

Natural Gas, Electricity and CHP

Evaluating and Marketing CHP

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Overview

- Natural Gas Background
- Electricity Rate Background
- Gas, Electricity and CHP



Natural Gas Overview

- Gas is produced by hundreds of independent producers in North America.
- Gas is delivered to market by independent regulated pipelines.
- Gas is delivered by utilities.
- Gas price clears on the North American market. Transmission/delivery price can be locally determined.



Regional Gas Prices

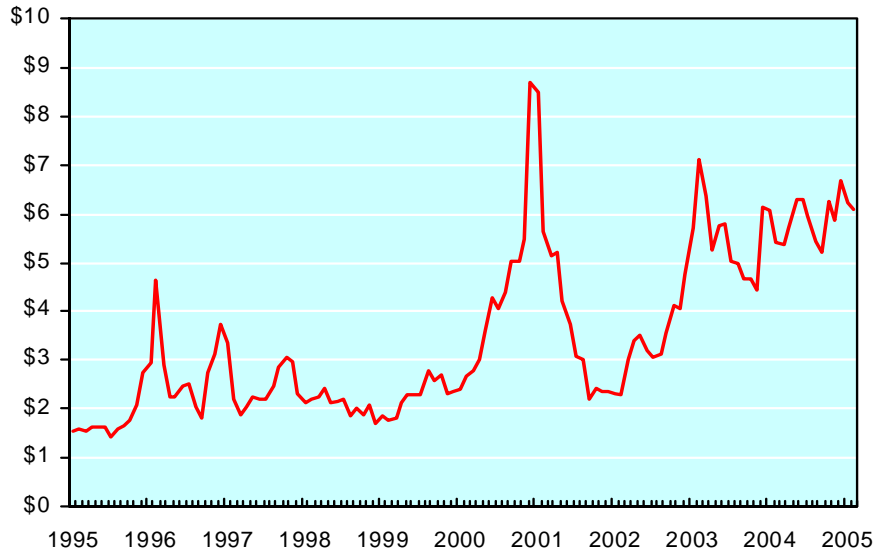
	Gas Price (\$/MMBtu)
Illinois	\$6.56
New York	\$6.93
Boston	\$6.72
Texas	\$6.47
California	\$5.70

Data Source: Enerfax Daily 5/16/05

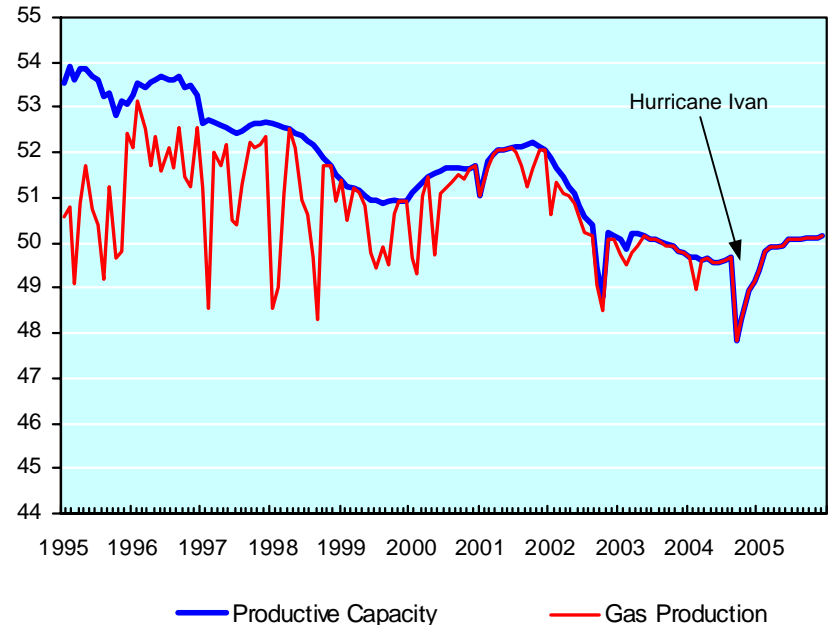


The Changing Gas Balance

Historical Gas Price at Henry Hub (\$ per MMBtu)



Lower-48 Dry Gas Production vs. Dry Gas Productive Capacity (Bcfd)



— Productive Capacity — Gas Production

Divergent trends in gas supply and demand have led to the tight balance between supply and demand, higher gas prices, and increased price volatility.

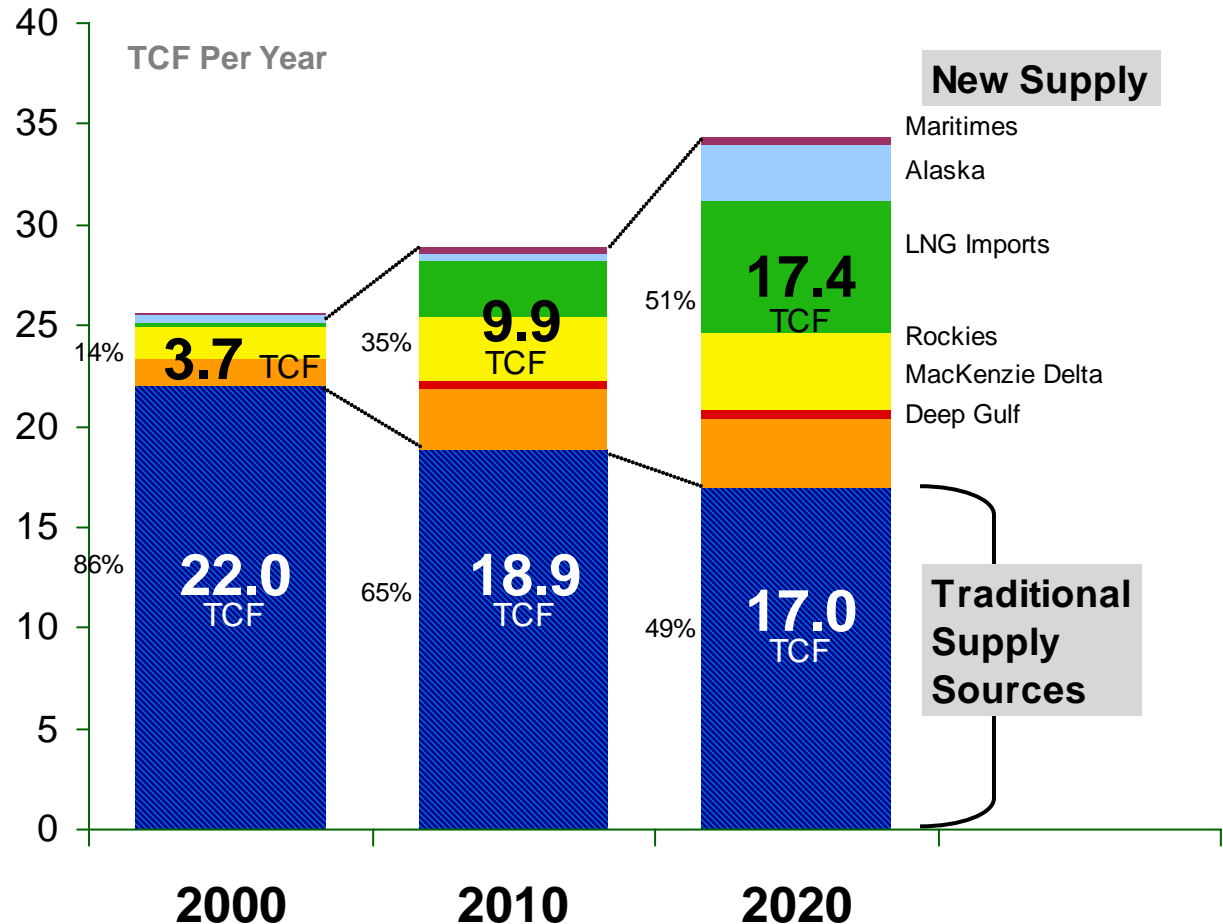
TIGHT BALANCE EXPECTED TO CONTINUE



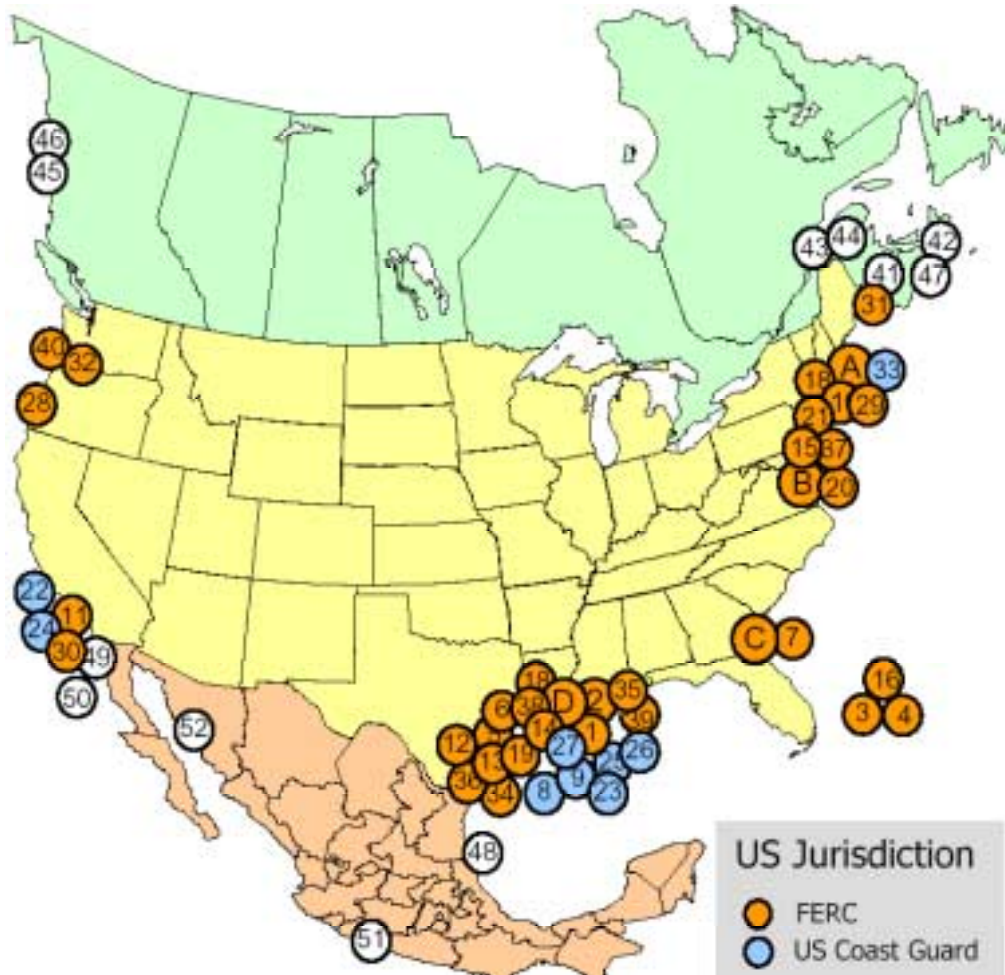
Natural Gas Supply

Relying On New Frontiers U.S. And Canada Gas Supply

- Production from mature producing areas will decline by 1.3 percent per year.
- New frontier supplies will account for 35 percent and 51 percent of total U.S. and Canada gas supply in 2010 and 2020, respectively.



Proposed LNG Terminals



Constructed

- A. Everett, MA : 1.035 Bcfd (Tractebel – DOMAC)
- B. Cove Point, MD : 1.0 Bcfd (Dominion – Cove Point LNG)
- C. Elba Island, GA : 0.68 Bcfd (El Paso – Southern LNG)
- D. Lake Charles, LA : 1.0 Bcfd (Southern Union – Trunkline LNG)

Approved by FERC

- 1. Lake Charles, LA : 1.1 Bcfd (Southern Union – Trunkline LNG)
- 2. Hackberry, LA : 1.5 Bcfd, (Sempra Energy)
- 3. Bahamas : 0.84 Bcfd, (AES Ocean Express)*
- 4. Bahamas : 0.83 Bcfd, (Calypso Tractebel)*
- 5. Freeport, TX : 1.5 Bcfd, (Cheniere/Freeport LNG Dev.)
- 6. Sabine, LA : 2.6 Bcfd (Cheniere LNG)
- 7. Elba Island, GA : 0.54 Bcfd (El Paso – Southern LNG)

Approved by MARAD/Coast Guard

- 8. Port Pelican : 1.6 Bcfd, (Chevron Texaco)
- 9. Gulf of Mexico : 0.5 Bcfd, (El Paso Energy Bridge GOM, LLC)

Proposed to FERC

- 10. Fall River, MA : 0.8 Bcfd, (Weaver's Cove Energy/Hess LNG)
- 11. Long Beach, CA : 0.7 Bcfd, (Mitsubishi/ConocoPhillips – Sound Energy Solutions)
- 12. Corpus Christi, TX : 2.6 Bcfd, (Cheniere LNG)
- 13. Corpus Christi, TX : 1.0 Bcfd (Vista Del Sol - ExxonMobil)
- 14. Sabine, TX : 1.0 Bcfd (Golden Pass - ExxonMobil)
- 15. Logan Township, NJ : 1.2 Bcfd (Crown Landing LNG – BP)
- 16. Bahamas : 0.5 Bcfd, (Seafarer - El Paso/FPL)
- 17. Corpus Christi, TX : 1.0 Bcfd (Ingleside Energy – Occidental Energy Ventures)
- 18. Providence, RI : 0.5 Bcfd (Keyspan & BG LNG)
- 19. Port Arthur, TX : 1.5 Bcfd (Sempra)
- 20. Cove Point, MD : 0.8 Bcfd (Dominion)
- 21. LI Sound, NY : 1.0 Bcfd (Broadwater Energy – TransCanada/Shell)

Proposed to MARAD/Coast Guard

- 22. California Offshore : 1.5 Bcfd (Cabrillo Port – BHP Billiton)
- 23. Louisiana Offshore : 1.0 Bcfd (Gulf Landing – Shell)
- 24. So. California Offshore : 0.5 Bcfd, (Crystal Energy)
- 25. Louisiana Offshore : 1.0 Bcfd (Main Pass McMoran Exp.)
- 26. Gulf of Mexico : 1.0 Bcfd (Compass Port – ConocoPhillips)
- 27. Gulf of Mexico : 2.8 Bcfd (Pearl Crossing - ExxonMobil)

Potential Sites Identified by Project Sponsors

- 28. Coos Bay, OR : 0.13 Bcfd, (Energy Projects Development)
- 29. Somerset, MA : 0.65 Bcfd (Somerset LNG)
- 30. California - Offshore : 0.75 Bcfd, (Chevron Texaco)
- 31. Pleasant Point, ME : 0.5 Bcfd (Quoddy Bay, LLC)
- 32. St. Helens, OR : 0.7 Bcfd (Port Westward LNG LLC)
- 33. Offshore Boston, MA : 0.8 Bcfd (Northeast Gateway – Excelerate Energy)
- 34. Galveston, TX : 1.2 Bcfd (Pelican Island – BP)
- 35. Pascagoula, MS : 1.0 Bcfd (Gulf LNG Energy LLC)
- 36. Port Lavaca, TX : 1.0 Bcfd (Calhoun LNG – Gulf Coast LNG Partners)
- 37. Philadelphia, PA : 0.6 Bcfd (Freedom Energy Center – PGW)
- 38. Pascagoula, MS : 1.3 Bcfd (ChevronTexaco)
- 39. Cameron, LA : 2.6 Bcfd (Creole Trail LNG – Cheniere LNG)
- 40. Astoria, OR : 1.0 Bcfd (Skipanon LNG – Calpine)

Canadian Approved and Potential Terminals

- 41. St. John, NB : 1.0 Bcfd, (Canaport – Irving Oil)**
- 42. Point Tupper, NS 1.0 Bcfd (Bear Head LNG - Anadarko)**
- 43. Quebec City, QC : 0.5 Bcfd (Project Rabaska – Enbridge/Gaz Met/Gaz de France)
- 44. Rivière-du-Loup, QC : 0.5 Bcfd (Cacouna Energy – TransCanada/PetroCanada)
- 45. Kitimat, BC : 0.34 Bcfd (Galveston LNG)
- 46. Prince Rupert, BC : 0.30 Bcfd (WestPac Terminals)
- 47. Goldboro, NS 1.0 Bcfd (Keltic Petrochemicals)

Mexican Approved and Potential Terminals

- 48. Altamira, Tamulipas : 1.12 Bcfd, (Shell)**
- 49. Baja California, MX : 1.0 Bcfd, (Sempra & Shell)**
- 50. Baja California - Offshore : 1.4 Bcfd, (Chevron Texaco)
- 51. Lázaro Cárdenas, MX : 0.5 Bcfd (Tractebel/Repsol)
- 52. Puerto Libertad, MX : 1.3 Bcfd (Sonora Pacific LNG)



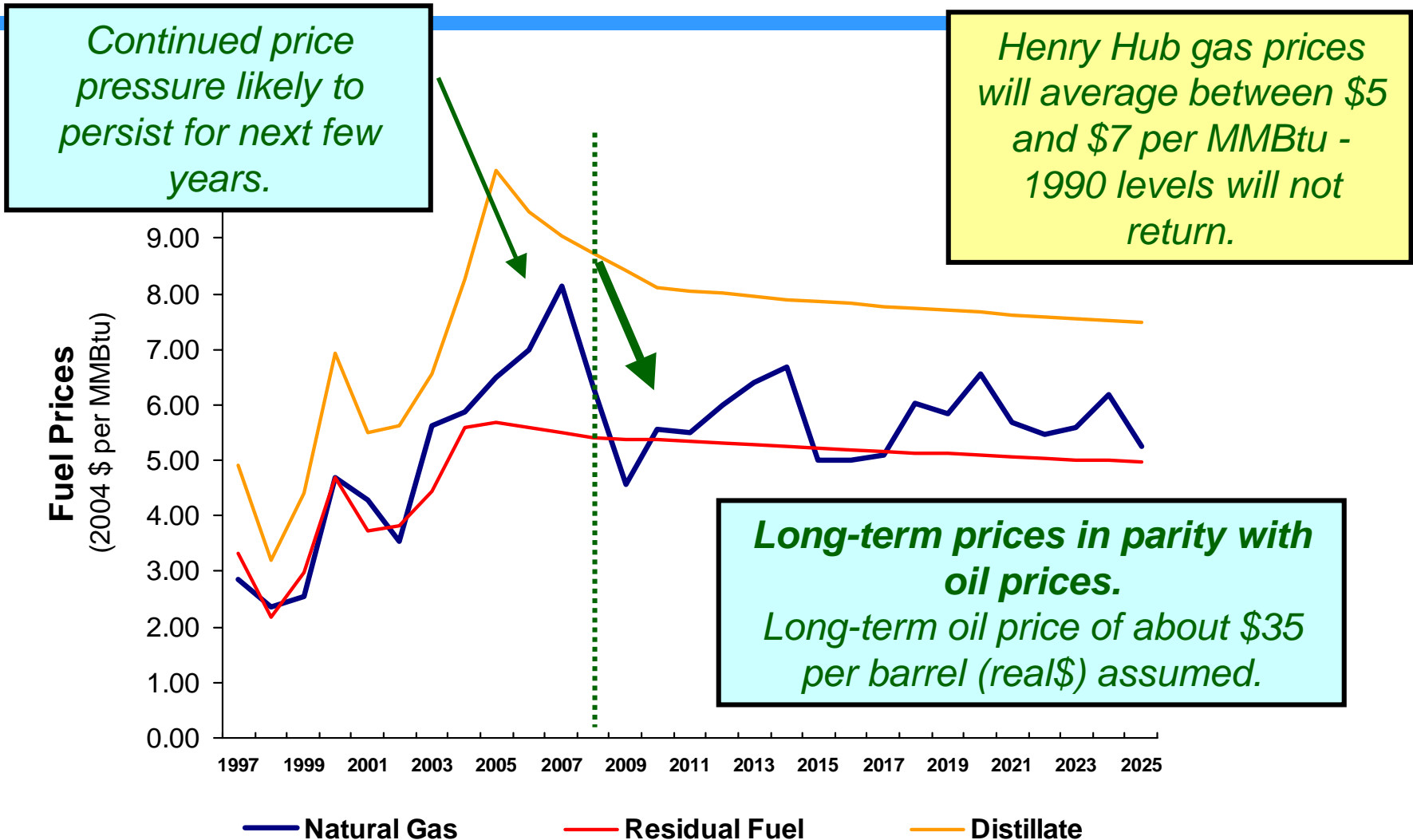
Obstacles For Supply Growth

- Large Capital Requirements
 - Liquidity Crunch
 - Access Restrictions
 - Investor Recognition of Opportunities
 - Price Volatility Creates Uncertainty
- Uncertainty About Future Gas Demand
 - E&P Infrastructure & Technology
 - Cumbersome Approvals Process
 - Environmental and Siting Issues

There is much uncertainty about future gas supply development.



Projected Annual Average Henry Hub Gas Price



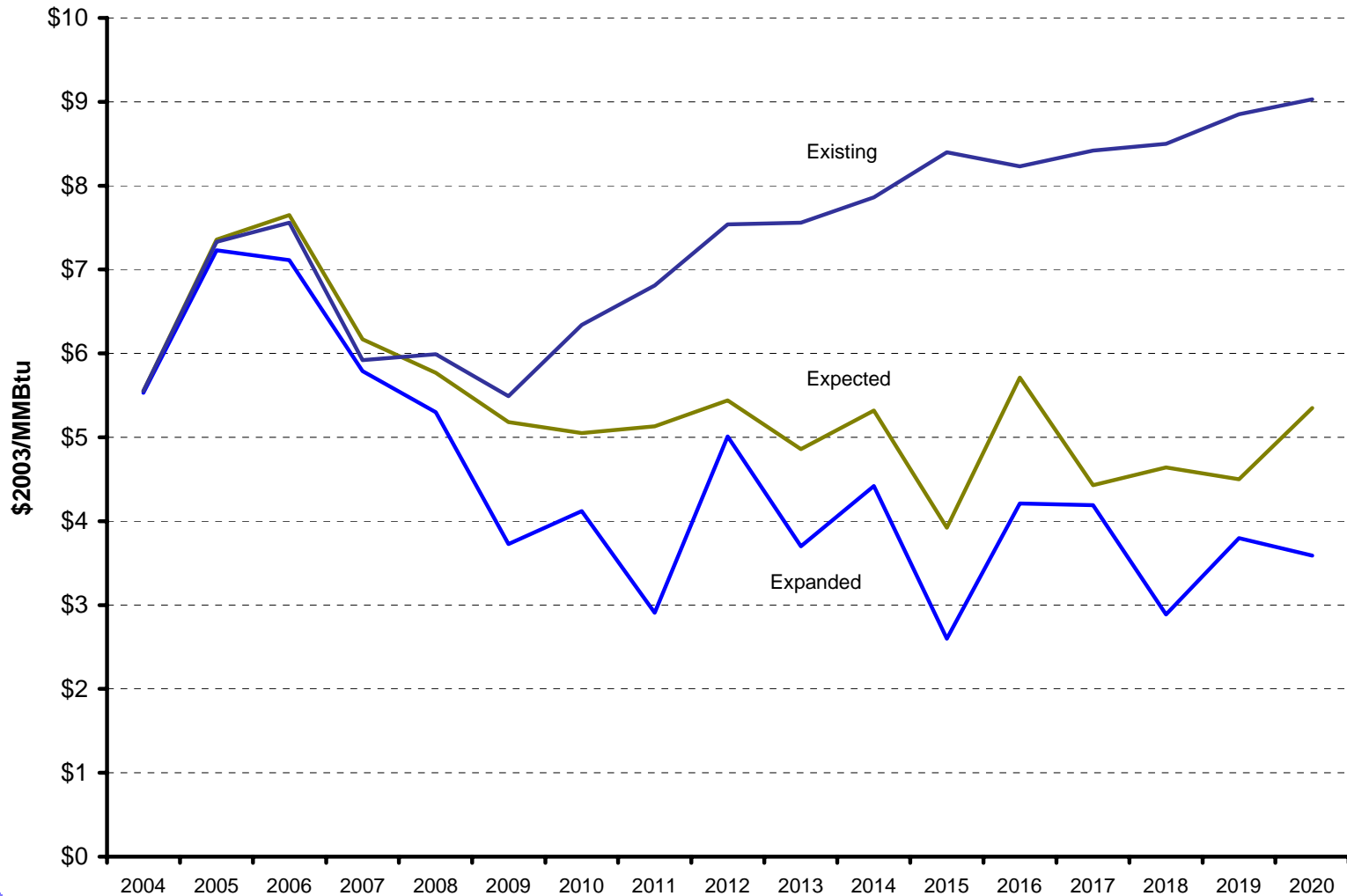
Sources: Historical data from Platts Gas Daily, Projection by Energy and Environmental Analysis, Inc.
Energy and Environmental Analysis, Inc.

AGF SCENARIO ASSUMPTIONS

	<u>Expected</u>	<u>Expanded</u>	<u>Existing</u>
Drilling Moratoria	Unchanged	Relaxed	Unchanged
Intermountain West Access	Unchanged	Increased	Unchanged
Alaskan Pipeline	2014	2014	Not Built
LNG in 2020	18 Bcfd	23 Bcfd	5.3 Bcfd
New Gas-Fired Generation	60 GW	30 GW	60 GW



AGF Gas Price Scenarios



CHP and Energy Prices

- Typical CHP application reduces electricity purchases, increases gas purchases.
- CHP trades increased capital cost and gas purchases for lower electric purchases.
- Electricity savings must offset gas and capital costs.



The Concern

- Higher gas prices will swamp electricity savings.
- A reasonable concern where gas and electricity prices are decoupled.
- *But* - electricity markets are changing and increasingly linking to gas markets...



The Price of Electricity

- Average cost/regulated prices
- VS
- Marginal cost/competitive prices



Historic Electricity Prices

- Regulated electric rates, based on average cost of utility generation.
- Majority of electricity generated by low-cost nuclear, coal, hydro assets.
 - Energy cost \$25-\$35/MWh (2.5 - 3.5 cents/kWh).
- Large electric user rates relatively low - <\$0.05/kWh (\$50/MWh).
 - Retail rates higher than wholesale energy cost.

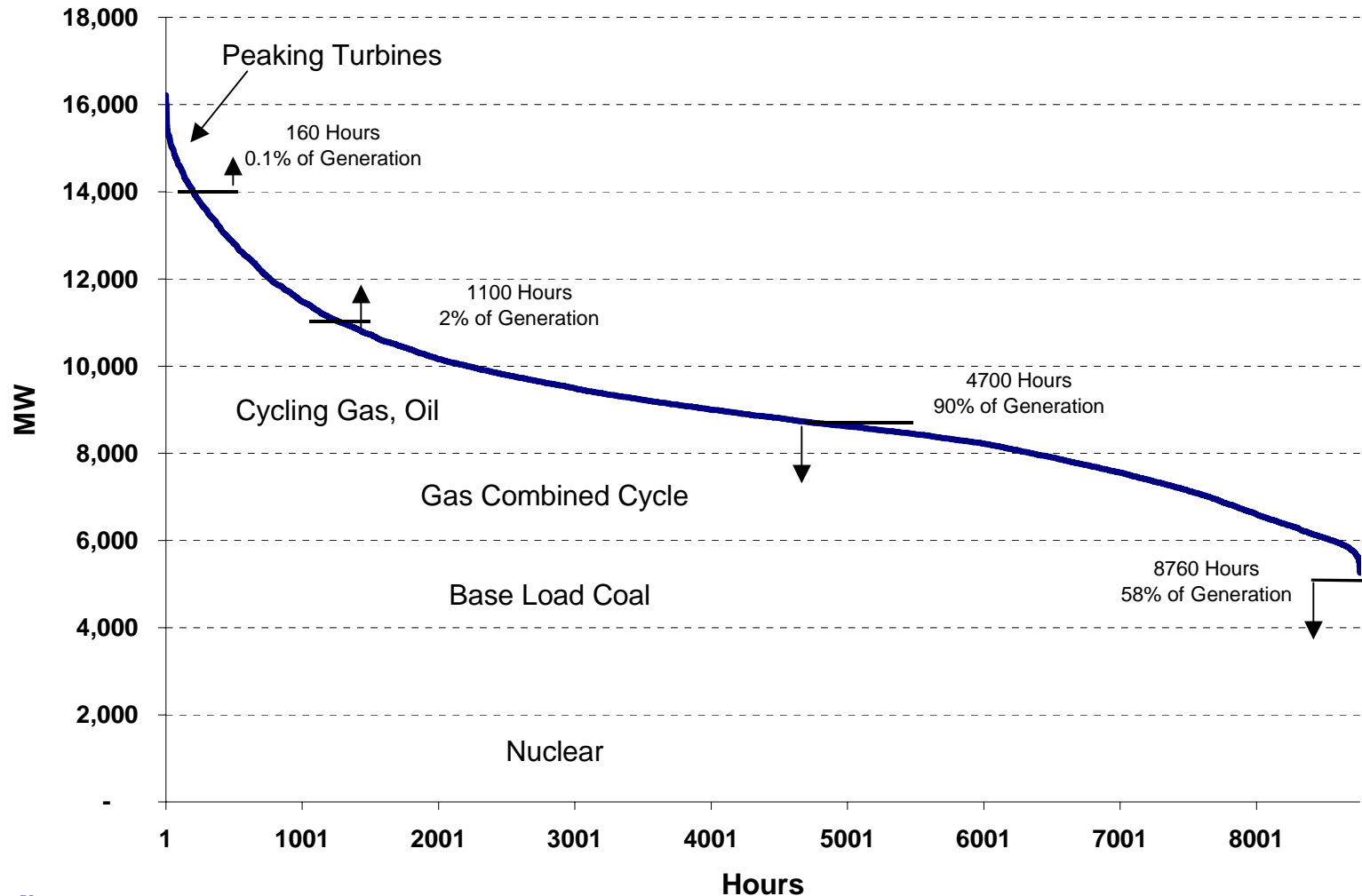


Restructured Electric Prices

- Wholesale price based on the marginal unit at each hour.
- Marginal units in many areas are gas-fired units for much of the year, even where coal is the primary energy source.
- In this case, gas and electricity prices are linked.



Load Duration Curve



When Are Electricity and Gas Linked

- Restructured electric markets
 - Marginal cost pricing
- Where gas-fired units are on the margin most of the time.
 - California/Northwest
 - Texas
 - Northeast U.S.
 - Illinois - more and more



Wholesale Gas/Electric Price Linkage

	Gas Price (\$/MMBtu)	Electricity Price (\$/MWh)
Illinois	\$6.56	\$47
New York	\$6.93	\$57
Boston	\$6.72	\$66
Texas	\$6.47	\$48
California	\$5.70	\$52

Data Source: Enerfax Daily 5/16/05



Changing Electric Rates

- Price caps are coming off in restructured markets.
- Utilities moving to market-based rates for large customers.
- Electricity prices will track gas prices.
- Electricity prices are more than the energy component.



Comm Ed Example

- Large customers being transitioned from Rate 6L to Rate HEP.
- Electricity charged at PJM day-ahead rates plus capacity charges.
- PJM hourly rates can be low at off-peak times but very high at peak, especially during high demand periods
 - Prices easily over \$0.10/kWh during summer.

Need to consider future pricing in project evaluation!



Conclusions

- Gas prices are higher and will stay higher.
- Electricity prices will track gas prices in restructured markets with gas on the margin.
- Need to consider forward-looking, full cost of electricity in project evaluation.
- CHP can be competitive in these markets.
- CHP has greater value than energy commodity price.

