

CHANGES AND CONSIDERATIONS IN THE NATURAL GAS MARKETPLACE



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Rocky Mountain Section of the American
Association of Petroleum Geologists

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Energy Analysis and Answers

If They Are Buying, You Shouldn't Be
Selling

What are our nation's natural gas resources?



- The results of The Potential Gas Committee's latest biennial assessment of the nation's natural gas resources, indicates that the United States possesses a total resource base of 1,898 trillion cubic feet (Tcf). This is the highest resource evaluation in the Committee's 46-year history. Most of the increase from the previous assessment arose from reevaluation of shale-gas plays in the Mid-Continent, Gulf Coast, and Rocky Mountain areas.

Proved Reserves vs. Resources

- **Known gas reservoirs**
- **Existing economic conditions**
- **Existing operating conditions**



- **Discovered**
- **Undiscovered**
- **Effects of technology**
- **Effects of economics**



POTENTIAL GAS AGENCY

COLORADO SCHOOL OF MINES

Natural Gas Resource Assessment of the Potential Gas Committee, 2008 (mean values)

Traditional Resources	1,739 Tcf
Coalbed Gas Resources	159.0 Tcf
Total U.S. Resources	1,897.8 Tcf
Proved Reserves (EIA)	272.5 Tcf*
Future Gas Supply	2,170.3 Tcf

* Value as of year-end 2009



POTENTIAL GAS AGENCY

COLORADO SCHOOL OF MINES

PGC Resource Assessment 2008

Total Traditional Resources (mean values) by category



Probable (existing fields)	441.4 Tcf
Possible (new fields)	736.9 Tcf
Speculative (frontier)	500.7 Tcf
Total	1,673.4 Tcf

PGC Resource Assessment 2008

Total Coalbed Gas Resources (mean values) by category

Probable
Resources



Probable (existing fields)

14.2 Tcf

Possible (new fields)

49.8 Tcf

Speculative (frontier)

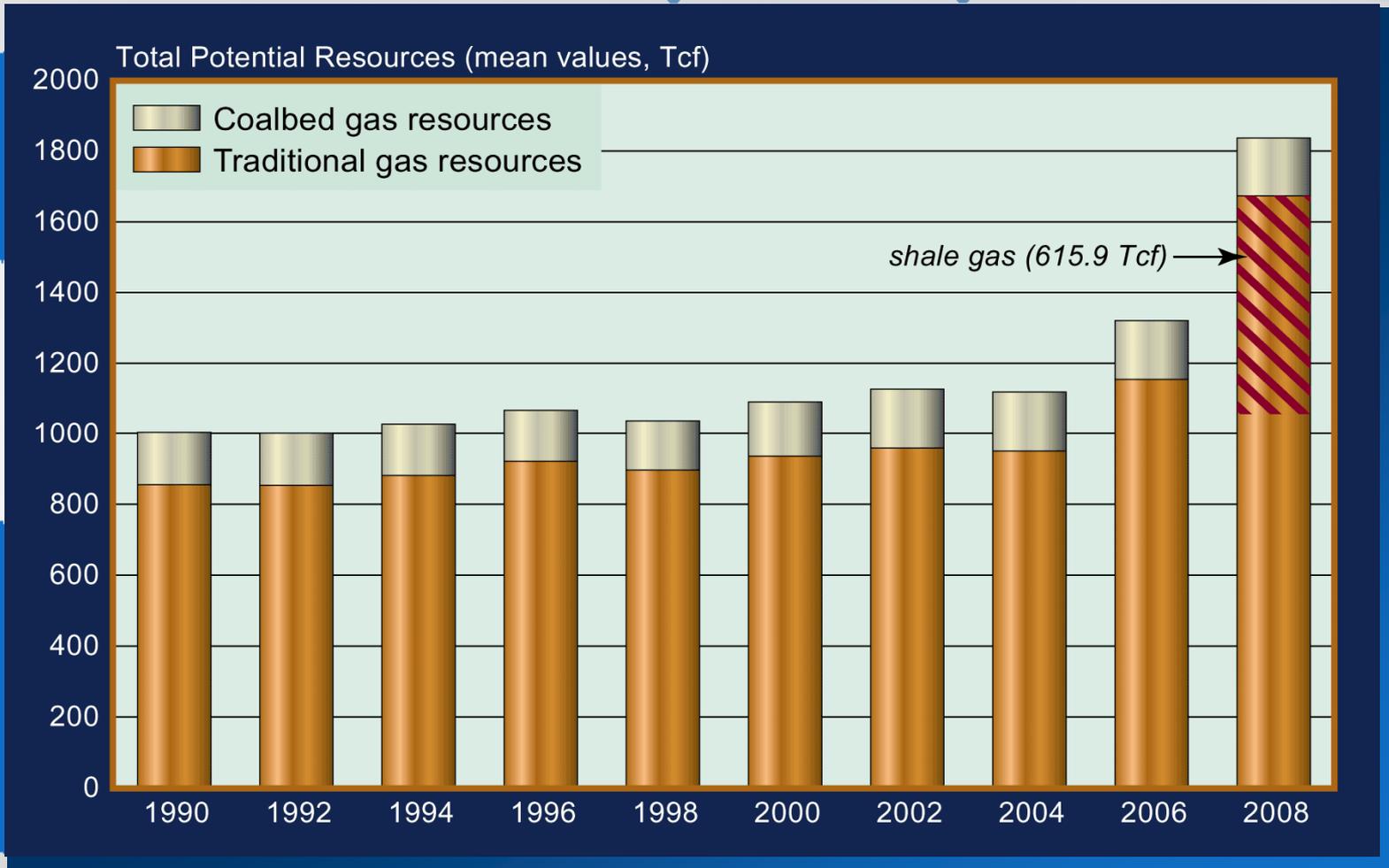
98.9 Tcf

Total

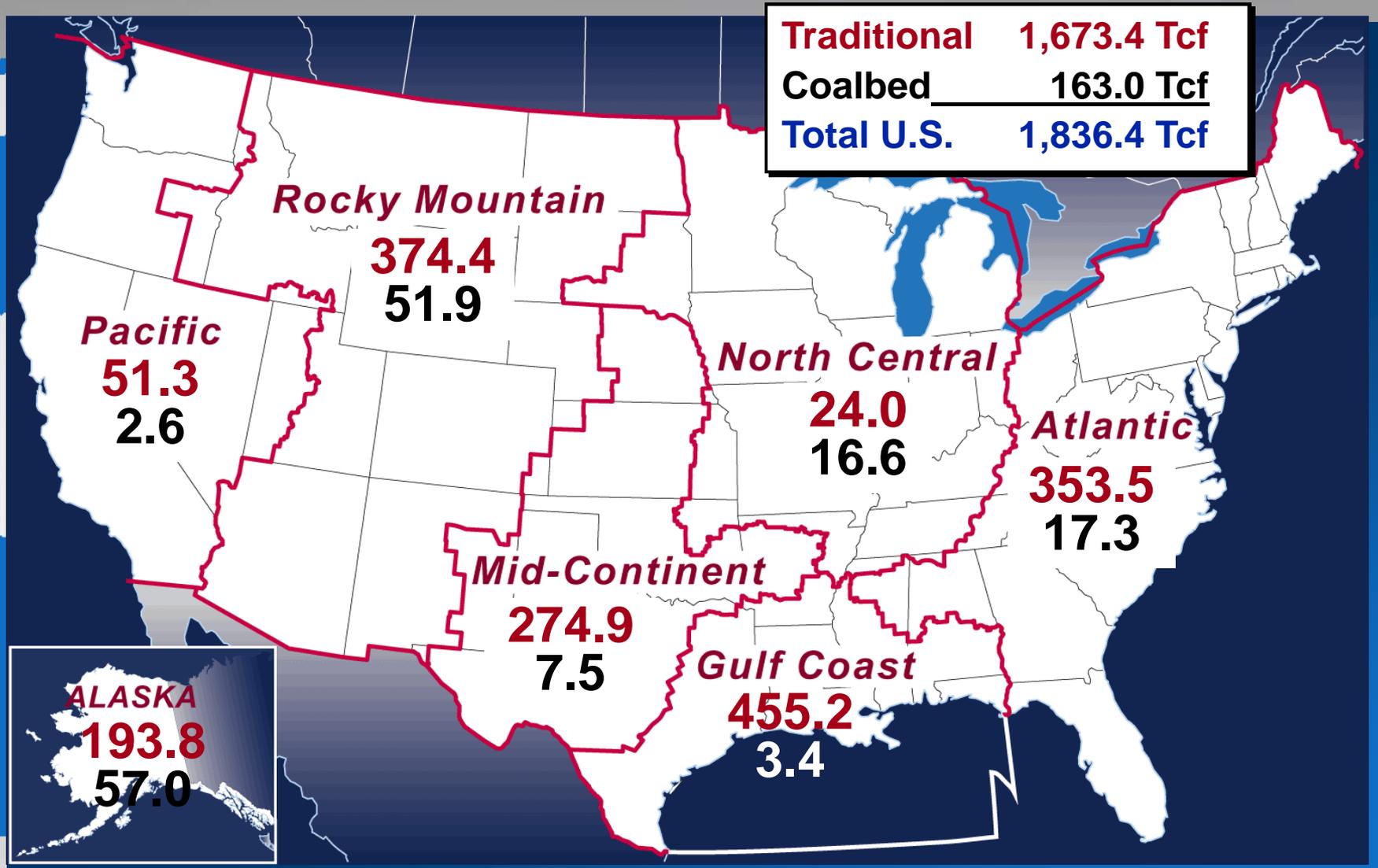
163.0 Tcf

PGC Resource Assessments, 1990-2008

Total Potential Gas Resources (mean values)



Regional Resource Assessment





What are our nation's natural gas resources?

As Dr. Curtis observed, “Our knowledge of the geological endowment of technically recoverable gas continues to improve with each assessment. Furthermore, new and advance exploration, well drilling and completion technologies are allowing us increasingly better access to domestic gas resources – especially ‘unconventional’ gas – which, not all that long ago, were considered impractical or uneconomical to pursue.”

“Consequently, our present assessment demonstrates an exceptionally strong and optimistic gas supply picture for the nation.”

Report of the Potential Gas Committee, June 2009

Dr. John B. Curtis, Ph.D., Geology

Conventional versus Unconventional



- The search for hydrocarbons usually began with the analysis of:
 - A geologic basin where predominantly marine sediments were deposited.
 - A source rock was present which had a high total organic carbon content.
 - A reservoir rock with porosity and permeability was present.
 - A cap rock that was very tight and would prohibit the hydrocarbons in the reservoir rock from escaping.
 - A structural or stratigraphic trapping condition which allowed the hydrocarbons to migrate from the source rock into the reservoir rock and be trapped and stay there.

Unconventional



- Coal bed methane, drilling and fracturing the coal seams to free the molecules of methane that were attached to the platelets of coal.
- Shale gas, the source rock of the conventional search becomes the reservoir and source rock all in one. The low permeability allows the gas to be trapped in and around the shale size particle of the formation.
- Tight sands gas, formations where the dominant lithology is silt and sand size particles. The rock has a low permeability and often low porosity. It is tight.

What has made the unconventional natural gas plays a reality?



- Price increases in commodity and new technology.
- Technology has changed in the way unconventional wells are drilled, analyzed through seismic and advanced logging techniques, and are completed. The higher price received by the producer for the commodity has allowed very costly, massive, stimulation completions to be employed, freeing large amounts of gas trapped under very high pressures.
- The ability to drill 15,000 feet vertically and then 30,000 feet horizontally and all combinations thereof have allowed large amounts of subsurface reservoirs to be exposed to the borehole from one surface location. Drilling large numbers of wells from a single drilling pad or drilling area has reduced environmental impacts and costs.

Natural Gas Supply and Transportation Considerations



- Natural Gas Supplies and Pricing

Mission:

- For a consumer, a stable supply of natural gas at the lowest possible price commensurate with the required degree of reliability and required time of delivery.
- For a producer, the highest price via a hedge or physical transaction as close to the wellhead as possible.

- Estimated Consumption Profile

- Quality
- Volumes
- Time of Use
- Price Comparison with electric market options
 - When to generate/when to buy

Pricing

- 
- Identify known **constants** and **variables** that act as price affecters short and long term. Using risk analysis, convert variables into constants.

Constants

- Real time market indicative pricing
- Price hedges in place
- Current demand
- Current drilling
- Current production
- Current source areas take away capacity
- Pipeline capacity firm
- Alberta/BC/Saskatchewan drilling/production reserves
- New geologic plays and impacts
 - Conventional
 - Unconventional
- Government taxes royalty rates
- Number of explorers
- Environmental issues
- Governmental rules and regulations
- War
- Regional consumption versus resources
- New storage

Pricing



Variables

- Market pricing short and long term (fluctuating)
- Drilling rates domestic
- Demand
- Production/deliverability
- Reserves addition
- National storage balance
- Canadian storage balance
- Winter weather
- Summer weather
- Hurricane season
- Market perceptions
- Oil demand U.S./Globally
- Oil reserves and deliverability and pricing
- LNG global liquifaction, regassification and markets and capacity
- Pipeline projects (take away effects)

Natural Gas Supply and Transportation Considerations



- Creditworthiness
 - Yours/theirs
- Taxes at the point of delivery
- Transportation
 - Match pipeline space with consumption
 - Firm versus interruptible
 - Benefits
 - Risks
 - Cost
 - Firm with interruptible
 - Transportation management
 - Cost versus personnel and ability to manage
 - Lay off capacity
 - Acquire capacity

Natural Gas Supply and Transportation Considerations



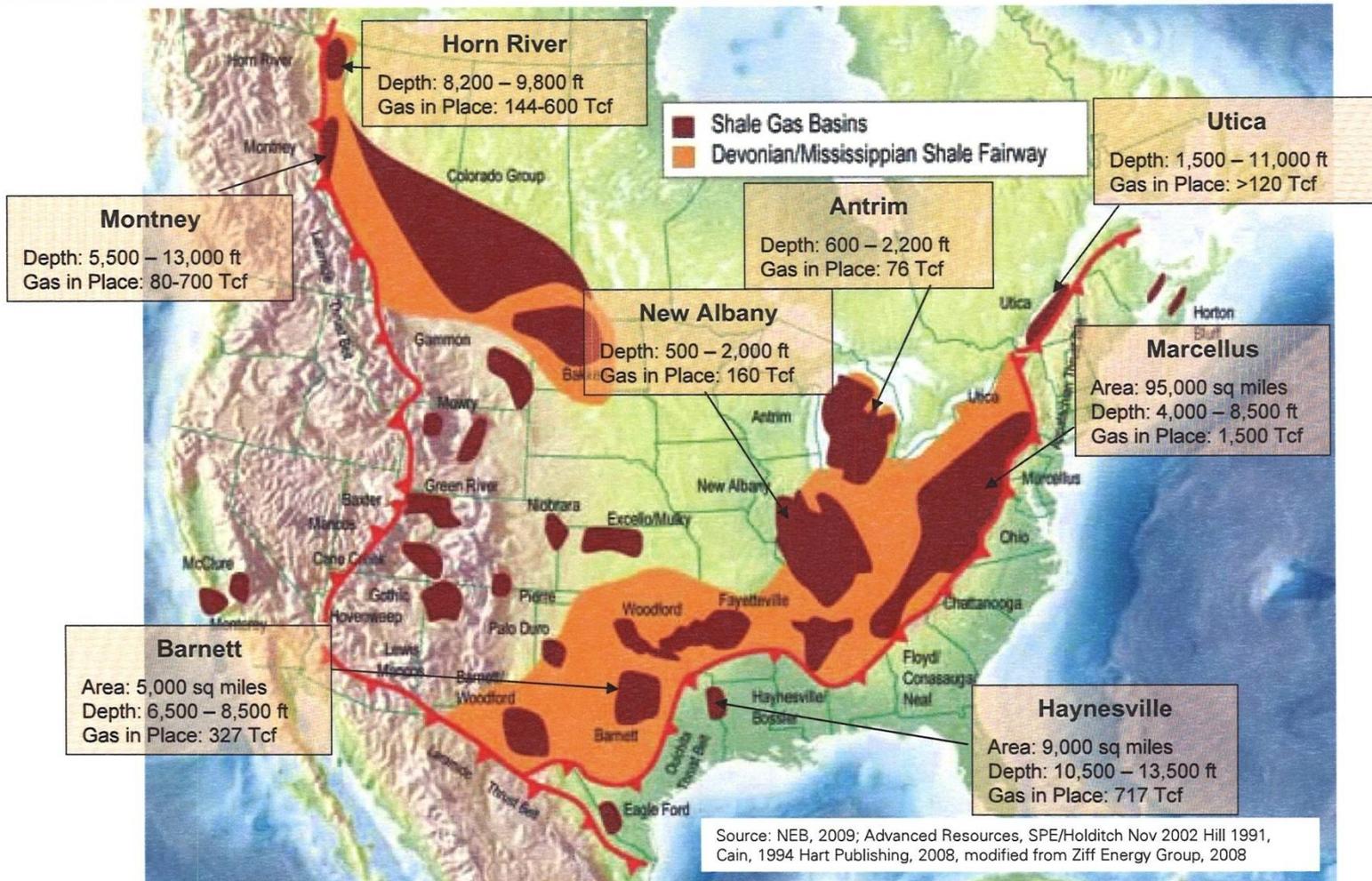
- Gas Supply and Transportation Management

- Benefits external – fees clearly defined and acceptable
- Benefits internal
- Diversified supply portfolio
- Ability to manage around pipeline constraints in a least fashion
- Potential to mitigate or eliminate effects of pipeline OFO's

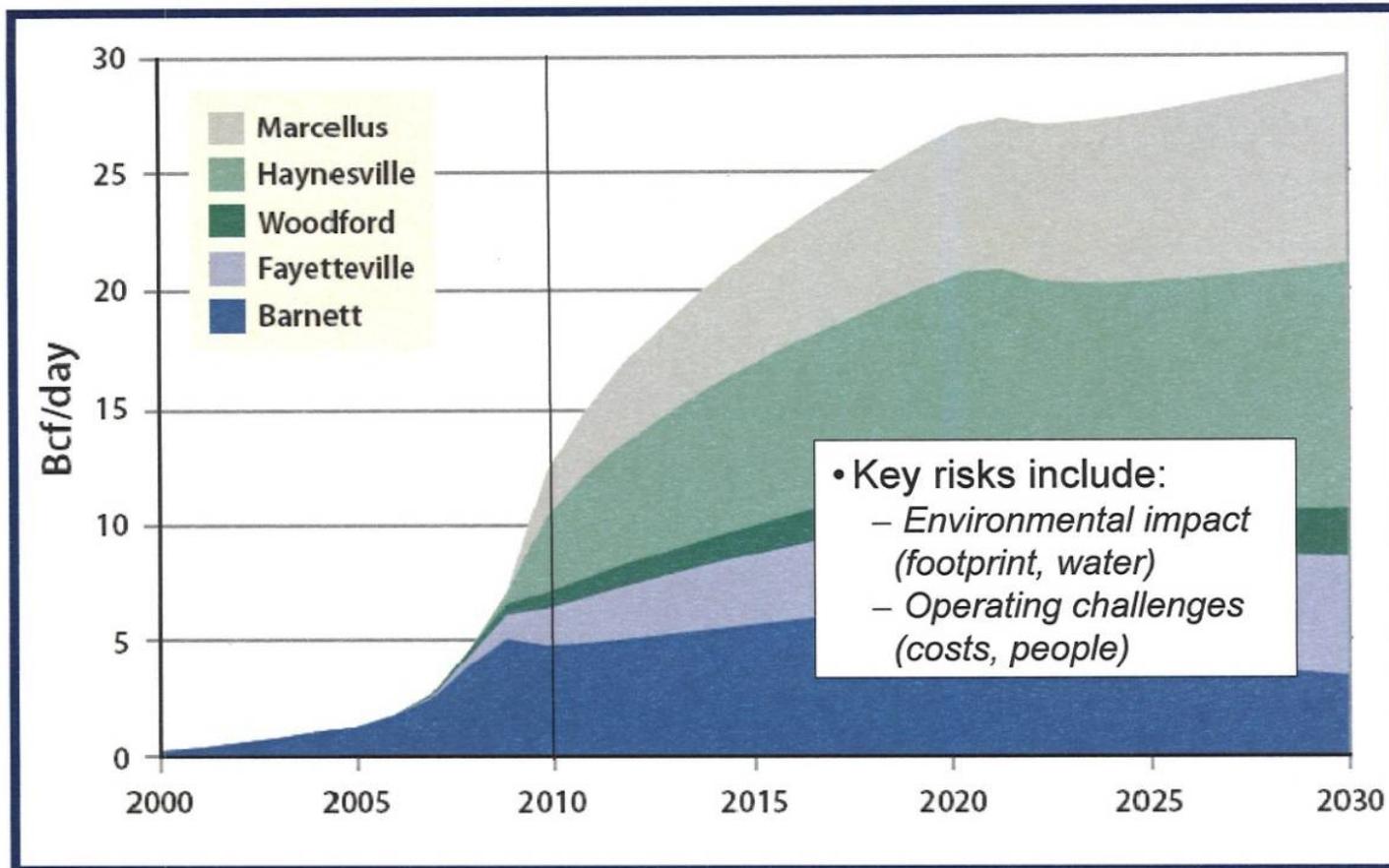
- Cost Recovery

- For a utility, choices above should be analyzed, in part, on the ability to recover 100 percent of the commodity and transportation expenses incurred, acceptable and demonstrable, subject to a reasonableness audit, by customers and the PUC.

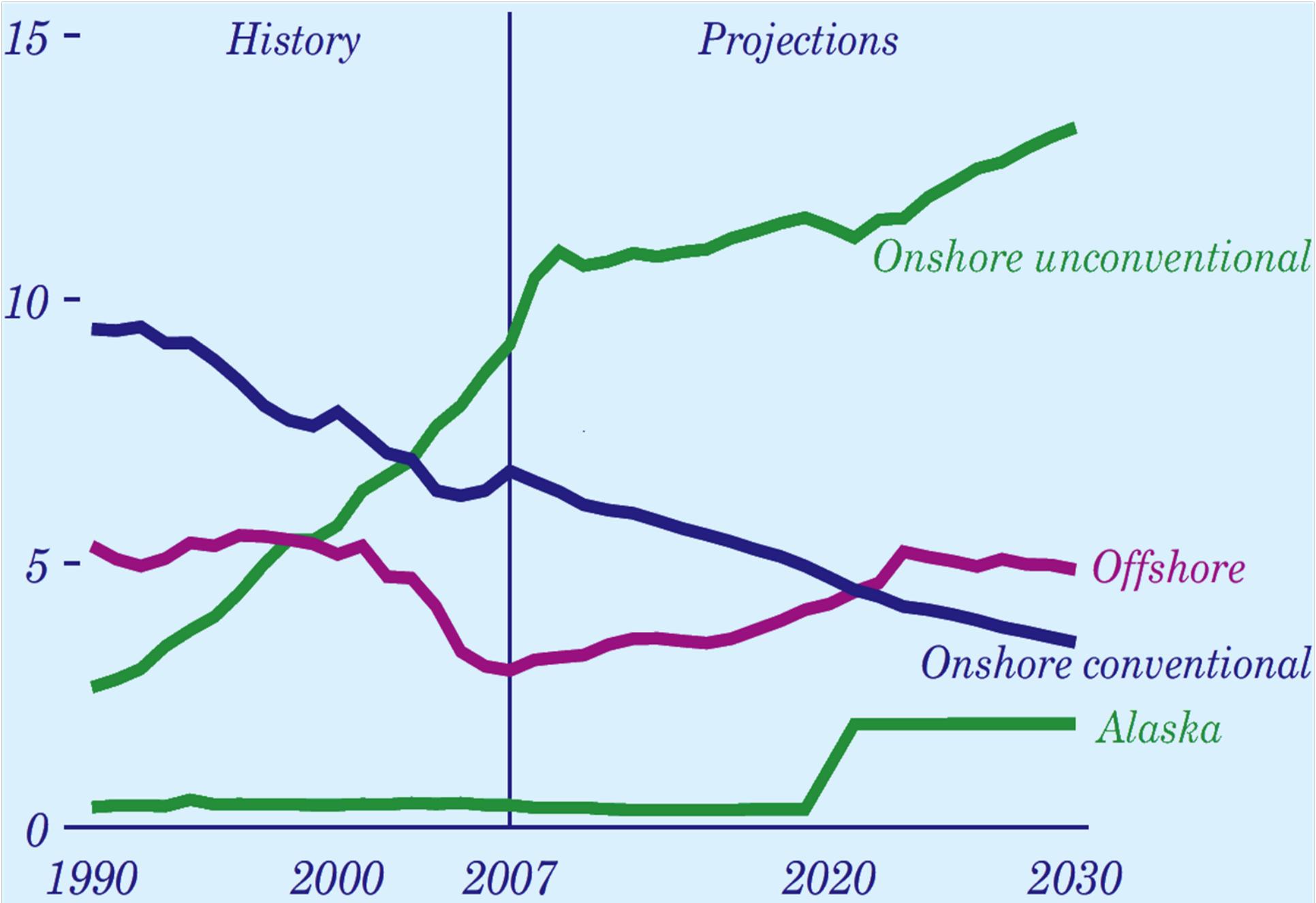
Emerging shale gas plays



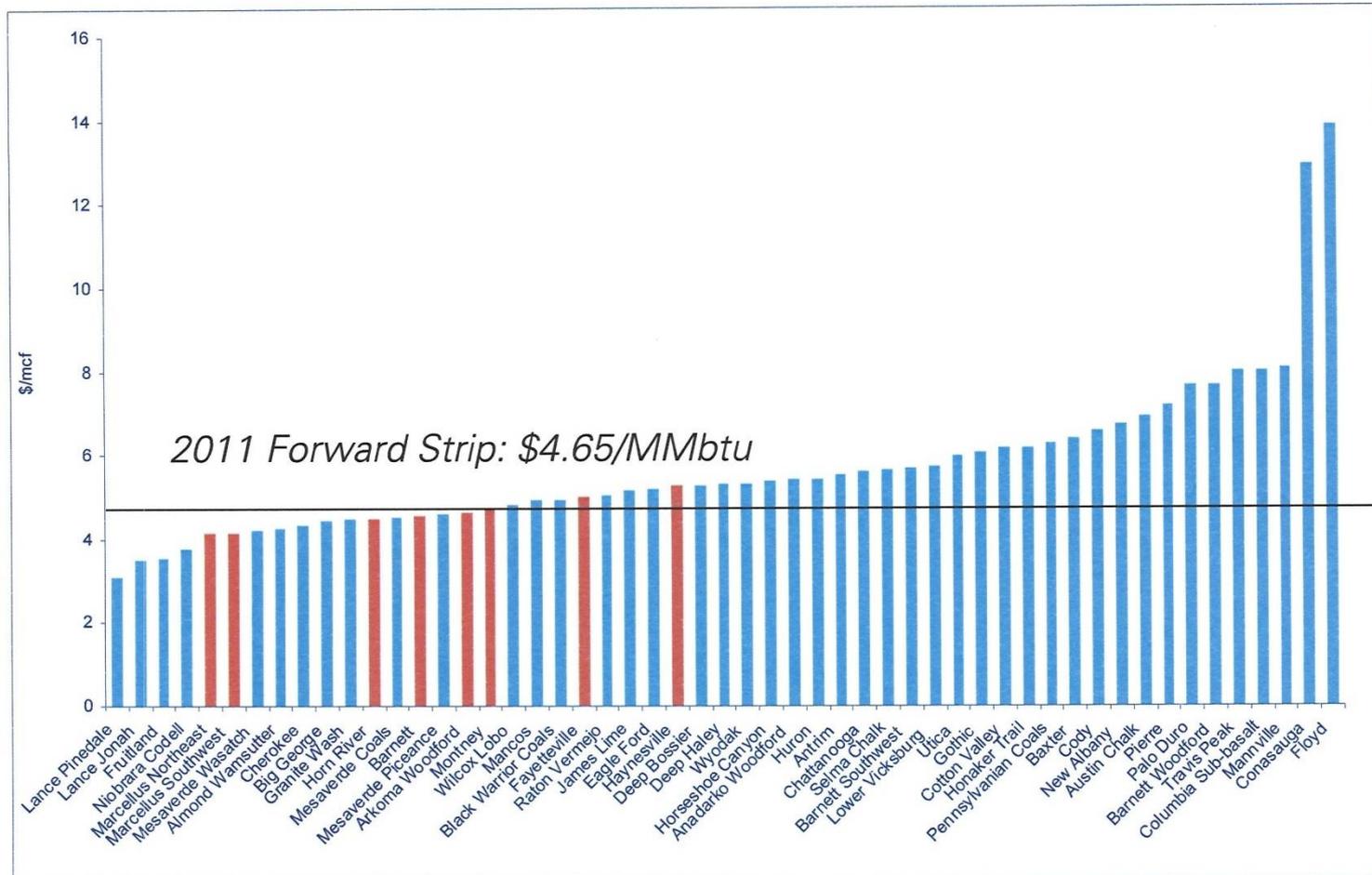
Shale Production Forecast: Significant Growth Potential



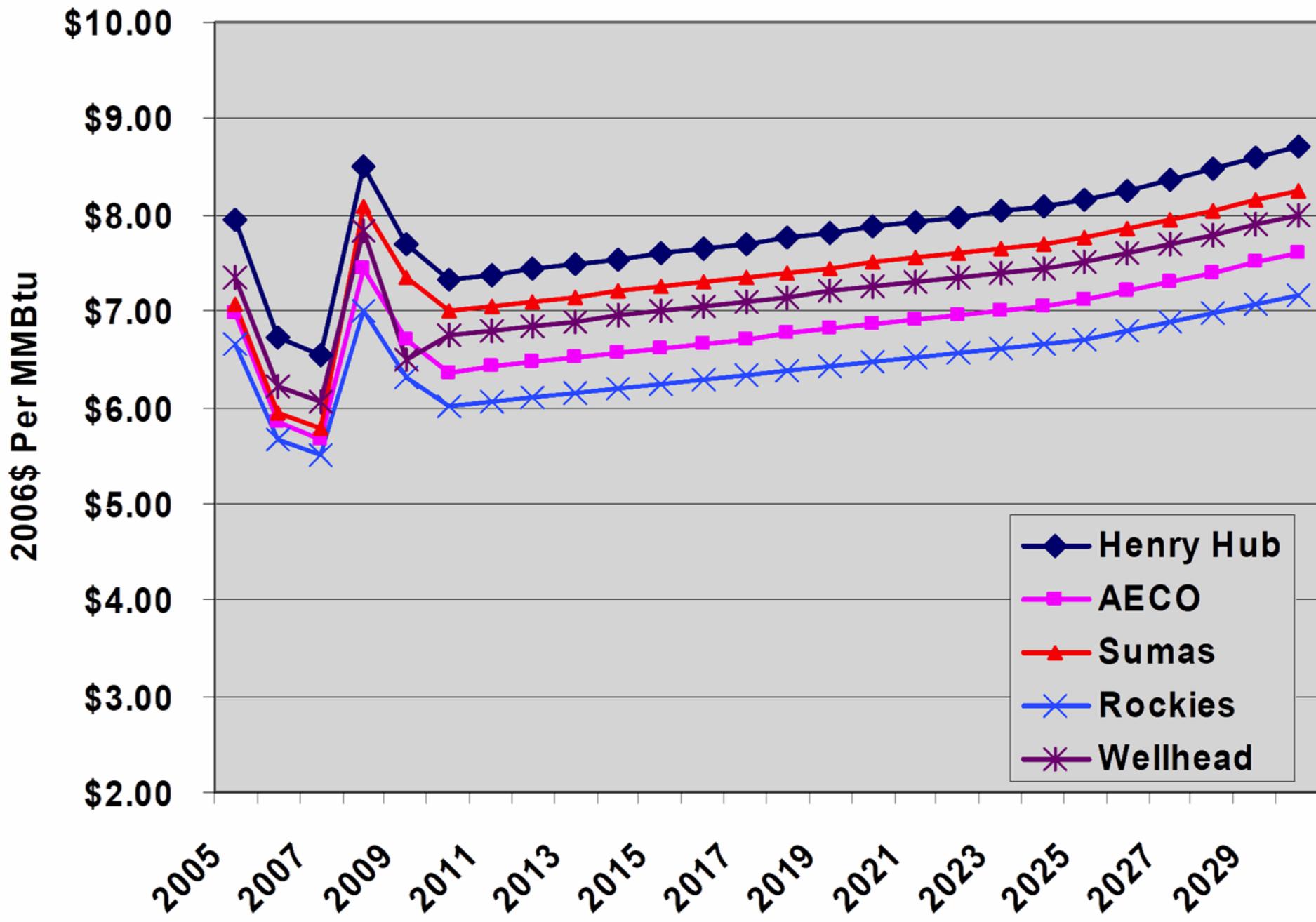
Source: MIT Study on the Future of Natural Gas



Lower costs continue to drive shale growth



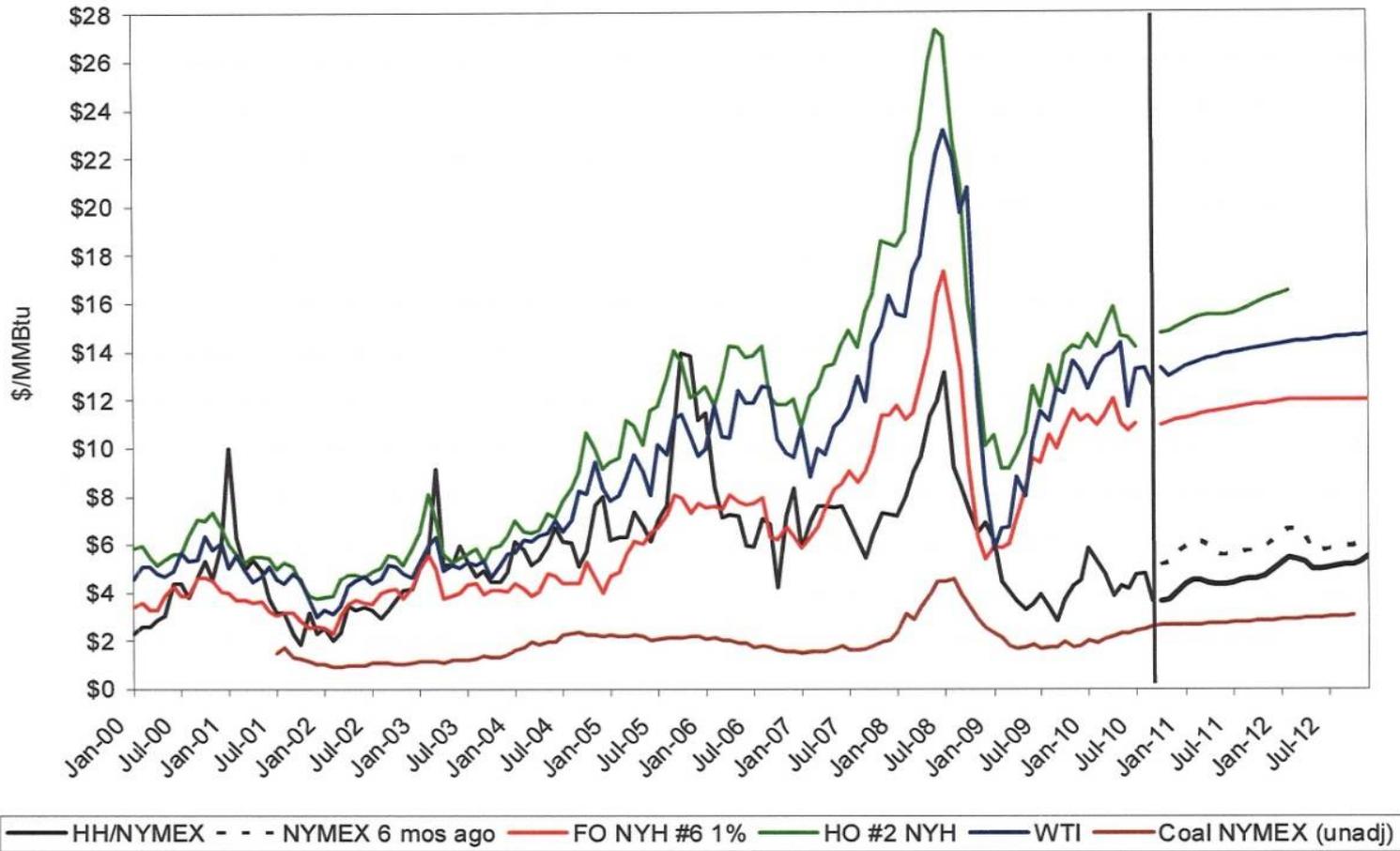
Source: WoodMackenzie



Natural Gas & Competing Fuels



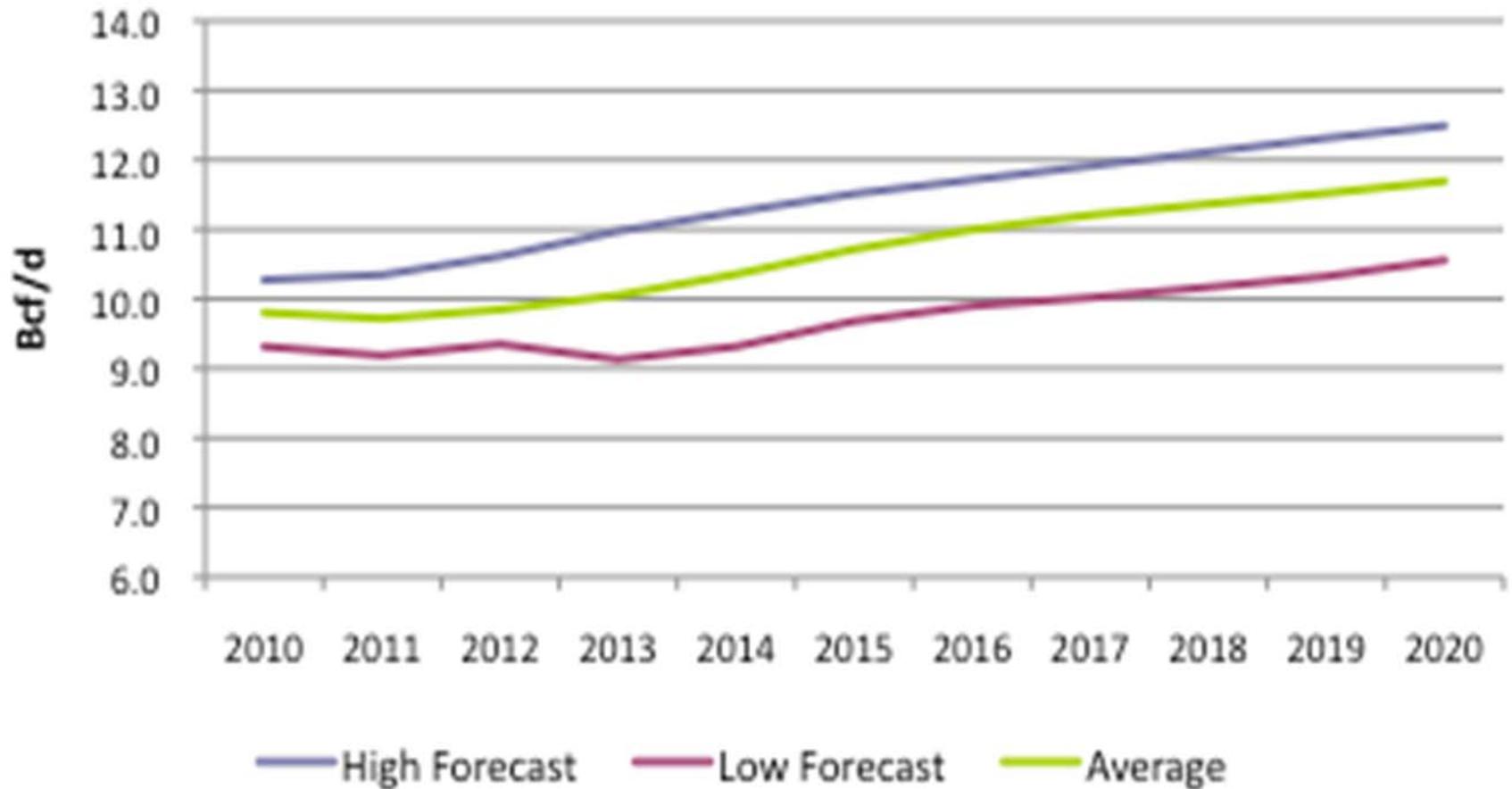
Source: Various, Aug 27/10



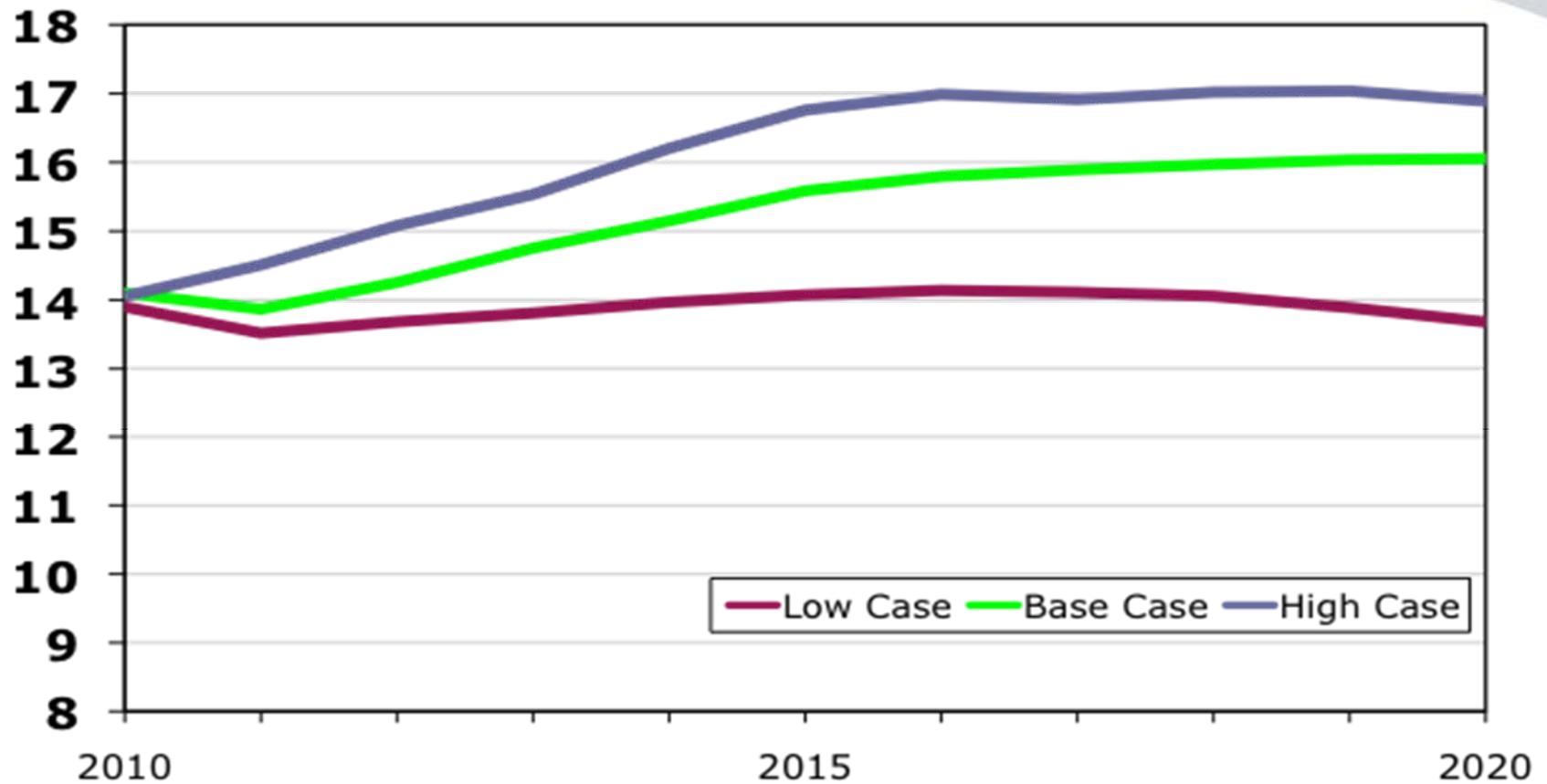
World LNG Estimated August 2010 Landed Prices

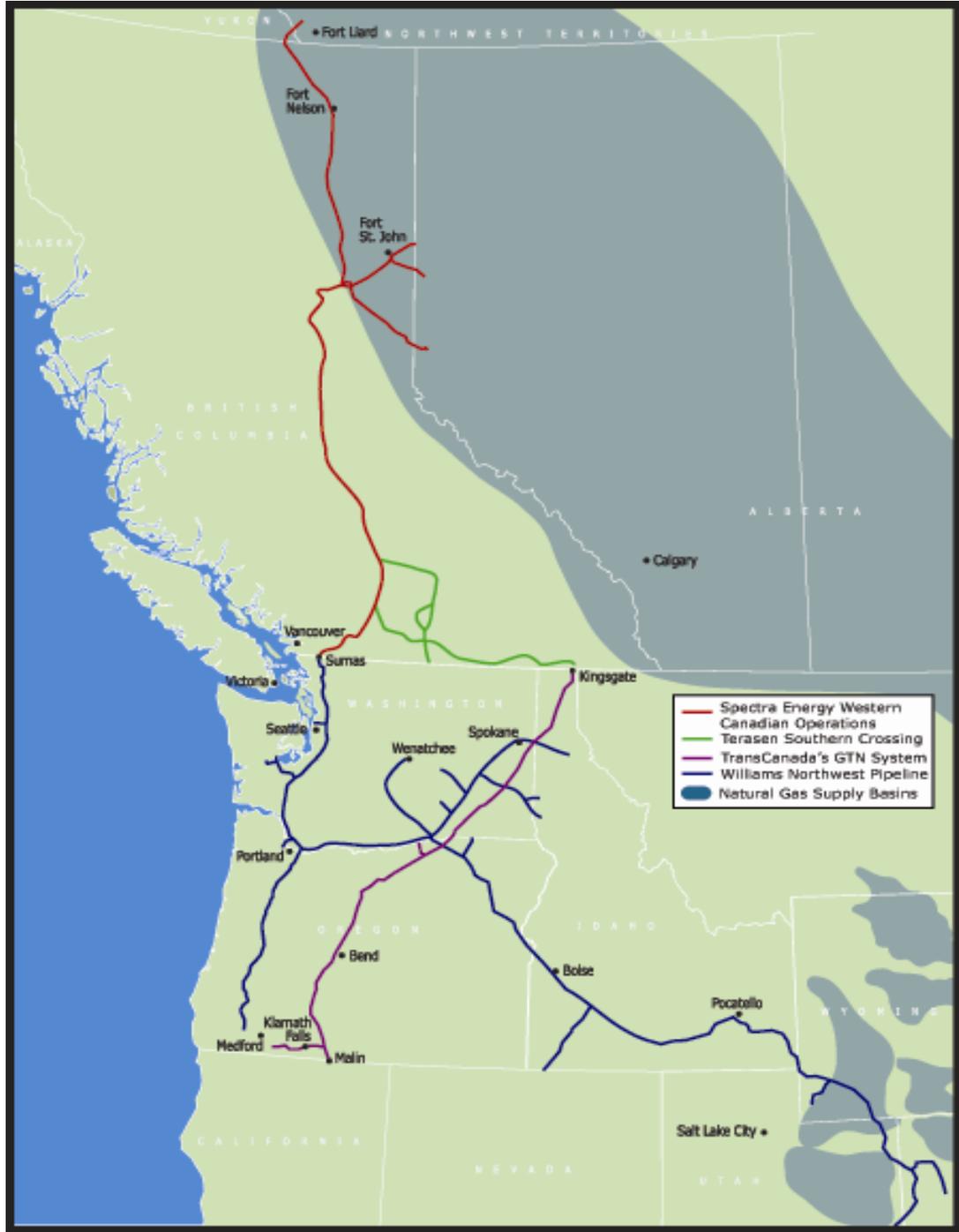


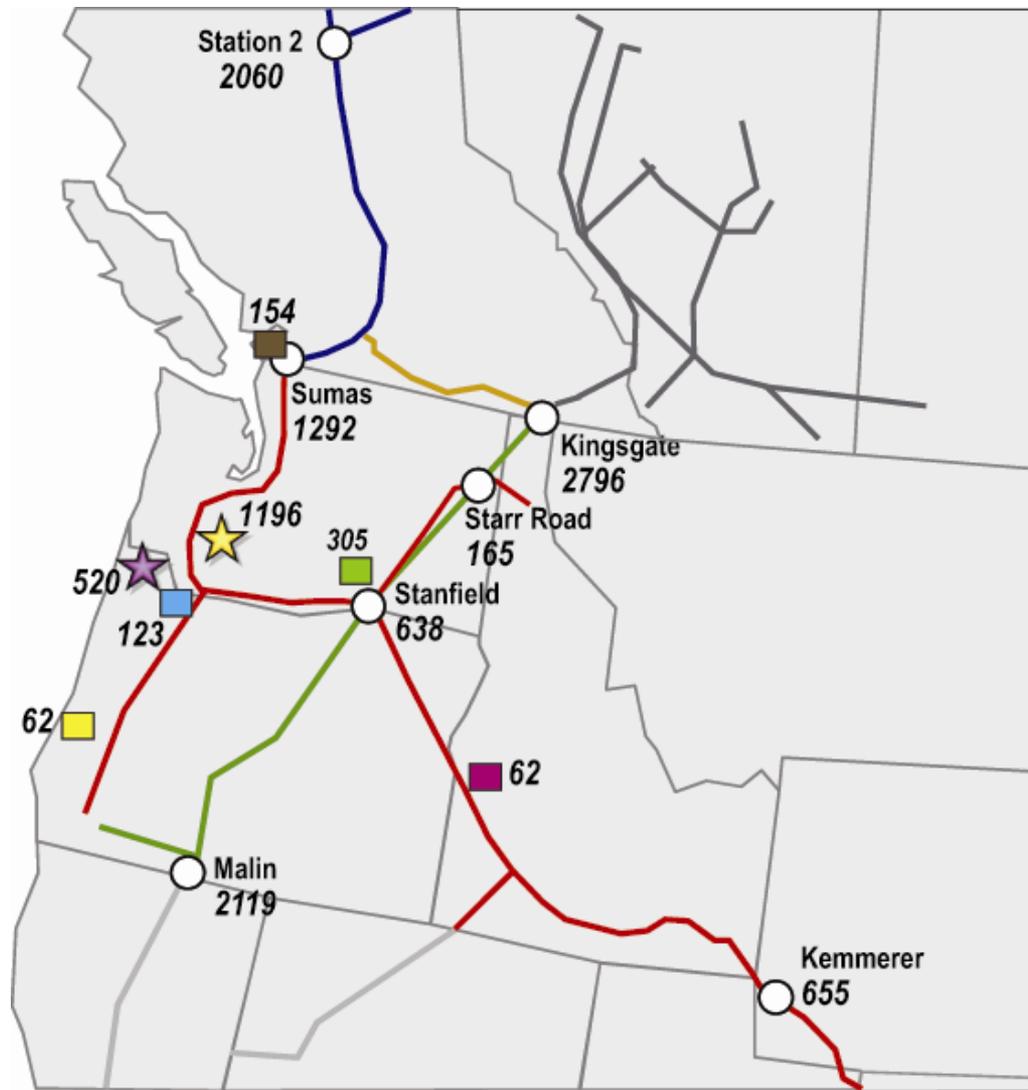
Rockies Production Forecasts



WCSB Production Forecast







Scale: Thousand Decatherm per day.

Pipelines

- Spectra Energy Western
- Canadian Operations
- Terasen S. Crossing
- TransCanada GTN
- Williams NWP
- Nova Inventory Transfer

Storage Facilities

- ★ Mist
- ★ Jackson Prairie

LNG Storage Facilities

- Nampa
- Newport
- Tilbury
- Plymouth
- Portland