



# DISCOVER THE POWER OF INTEGRATION

Pace Global, a Siemens business, is a leading energy consulting and management company. Pace Global combines deep industry knowledge with commercial, technical, financial and regulatory expertise to help organizations maximize value and manage risk in today's complex energy and environmental markets. For more than 35 years and in over 60 countries, Pace Global teams have worked closely with clients to define strategies and implement solutions. Now a part of the Sustainability and Energy Management business within Siemens, Pace Global helps to provide full end-to-end integrated energy solutions for enterprise clients and governments worldwide.

## CIBO Presentation 11 September 2012

# Natural Gas: Domestic Supply Security and Global Abundance



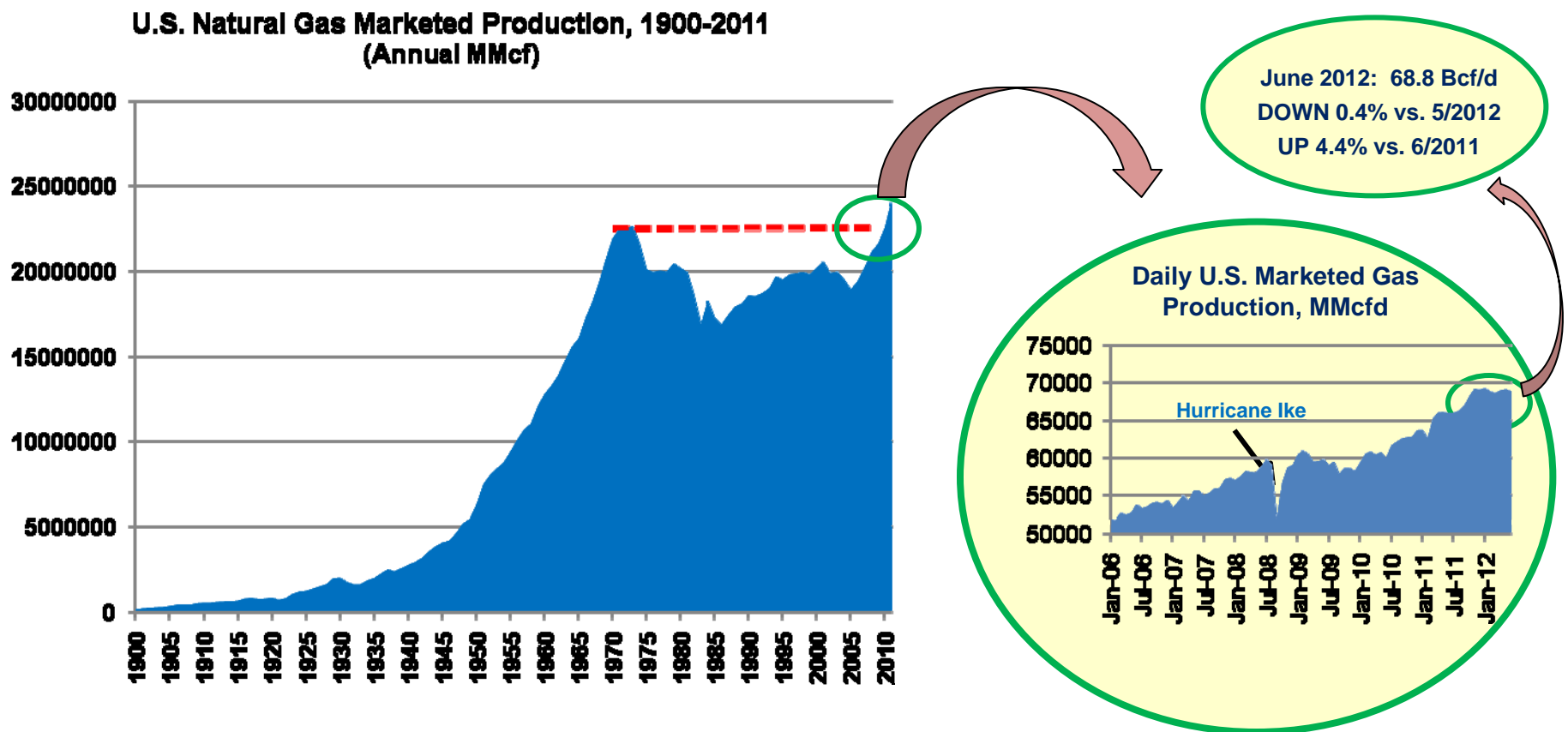
Over the past decade, as oil demand and production costs rose and security and availability issues dominated the global oil market, the global natural gas industry has seen an unprecedented period of market integration (via LNG and pipeline) while supply growth outpaced rapid demand growth around the world.

Prevailing high energy prices drove investment in LNG transportation systems linking “stranded” gas fields to energy-hungry markets. Meanwhile, these same high prices justified the trial-and-error development of new oil & gas extraction techniques at the core of the current U.S. energy boom: horizontal drilling and multi-zone hydraulic fracturing.



# Forty Years of U.S. Natural Gas Supply Worries

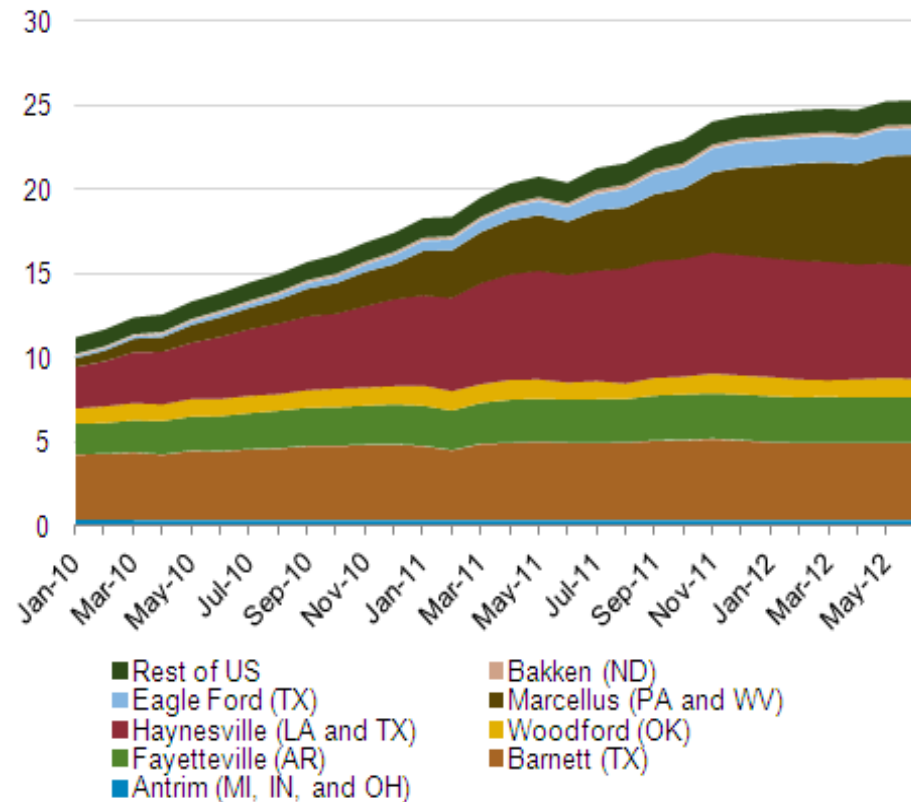
- Since 1970, generation planners have been nervous about future gas supplies.
- Now, the only real question is price.



# The Production Growth Driver is Shale Gas

- The combination of prevailing high prices pre-2009, commercial proof-of-concept of shale development and completion technologies and the enormous scale of the shale resource kicked off a quest for *resource control*
  - Production growth (and falling prices) is a consequence of this quest, not its specific goal
- Unrivalled and scalable oilfield services infrastructure, private mineral ownership and a massive flow of capital into the sector have made it possible

2010-2012 Production  
from U.S. Shale Gas Basins (Bcf/d)

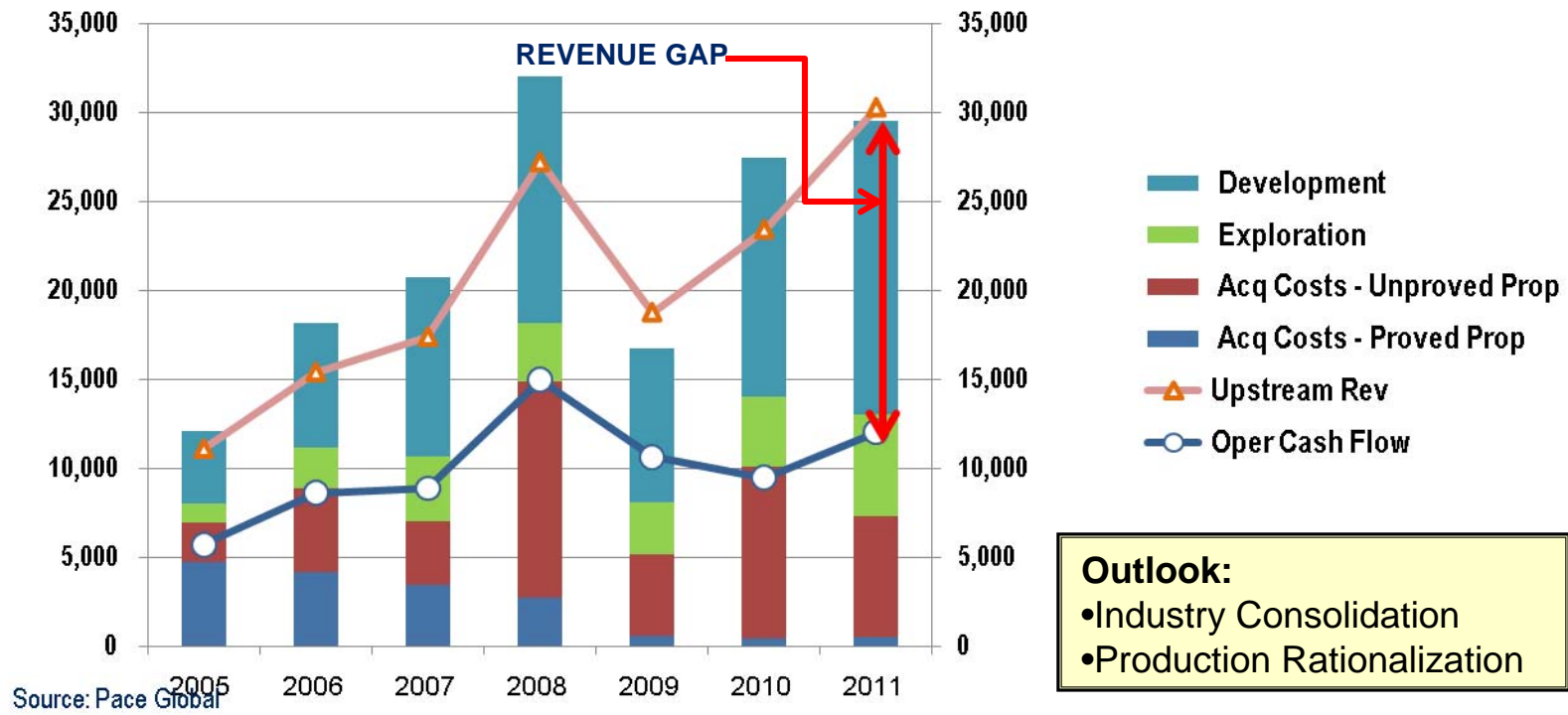


Source: Lippman Consulting, Inc. Gross withdrawal estimates are as of July 2012 and converted to dry production estimates with EIA-calculated average

# Development Costs Exceed Operating Cash Flow

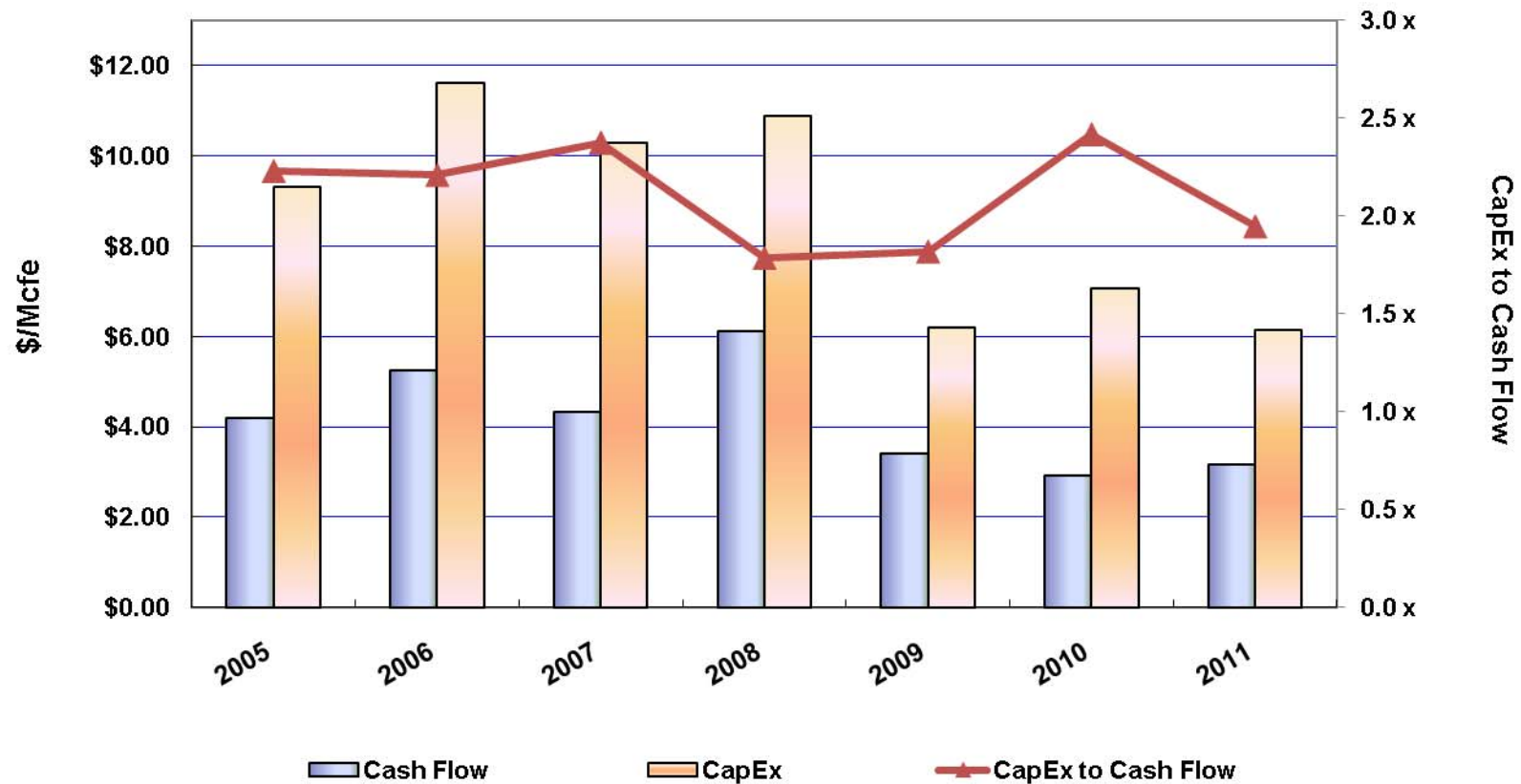
Pace Global's ongoing survey of ten heavily gas-weighted shale developers (>70% shale gas) indicates that operating cash flow averages half of finding and development costs (excludes production costs, overheads, etc.) for the past seven years.

**Finding & Development Costs vs. Revenue (\$ MM)**



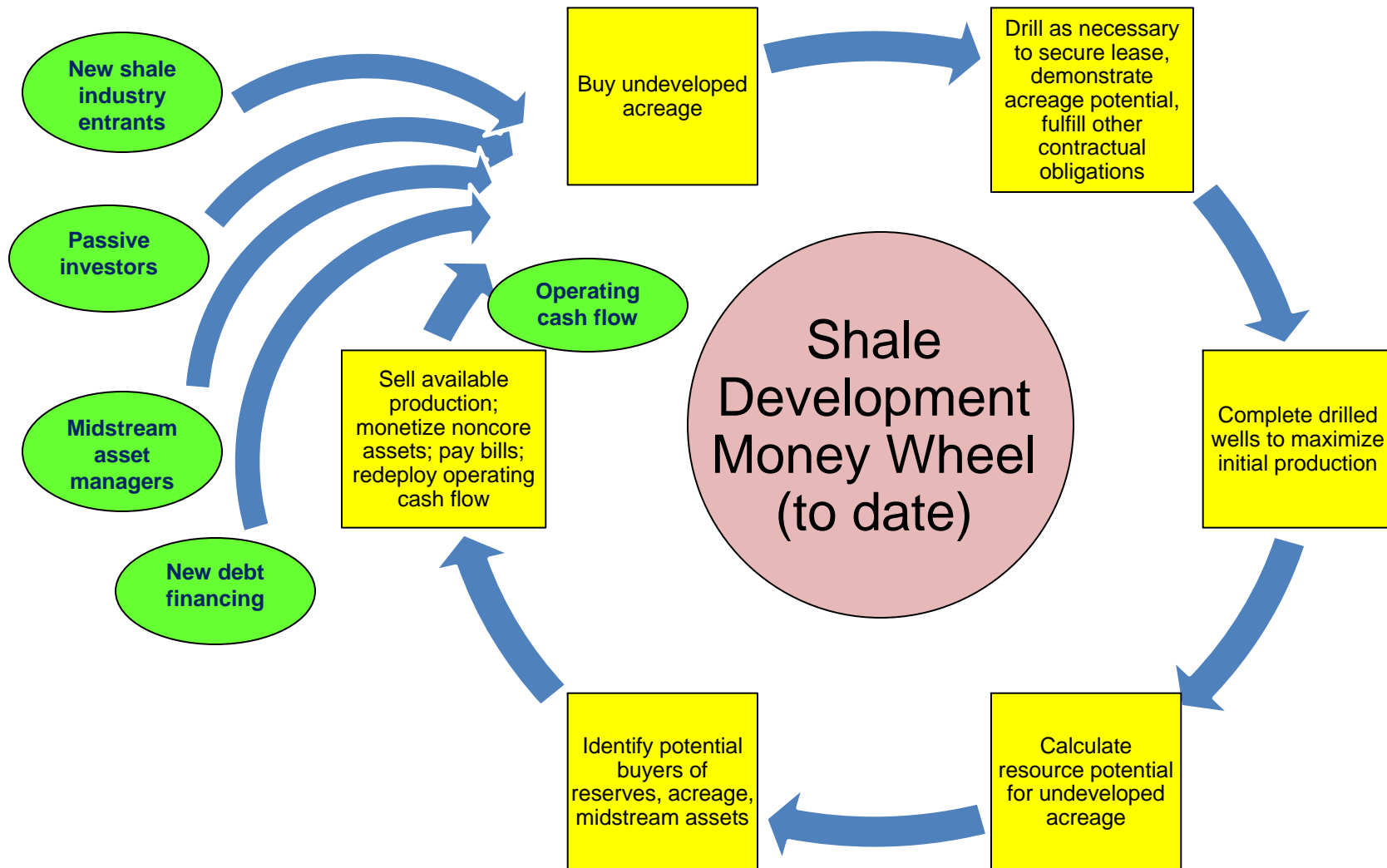
# Financial Origins of the Surplus

How do you fund a business plan that delivers these results?



Source: Pace Global

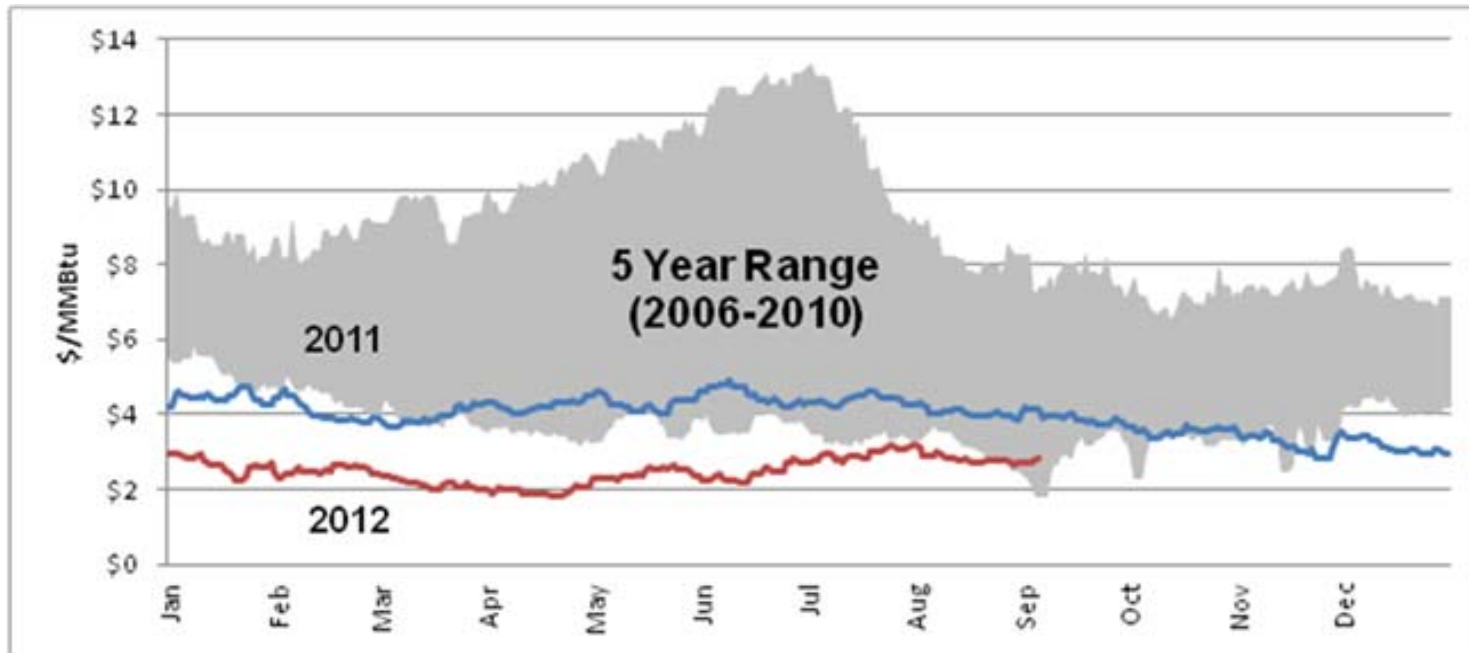
# The Shale "Boom" to Date: Lots of Money in, not Much Out



## The Supply Boom led to Deteriorating Prices

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The warm winter of 2011-12 significantly exacerbated the problem, leaving record gas storage inventories this spring.

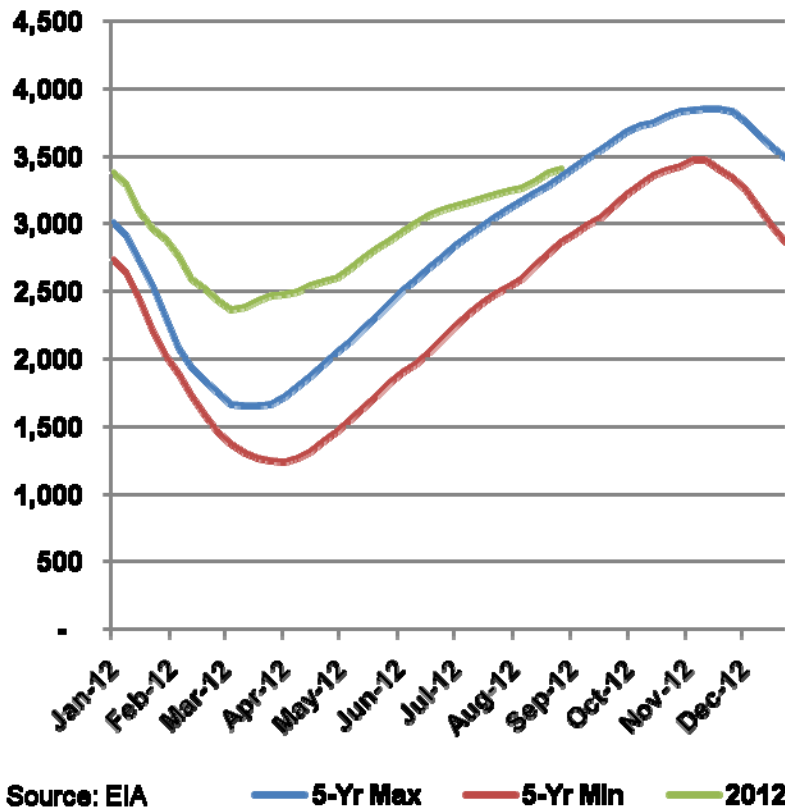


Source: U.S. Department of Energy (DOE), Energy Information Administration (EIA), August 2012.

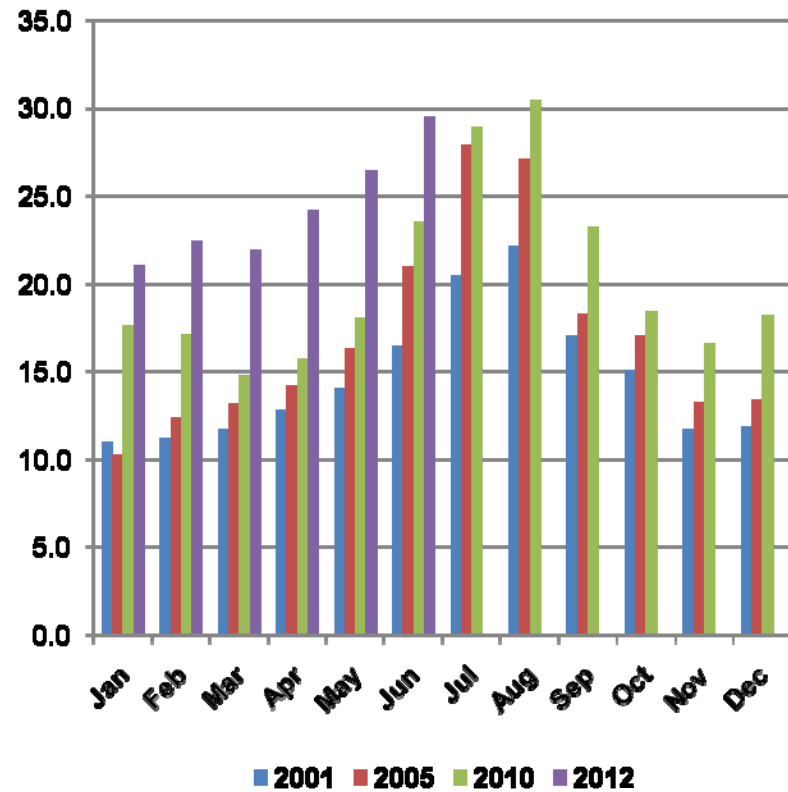


# The Power Sector Obligated to Consume the Surplus

**Working Gas In Storage, Bcf,  
2012 vs. 2007-2011 Max/Min Range**



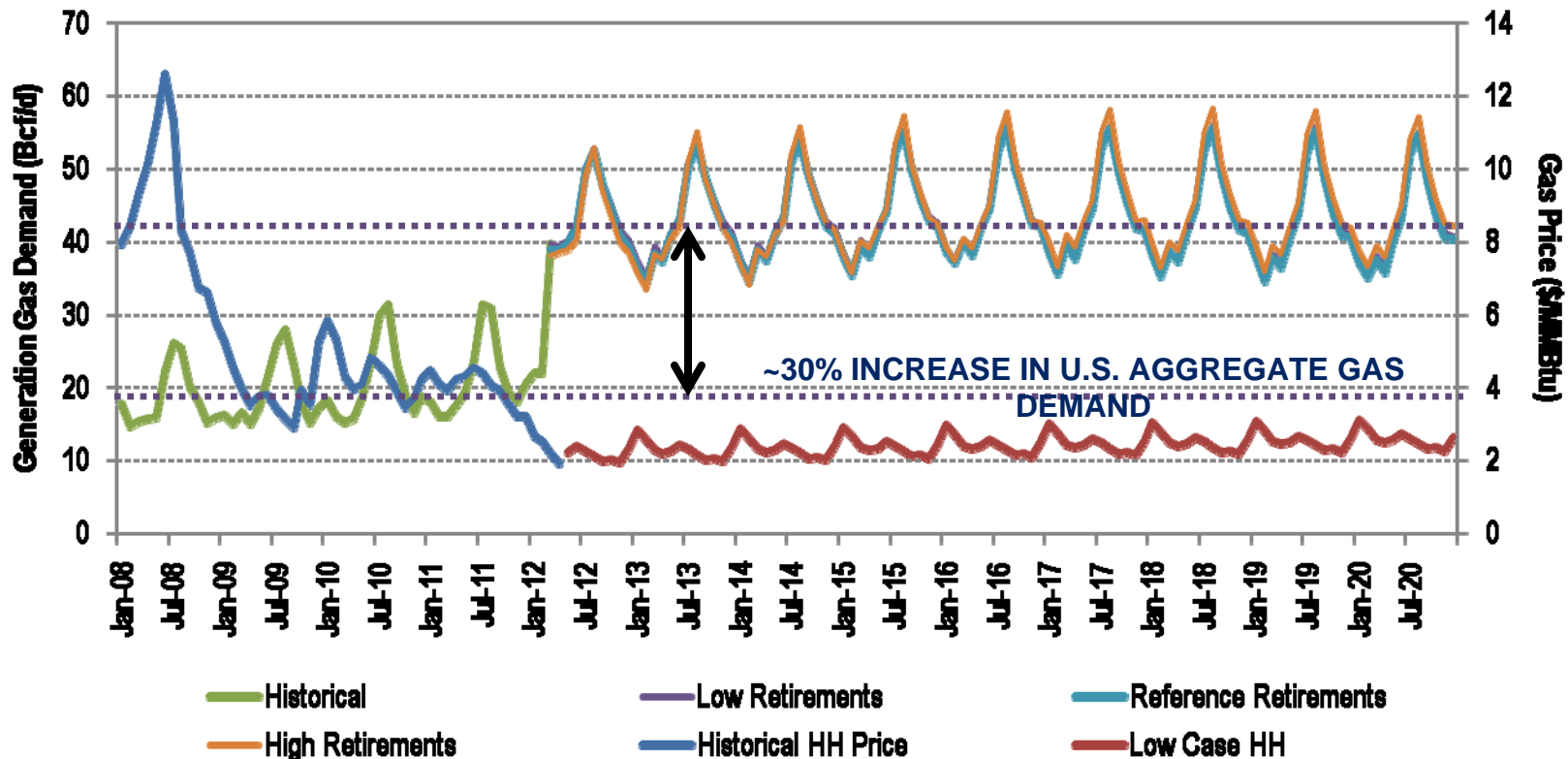
**Monthly U.S. Natural Gas Deliveries for  
Power Generation, Bcf/d**



# What if Gas Prices Stay Low?

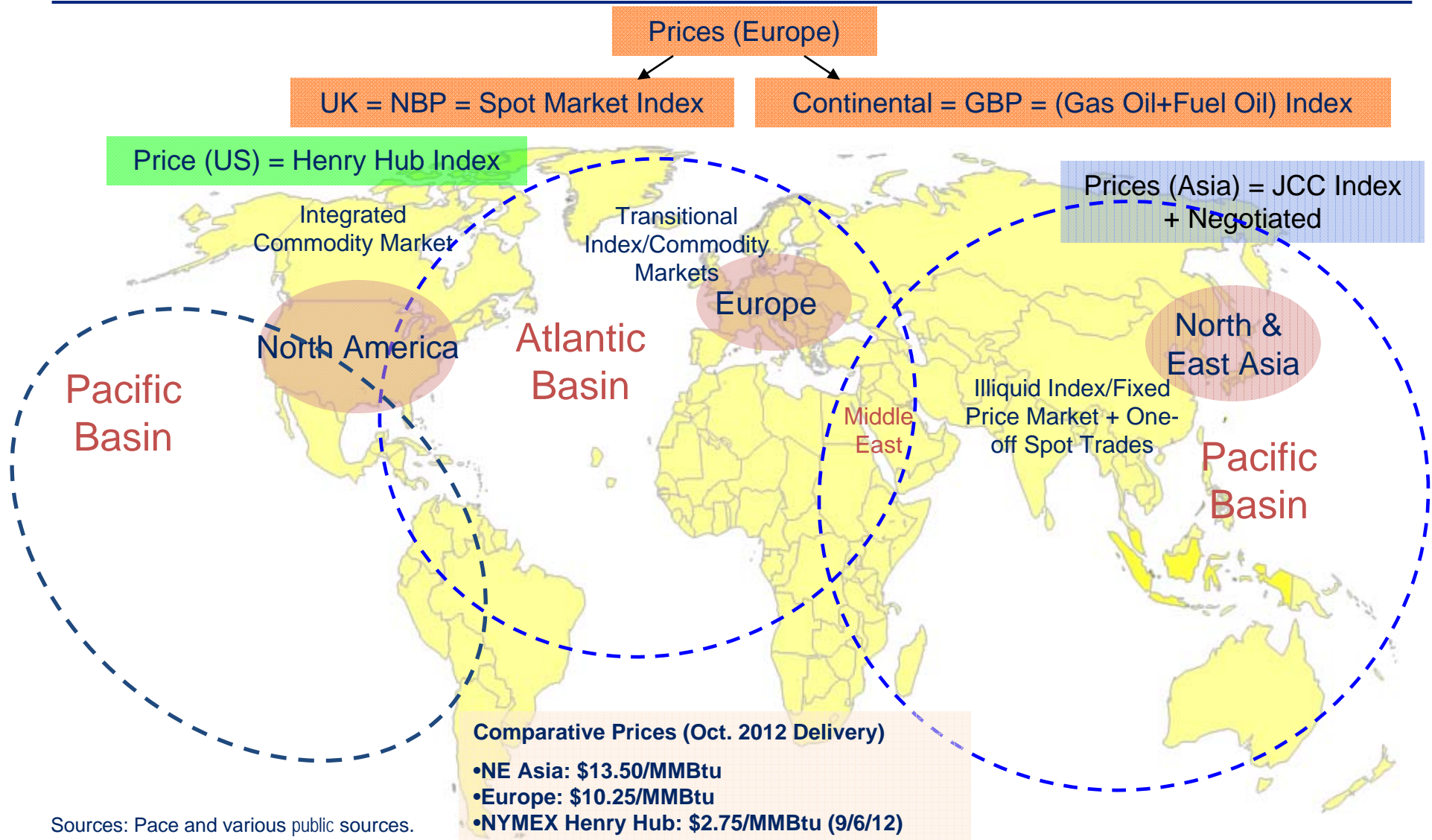
In a frictionless world of fuel choice, installed CCGT capacity could effectively double power generation gas demand overnight.

- No more surplus



Source: Pace Global

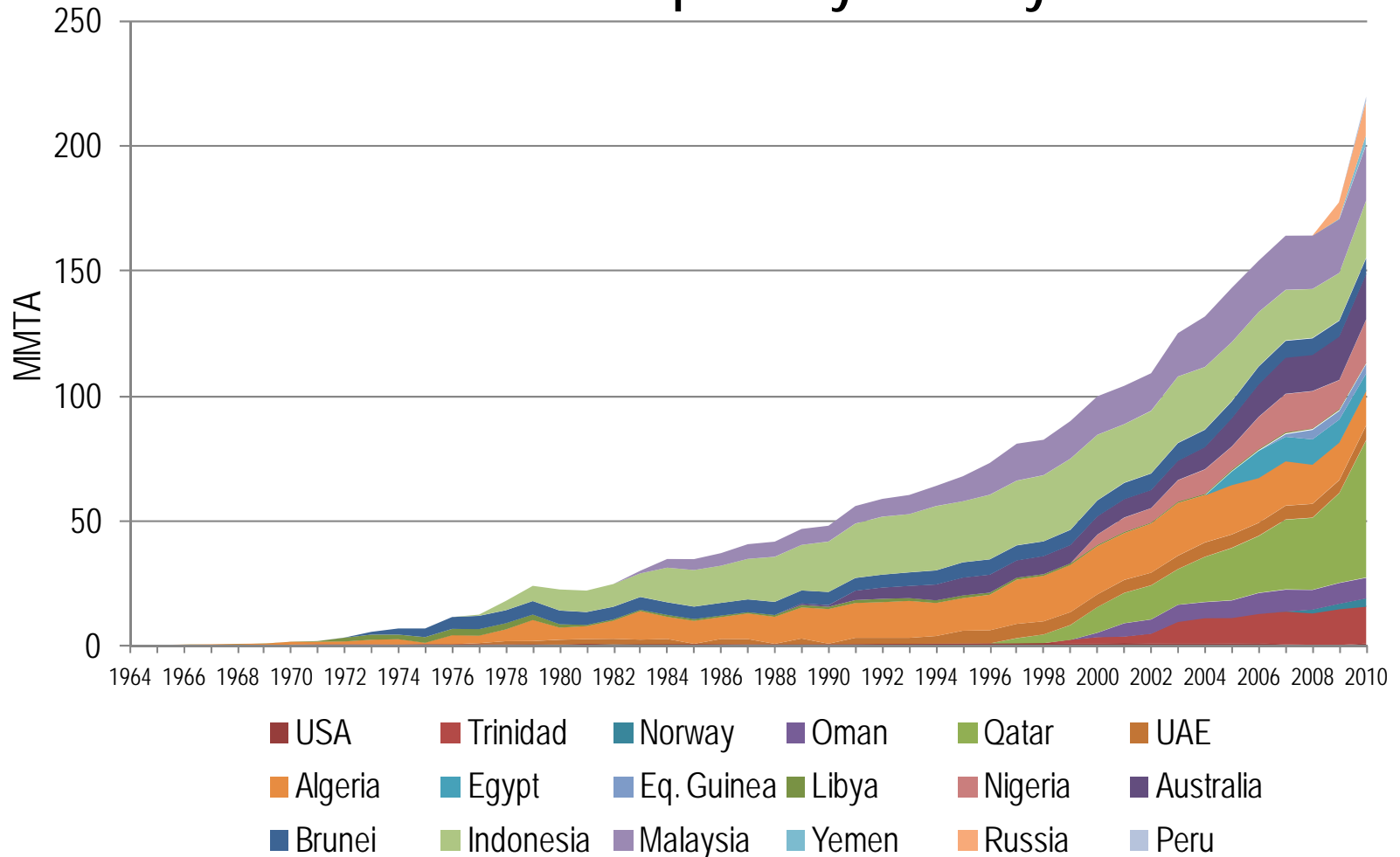
# Historically Distinct Regional Gas Markets and Global Convergence



Sources: Pace and various public sources.

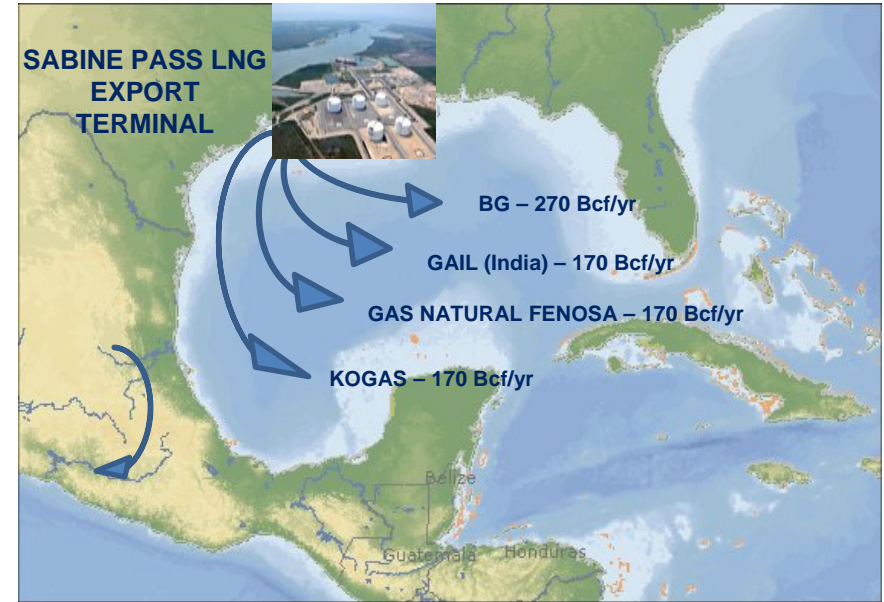
# World Trade in LNG has Grown Rapidly in Recent Years

## LNG Exports by Country



Source: BP

# One Solution to U.S. "Surplus": Join the LNG Party



## Proposed to FERC

1 Freeport, TX	Freeport LNG	51.0 MMcm/d
2 Corpus Christi, TX	Cheniere - Corpus Christi LNG	51.0 MMcm/d
3 Coos Bay, OR	Jordan Cove Energy Project	25.5 MMcm/d
4 Lake Charles, LA	Trunkline LNG	68.0 MMcm/d
5 Cove Point, MD	Dominion - Cove Point	28.3 MMcm/d
6 Hackberry, LA	Sempra - Cameron LNG	48.1 MMcm/d
7 Cameron Parish, LA	Sabine Pass	34.0 MMcm/d

## Proposed Canadian Sites Identified by Project Sponsors

8 Kitimat, BC	Apache Canada	19.8 MMcm/d
9 Douglas Island, BC	BC LNG Export Cooperative	7.1 MMcm/d

## Potential U.S. Sites Identified by Project Sponsors

10 Brownsville, TX	Gulf Coast LNG Export	79.3 MMcm/d
11 Astoria, OR	Oregon LNG	35.4 MMcm/d

## Potential Canadian Sites Identified by Project Sponsors

12 Prince Rupert Island, BC	Shell Canada	28.3 MMcm/d
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Source: U.S. Federal Energy Regulatory Authority, 26 April 2012, and Pace Global

## The Question is: Will These Arbitrage Opportunities Last?

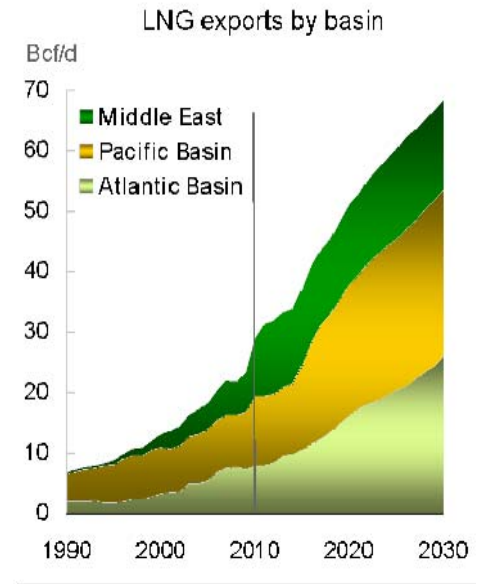
- The 2010-11 run-up in LNG prices was caused in part by high oil prices (attributable to supply security fears) and the 30% surge in Japanese LNG demand triggered by nuclear plant closures after the Fukushima Daiichi incident.



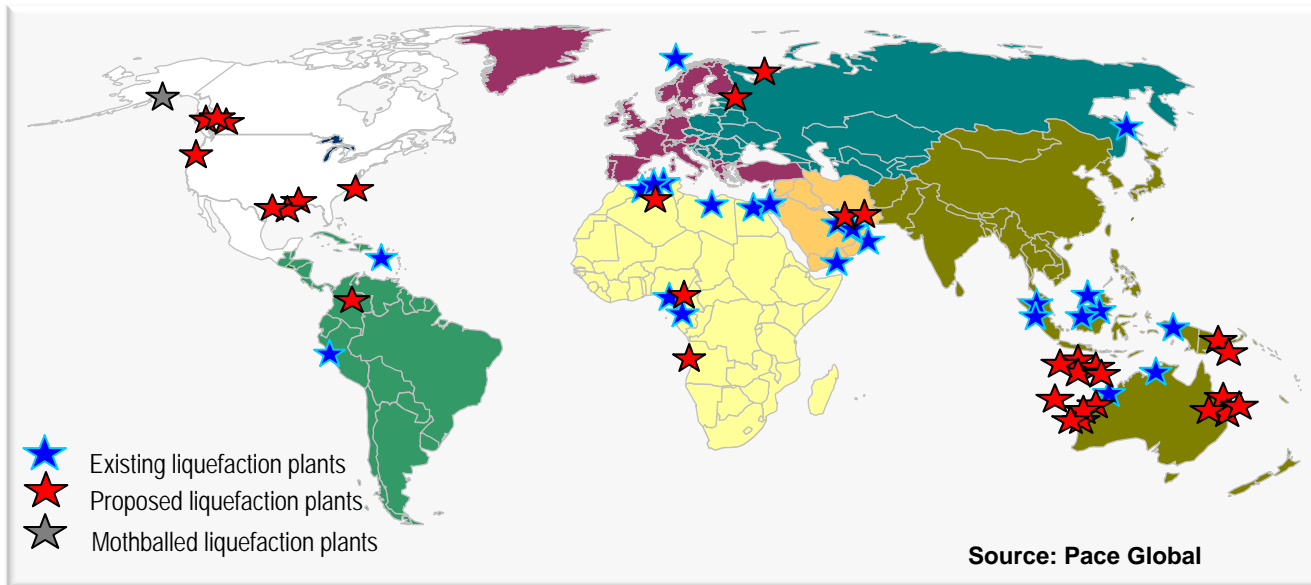
- Asian LNG prices have fallen by a third as customers demand prices more attuned with European and North American levels.

# LNG Export Capacity Continues to Grow Rapidly...

- Australia will soon overtake Qatar as the leading LNG exporter
- LNG export capacity is planned for British Columbia (Canadian shale gas) and SE Alaska (North Slope)
- Massive new gas discoveries offshore East Africa could support greater export capacity than either Qatar or Australia

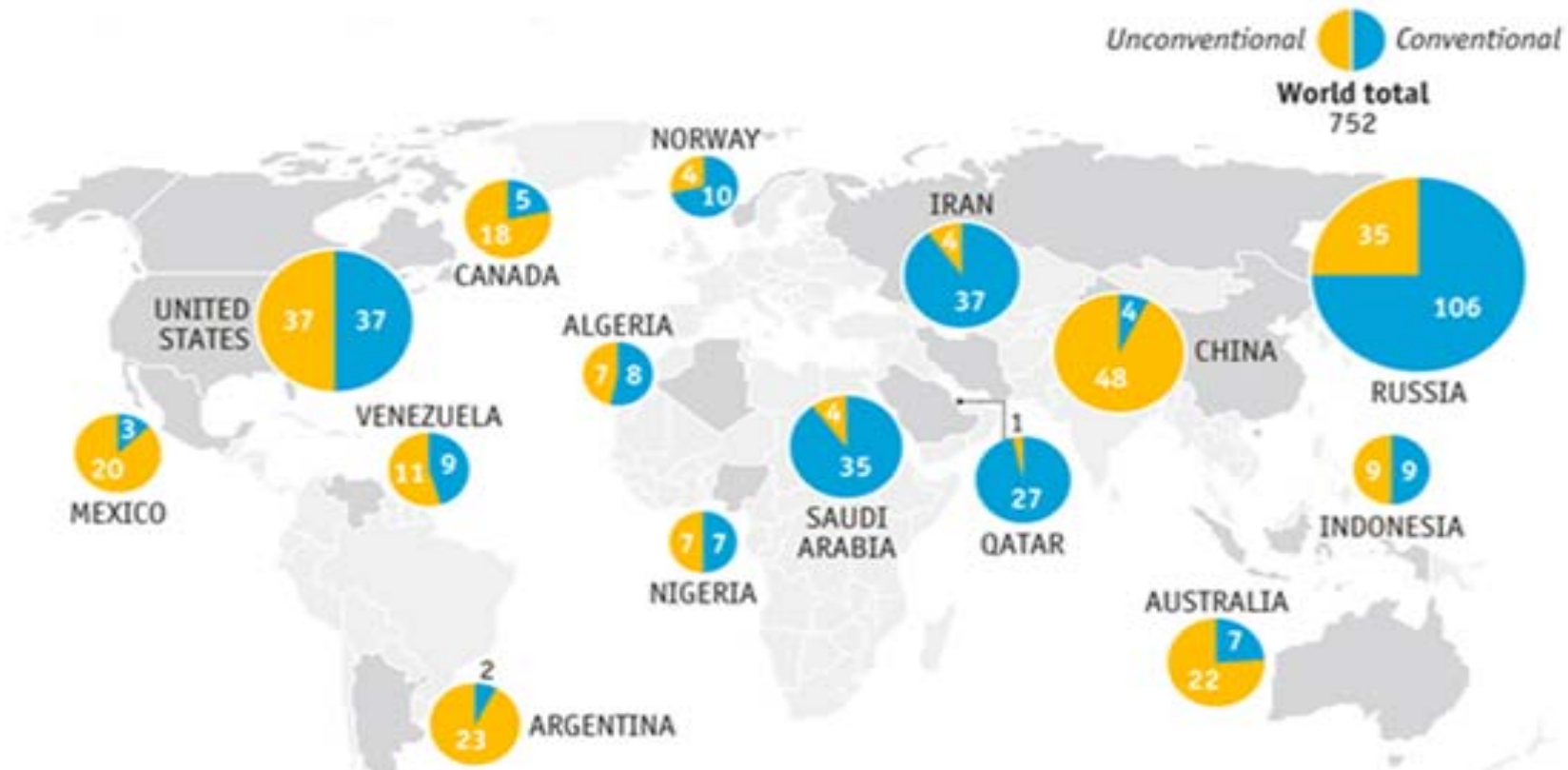


Source: BP



## ...and Shale Gas is not Just a North American Phenomenon

The Shale Revolution has only just begun in such nations as China, Poland and Argentina. Its course will, once again, dramatically alter global gas flows over the coming decades.



Source: IEA (International Energy Agency)

TRILLION CUBIC METERS; 1 Tcm = 35.3 Tcf



# Takeaways

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- The market-distorting actions and effects of the Shale Boom are still with us, but ebbing in significance.
- The power, coal and gas industries, aspiring LNG exporters, and individual participants in each sector will continue to economically self-optimize within the constraints and objectives of their individual positions.
- These differing objectives and decisions, and their implementation timelines, will continue to pull us away from an imaginary “equilibrium” that will exacerbate broader problems while achieving individual goals.
- Fast-growing gas demand in Asia and long-term energy security needs for major importing markets around the world will be met by a combination of expanding indigenous supplies, an increasingly liquid and flexible LNG market, and a growing network of transnational pipelines.
- U.S. LNG exports will compete on price in a world of growing gas supply, growing market integration, and will decrease arbitrage opportunities over time.



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Mark Eisenhower

Managing Director

703-539-1136

Mark.Eisenhower@ PaceGlobal.com