Global LNG and Pipeline Gas Markets - Supply/Demand Issues for UNECE Countries

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Agenda

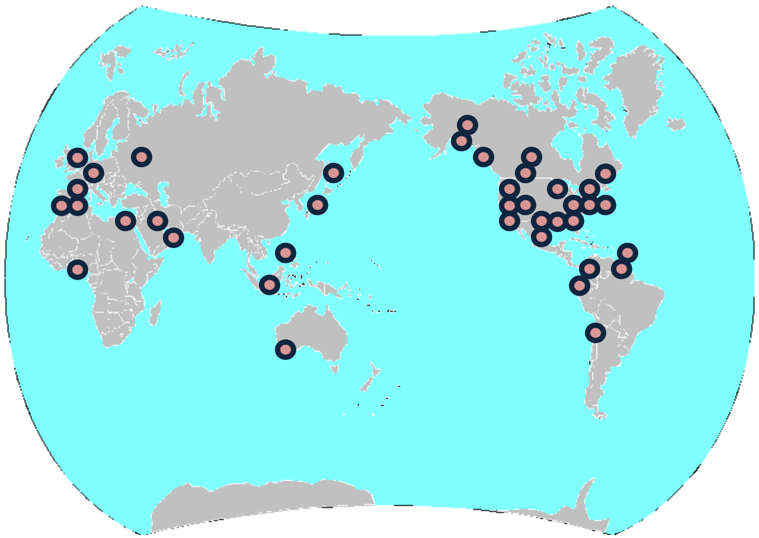
- Introduction
- Gas supply and demand expectations – shale gas
- Pricing and trade consequences
- Shale gas-LNG-pipeline gas competition
- Looking ahead.

BSA – 26 YEARS OF ADVISORY SERVICE TO GAS AND ENERGY INDUSTRIES.

Expertise

- Energy economics, rates, price risks, contracting.
  - Market research
  - Lender due diligence – power plants, storage, LNG
  - Litigation support/rate cases, 16 jurisdictions
  - Training.
- 500+ assignments since 3/84.
- Galway Group – LNG transactions and project management.

Major Assignments

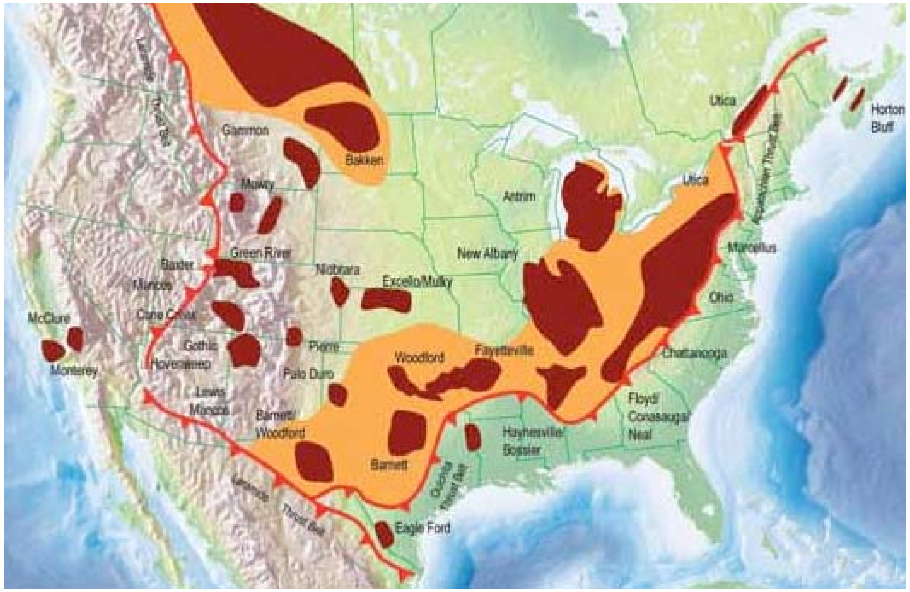


Clients: Energy traders, power generators, utilities, banks, governments, universities.

UNECE WPGas LNG Report – Chapter 1, LNG Markets.

- Main elements taken from Eurogas, IEA, IGU and other recent studies:
  - Physical status, by area/basins – gas reserves, supply, demand, flows/trade
  - Economic status – area / basin projections of supply and demand
  - Industry status – liquefaction, tankage and regasification capacities (existing, in construction, planned)
  - Commercial status – contracting and pricing mechanisms.
- Today's focus is on the interaction of shale gas and LNG, and how this affects Europe.

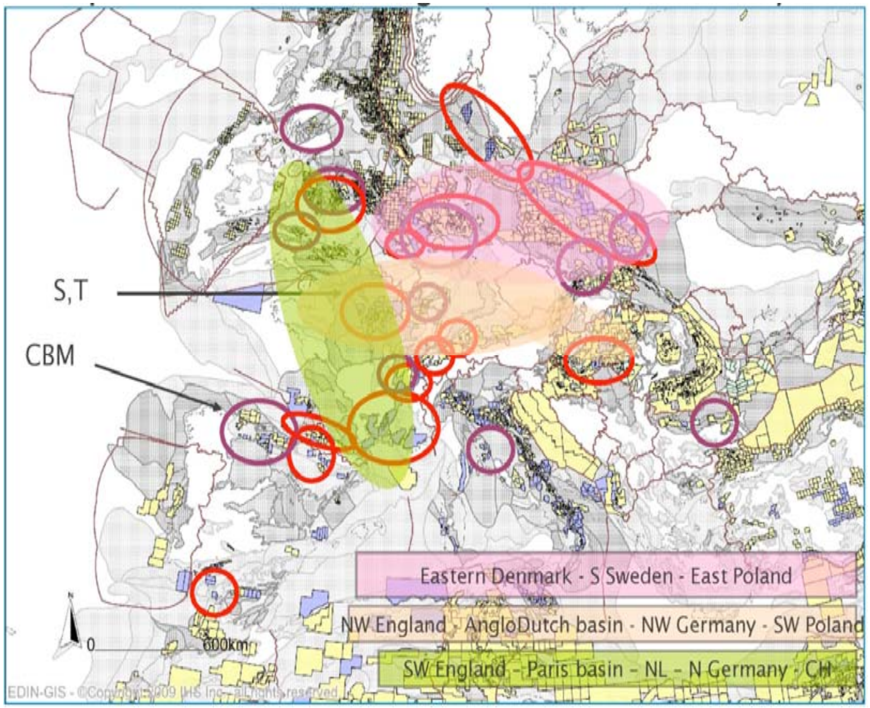
North American unconventional gas surplus affects US and world markets.



- Top shale gas plays:
  - Texas (Barnett, Eagle Ford)
  - Alabama/Oklahoma/Arkansas (Haynesville, Fayetteville, Woodford)
  - British Columbia (Horn River, Montney)
  - Pennsylvania, New York, West Virginia and other Appalachian states (Marcellus)
  - Bakken (North Dakota and Saskatchewan)
  - New York and Quebec (Utica).
- Also, tight sands and coal-

Map from NEB of Canada.

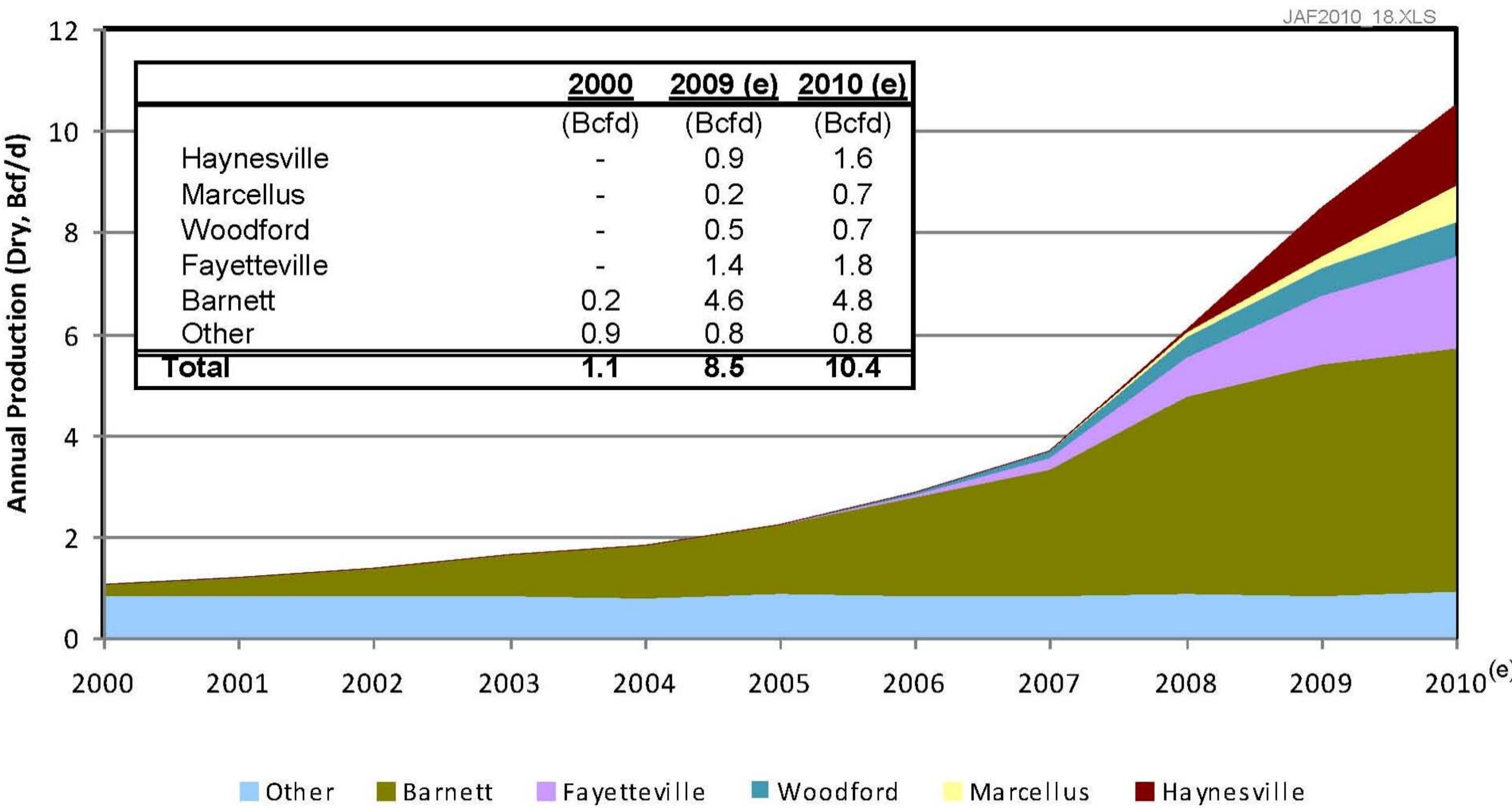
Three promising shale-bearing areas in Central and Western Europe.



- Poland and Scandinavia
  - Alum Basin, Norwegian-Danish Basin, Silurian Shale (Poland), Gdansk Depression
- Northern Europe / England
  - Northwestern England (Cheshire Basin), Anglo-Dutch Basin, Posidonia shales of northeastern Poland.
- Western Europe
  - Southern England (Weald Basin) through Paris Basin, northwestern Germany, Switzerland (Mulasse

Map from Statoil..

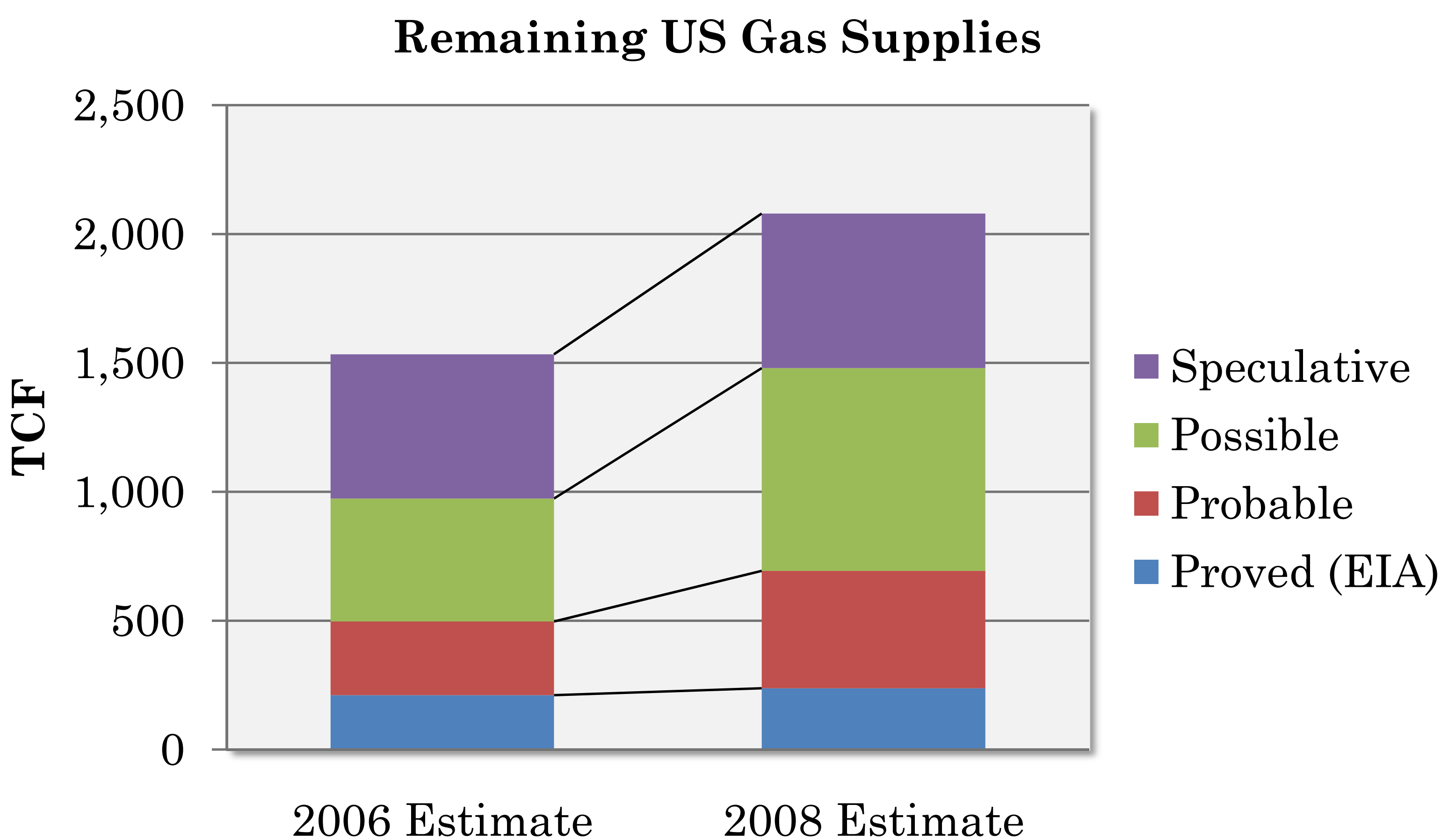
US SHALE GAS PRODUCTION HAS GROWN 10-FOLD, AND HAS REACHED 18% OF US SUPPLY.



	2000 (Bcfd)	2009 (e) (Bcfd)	2010 (e) (Bcfd)
Haynesville	-	0.9	1.6
Marcellus	-	0.2	0.7
Woodford	-	0.5	0.7
Fayetteville	-	1.4	1.8
Barnett	0.2	4.6	4.8
Other	0.9	0.8	0.8
Total	**1.1**	**8.5**	**10.4**

Source: Vello Kuuskraa, Advanced Resources, International, before NCAC-USAEE/CSIS Shale Conference, March 9, 2010, Washington, DC.

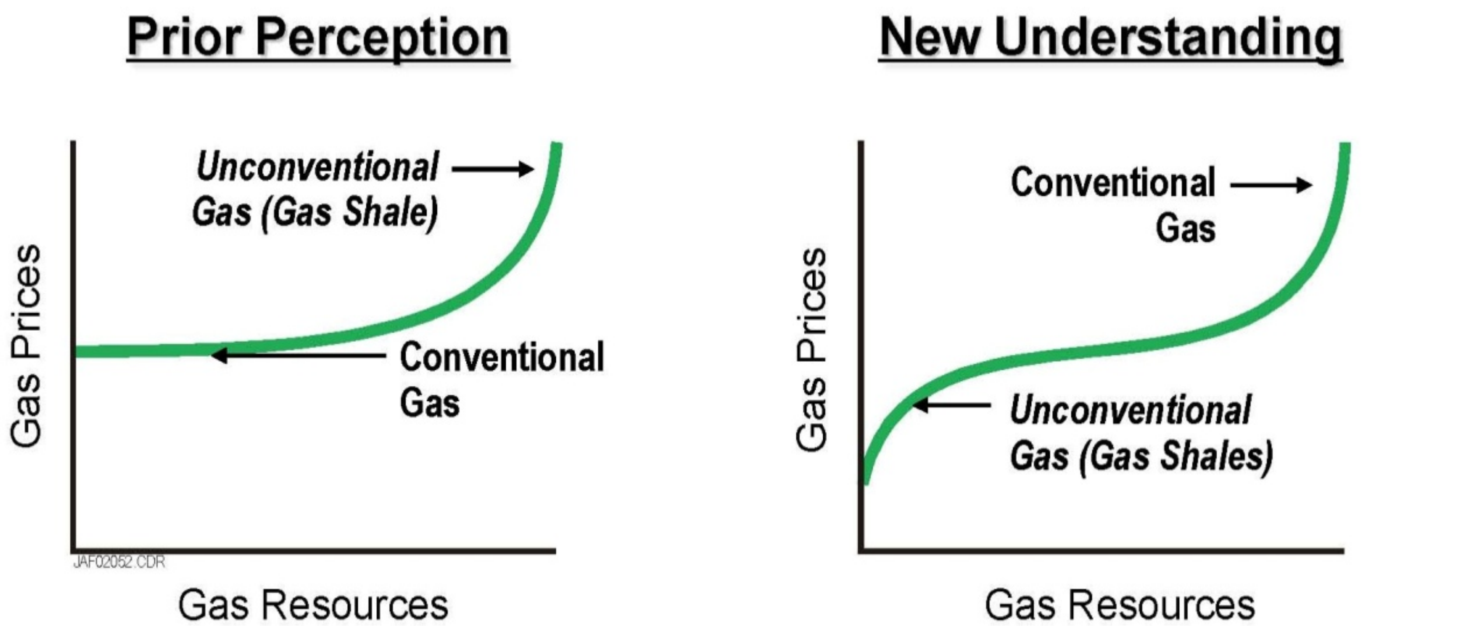
MOST OF NORTH AMERICA'S SHALE GAS BOUNTY IS STILL BEING PROVED, THUS IS P50 OR HIGHER.



Source: *Potential Gas Committee, Colorado School of Mines, 2009.*

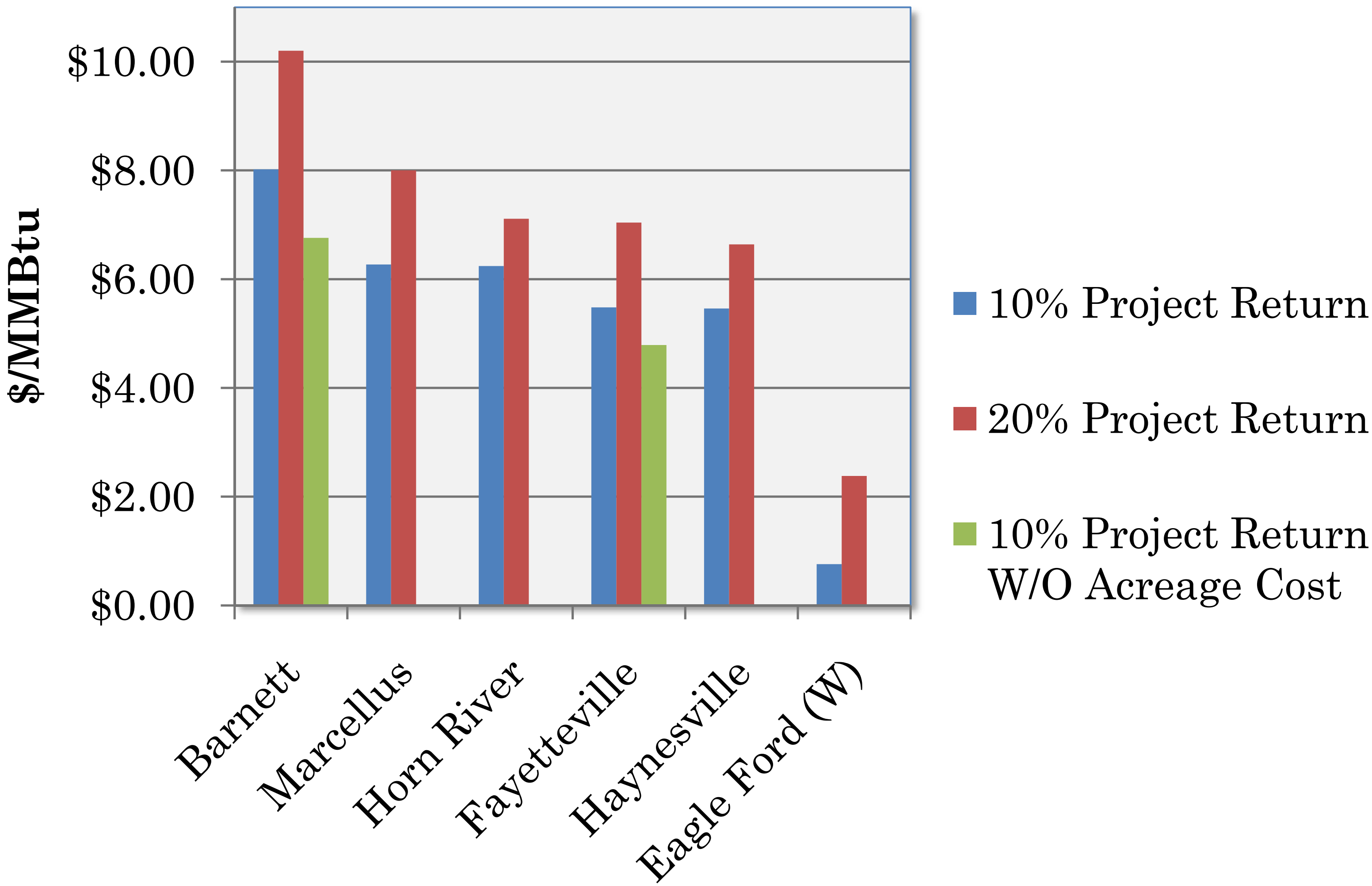
Shale gas has moved to the bottom of the US gas supply curve.

- Until recently, conventional gas was viewed as low-cost, while shale gas was an abundant but high-cost US resource – that perception has now reversed.



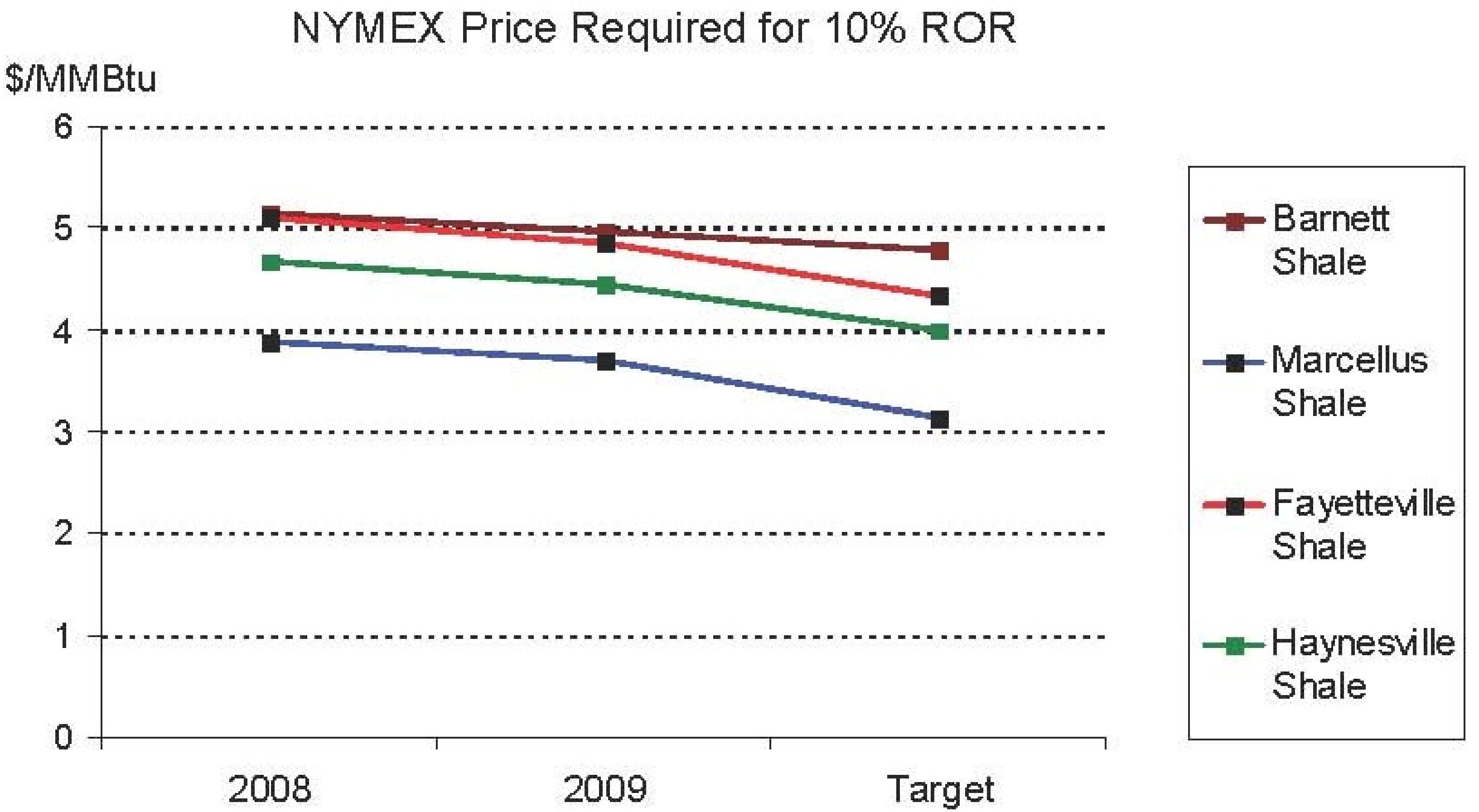
Source: Vello Kuuskraa, Advanced Resources, International, before NCAC-USAEE/CSIS Shale Conference, March 9, 2010, Washington, DC.

In theory, sustained shale production requires prices over $5-$6 per MMBtu.



Source: Galway Group, LP, Houston, 5/2010. PROPRIETARY

But the economic analyses differ sharply, for example:



Source: A. Lecarpentier, Cedigaz, Lyon, June 4, 2010, from company reports.

Why, despite low prices, do shale gas drilling and production rise in 2009-10?

- Numerous program and technology refinements:
  - Focus on high grade prospects
  - Drilling from multi-well pads
  - Longer, multi-stage horizontal well bores
  - More intensive fracking methods
  - Skid-mounted rigs
  - Reduced costly fracking water components
  - Drilling operations in shorter time periods
- Financially accommodating project structures; prices hedged through 2011.
- Need to meet acreage development requirements/deadlines.

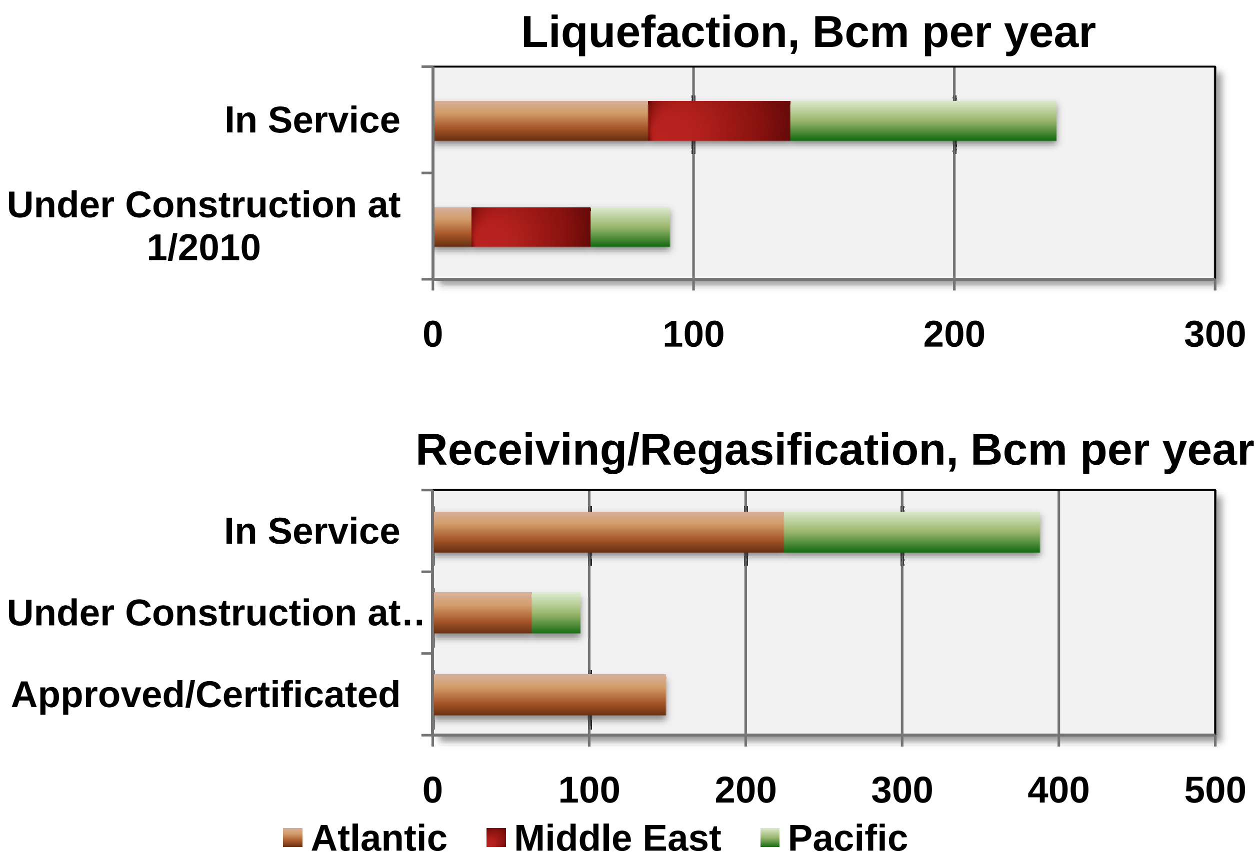
Source: BSA 2010, from V. Kuuskraa, Advanced Resources International, Inc., and J. Snyder, Wood McKenzie, at 3/7/10 NCAC/CSIS Conference, Washington DC.

ISSUES FACING GROWTH IN SHALE E&P OPERATIONS:

- Early year decline rates require intensive drilling.
- Some pipeline capacity constraints, especially:
  - Perryville congestion
  - Marcellus and REX blocked from East Coast market growth.
- Water, water, water!
  - Groundwater contamination
  - Wastewater disposal methods, volumes, composition
  - Organics and other fracking fluids.
- Concern with potential Federal brakes
- Demand deficit
- LNG!

Source: BSA 2010, from V. Kuuskraa, Advanced Resources International, Inc., and J. Snyder, Wood McKenzie, at 3/7/10 NCAC/CSIS Conference, Wash., DC.

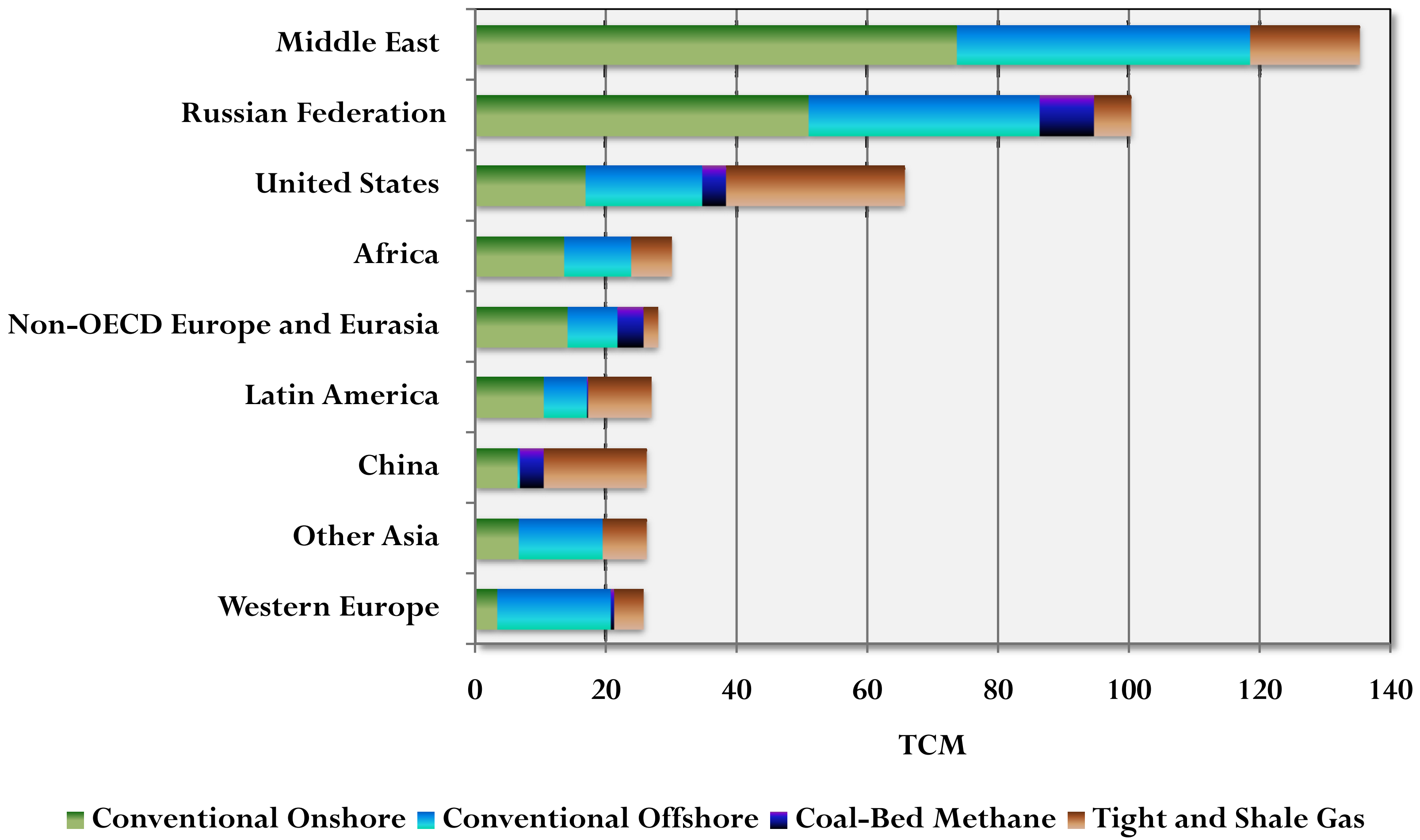
GLOBAL LNG SUPPLIES ARE SET TO INCREASE BY 38% IN THE NEXT TWO YEARS.



Much of this gas was aimed at US markets, where LNG demand will grow more slowly than expected.

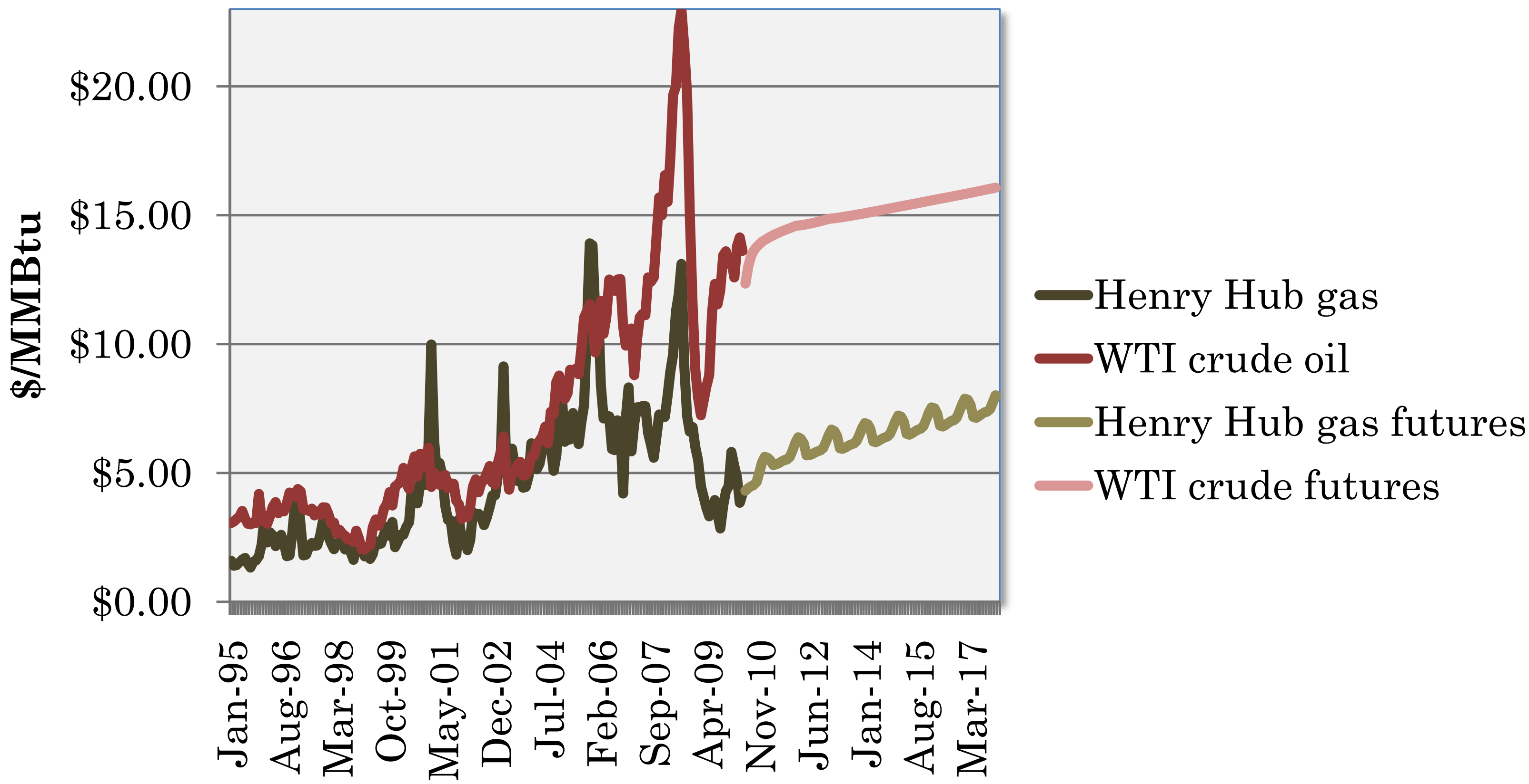
Source: Galway BSA 2010, from UNECE LNG Report, Chapter 1 (draft).

MAJOR P50 RESERVE HOLDERS EXPORT GAS – US AND CANADA ALREADY DO SO AS WELL.



Sources: UNECE LNG Report, Chapter 1 (draft); EIA, Journal of Petroleum Technology 6/2006, Potential Gas Committee 2009, BSA 2010..

GLOBAL GAS CONTRACT PRICES TIED TO OIL ARE UNDER PRESSURE FROM SPOT PRICES.



A large, persistent gap has opened between European/ Asian gas contract prices vs. US spot gas prices.

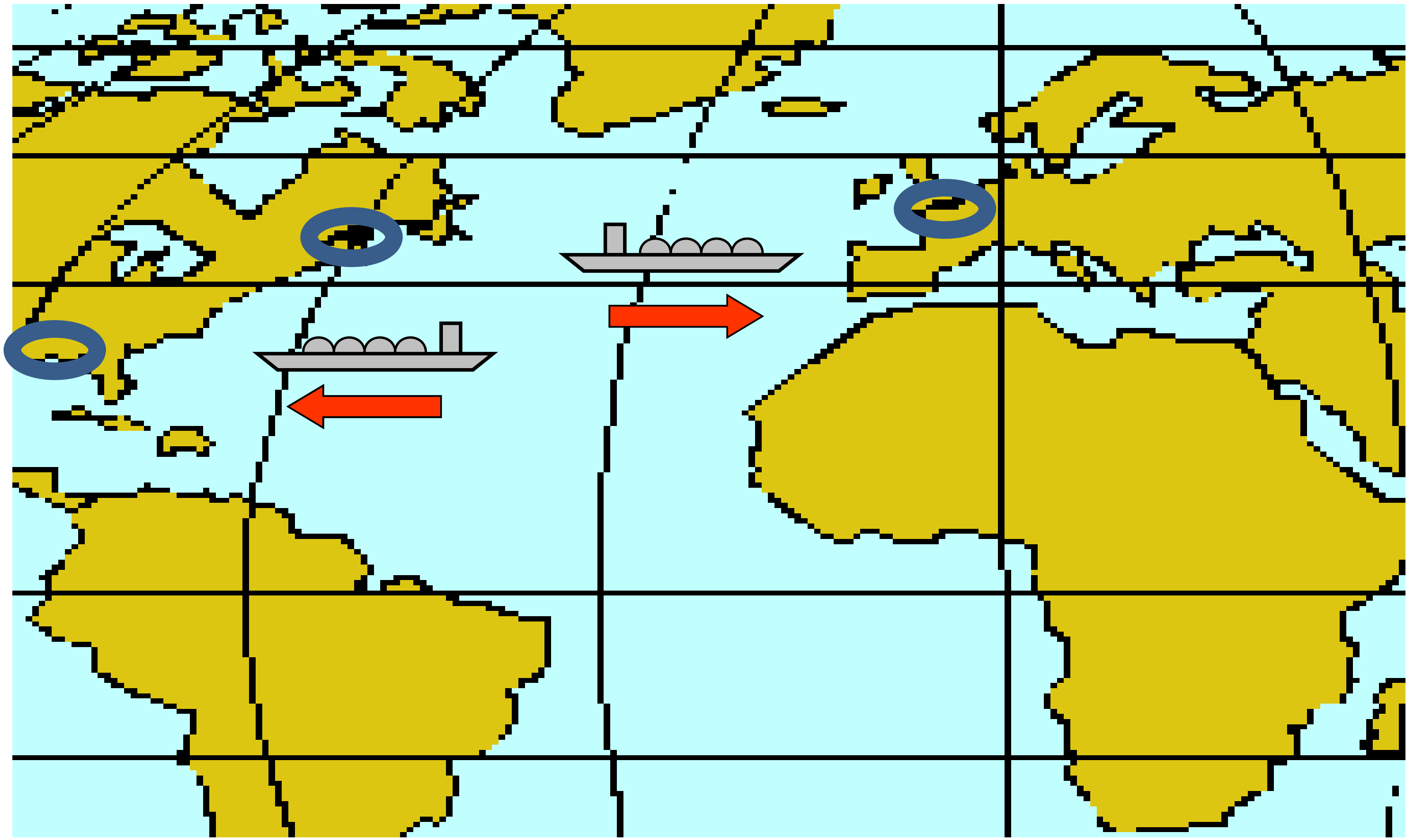
Source: BSA 2010, from NYMEX,close at 14-May-10.

European gas trading hubs have emerged along lines of US spot markets.

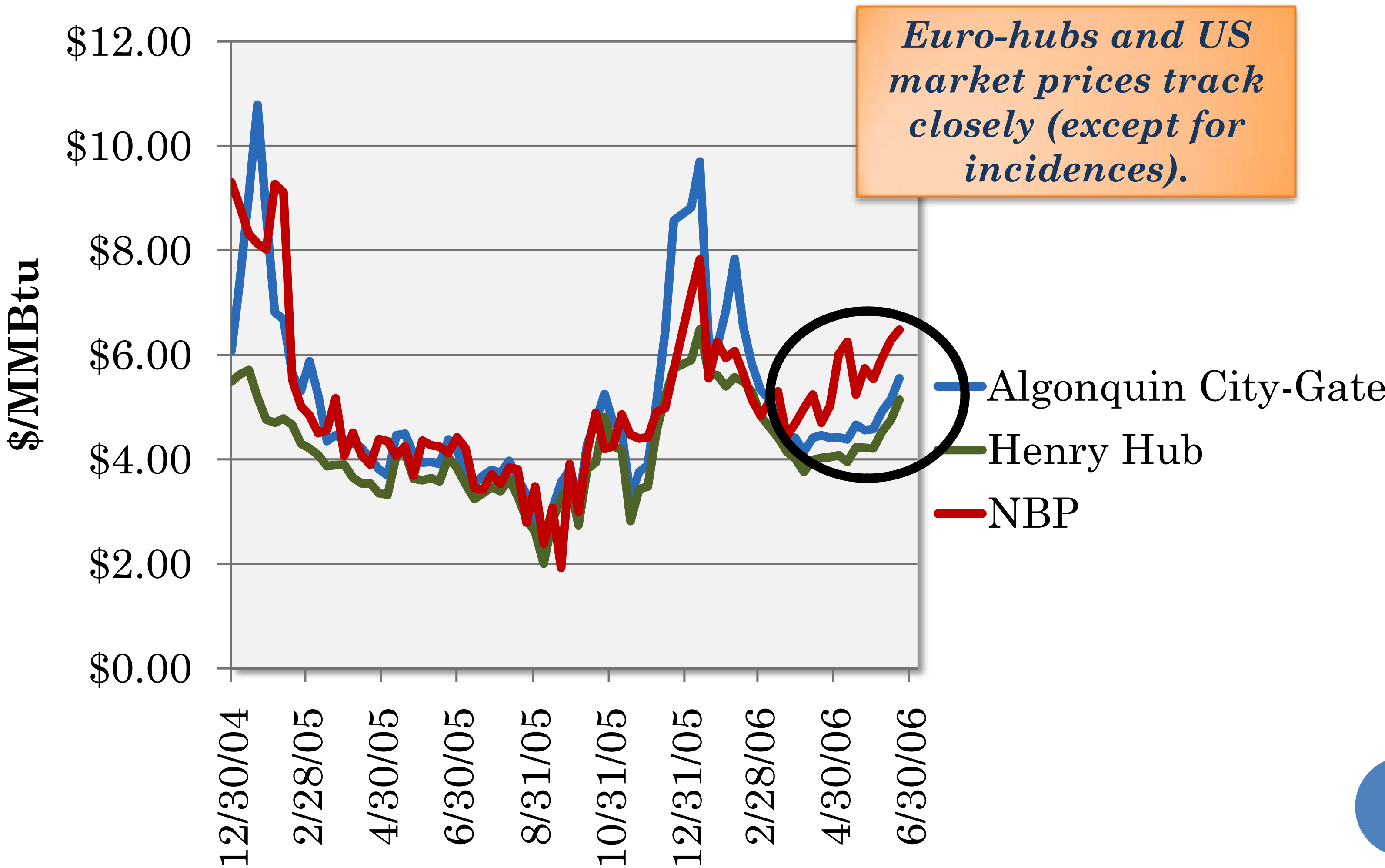
- EU has strongly promoted pipeline access.
- Trading hubs include:
  - NBP/UK market
  - Zeebrugge/Zeehub
  - TTF in Holland
  - German hub (EON).
- Compete with contracts on margin, e.g., makeup gas.
- March 2010: Gazprom will price 15% of volumes at hub index to 12/2012.

Source: BSA 2010, map from World Gas Intelligence.

Atlantic LNG spot cargoes supply Euro-hubs and NA East and Gulf Coasts.



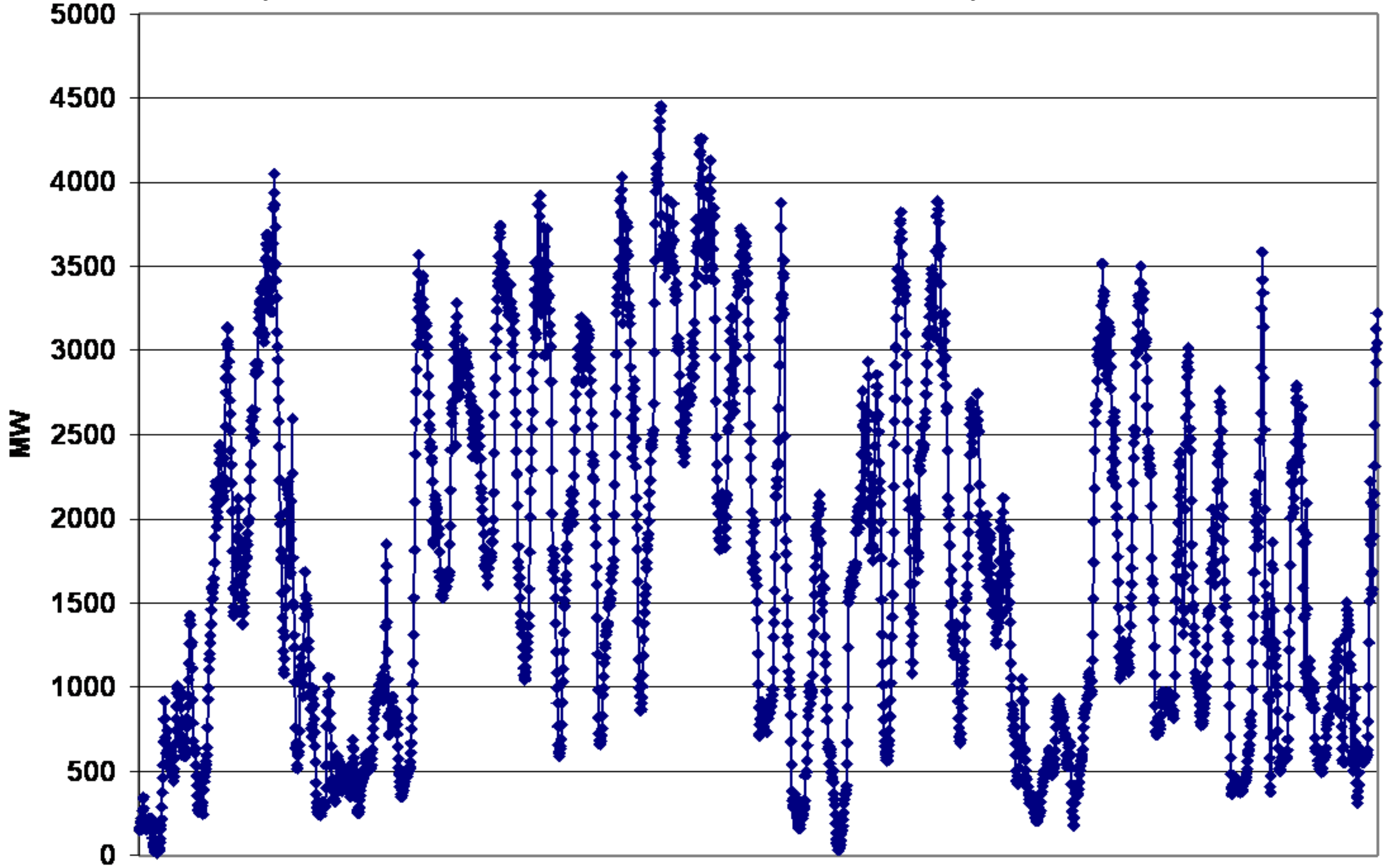
TRANS-ATLANTIC SPOT LNG COMPETITION AFFECTS ALL THREE MARKETS.



Source: BSA 2010, World Gas Intelligence.

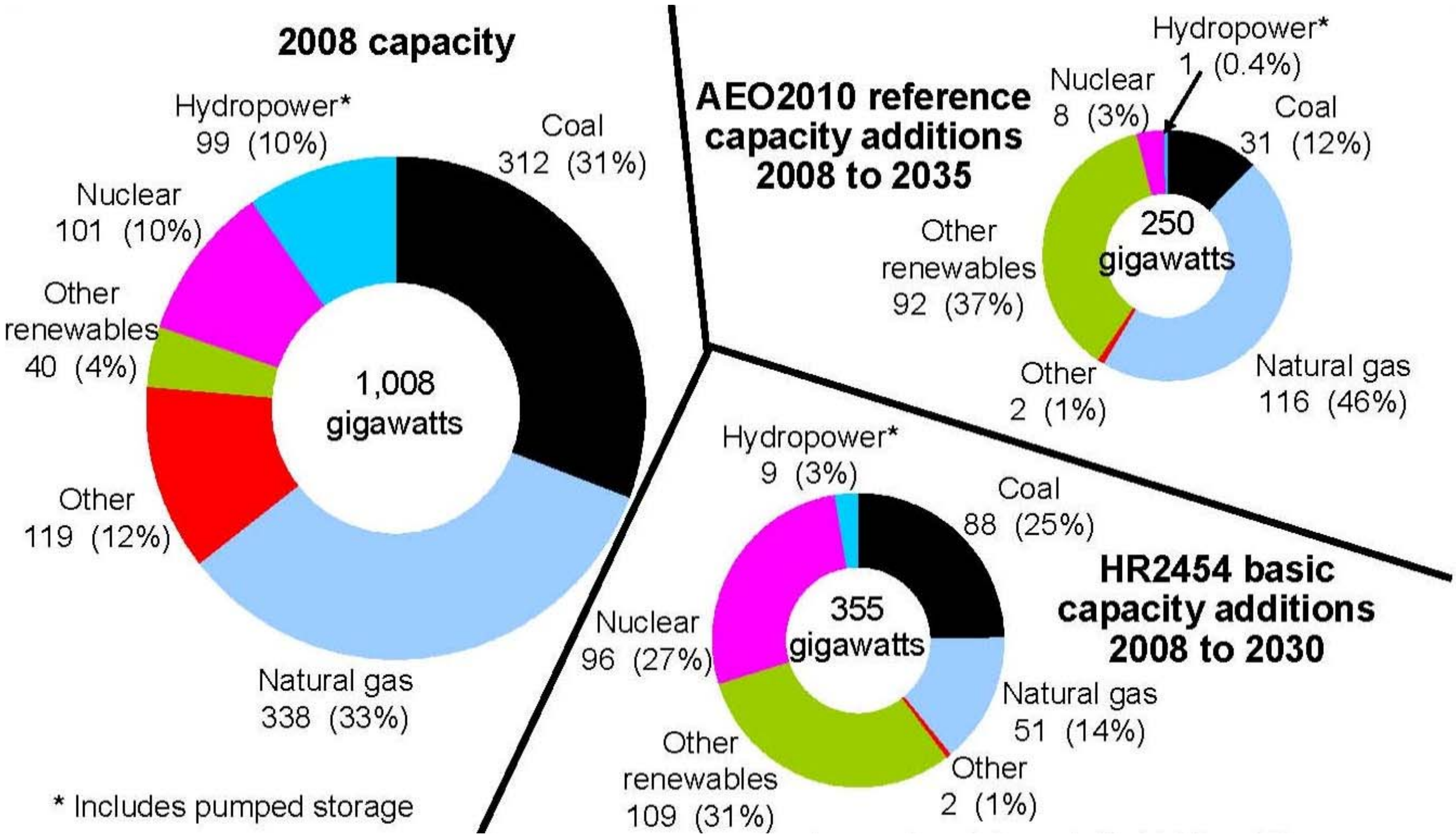
Gas has an organic role in offsetting renewable generation variability.

Hourly Wind Production in Texas, July 2009.



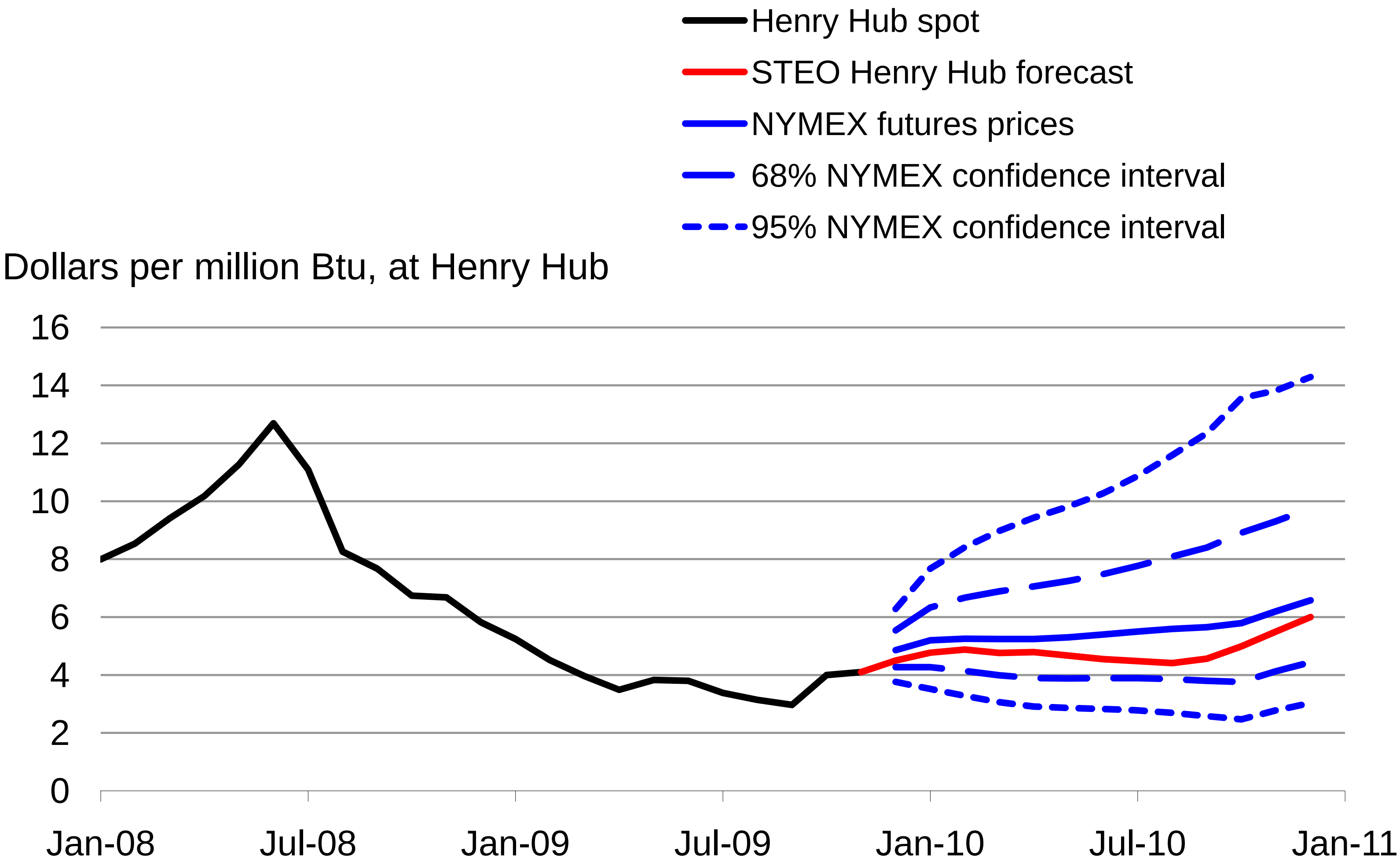
Source: K. Forbes 2010, ERCOT data..

But global warming legislation could reduce gas-fired power plant additions.



Source: John Conti, EIA, from AEO 2010 and EIA analysis of HR 2454 (Waxman-Markey)..

THE DIRECTION FOR NATURAL GAS SPOT PRICES REMAINS HIGHLY UNCERTAIN.



Source: EIA Administrator Richard Newell, November 20, 2009, before NCAC-USAEE, Washington, DC.

IMPLICATIONS, COMMERCIAL RISKS…

- Uncertainty remains large – gas prices will be driven by such fundamentals as world economic growth, shale extraction technology, global LNG, carbon policy.
- Another gas contract crisis is brewing.
  - It is likely that European gas contracts are better structured than the old US contracts to withstand the coming shale-and-LNG-driven spot price onslaught.
  - Movements in Asian markets may take place as well, probably led by China's LNG importers.
- Demand deficit – even with economic recovery, major legislation and capex in renewables may ultimately curb world gas demand growth, further pressuring world gas prices and supply agreements.
- Corporate assumptions and contracts may need to be reviewed.

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