Changes and Considerations in the Natural Gas Marketplace*

David H. Hawk[1]

Search and Discovery Article #70108 (2011)
Posted October 11, 2011

*Adapted from oral presentation at AAPG Rocky Mountain Section meeting, Cheyenne, Wyoming, USA, June 25-29, 2011.

[1]Energy Analysis and Answers, Boise, ID (dhawk3@cableone.net)

Abstract

The Potential Gas Committee has reported the natural gas resource base in the United States has grown to over 2000 TCF in their last report. Some estimate that number may grow to over 2600 TCF in their next report. The advent of an increasing role for unconventional natural gas is dominating the prospect generations, lease acquisition, drilling and the merger and acquisition activity worldwide. We are discovering that not all tight sands nor are all shales the same - the economic development threshold for each reservoir is different. The risk dollars for prospect identification, lease acquisition and drilling are borne by the industry, not through tax or production credits. We are an old economy pretty much on our own hook.

To be successful, both geologically and economically, we must understand our business from the concept to the point of consumption. We must understand the variables and constants that affect pricing for the seller and buyer, consumption, transportation and methods to stem volatility and risk. It is still fair, important and vital for our industry to make money.

CHANGES AND CONSIDERATIONS IN THE NATURAL GAS MARKETPLACE

Presented to:
Rocky Mountain Section of the American Association of Petroleum Geologists

June 20, 2011

GUEST SPEAKER:
David H. Hawk
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

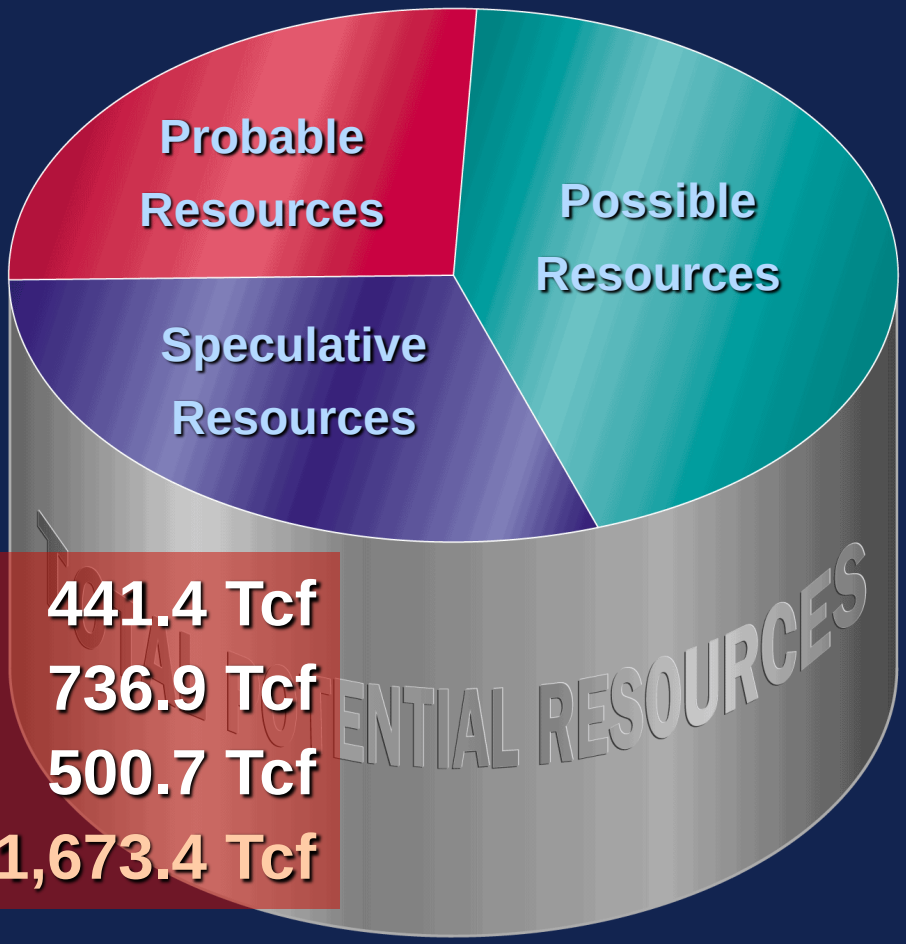
Natural Gas Resource Assessment of the Potential Gas Committee, 2008 (mean values)

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

PGC Resource Assessment 2008

Total Traditional Resources (mean values) by category

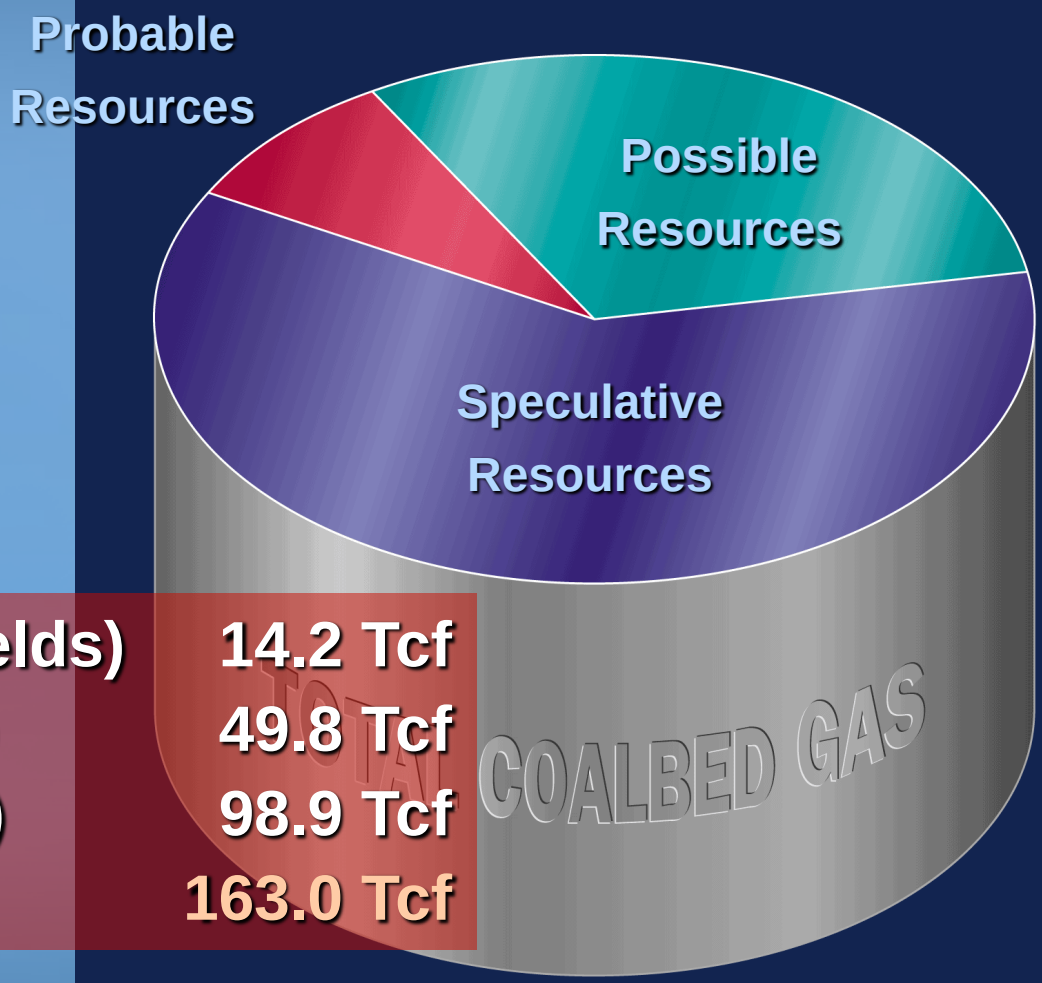


Probable (existing fields)	441.4 Tcf
Possible (new fields)	736.9 Tcf
Speculative (frontier)	500.7 Tcf
Total	1,673.4 Tcf

Data source: Potential Gas Committee (2009)

PGC Resource Assessment 2008

Total Coalbed Gas Resources (mean values) by category

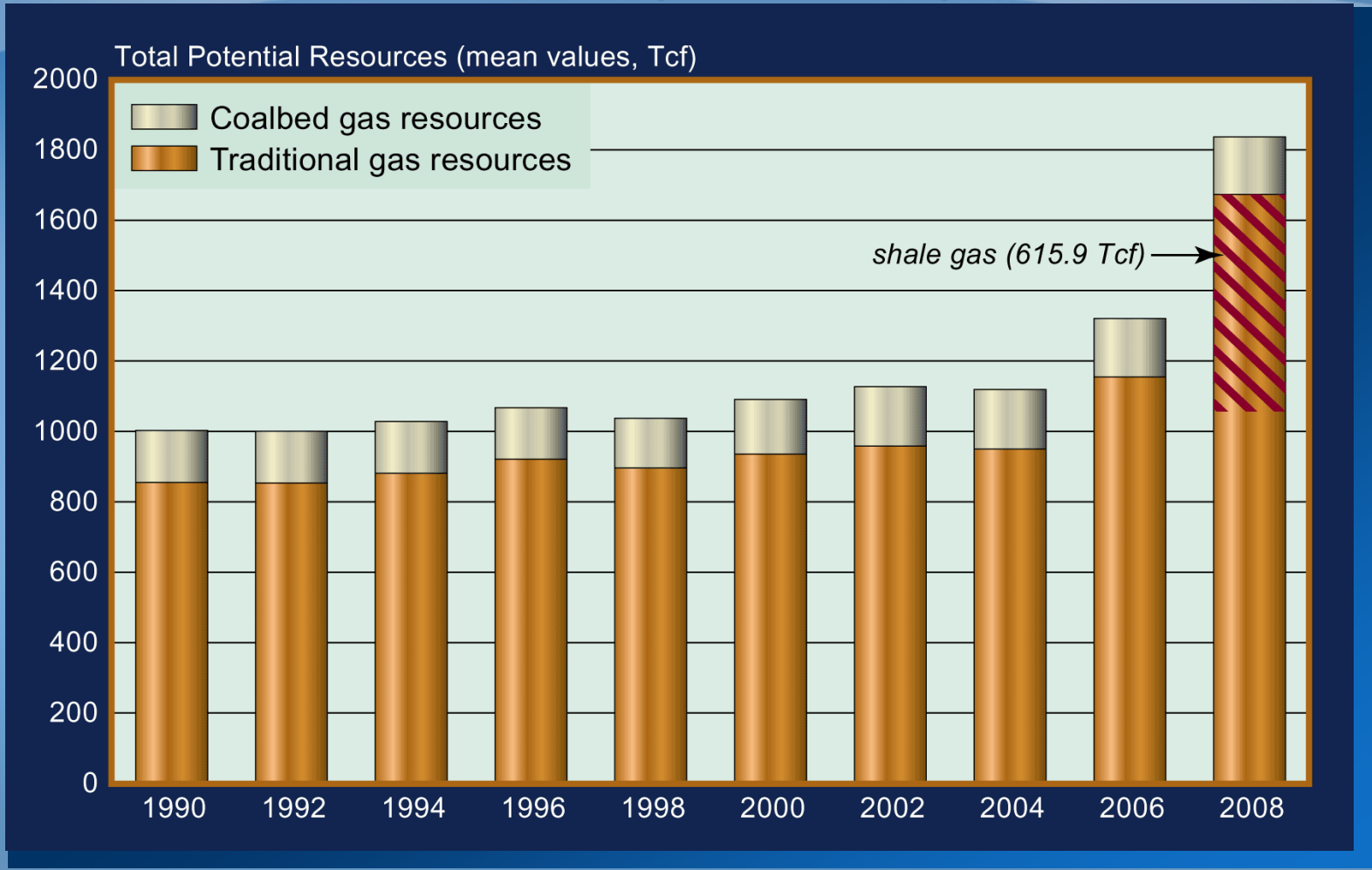


Probable (existing fields)	14.2 Tcf
Possible (new fields)	49.8 Tcf
Speculative (frontier)	98.9 Tcf
Total	163.0 Tcf

Data source: Potential Gas Committee (2009)

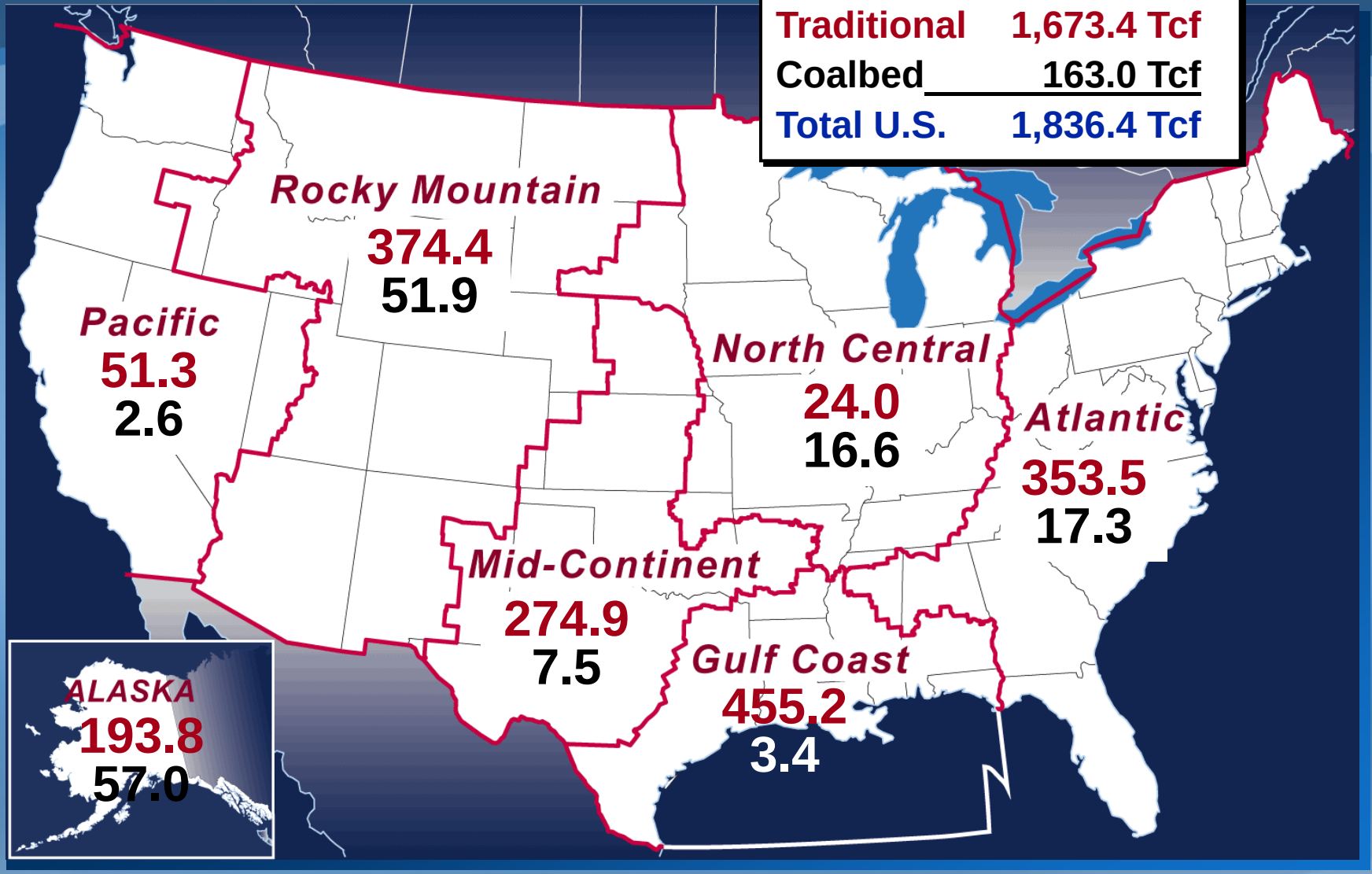
PGC Resource Assessments, 1990-2008

Total Potential Gas Resources (mean values)



Data source: Potential Gas Committee (2009)

Regional Resource Assessment



Data source: Potential Gas Committee (2009)

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)

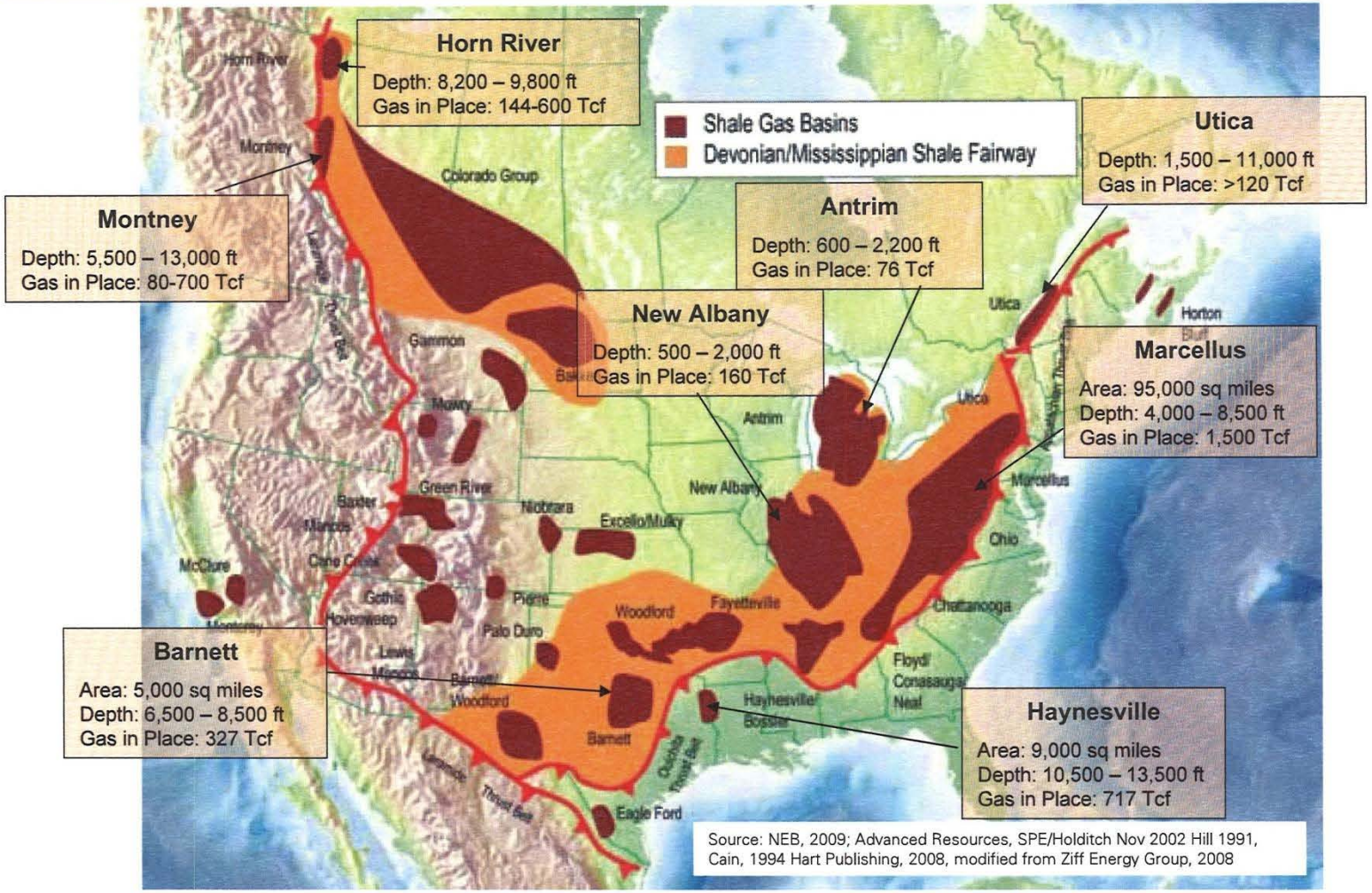
Natural Gas Supply and Transportation Considerations

- 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

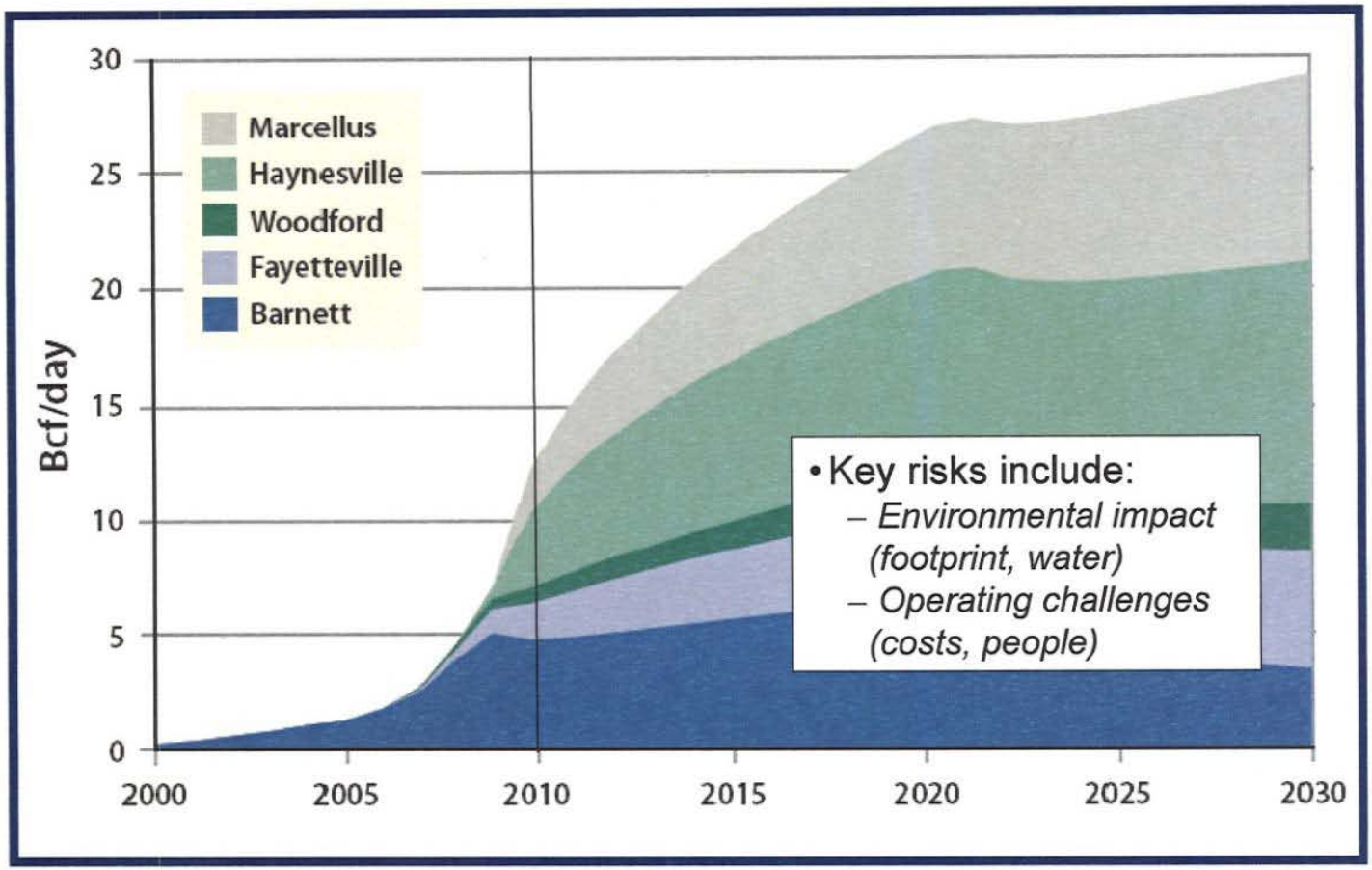
- Gas Supply and Transportation Management
  - Benefits external – fees clearly defined and acceptable
  - Benefits internal
  - Diversified supply portfolio
  - Ability to manage around pipeline constraints in a least fashion
  - Potential to mitigate or eliminate effects of pipeline OFO's
- Cost Recovery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

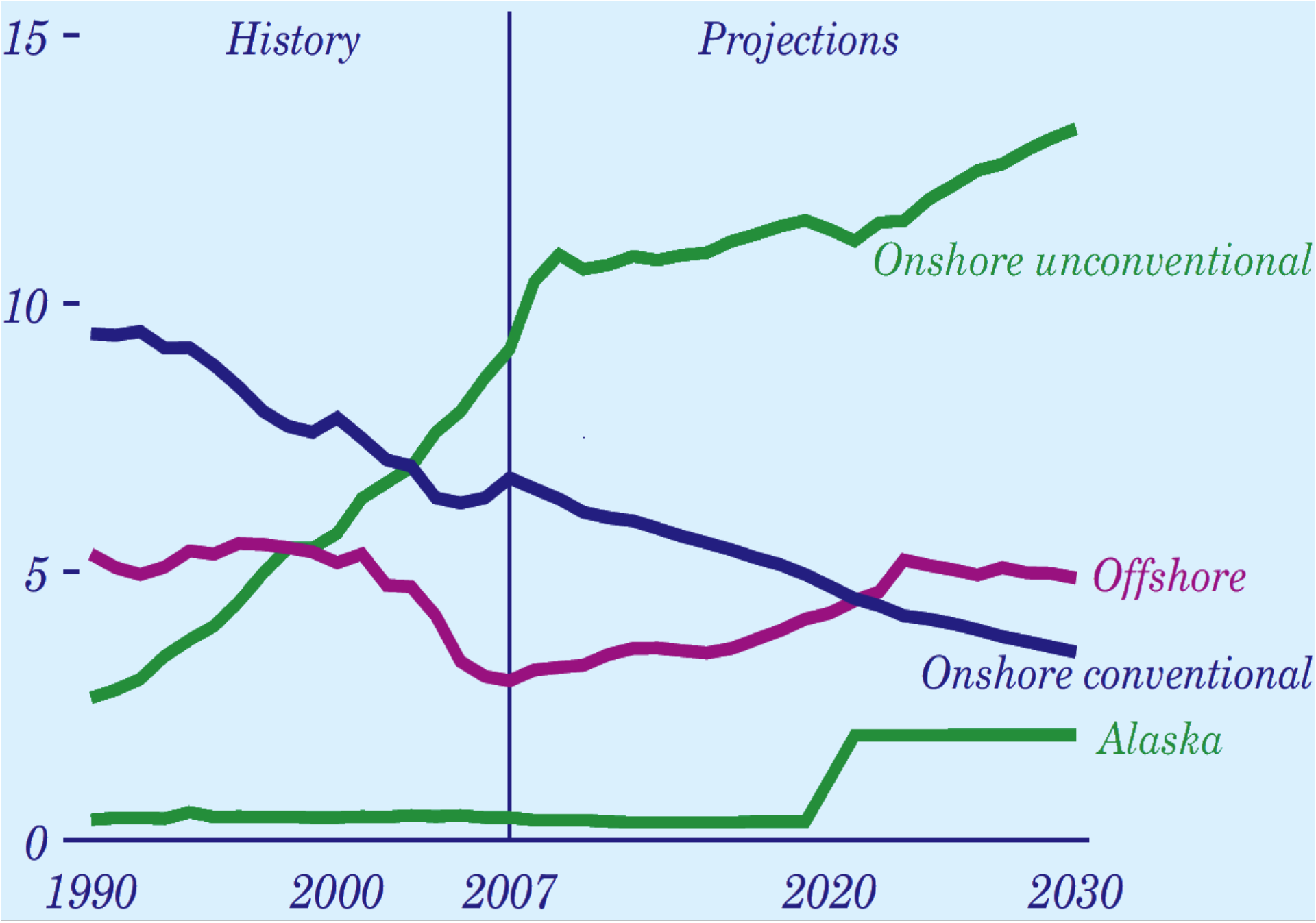


Source: NEB, 2009; Advanced Resources, SPE/Holditch Nov 2002 Hill 1991, Cain, 1994 Hart Publishing, 2008, modified from Ziff Energy Group, 2008

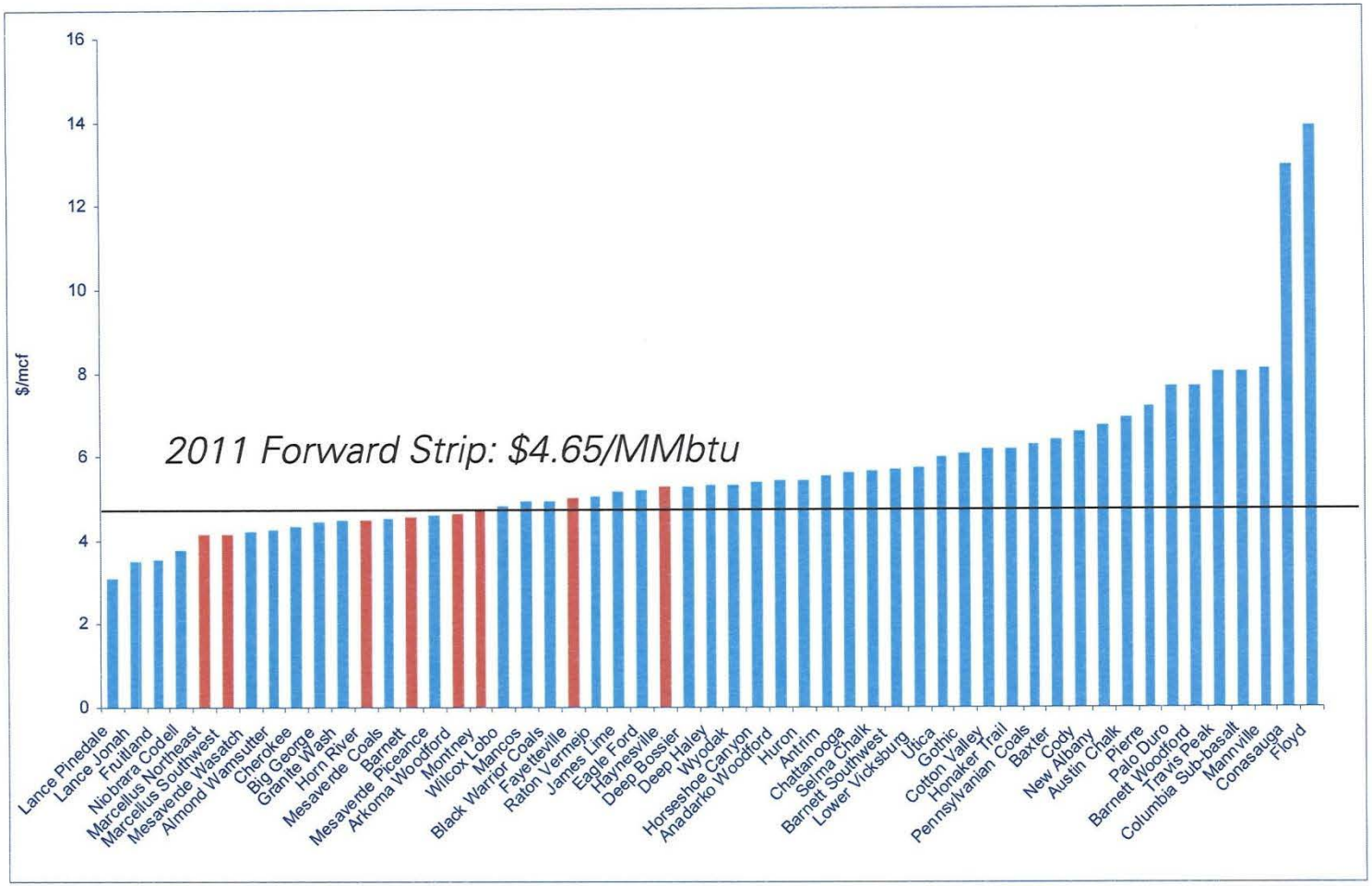
Shale Production Forecast: Significant Growth Potential



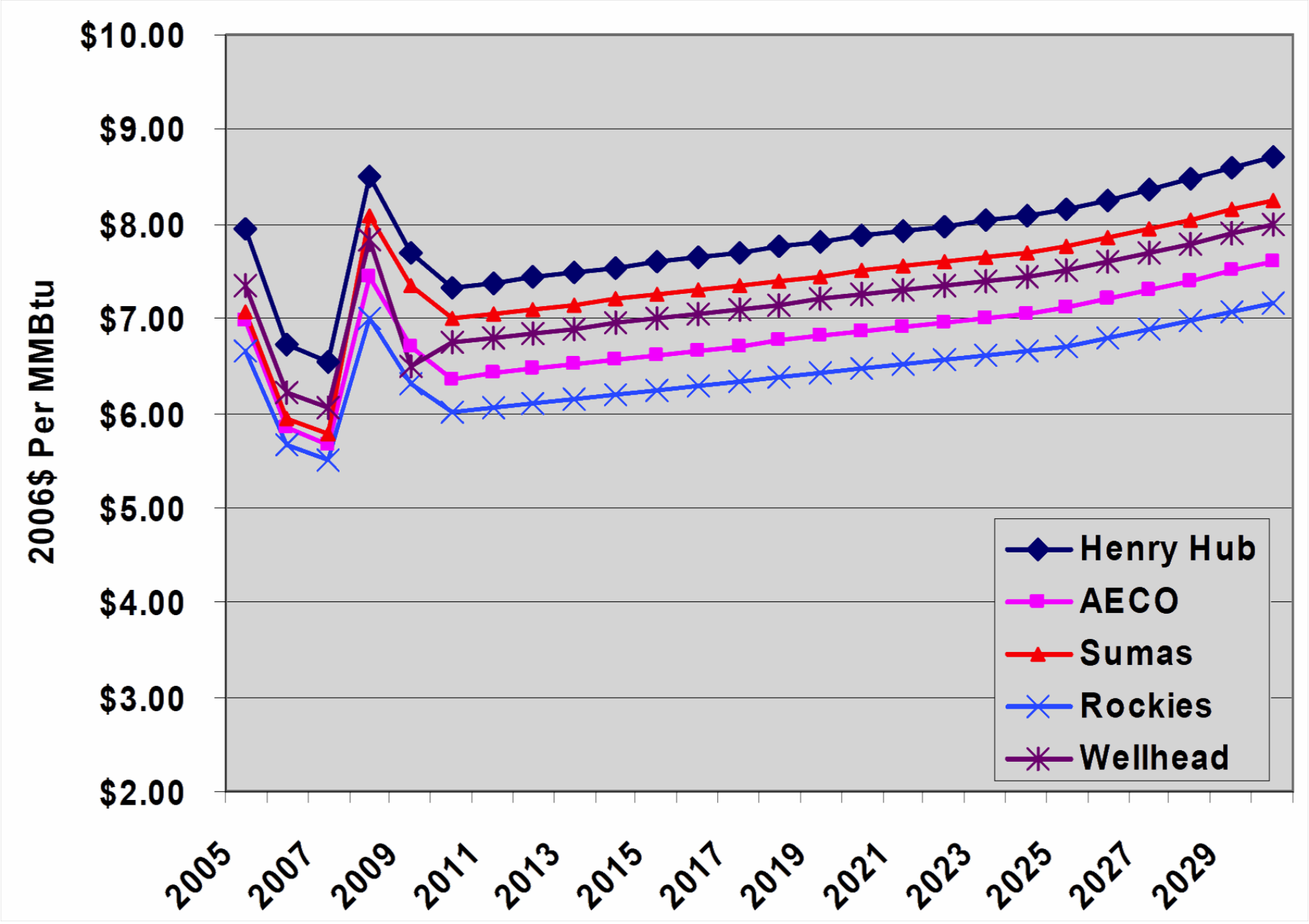
Source: MIT Study on the Future of Natural Gas


15
10
5
0
History
Projections
Onshore unconventional
Offshore
Onshore conventional
Alaska
1990
2000
2007
2020
2030

Lower costs continue to drive shale growth

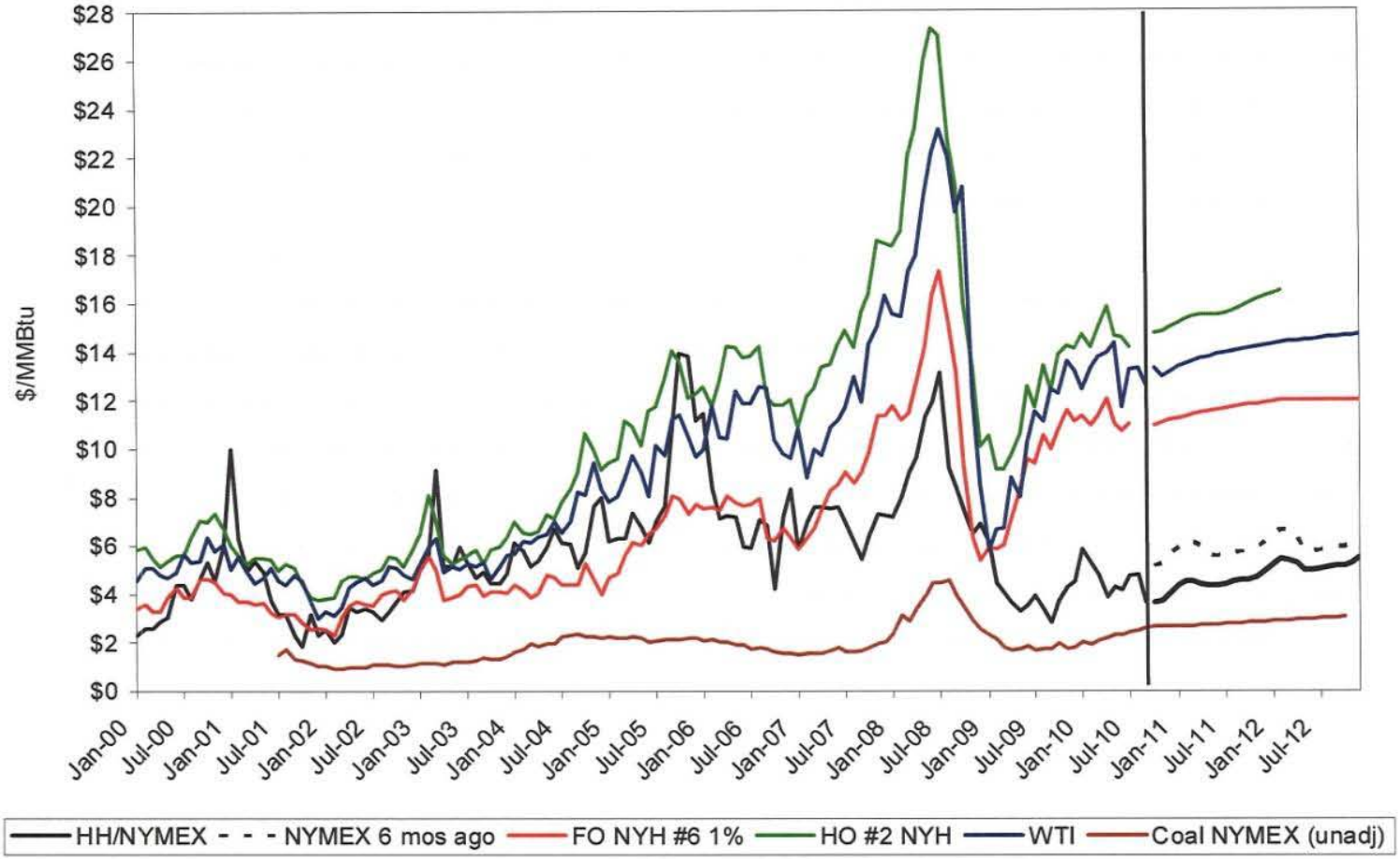


Source: WoodMackenzie


$10.00
$9.00
$8.00
$7.00
$6.00
$5.00
$4.00
$3.00
$2.00
2006$ Per MMBtu
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023
2025
2027
2029
Henry Hub
AECO
Sumas
Rockies
Wellhead

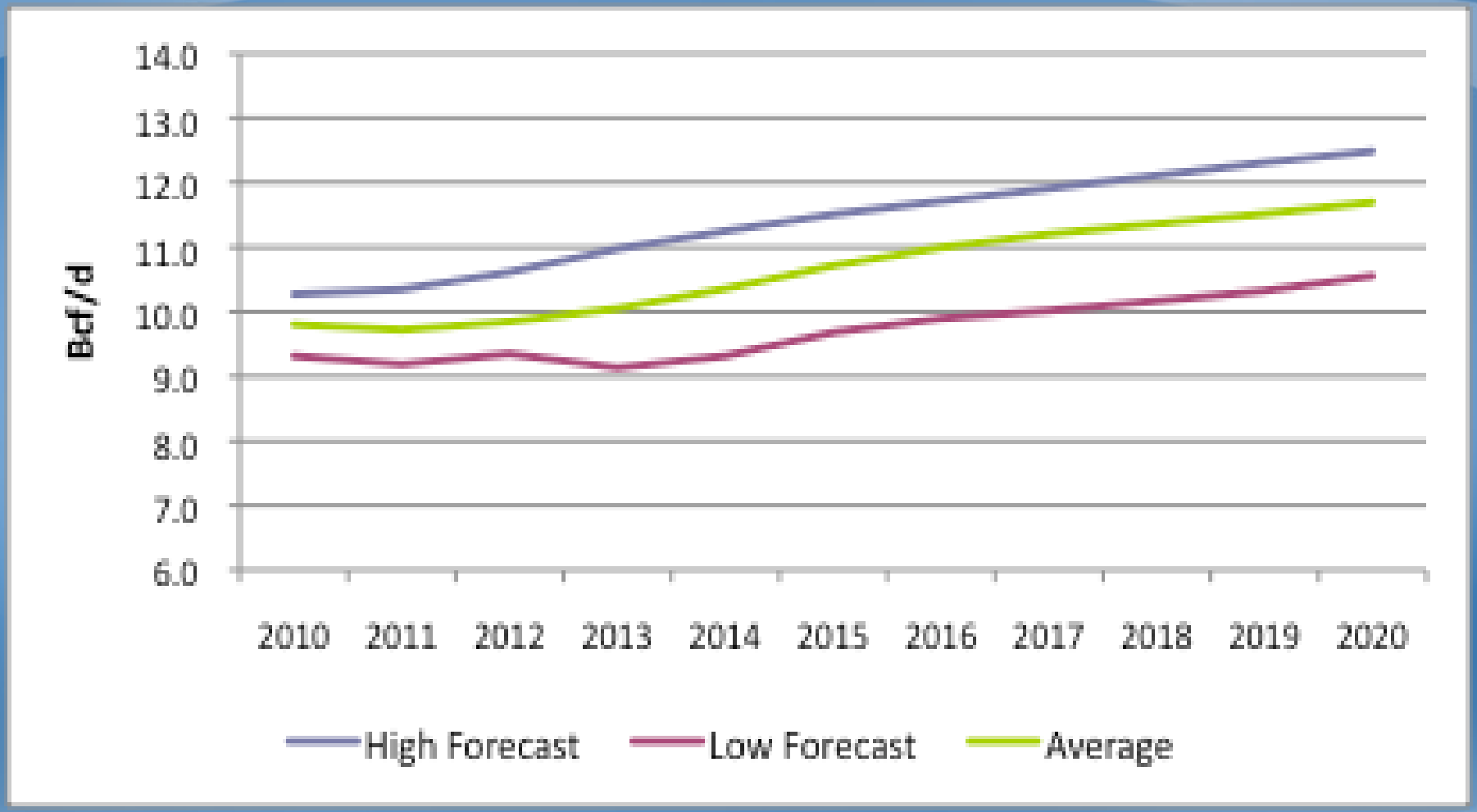
Natural Gas & Competing Fuels

Source: Various, Aug 27/10

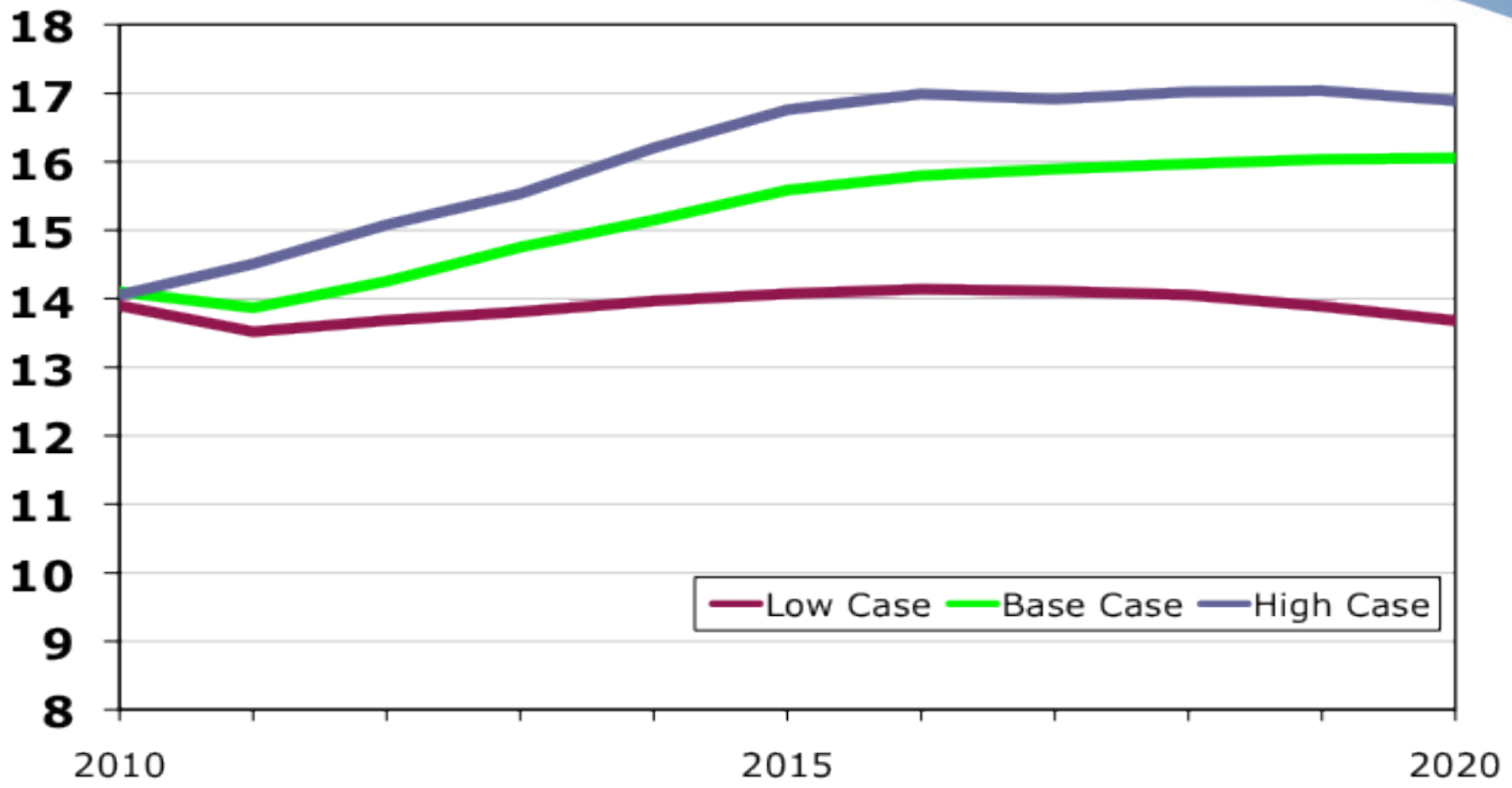


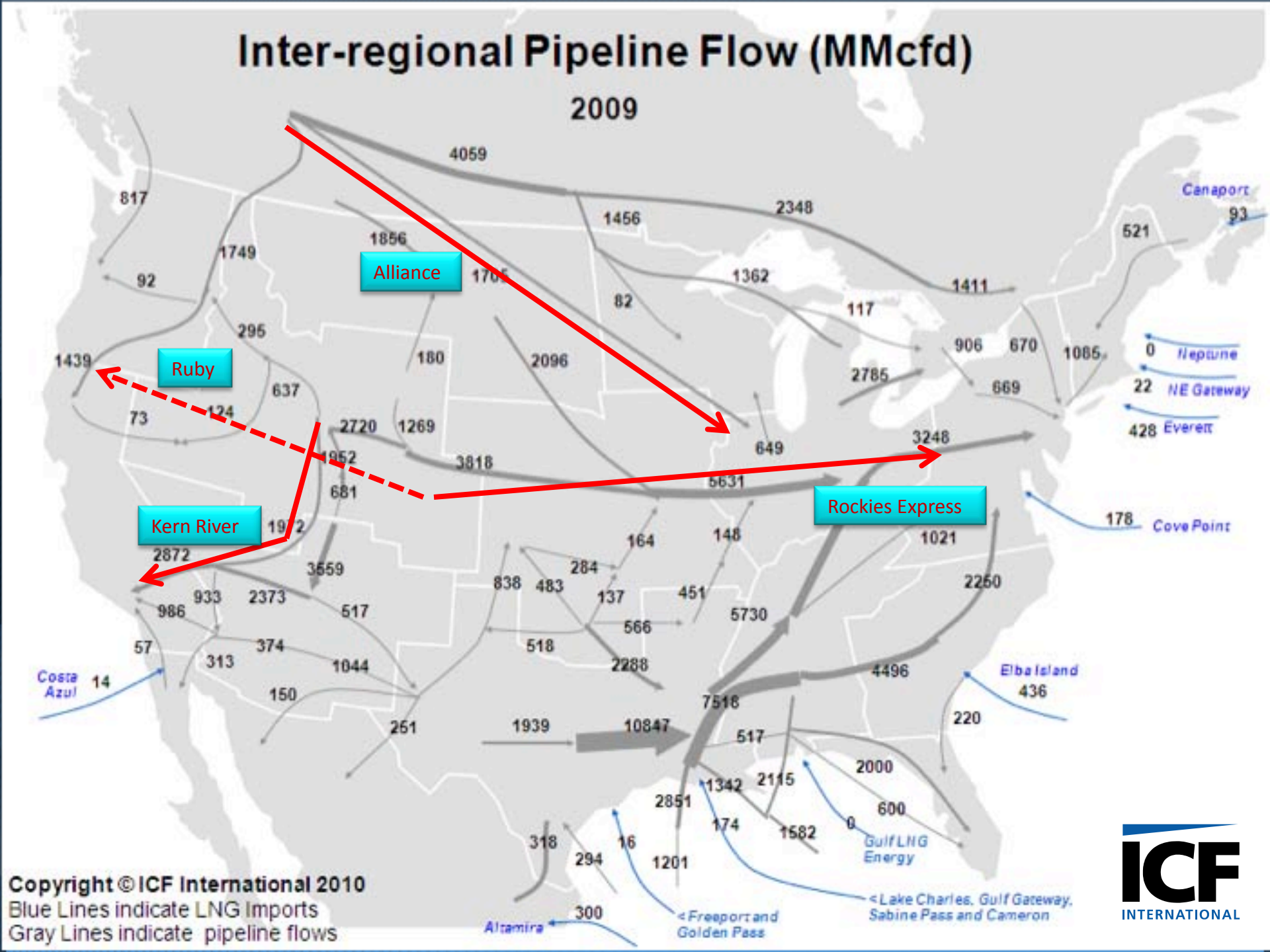
World LNG Estimated August 2010 Landed Prices

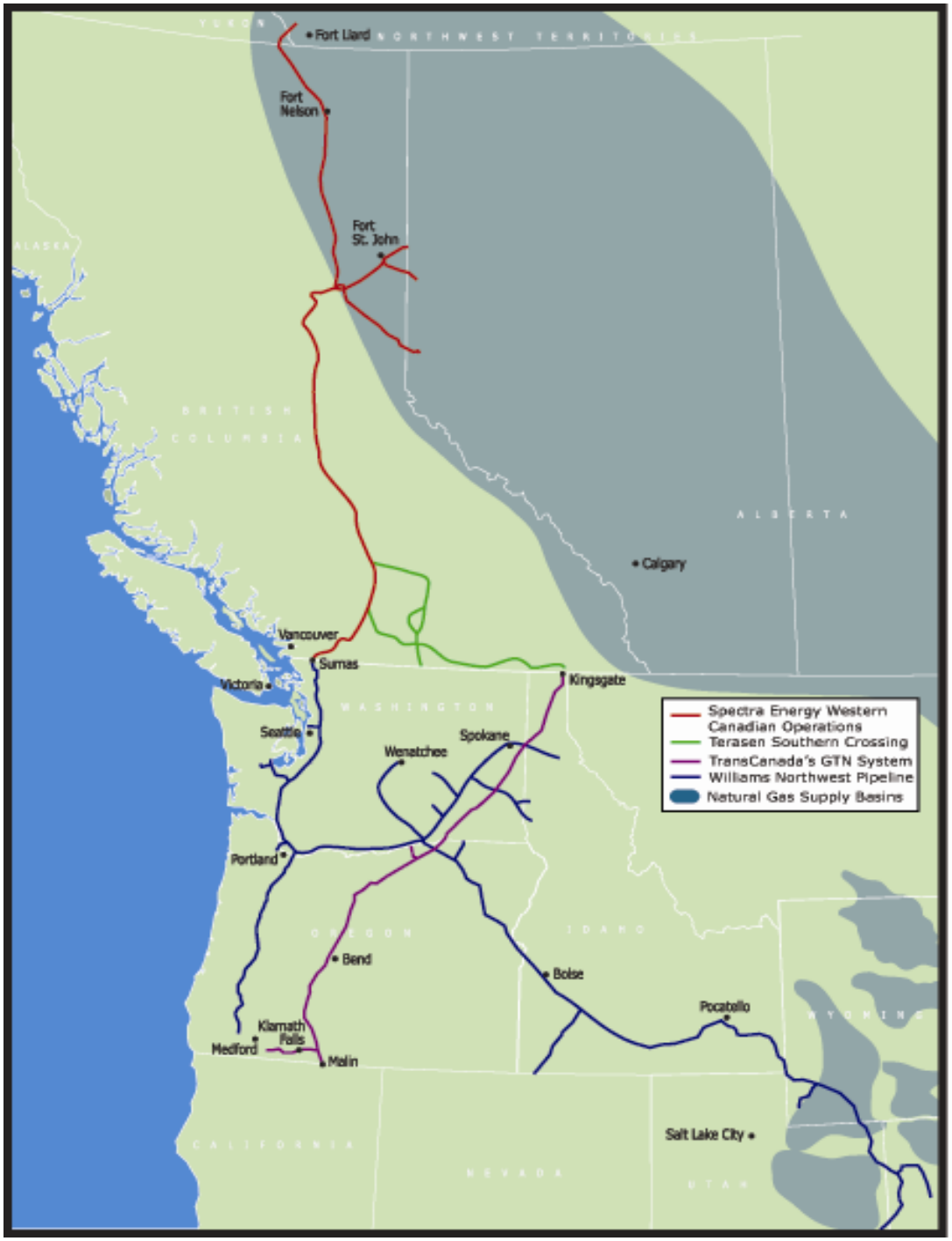
Rockies Production Forecasts

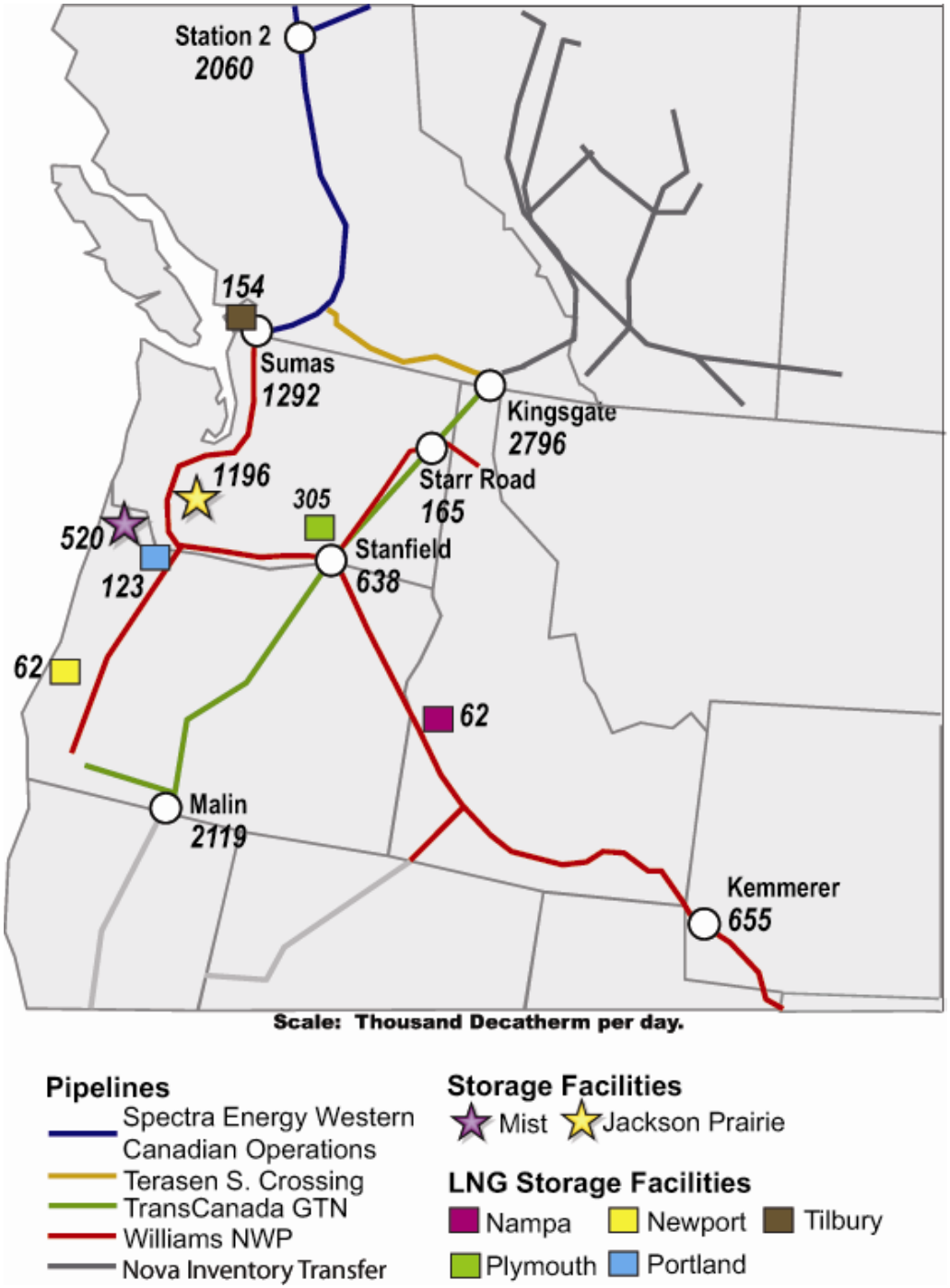


WCSB Production Forecast




Inter-regional Pipeline Flow (MMcfd)
2009
Alliance
Ruby
Kern River
Rockies Express
4059
817
1749
92
1856
1705
1456
2348
1362
1411
82
117
521
Canaport
93
906
670
1085
0
Neptune
22
NE Gateway
428
Everett
2785
669
1439
637
73
124
295
180
2096
2720
1269
1952
3818
649
3248
5631
681
178
Cove Point
1021
2872
3659
164
148
284
838
483
137
451
2250
933
2373
986
517
5730
566
57
374
313
518
2288
1044
4496
Costa Azul
14
Elba Island
436
150
7516
220
251
1939
10847
517
2000
1342
2115
2851
600
174
1582
0
Gulf LNG Energy
318
16
294
1201
Lake Charles, Gulf Gateway, Sabine Pass and Cameron
Freeport and Golden Pass
Altamira
300
Copyright © ICF International 2010
Blue Lines indicate LNG Imports
Gray Lines indicate pipeline flows
ICF
INTERNATIONAL


YUKON
Fort Liard
NORTHWEST TERRITORIES
Fort Nelson
Fort St. John
ALASKA
BRITISH COLUMBIA
ALBERTA
Calgary
Vancouver
Sumas
Victoria
Kingsgate
WASHINGTON
Seattle
Spokane
Wenatchee
Portland
OREGON
IDAHO
Bend
Boise
Pocatello
WYOMING
Klamath Falls
Medford
Malin
Salt Lake City
CALIFORNIA
NEVADA
UTAH
Spectra Energy Western Canadian Operations
Terasen Southern Crossing
TransCanada's GTN System
Williams Northwest Pipeline
Natural Gas Supply Basins


Station 2
2060
154
Sumas
1292
Kingsgate
2796
Starr Road
165
1196
305
520
123
Stanfield
638
62
62
Malin
2119
Kemmerer
655
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