landed Prices



Source: Federal Energy Regulatory Commission (FERC)

World LNG Estimated May 2012 Landed Prices



Key question: Will U.S. supply be able to keep up with demand including exports?

- If no, the price will likely increase sharply until supply catches up with demand.
 - Price volatility might also rise due to temporal tightness of supply-demand balance.
- If yes, price impact likely will be minimal.
 - Price impact will be determined largely by the change in production cost of marginal field, which should be minimal given a flat supply curve.
 - Recent history demonstrates how dynamic the market is.





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Deloitte MarketPoint is a decision support solutions company focused on fundamental market analysis and price forecasting. We provide software and models with consulting services to help energy companies make informed decisions. Our solutions are comprised of our software applications, such as MarketBuilder, our models, our market data, and consulting services. Certain services may not be available to attest clients under the rules and regulations of public accounting.

Deloitte MarketPoint LLC, the result of Deloitte's acquisition of substantially all the assets of MarketPoint Incorporated and Altos Management Partners (MarketPoint/Altos) in 2011, combines the global strength and quantitative experience of Deloitte and the member firm network of Deloitte Touche Tohmatsu Limited with the market-leading software and time-tested energy market success of MarketPoint/Altos. Deloitte MarketPoint is located within the Deloitte Center for Energy Solutions. www.deloittemarketpoint.com

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The Shale Gas Revolution: Implications for the United States

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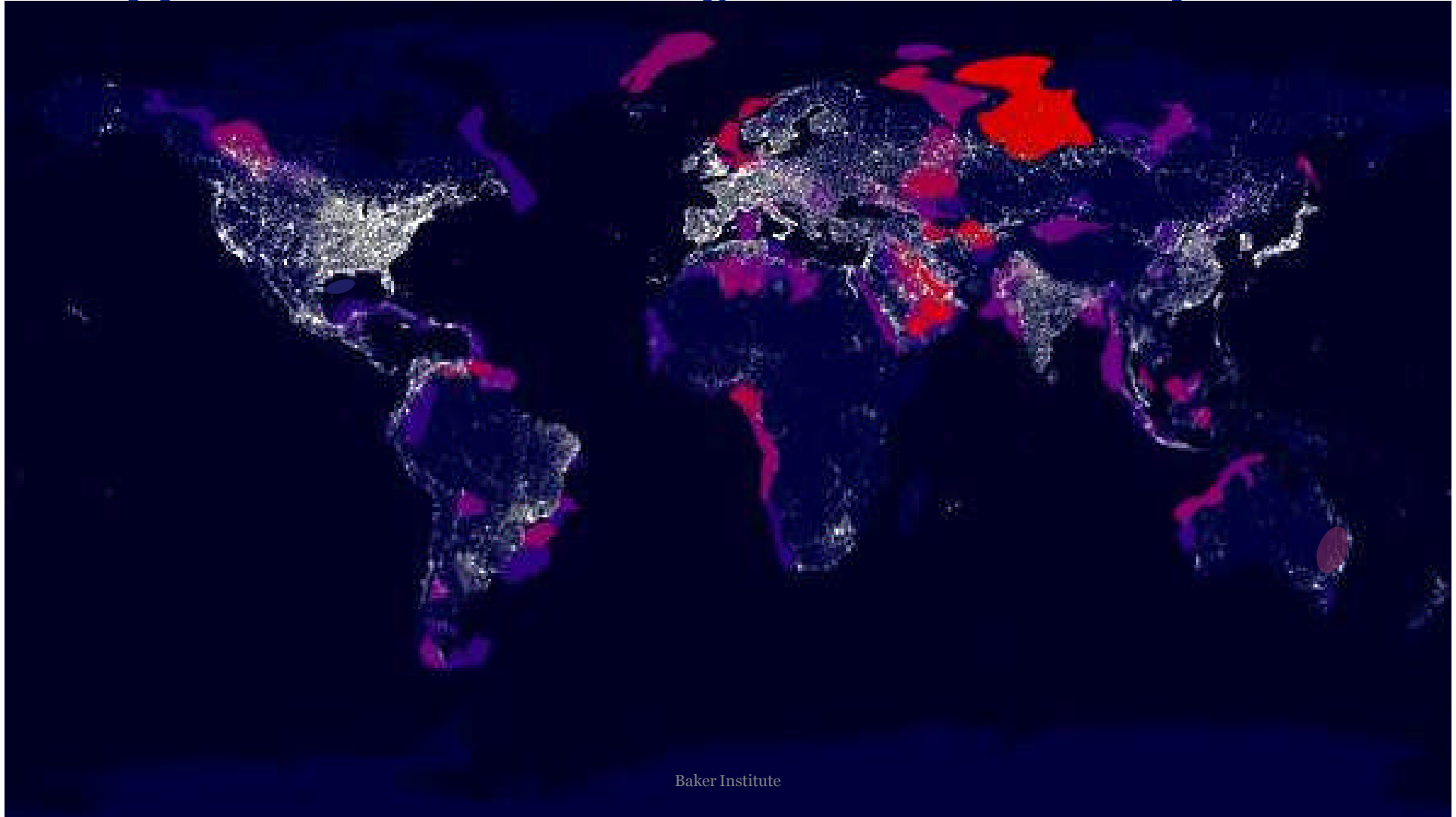
Mayer Brown LLP

May 23, 2012



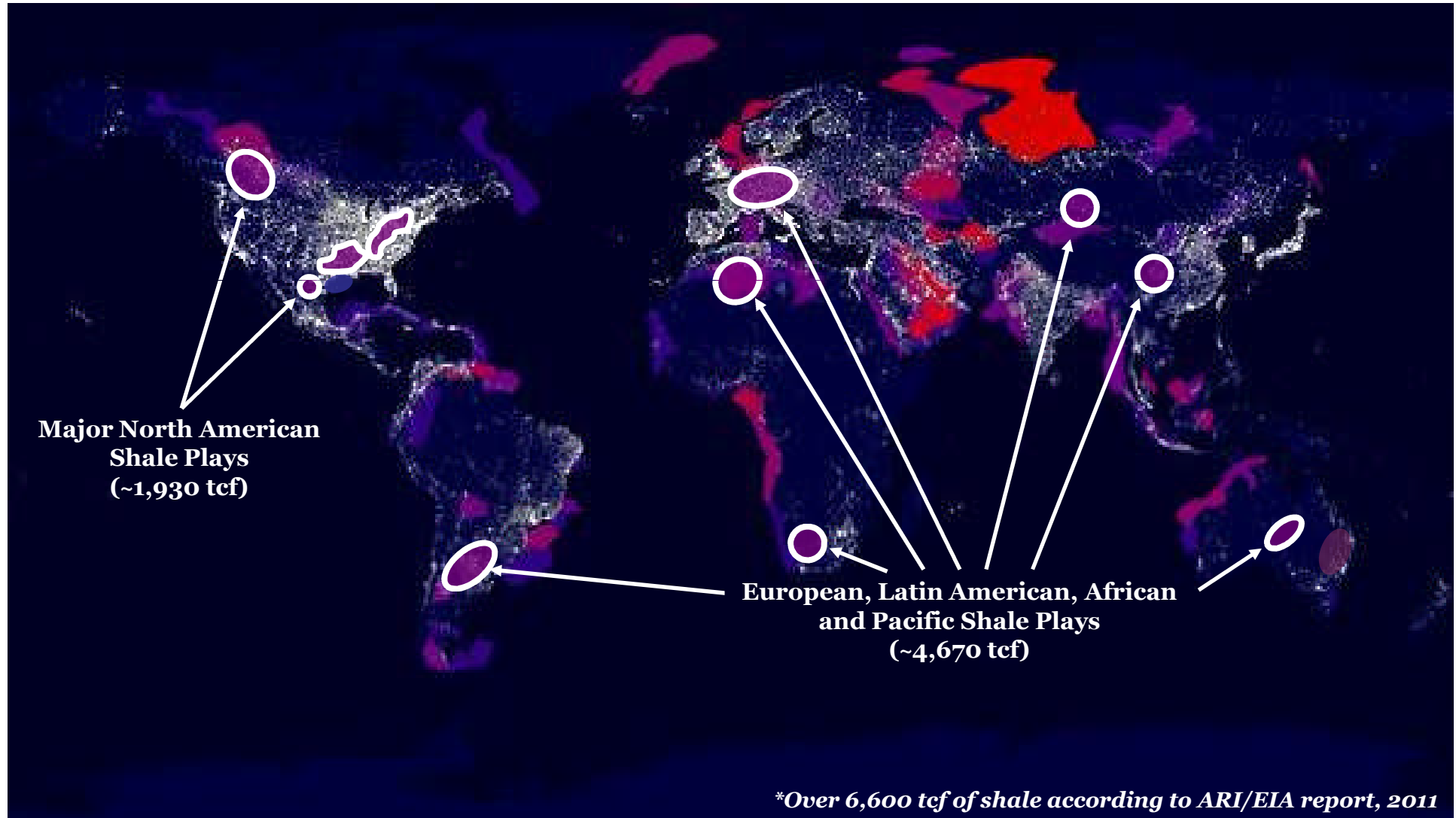
RICE UNIVERSITY

Prior to 2005, it looked like remaining large reserves were far from end-use markets and Middle East/FSU supplies would dominate global market ala “peak oil”



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New World Vision: Shale will alter the energy security picture for major end-use markets, limiting individual producer petro-power and creating a more competitive marketplace for LNG and potentially enable further market liberalization in Europe and elsewhere



What has the “shale revolution” meant for the United States?

US Shale: No sign of Slowdown

- As knowledge expands, more shale plays may become commercial targets and greater proportions of shale resources may become technically feasible.
- Developers also becoming better at identifying optimal drill sites... Barnett is a good case in point.
- Investors shifting to liquids rich plays, with natural gas as a byproduct
- Low prices might bring consolidation but unlikely to derail investment trend



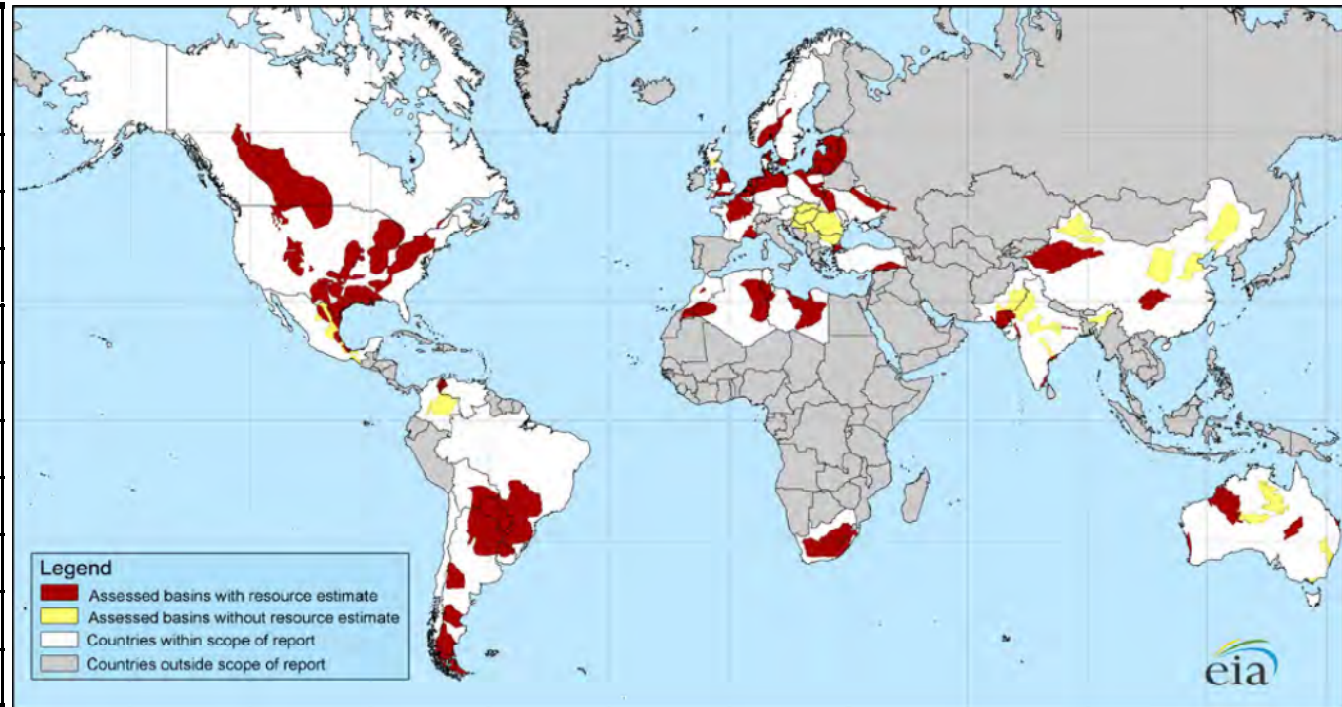
Over ten shale plays have high liquids potential

- Total technically recoverable resource endowment may exceed 60 billion barrels
- Oil potential is widely distributed geographically
- North Dakota (Bakken); Texas-New Mexico (Permian Basin, Avalon, Bone Springs, Wolfcamp, Eagleford); Ohio (Utica); Pennsylvania (Marcellus); Colorado-Wyoming (Niobrara); Florida (Sunniland); Louisiana (Tuscaloosa); Oklahoma (Mississippi Lime); California (Monterrey Basin)
- Technical and cost challenges rapidly being overcome through experience



The Global Shale Gas Resource

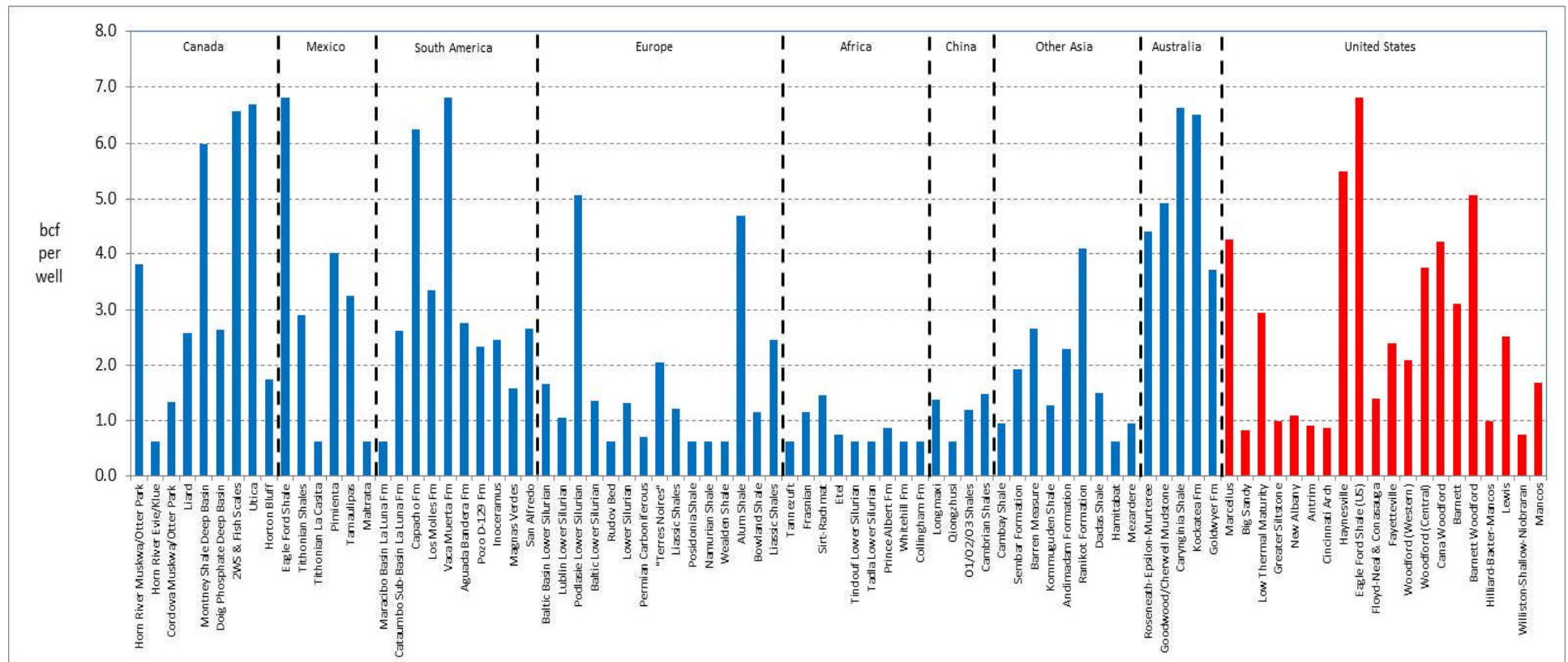
Region	Technically Recoverable Resource (tcf)
North America	1,931
Latin America	1,225
Europe	639
Former USSR	---
China and India	1,338
Australasia	396
Africa	1,043
Middle East	---
Other	51
Total	6,622



Source: ARI/EIA (2011)

EURs in Shale Plays

- EURs estimated using geophysical data for known shale plays in North America and econometrically fit for RoW shales.
 - Tiers constructed with pdfs of EURs informed by average EUR and US well performance.



- Drilling and Completion costs estimated using known North American plays and econometrically fit to drilling depth.

		Tier 1		Tier 2		Tier 3	
	Total Included Recoverable Resource (tcf)	Recoverable Resource (tcf)	Wellhead Breakeven Price (\$/mcf)	Recoverable Resource (tcf)	Wellhead Breakeven Price (\$/mcf)	Recoverable Resource (tcf)	Wellhead Breakeven Price (\$/mcf)
Antrim	7.9	4.0	\$ 4.91	4.0	\$ 7.09	5.3	\$ 13.87
Devonian/Ohio	299.9						
Utica	6.8	3.4	\$ 3.74	3.4	\$ 5.40	4.5	\$ 10.56
Marcellus	278.0	83.4	\$ 2.93	83.4	\$ 4.24	111.2	\$ 8.28
Cincinnati Arch	0.7	0.4	\$ 6.03	0.4	\$ 8.71	0.5	\$ 17.03
Devonian Siltstone and Shale	7.0	3.5	\$ 5.34	3.5	\$ 7.71	4.7	\$ 15.07
Big Sandy	5.0	2.5	\$ 6.31	2.5	\$ 9.11	3.3	\$ 17.81
Nora Haysi	2.4	1.2	\$ 6.47	1.2	\$ 9.34	1.6	\$ 18.27
New Albany	8.3	4.1	\$ 5.05	4.1	\$ 7.29	5.5	\$ 14.25
Floyd-Neal & Conasauga	2.6	1.3	\$ 6.25	1.3	\$ 9.02	1.7	\$ 17.65
Haynesville	106.0	31.8	\$ 2.92	31.8	\$ 4.22	42.4	\$ 8.25
Fayetteville	36.2	10.9	\$ 2.79	10.9	\$ 4.03	14.5	\$ 7.88
Woodford Arkoma	22.3	6.7	\$ 3.13	6.7	\$ 4.51	8.9	\$ 8.83
Woodford Ardmore	4.2	1.3	\$ 4.54	1.3	\$ 6.56	1.7	\$ 12.83
Cana Woodford	8.0	2.4	\$ 3.31	2.4	\$ 4.78	3.2	\$ 9.35
Barnett	58.0	17.4	\$ 2.66	17.4	\$ 3.83	23.2	\$ 7.50
Barnett and Woodford	35.4	10.6	\$ 2.88	10.6	\$ 4.16	14.2	\$ 8.13
Eagle Ford	42.0	12.6	\$ 2.36	12.6	\$ 3.40	16.8	\$ 6.66
Lewis	20.2	6.1	\$ 3.12	6.1	\$ 4.50	8.1	\$ 8.79
Bakken	3.8	1.1	\$ 2.31	1.1	\$ 3.34	1.5	\$ 6.53
Niobrara	0.8	0.8	\$ 7.28	0.8	\$ 10.50	1.1	\$ 20.54
Hilliard/Baxter/Mancos	3.5	3.5	\$ 9.65	3.5	\$ 13.94	4.7	\$ 27.25
Paradox/Uinta	9.5	4.7	\$ 6.80	4.7	\$ 9.82	6.3	\$ 19.21
Total US Shale	668.7						

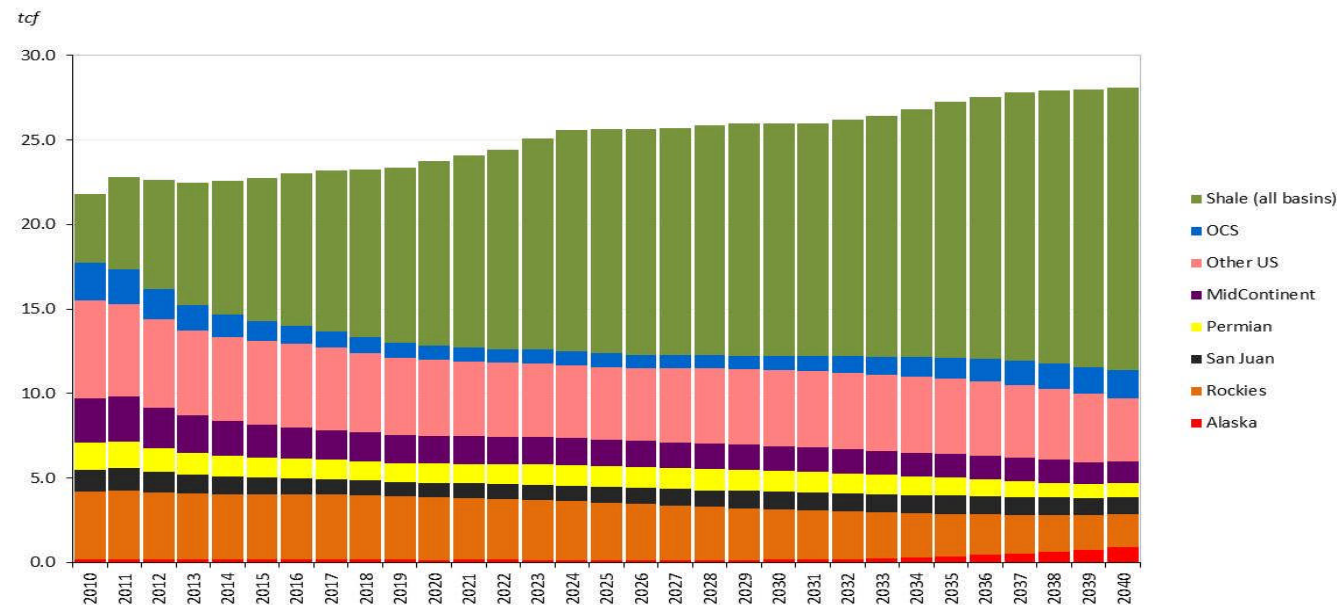
	Total Included Recoverable Resource (tcf)	Tier 1		Tier 2		Tier 3	
		Recoverable Resource (tcf)	Wellhead Breakeven Price (\$/mcf)	Recoverable Resource (tcf)	Wellhead Breakeven Price (\$/mcf)	Recoverable Resource (tcf)	Wellhead Breakeven Price (\$/mcf)
Horn River/Cordova/Liard	158.5	56.7	\$ 3.69	48.6	\$ 5.33	53.2	\$ 10.42
Montney/Deep Colorado	136.0	40.8	\$ 2.58	40.8	\$ 3.73	54.4	\$ 7.30
Utica	27.0	8.1	\$ 2.89	8.1	\$ 4.17	10.8	\$ 8.16
Horton Bluff	1.2	0.6	\$ 4.85	0.6	\$ 7.00	0.8	\$ 13.69
Total Canadian Shale	321.5						
Burgos/Sabinas (incl. Eagle Ford)	163.3	51.3	\$ 2.96	48.0	\$ 4.27	64.0	\$ 8.36
Tampico/Tuxpan/Veracruz	33.3	18.0	\$ 3.64	15.3	\$ 5.26	20.4	\$ 10.29
Total Mexican Shale	196.6						
Maracaibo/Catatumbo (Venezuela)	7.5	5.4	\$ 4.62	2.1	\$ 6.67	2.8	\$ 13.04
Catatumbo (Colombia)	7.2	3.6	\$ 2.98	3.6	\$ 4.30	4.8	\$ 8.41
San Alfredo (Bolivia)	31.3	15.6	\$ 4.86	15.6	\$ 7.01	20.8	\$ 13.71
San Alfredo (Brazil)	137.5	68.8	\$ 4.27	68.8	\$ 6.16	91.7	\$ 12.04
San Alfredo (Paraguay)	40.6	20.3	\$ 4.54	20.3	\$ 6.56	27.1	\$ 12.82
San Alfredo (Argentina)	103.2	51.6	\$ 4.27	51.6	\$ 6.16	68.8	\$ 12.04
Neuquen (Argentina)	407.0	122.1	\$ 2.76	122.1	\$ 3.98	162.8	\$ 7.79
San Jorge/Magallanes (Argentina)	160.2	80.1	\$ 4.38	80.1	\$ 6.32	106.8	\$ 12.35
Total South American Shale	894.5						
Australia (Cooper)	85.0	25.5	\$ 3.10	25.5	\$ 4.47	34.0	\$ 8.75
Australia (Maryborough)	23.0	6.9	\$ 3.32	6.9	\$ 4.79	9.2	\$ 9.37
Australia (Perth)	59.0	17.7	\$ 2.96	17.7	\$ 4.27	23.6	\$ 8.35
Australia (Canning)	229.0	68.7	\$ 3.57	68.7	\$ 5.16	91.6	\$ 10.09
Total Australian Shale	396.0						

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	Total Included Recoverable Resource (tcf)	Tier 1		Tier 2		Tier 3	
		Recoverable Resource (tcf)	Wellhead Breakeven Price (\$/mcf)	Recoverable Resource (tcf)	Wellhead Breakeven Price (\$/mcf)	Recoverable Resource (tcf)	Wellhead Breakeven Price (\$/mcf)
Austria (Mikulov)	32.0	16.0	\$ 6.50	16.0	\$ 9.38	21.3	\$ 18.35
Poland (Baltic)	77.4	38.7	\$ 6.68	38.7	\$ 9.64	51.6	\$ 18.86
Poland (Lublin)	13.2	13.2	\$ 9.64	13.2	\$ 13.92	17.6	\$ 27.22
Poland (Podlasie)	14.0	4.2	\$ 3.48	4.2	\$ 5.02	5.6	\$ 9.82
Lithuania (Baltic)	13.8	6.9	\$ 6.68	6.9	\$ 9.64	9.2	\$ 18.86
Ukraine (Dneiper-Donets)	---	3.6	\$ 18.21	3.6	\$ 26.29	4.8	\$ 51.41
Ukraine (Lublin)	18.0	9.0	\$ 7.40	9.0	\$ 10.68	12.0	\$ 20.88
France (Permian Carb)	---	22.8	\$ 17.68	22.8	\$ 25.52	30.4	\$ 49.91
France (Terres Noires/Liassic)	62.4	31.2	\$ 4.58	31.2	\$ 6.60	41.6	\$ 12.92
Germany (Posidonia/Wealden)	7.5	7.5	\$ 10.02	7.5	\$ 14.46	10.0	\$ 28.28
Norway (Alum)	82.3	24.7	\$ 3.15	24.7	\$ 4.54	32.9	\$ 8.88
Sweden (Alum)	41.2	12.3	\$ 3.22	12.3	\$ 4.65	16.5	\$ 9.09
Denmark (Alum)	23.5	7.1	\$ 3.18	7.1	\$ 4.59	9.4	\$ 8.97
UK (Bowland)	11.4	5.7	\$ 5.89	5.7	\$ 8.50	7.6	\$ 16.62
UK (Liassic)	13.2	6.6	\$ 4.55	6.6	\$ 6.57	8.8	\$ 12.85
Total European Shale	409.9						
Algeria (Ghadames)	63.1	63.1	\$ 8.87	63.1	\$ 12.80	84.1	\$ 25.04
Algeria (Tindouf)	---	15.0	\$ 15.31	15.0	\$ 22.10	20.0	\$ 43.23
Tunisia (Ghadames)	6.2	6.2	\$ 8.51	6.2	\$ 12.29	8.3	\$ 24.03
Libya (Sirt/Etel)	81.9	81.9	\$ 7.83	81.9	\$ 11.30	109.2	\$ 22.10
Morocco (Tadla)	---	0.9	\$ 14.65	0.9	\$ 21.15	1.2	\$ 41.37
South Africa (Prince Albert/Whitehill/Collingham)	145.5	145.5	\$ 10.34	145.5	\$ 14.93	194.0	\$ 29.19
Total African Shale	296.7						
China (Sichuan-Longmaxi/Qiongzhusi)	415.2	207.6	\$ 7.15	207.6	\$ 10.33	276.8	\$ 20.20
China (Tarim-O1,O2,O3 Shales/Cambrian)	349.8	174.9	\$ 6.87	174.9	\$ 9.92	233.2	\$ 19.40
India (Cambay/Indus)	24.0	12.0	\$ 6.25	12.0	\$ 9.03	16.0	\$ 17.65
India (Damodar/Krishna)	20.4	10.2	\$ 4.11	10.2	\$ 5.93	13.6	\$ 11.60
India (Cauvery)	5.4	2.7	\$ 5.47	2.7	\$ 7.90	3.6	\$ 15.45
Pakistan (Indus)	18.6	9.3	\$ 4.19	9.3	\$ 6.05	12.4	\$ 11.83
Turkey (Anatolia)	5.4	2.7	\$ 6.73	2.7	\$ 9.71	3.6	\$ 18.99
Turkey (Thrace)	1.8	1.8	\$ 10.31	1.8	\$ 14.89	2.4	\$ 29.11
Total Asian Shale	840.6						

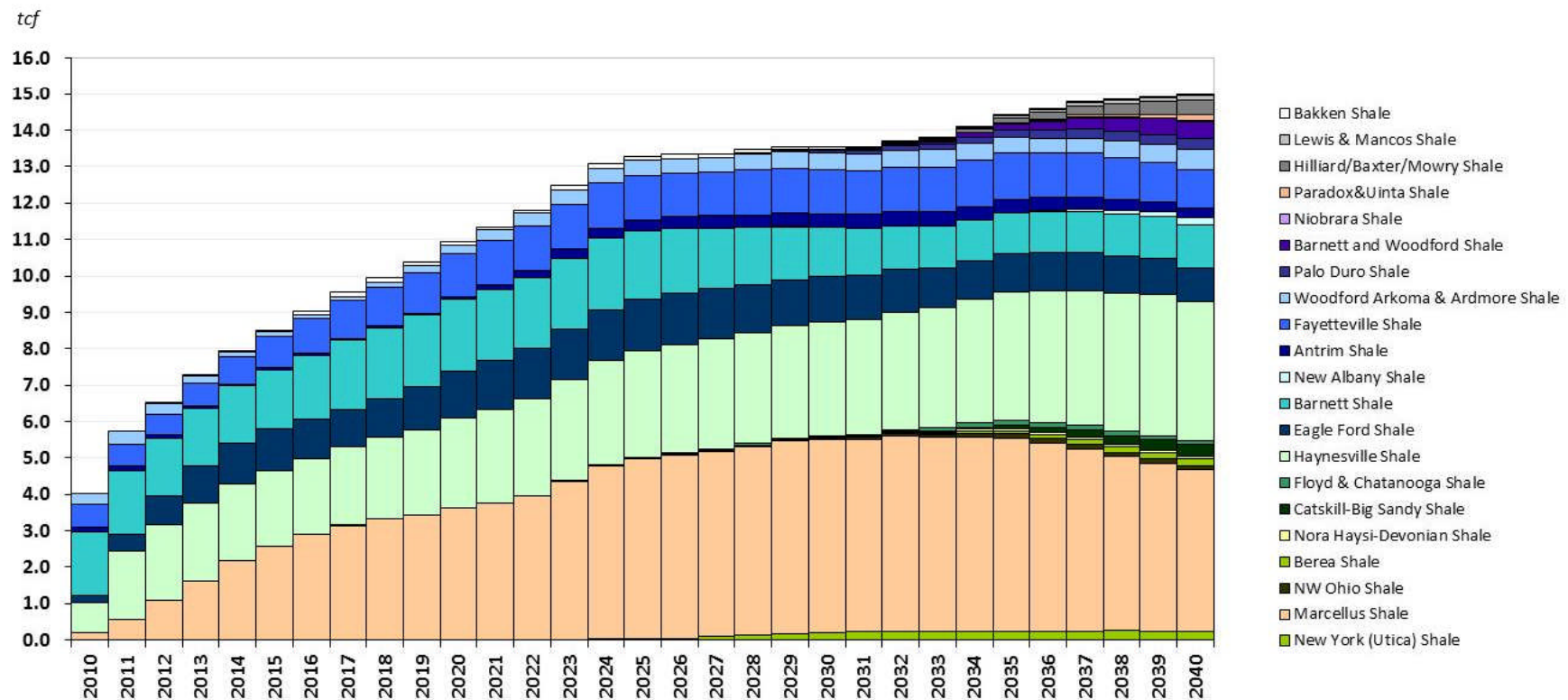
Baker Institute Reference Case, 2010-2040

- U.S. shale gas production exceeds 50% of total production by 2030.
- US economy gradually shifts away from carbon-intensive coal use to a higher proportion of natural gas, reducing overall national GHG emission levels that would take place in a world without shale. However, in the reference case where shale gas wins the day over coal (ie coal isn't protected), US GHG emissions still rise by 20% by 2050.
- Rising US shale gas production means a shift to electrified vehicles can be done at a lower cost than might otherwise have been possible.



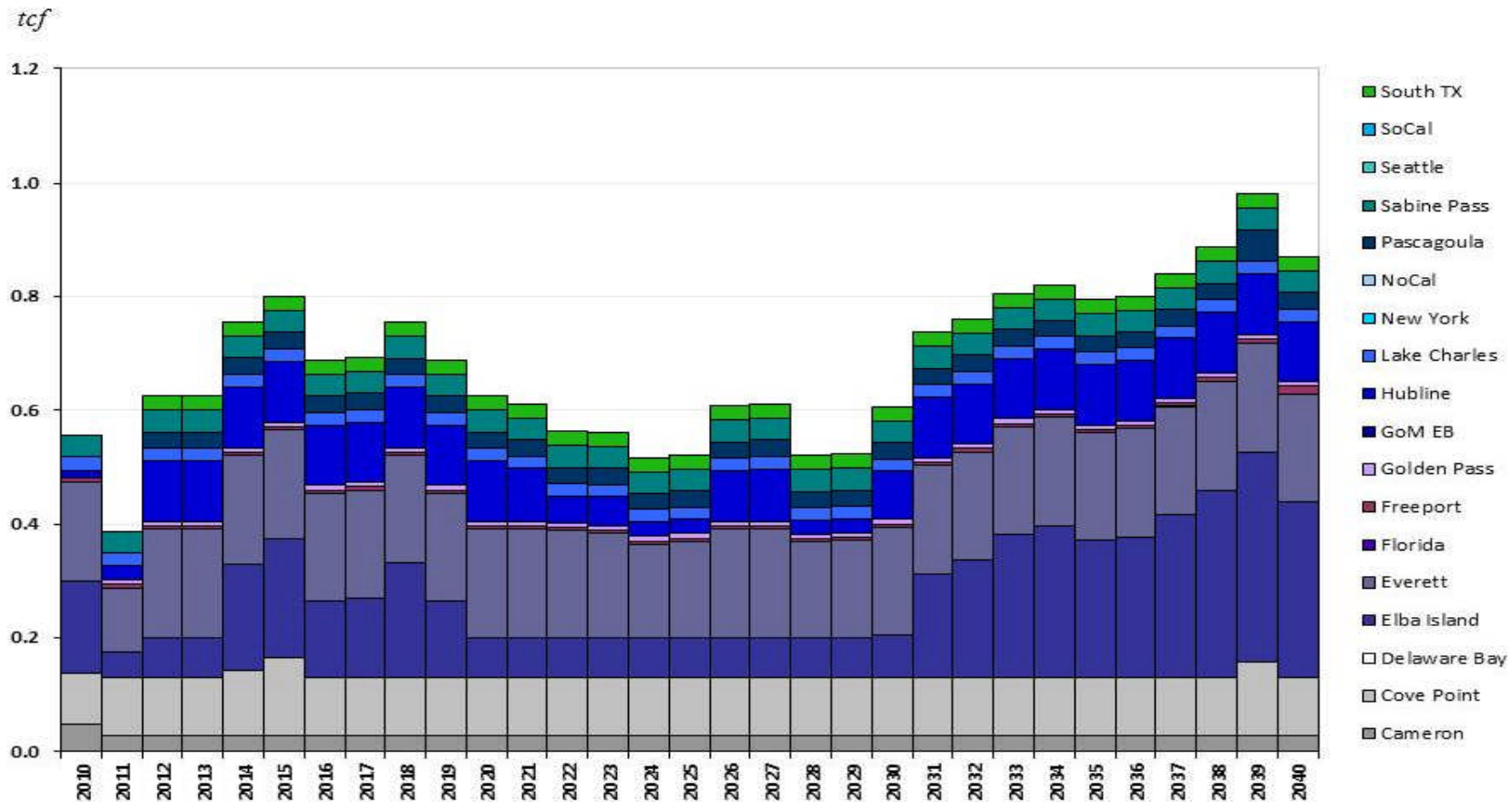
Baker Institute Reference Case: U.S. Shale Production, 2010-2040

- US shale production accounts for over 50% of domestic production by the 2030s.
- Strongest long term production in the Marcellus and Haynesville shales, followed by Barnett, Eagle Ford, and Fayetteville shales.

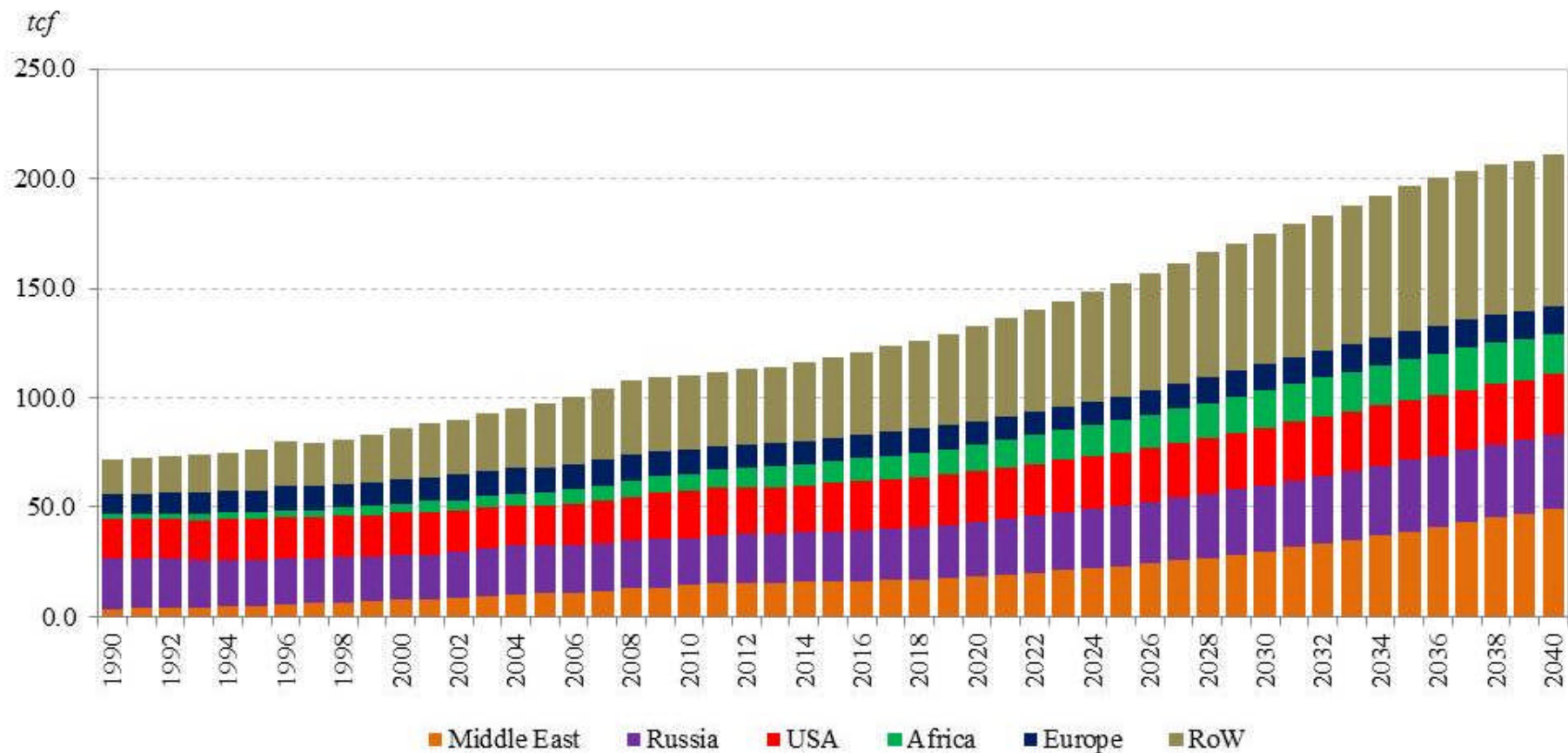


Baker Institute Reference Case: Need for U.S. LNG Imports Virtually Eliminated for Two Decades

- Very low re-gas terminal capacity utilization through 2040.



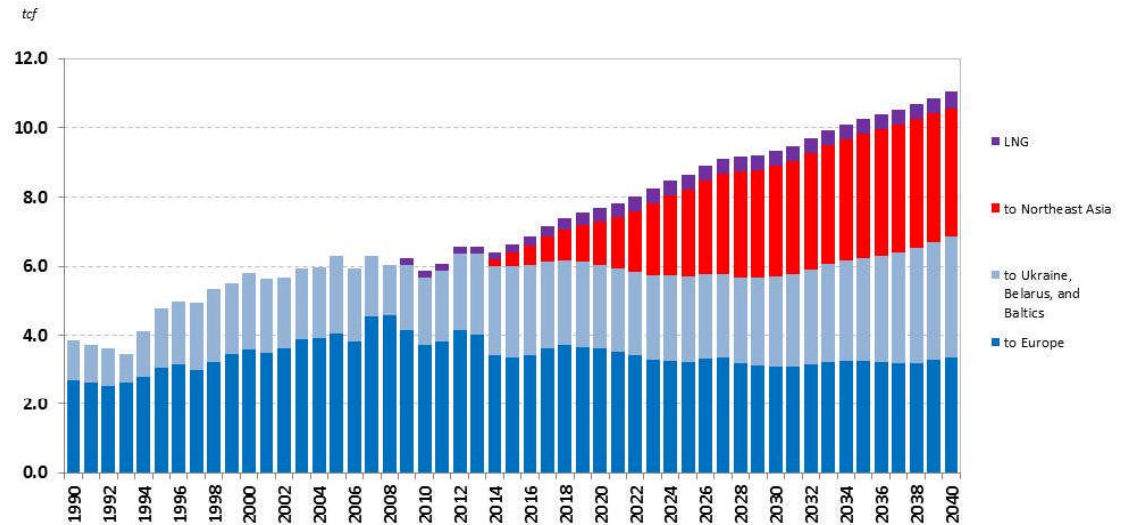
Already, shale gas is delaying heavy reliance on Middle East Gas for decades



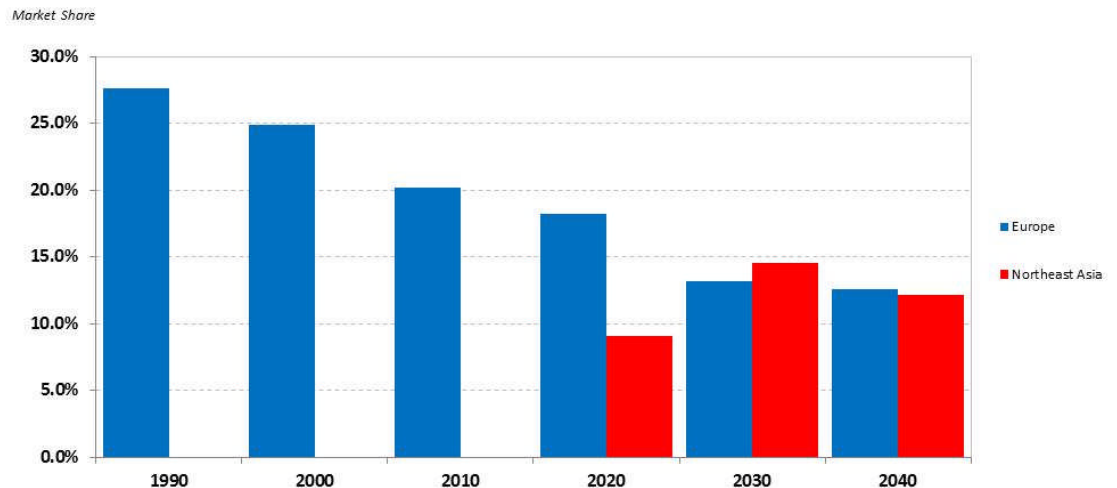
World Supply by Region, 1990-2040 (Baker Institute Reference Case)

Baker Institute Reference Case: Russian Exports, 1990-2040

- Russian opportunities to Europe are diminishing as a result of shale production growth and Europe's increased pull on LNG.

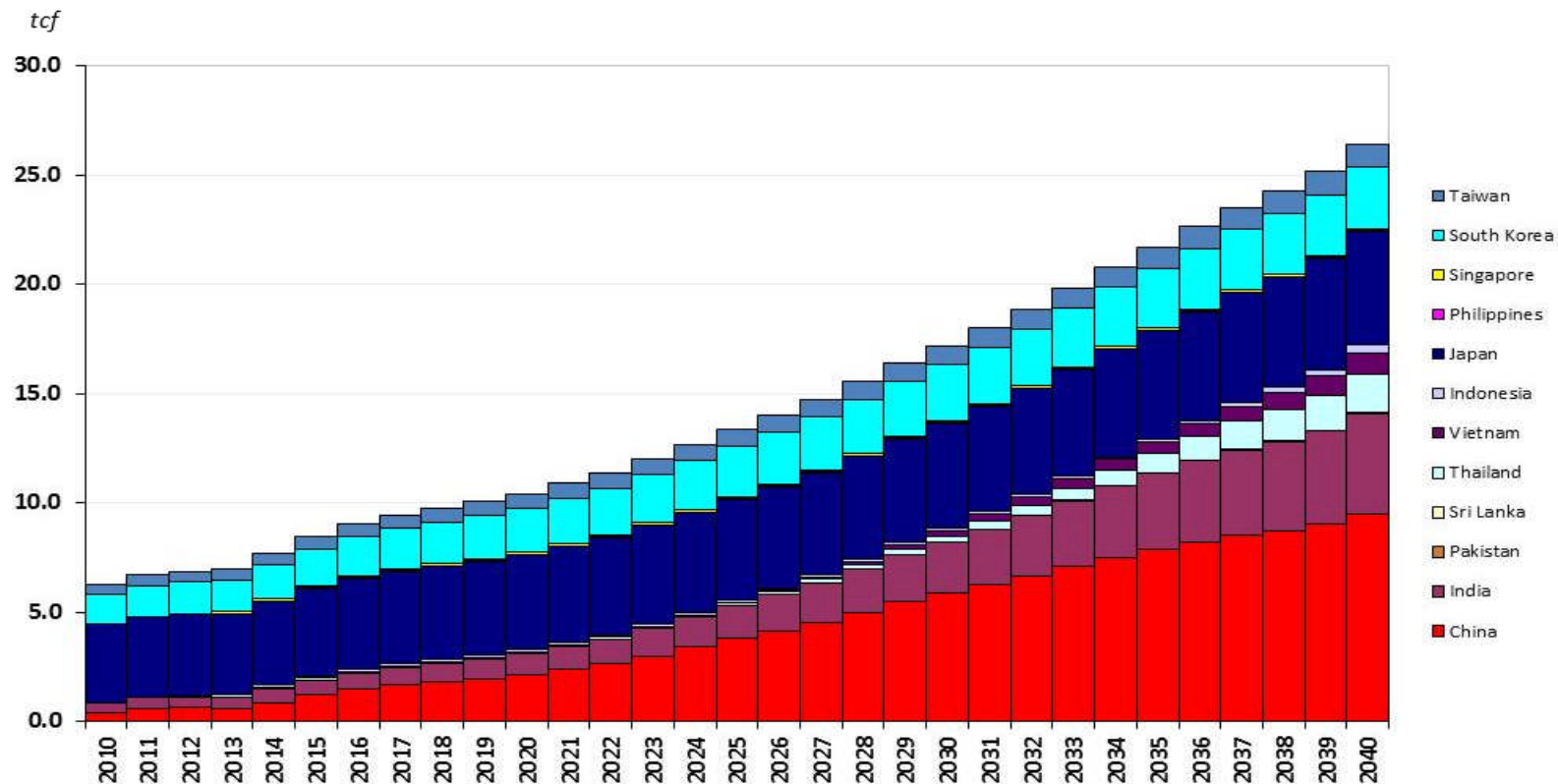


- The market share of Russia in non-FSU Europe is falling and could be below 13% by 2040.



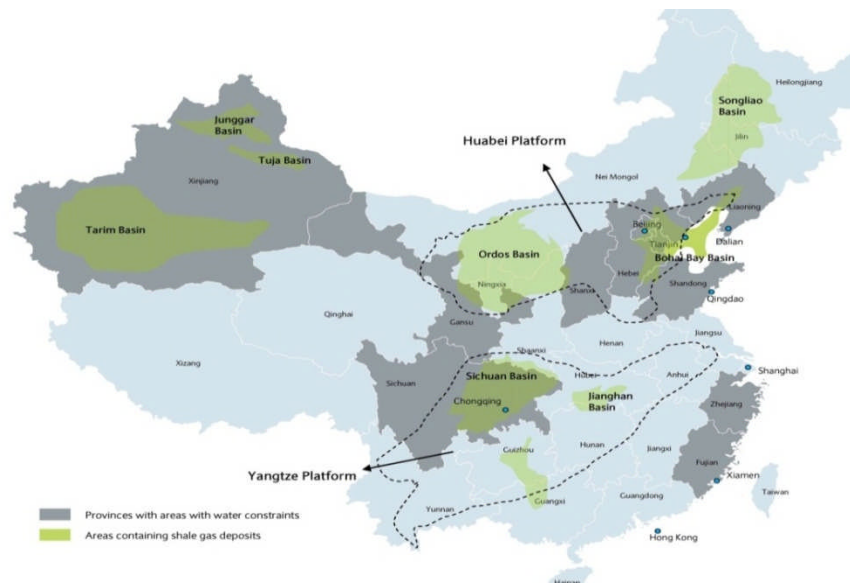
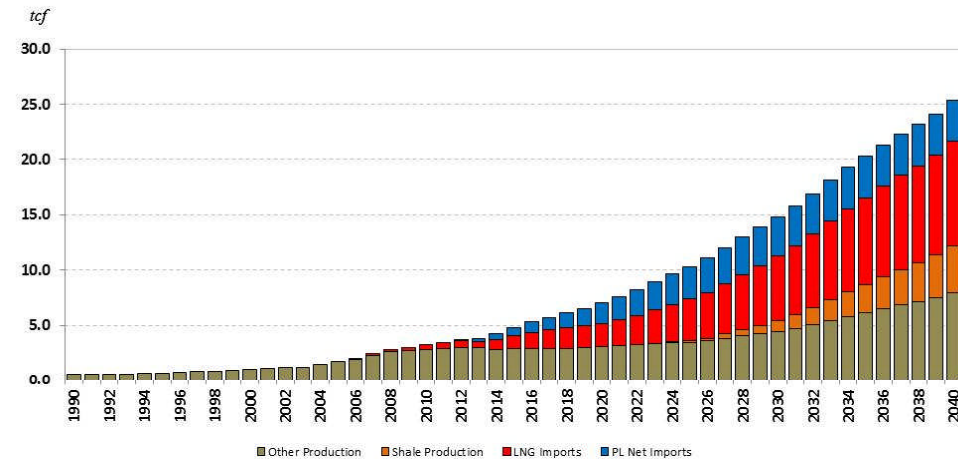
Baker Institute Reference Case: LNG Imports to Asia 2010-2040

- Strong demand growth means Asia is the major destination for future LNG exports.
 - China leads in LNG import growth despite growth in both pipeline imports and supplies from domestic unconventional sources.



Reference Case: Shale Production in Asia, 1990-2040

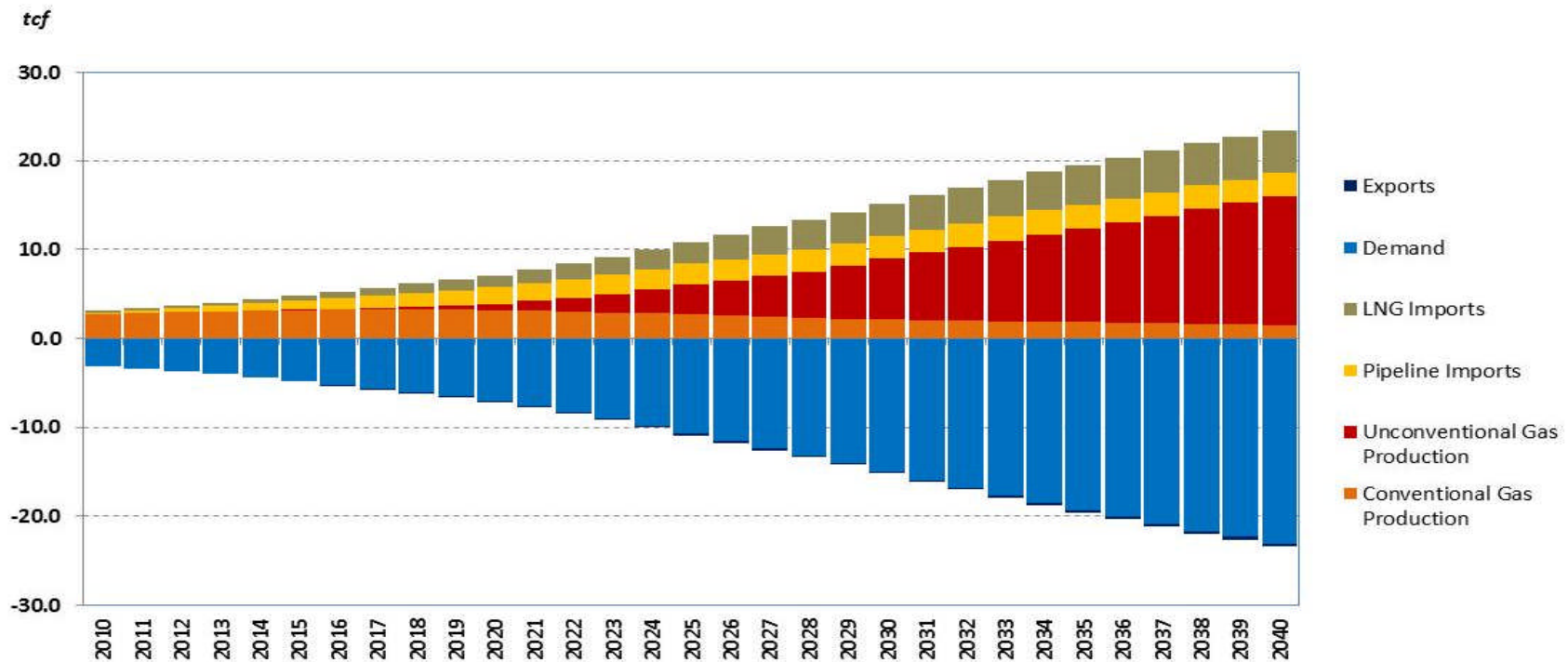
- Shale gas production in China grows to about 15% of the domestic market, but LNG is by far the largest single source of natural gas supply to China out to 2040.



- Water will likely play a major role in Chinese shale production endeavors, as indicated by the fact that known shale plays are coincident with regions where water stress is already high.

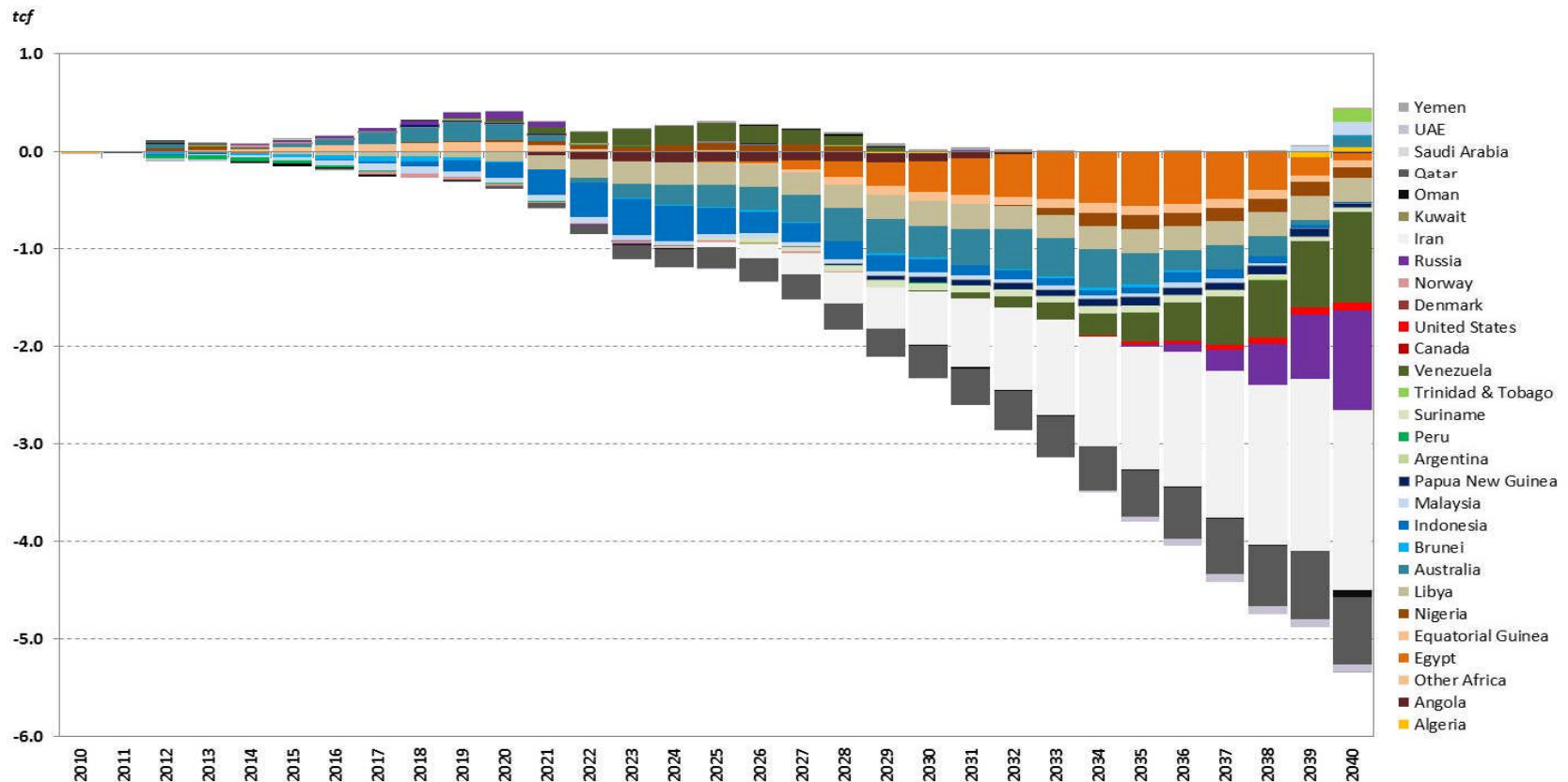
China High Shale Scenario Case: LNG Imports to Asia 2010-2040

- If China could develop its own shale rapidly, window for LNG imports would significantly shrink



China High Shale Scenario Case: LNG Exports by Country 2010-2040

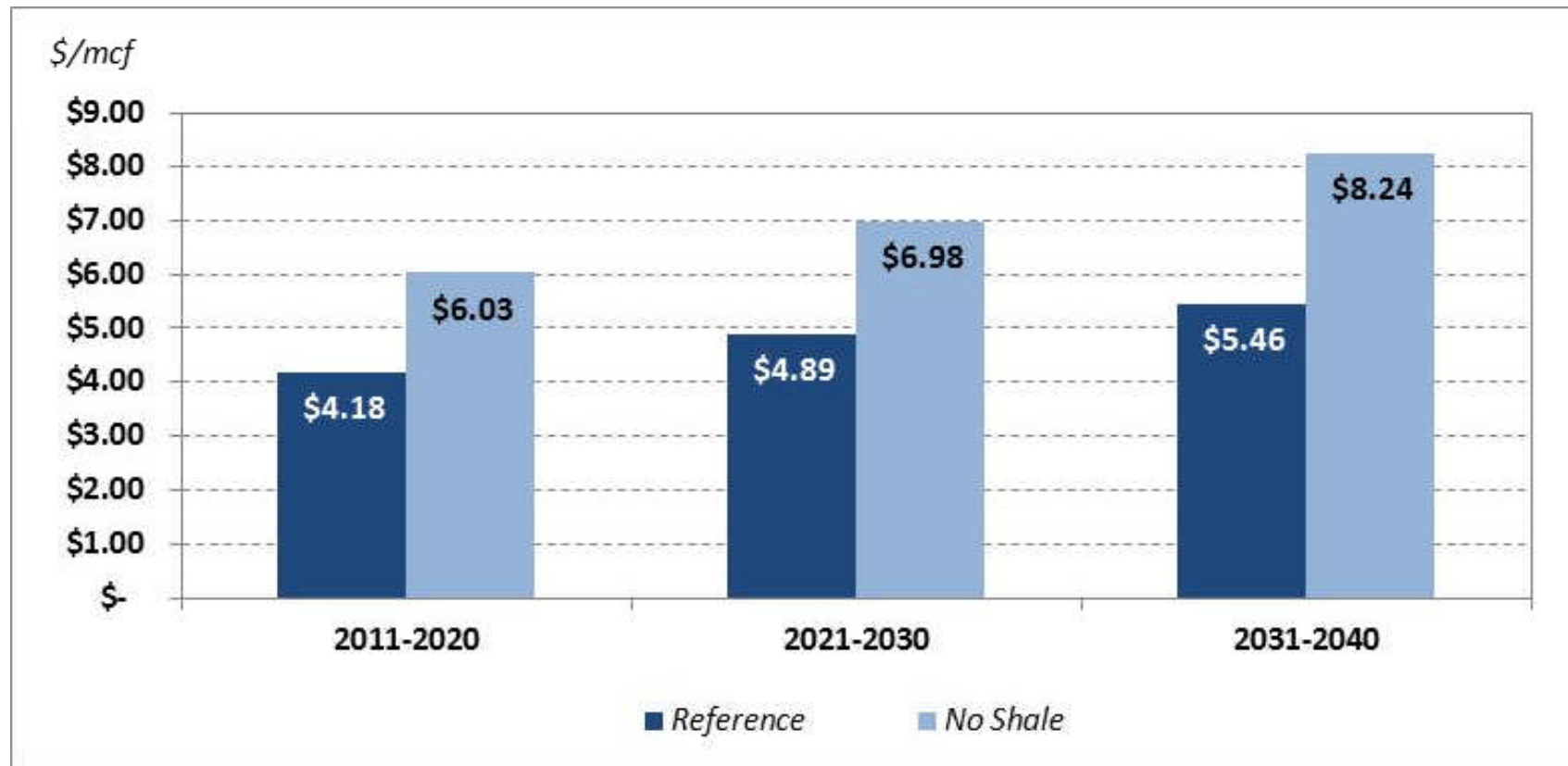
- Exports from Iran, Venezuela, Qatar and Russia most affected



Impact of Shale on Henry Hub Prices, 2011-2040

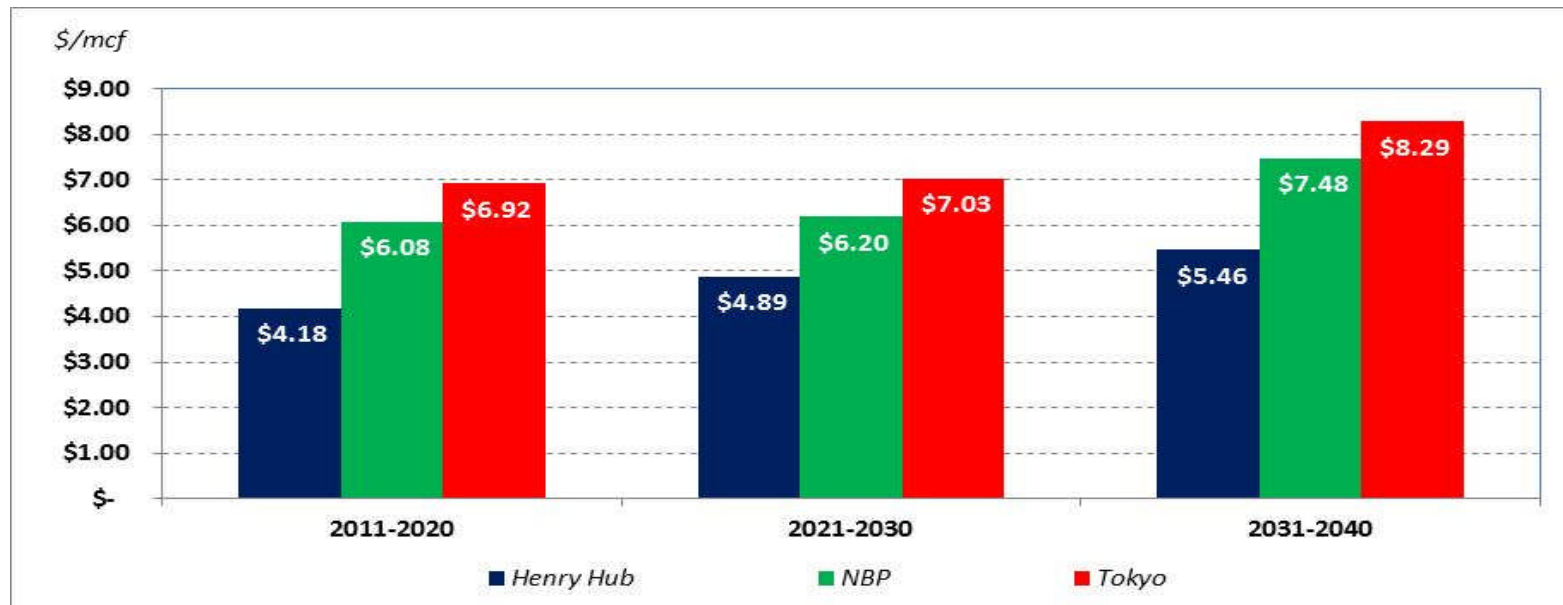
- The domestic supply curve is much more elastic as a result of shale gas developments. In fact, production is lower and price is higher without shale.
- Domestic long run elasticity
 - with shale = 1.52; without = 0.29.

Source: Medlock, Jaffe, Hartley 2010



Baker Institute Reference Case: Global Marker Prices, 2010-2040

- US will enjoy an energy cost advantage over other economies. This could have several policy implications:
 - 1) lower the costs in terms of global economic competition of implementing carbon abatement policies vs costs that would have resulted from rising US dependency on LNG premiums
 - 2) attract carbon-intensive industries back to US, making it harder for US to lower GHG emissions overall
- *Note, the US price is Henry Hub, the European price is NBP, and the indicated Asian price is the Japanese price paid for spot LNG ex-ship. Global prices remain above the US price. The prices indicated are spot prices rather than contract prices.*



Canadian Shale Gas

- Shale is expected to reach one third of natural gas output in Canada by the 2030s
- Supply potential in BC, in particular, has pushed the idea of LNG exports targeting the Asian market
 - Oil indexation in Asia could create an export opportunity.
 - Competing projects include pipelines from Russia and the Caspian States, as well as LNG from Middle East, Australia and perhaps eventually shale from Argentina.
 - BC and Alaska gas could now be relatively stranded, but selling to Asia could provide more value to developers.



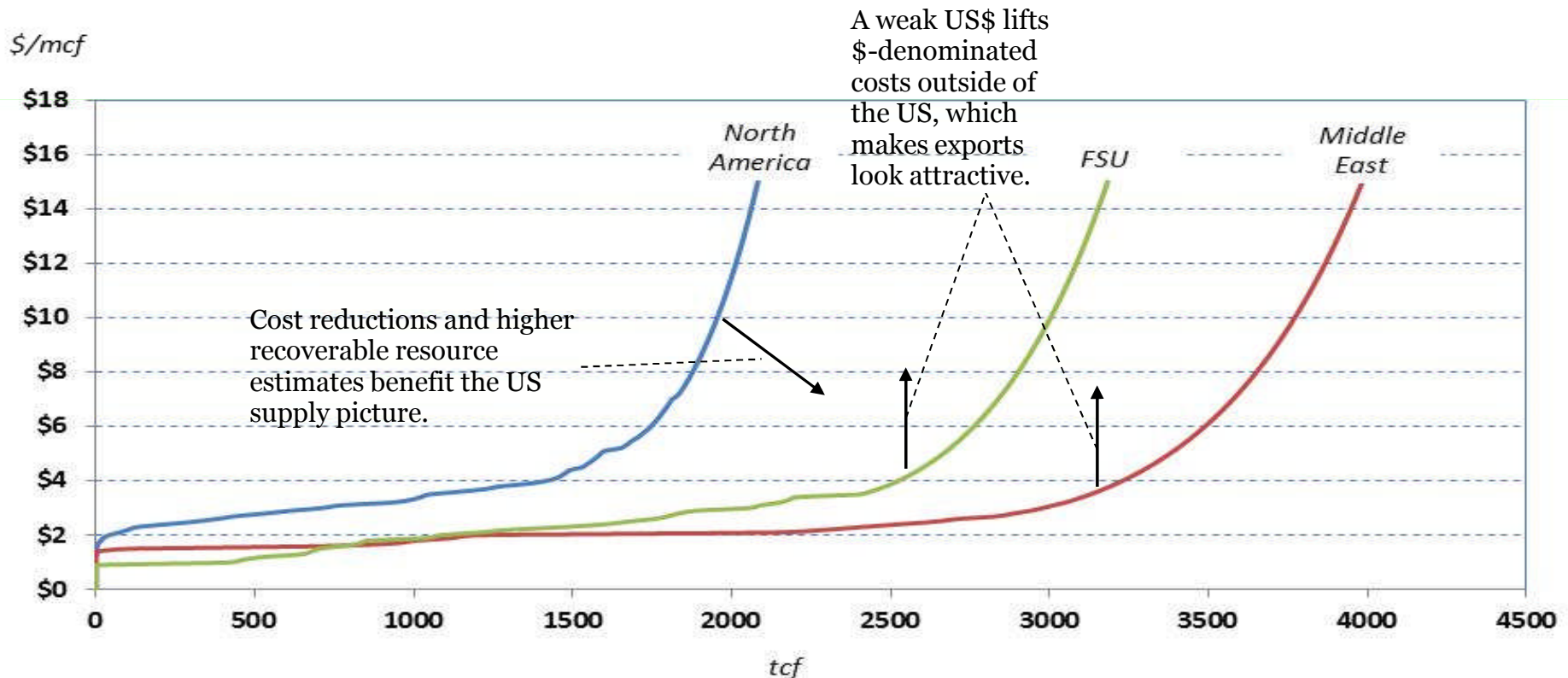
Reference Case: US Gulf Coast LNG Arbitrage Value, 2011-2040

- Modeling indicates the current arbitrage value may be transitory. In fact, the positive export margin could disappear after 2015.
- Rise in US dollar would mean US based projects would be less competitive in relative costs than they are at present because the current currency advantage enjoyed by US would be smaller

	<u>2011</u>	<u>2011-2020</u>	<u>2021-2030</u>	<u>2031-2040</u>
Feed gas cost (\$/mcf)	\$ 3.80	\$ 3.98	\$ 4.69	\$ 5.26
Liquefaction (\$/mcf)	\$ 2.51	\$ 2.51	\$ 2.51	\$ 2.51
Transport cost (\$/mcf)				
UK	\$ 1.07	\$ 1.07	\$ 1.07	\$ 1.07
Japan	\$ 2.15	\$ 2.15	\$ 2.15	\$ 2.15
Landed cost (\$/mcf)				
UK	\$ 7.38	\$ 7.56	\$ 8.27	\$ 8.85
Japan	\$ 8.46	\$ 8.64	\$ 9.35	\$ 9.93
Market price (\$/mcf)				
NBP	\$ 8.84	\$ 6.08	\$ 6.20	\$ 7.48
Tokyo	\$ 11.73	\$ 6.92	\$ 7.03	\$ 8.29
Export Margin (\$/mcf)				
UK	\$ 1.46	\$ (1.48)	\$ (2.07)	\$ (1.37)
Japan	\$ 3.26	\$ (1.72)	\$ (2.31)	\$ (1.63)

LNG Exports: North America in a Global Context

- North American resources are large, but must be placed in a global context.
 - Multiple forces are at work: cost reduction and exchange rate movements.
 - Former Soviet Union (FSU) and Middle East (pictured for comparison) are larger and generally less costly. Access, transportation costs and the value of the dollar make North American resources preferential in the short-to-medium term *in North America*.

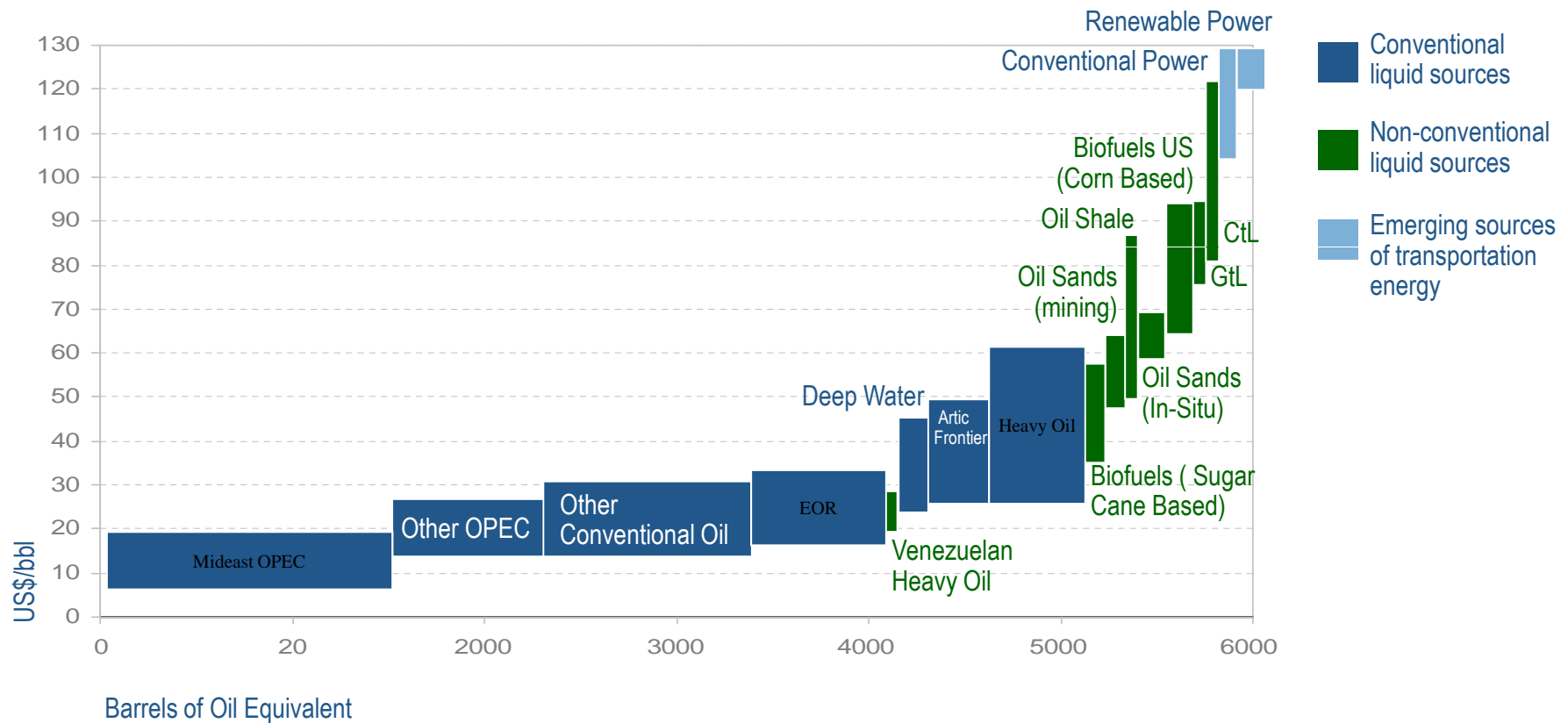


The Oil Implications of Shale

The Marginal Cost of Supply is Changing

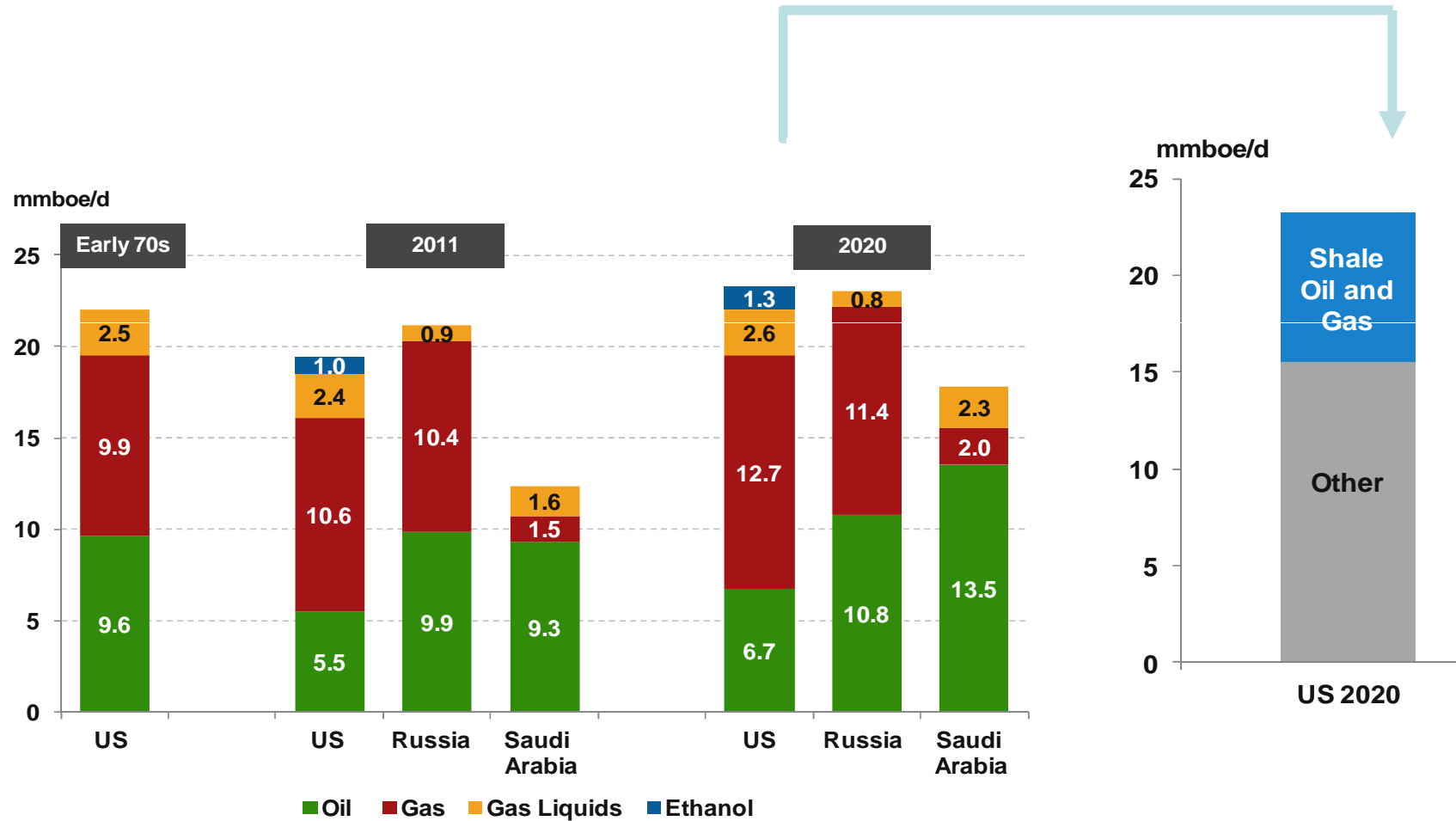
Exploitation of various resources on along the energy “cost curve” is happening simultaneously. Innovation and technological advances in shales will render this energy view of the world obsolete.

Producing basins by marginal cost



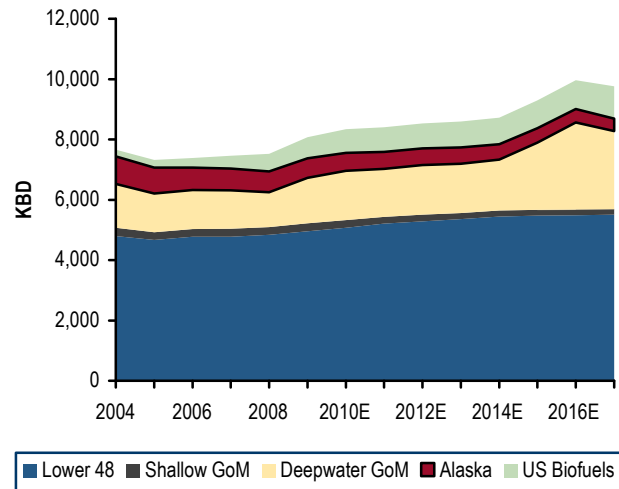
Source: Booz Allen/IEA - Assumed average vs. marginal costs; 10% return for conventional and 13% return for unconventional technologies; no subsidies for biofuels; no carbon offset costs; after severance and production taxes

Shale Oil and Gas Production will Propel the US Past Early 1970s Levels

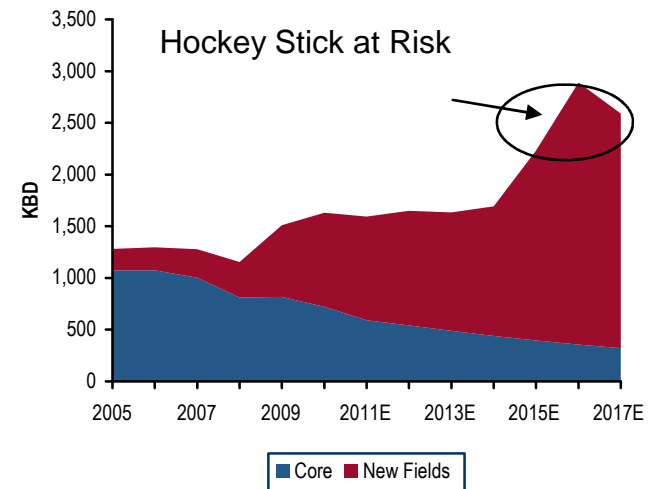


Source: PFC Energy

US Supply Outlook



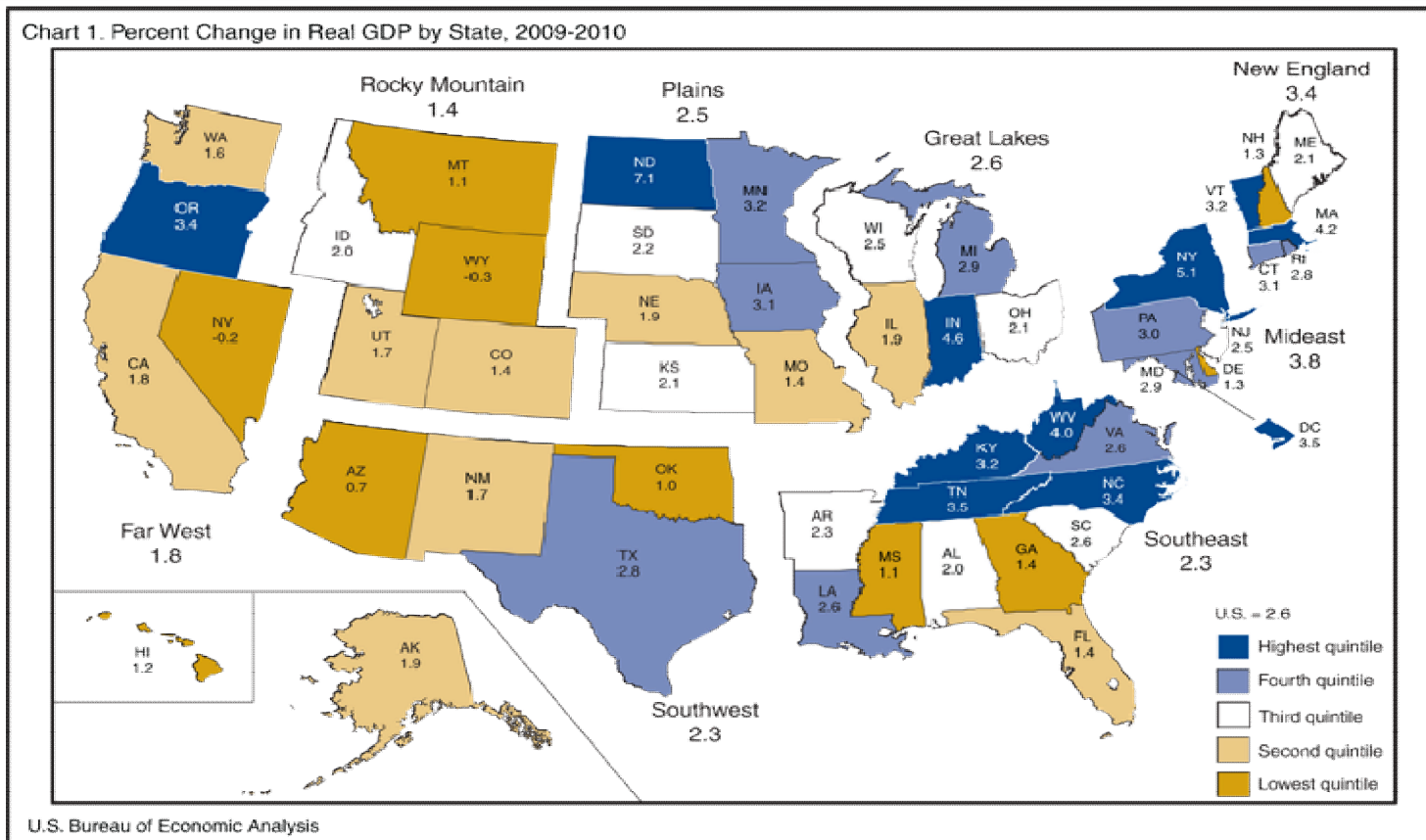
US Gulf of Mexico Potential



- New, unexpected onshore growth gaining pace and expected soon to hit close to 1 million b/d at Bakken and Eagleford; Williston Basin production is expected to climb to 900,000 b/d to 1.2-m b/d by 2015; New estimates as high as 3 to 5 million b/d of oil liquids from shale formations by the 2020s
- US Gulf Of Mexico could add upwards of 2 to 3 million b/d
- US CAFÉ Standards could shave 2 to 3 million b/d off US oil demand by 2025
- US could once again become largest producer in the world

Implications of Industry Shift To Liquids Orientation for US Shale Development

- Oil potential from shale will likely slow momentum of American firms shift to a more natural gas based portfolio
- Drilling activity is shifting to those regions where oil production potential is highest
- Pressure building to have stricter regulation on flaring and methane leakage as natural gas reverts to being an associated “by-product” of oil production in some regions and not as the end game itself
- Unintended consequences of rising US oil production include pressure on existing pipeline infrastructure, including the ability to release the Strategic Petroleum Reserve
- Over time, lessons learned for oil production from shale will be applied internationally
- Global market impact of shale gas has been somewhat muted because of nuclear shutdowns in the aftermath of the Fukushima accident, but US gas surplus could spread globally and extend eventually to oil
- Global and US climate policy will over time have to be taken against the backdrop of a resurgence of oil and gas abundance



- What if the number of oil and gas states were to multiply dramatically over the next ten years?
- What if the next time oil prices went way up, American petro-dollars stayed in Pennsylvania and not Saudi Arabia?
- Between 1990 and 2000, *incremental* growth US demand represented over 55 percent of the increase in OPEC's oil export trade