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Shale Plays in the Intermountain West: Legal  
and Policy Issues (November 12)

2010

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11-12-2010

### SLIDES: The Here and Now of U.S. Nat Gas

Michelle Michot Foss

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## The Here and Now of U.S. Nat Gas

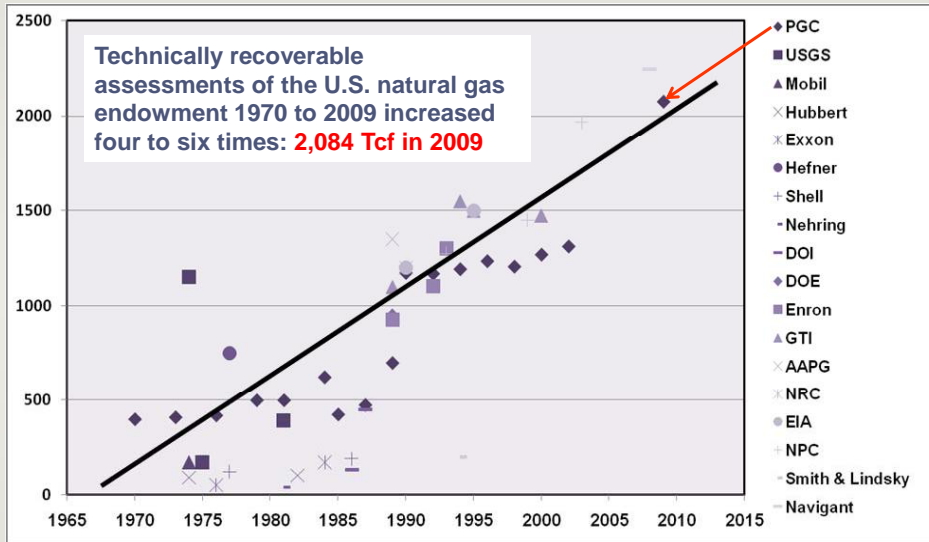
*UC-NRLC, November 12, 2010*

*Dr. Michelle Michot Foss, CEE/BEG/JSG/UT*

### High Altitude

- 1970s & 1990s “redux” with regard to perceptions about reliability, deliverability
  - Similar policy/regulatory disconnects
  - Risk that demand will be encouraged while supply and deliverability are constrained
- Even without GHG policy, gas “push” is inevitable
  - <http://www.sierraclub.org/coal/>
  - Strategic opposition to electric power transmission hinders both coal and renewables
- Drilling is essential
  - Environment, oil and gas tax policies

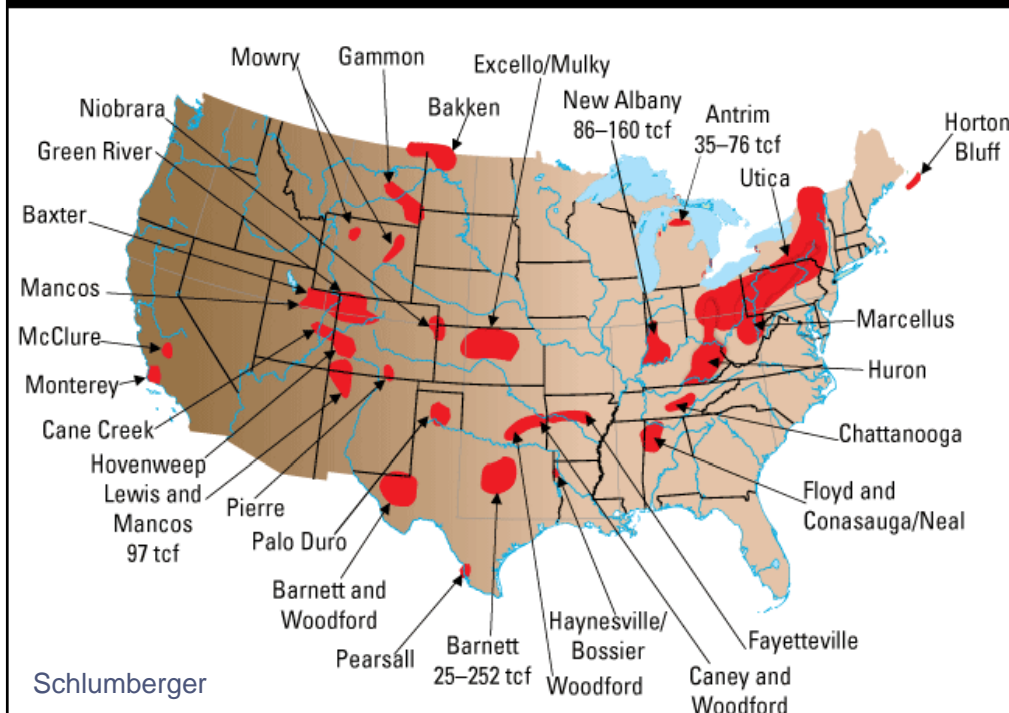
# Natural Gas Resource Assessments



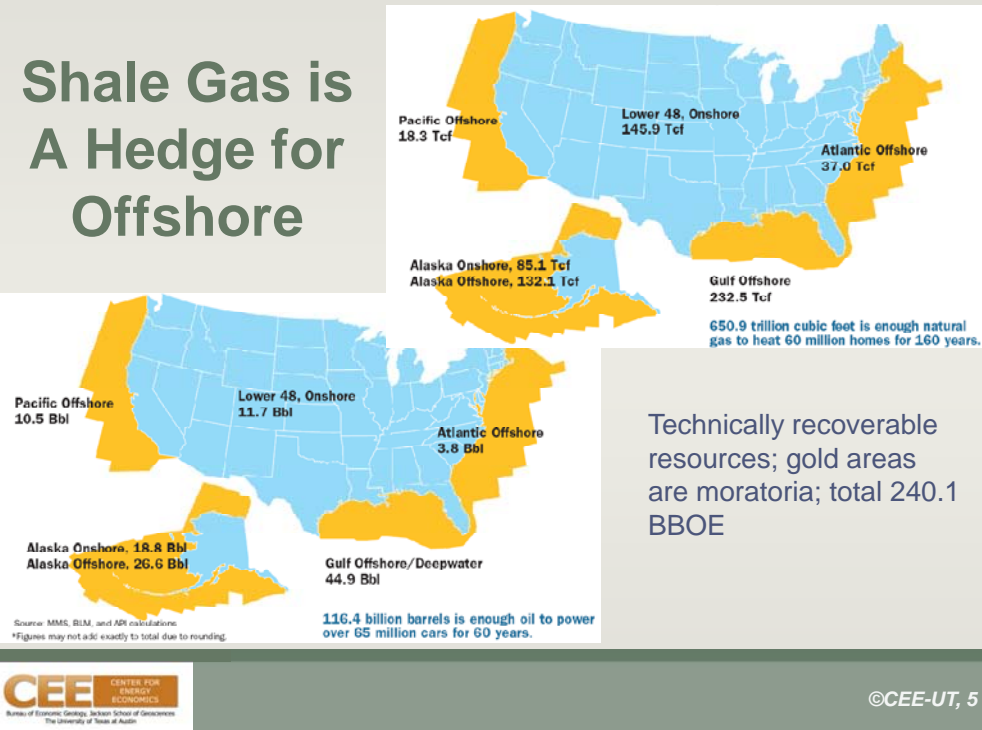
Source: Modified from Bill Fisher et. al., BEG-UT; GTI

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## Major US shale basins.



## Shale Gas is A Hedge for Offshore



## Barnett Shale Experience

- Water use for “frac’ing” and other Barnett Shale development is less than 1% of total water use in affected counties (BEG)
  - Water use will grow, but rate of use will be lower with technology improvement and recycling/re-use
  - Operators are actively testing recycling and reductions to manage water demand and produced water

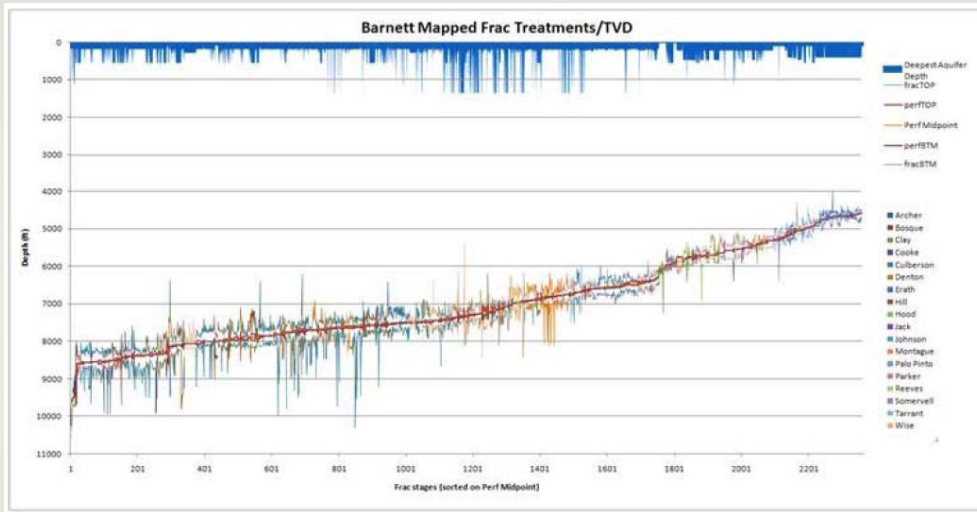
- NETL Produced Water MIS

<http://www.netl.doe.gov/technologies/PWMIS/>

- NETL Frac Technologies

[http://www.netl.doe.gov/technologies/oil-gas/EP\\_Technologies/ImprovedRecovery/AdvancedStimulation/Adv\\_Stimulation.html](http://www.netl.doe.gov/technologies/oil-gas/EP_Technologies/ImprovedRecovery/AdvancedStimulation/Adv_Stimulation.html)

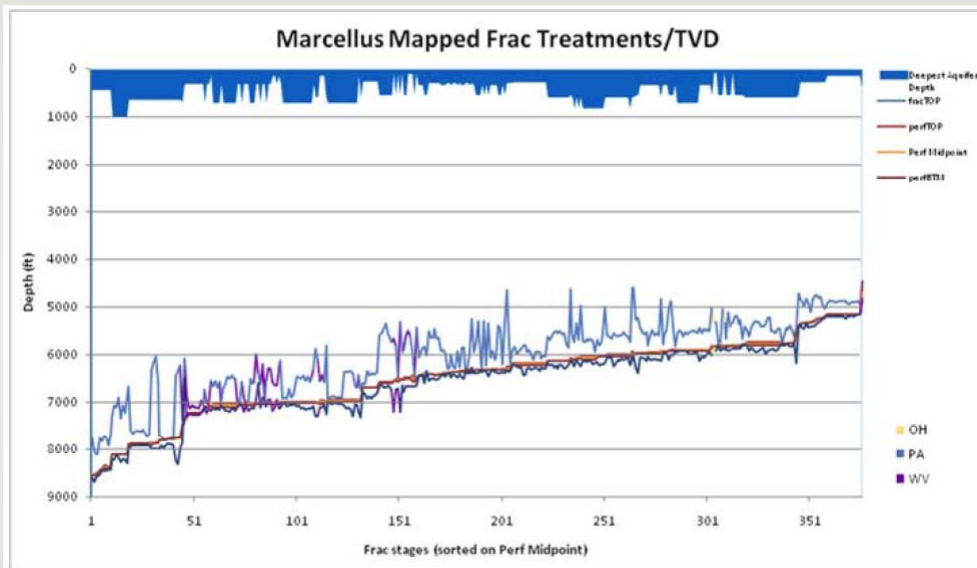
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Pinnacle Technologies/Energy in Depth

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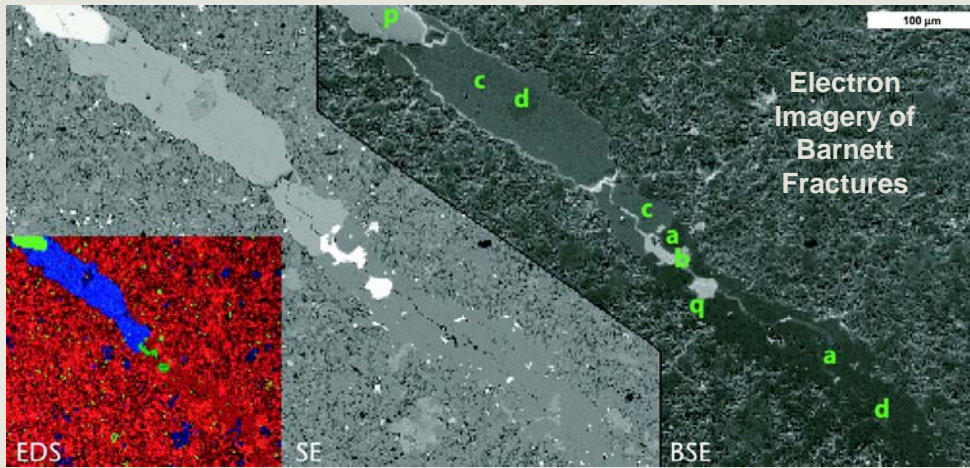


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# The Frontier



Gale, J. F. W., Reed, R. M., and Holder, Jon, 2007, *Natural fractures in the Barnett Shale and their importance for hydraulic fracture treatments*: AAPG Bulletin, v. 91, no. 4, p. 603–622.

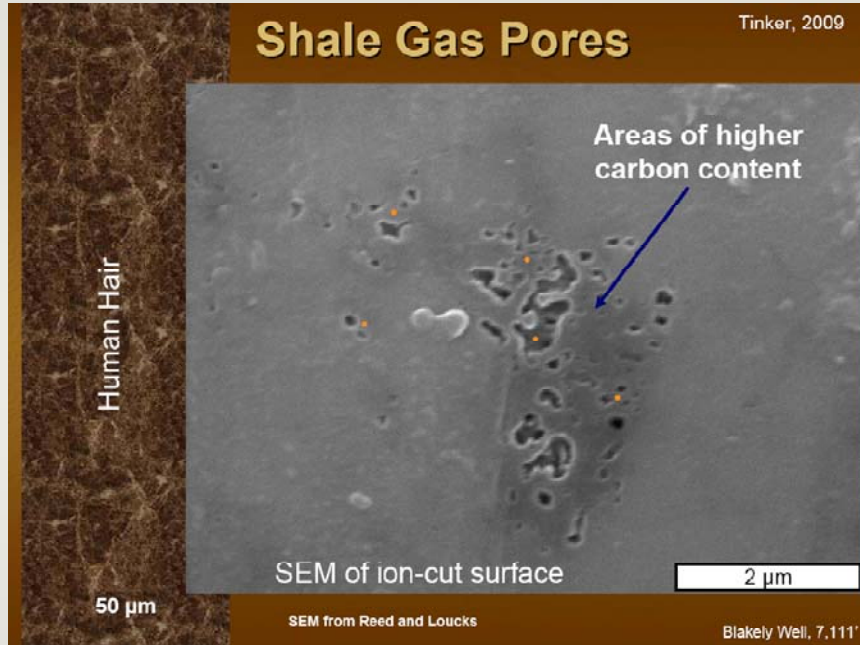


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# Shale Gas Pores

Tinker, 2009



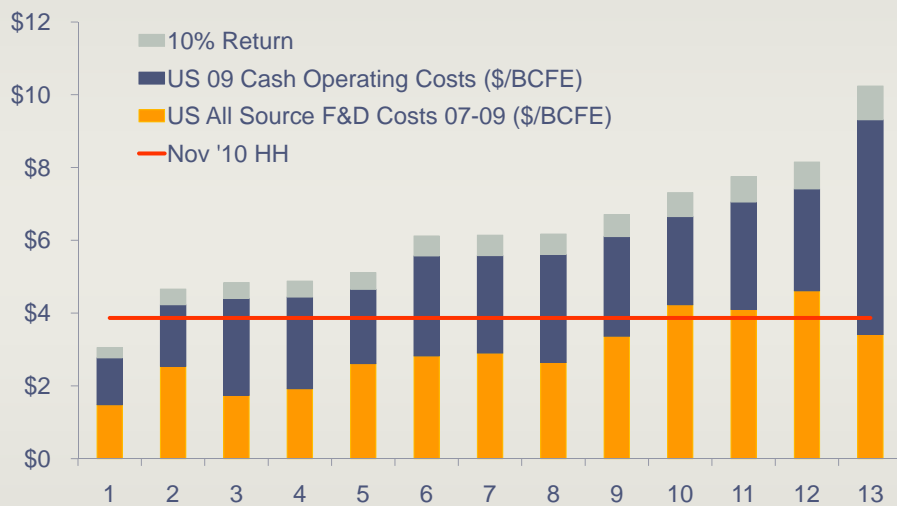
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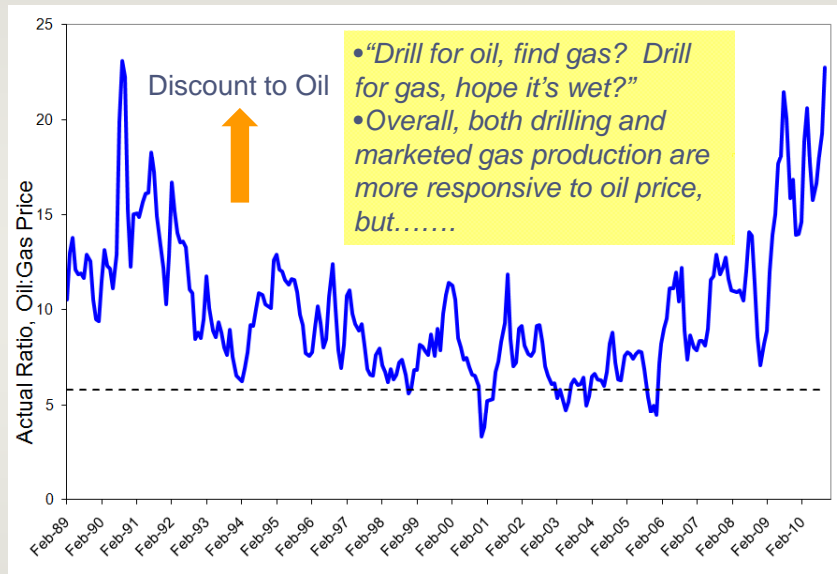
## The New “Nanodarcy” Universe of Technology

- Detection and advanced stimulation
  - Slow decline curves
  - Reduce drilling (fewer rigs, lower costs, smaller footprint)
  - Manage water disposal and other production issues
- Enhanced recovery
  - Extend field life

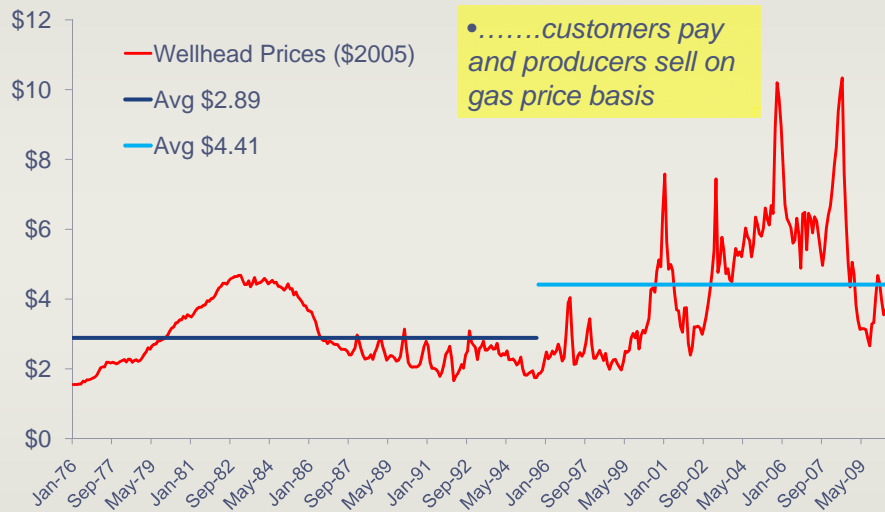
## A Tough Business, Anyway



## Price Trends

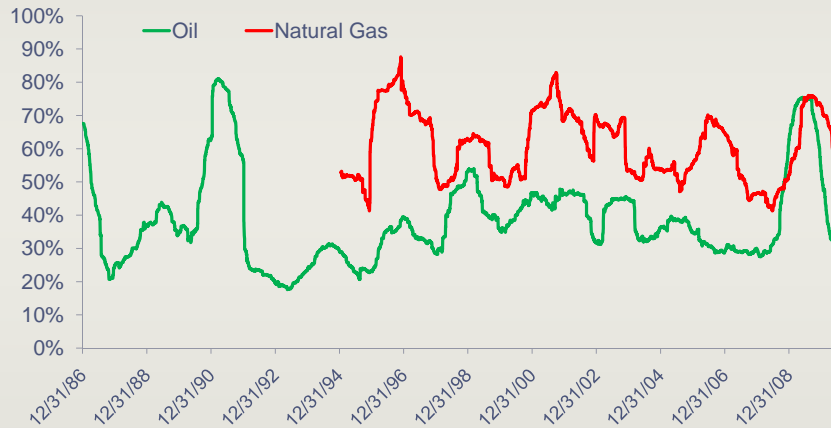


## Wellhead Price Eras





## Price Level and Volatility Matter



## Average price (\$2005)

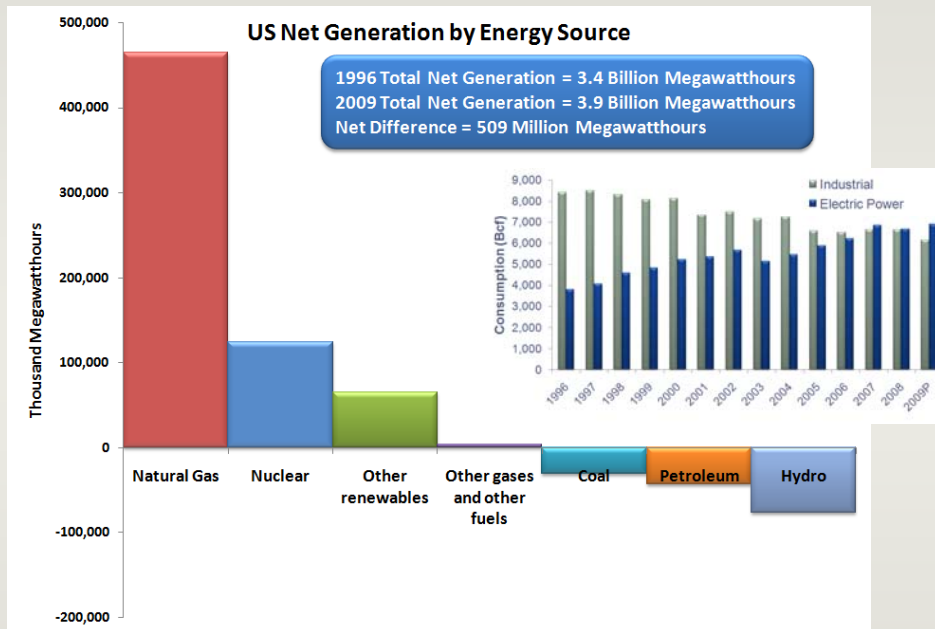
	Wellhead	City Gate	Res	Comm	Ind	Elec. Power
<b>Before 99:12</b>	2.82 <sup>a</sup>	4.39 <sup>b</sup>	8.96 <sup>c</sup>	7.04 <sup>b</sup>		
<b>00:01-09:11</b>	5.30	6.73	11.99	9.61	6.68 <sup>d</sup>	6.49 <sup>e</sup>
<b>Change</b>	88%	53%	34%	37%		
<sup>a</sup> 76:01-99:12; <sup>b</sup> 83:10-99:12; <sup>c</sup> 81:01-99:12; <sup>d</sup> 01:01-09:12; <sup>e</sup> 02:01-09:12						

## \*Price volatility (\$2005)

	Wellhead	City Gate	Res	Com	Ind	Elec. Power
Before 99:12	7.2% <sup>a</sup>	6.0% <sup>b</sup>	6.3% <sup>c</sup>	2.5% <sup>b</sup>		
00:01-09:11	12.2%	10.5%	7.7%	5.3%	11.4% <sup>d</sup>	10.6% <sup>e</sup>
Change	71%	74%	22%	110%		

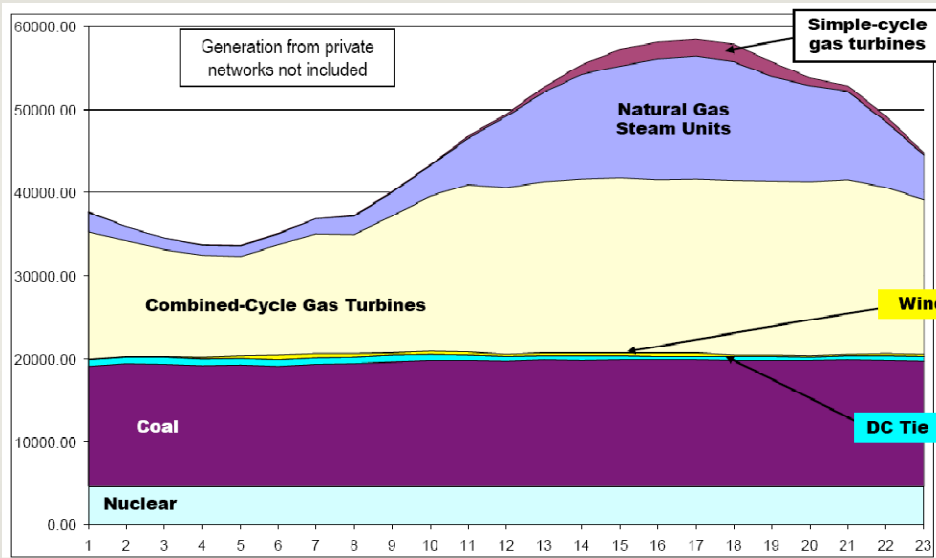
<sup>a</sup> 76:01-99:12; <sup>b</sup> 83:10-99:12; <sup>c</sup> 81:01-99:12; <sup>d</sup> 01:01-09:12; <sup>e</sup> 02:01-09:12

\* Std dev of change in price



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# ERCOT Peak Day by Fuel Type

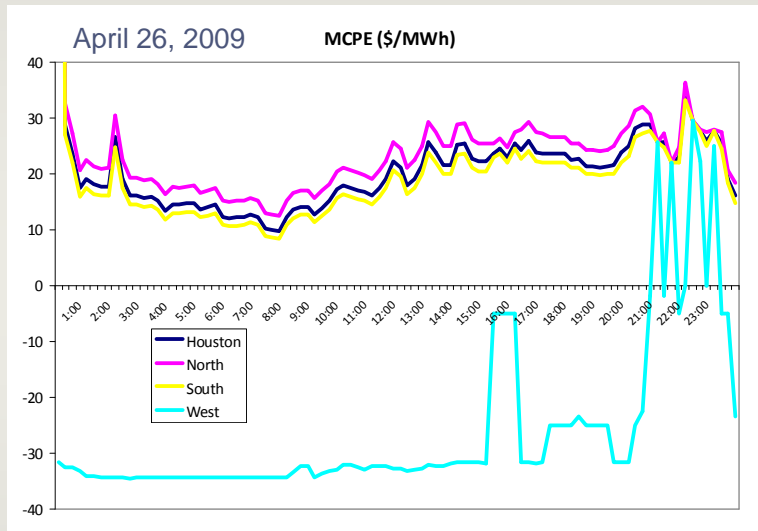


Electric Reliability Council of Texas (ERCOT)

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# Does Renewable Energy Create Volatility?



Negative price intervals (15 min)

2006	76
2007	338
2008	4,894
2009	3,069
2010	2,413 (5/31)



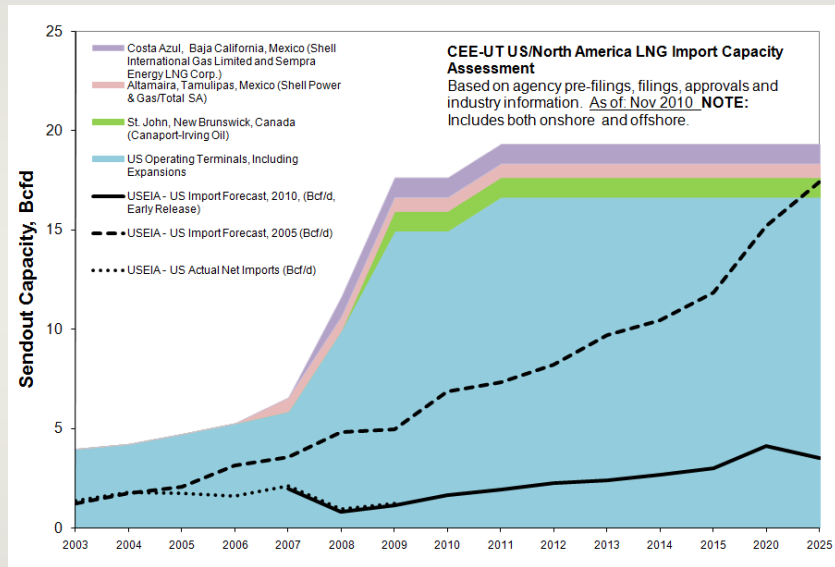
Compiled by CEE using ERCOT data

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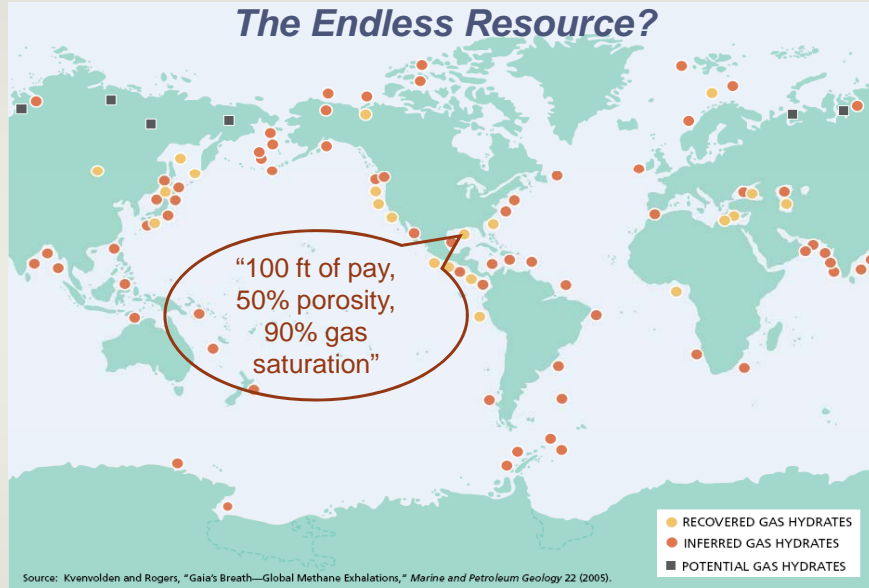
## Price Observations

- **Volatility** is a sensitive issue for large users and regulated utilities; lack of data prevents analysis on changes over time
- Residential (and some commercial) customers are sheltered by regulators
- Wellhead price takers both suffer from and may contribute to volatility
- Electric power demand swings on marginal gas generators + impact of renewables may contribute to volatility

## LNG “Optionality”



## Beyond Unconventional The Endless Resource?



## Critical Role of Natural Gas in the U.S. Energy Mix

- Benefits of utilization – options for natural gas uses
  - For lower carbon electric power?
  - Industrial revitalization?
- Supply and price volatility
  - Frontiers, production management, frac and water issues
- Electric power dynamics – effective, optimal dispatch?