Power Market Trends

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DAI

Who is DAI?

- Energy Market Experts
  - Industry-leading clients
  - University-affiliated experts at the Carnegie Mellon University Electricity Industry Center
  - Published, peer-reviewed research
- Appraisal & Valuation Specialists
  - ASA-accredited senior appraisers
- Power & Energy Market Engineers
- Electric Market Economists
- Plant Managers & Operators

Recognized Expertise

- American Society of Appraisers Certified
- Licensed Professional Engineer by National Council of Examiners for Engineering
- Published, peer-reviewed research
  - *The Appraisal Journal*
  - *Journal of Structured and Project Finance*
  - *Journal of Economic Behavior and Organization*
  - *Public Utilities Fortnightly*

Decision Analysis

- Quantitative Risk Analysis ("QRA")
- Electric and Fuel Market Studies
- Electric Market Forecasts
- Fuel Market Forecasts
- Statistical Analysis of Asset Performance
- Hedging Strategy Analysis
- Analysis of Capital Cost Uncertainty
- Default Analysis for Loan Guarantees
- Acquisition and Divestiture Advisory
- Valuation Litigation Support

Appraisal & Valuation

- Equipment Fair Market Value Appraisal
- Residual Value Determination
- Liquidation Value Determination
- Tax Analysis/Support
  - Alternative Energy Property Allocations
  - Business Combinations (SFAS 141)
  - Goodwill and Intangible Assets (SFAS 142)
  - Gain or Loss from Acquisition (IRC 1060)

Energy Market Trends

- Trend #1: New shale supplies are a massive force holding prices down and reshaping the energy supply curve.

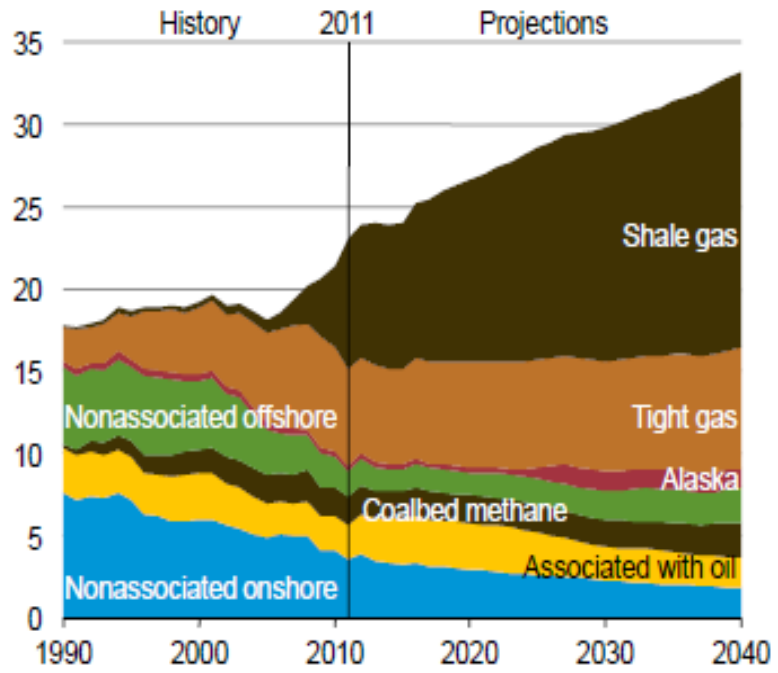
- Trend #2: Stagnant demand coupled with increased energy efficiency and demand response efforts have reshaped the demand curve.

- With both supply and demand curves reshaped, a new market equilibrium has emerged.

The Impact of New Shale Gas Supplies on Energy Markets

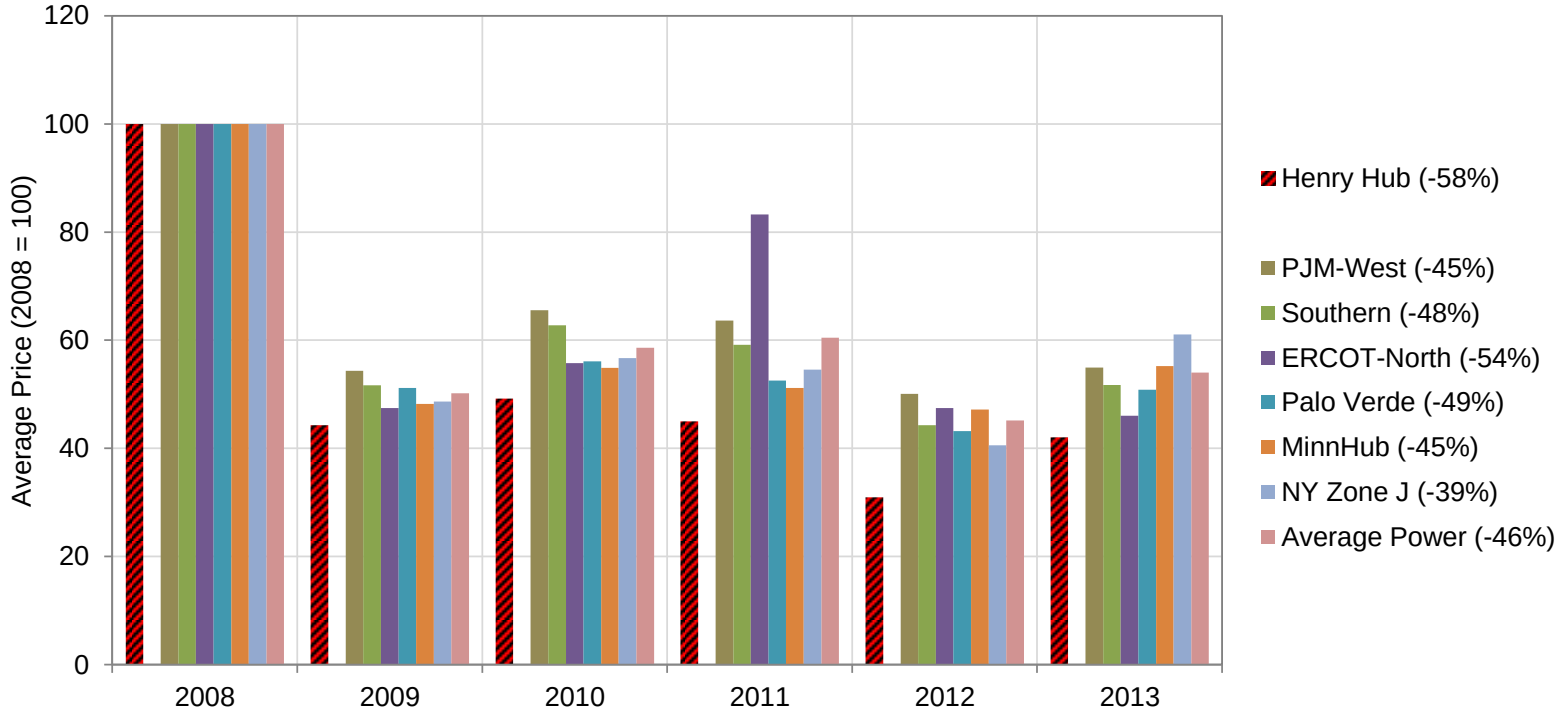
- Shale gas production has tripled from 5 years ago.
- Shale production is expected to double again by 2030 to nearly half total natural gas production.

Historical and Projected Natural Gas Production (in Tcf)



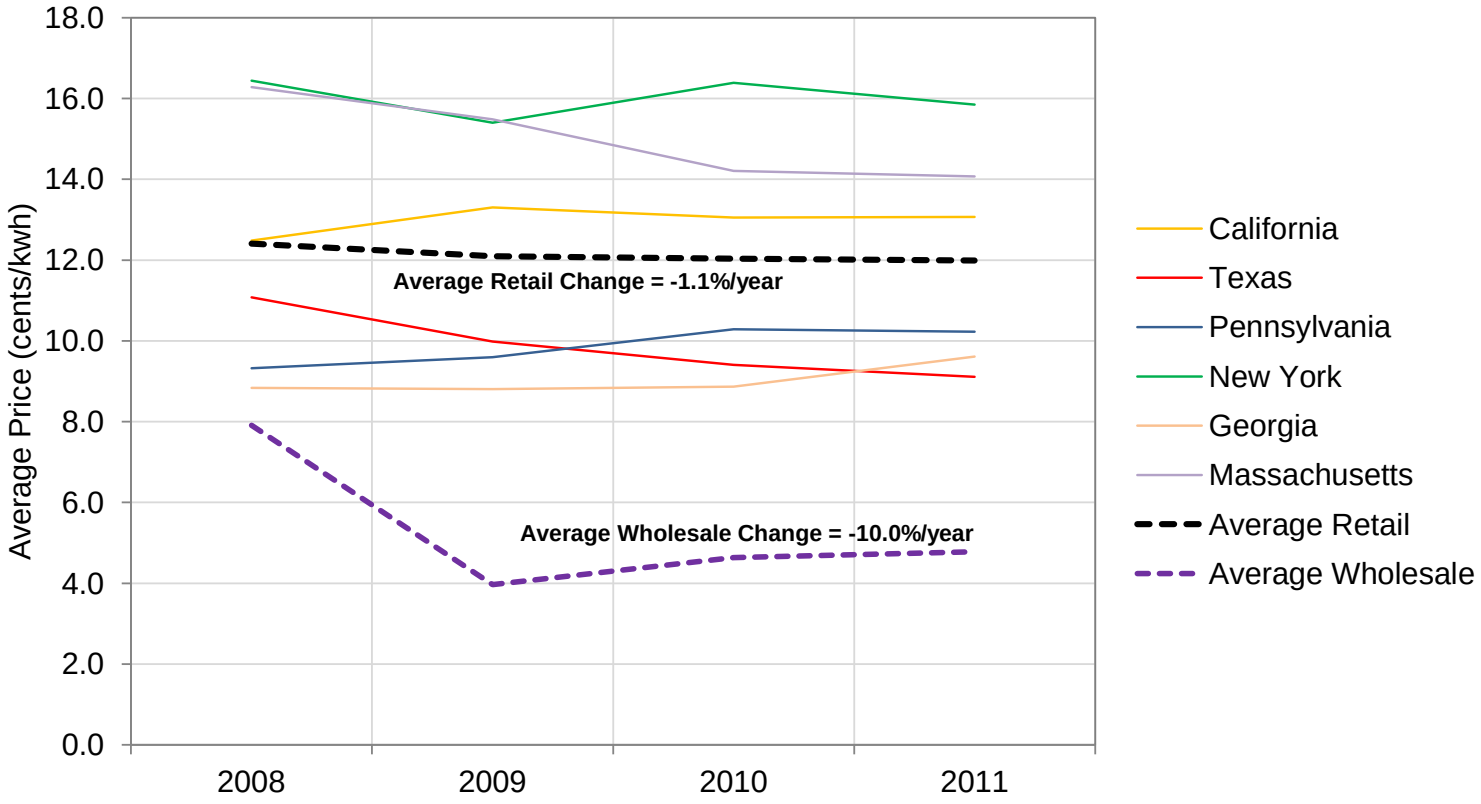
The Impact of New Shale Gas Supplies on Energy Markets

- Virtually all energy markets in the U.S. are dominated by natural gas-fired generation.
- The marginal, or price-setting, generator in these markets is typically a GTCC unit.
- The consequence? Energy prices track natural gas prices…



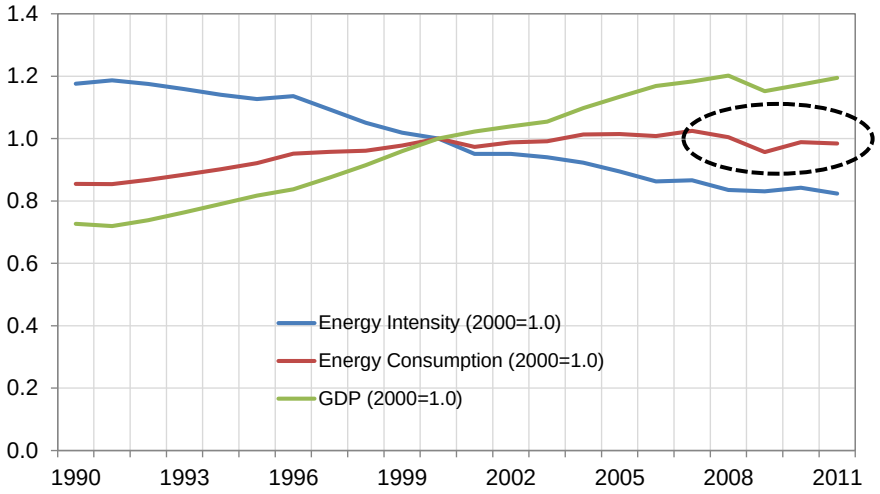
The Impact of Weak Demand on Energy Markets

- Normally falling prices would stimulate demand for energy and re-equilibrate the system.
- But… *retail* prices have <u>not</u> fallen. Utilities have kept retail prices high to recover large CapEx investments for environmental compliance.



The Impact of Weak Demand on Energy Markets

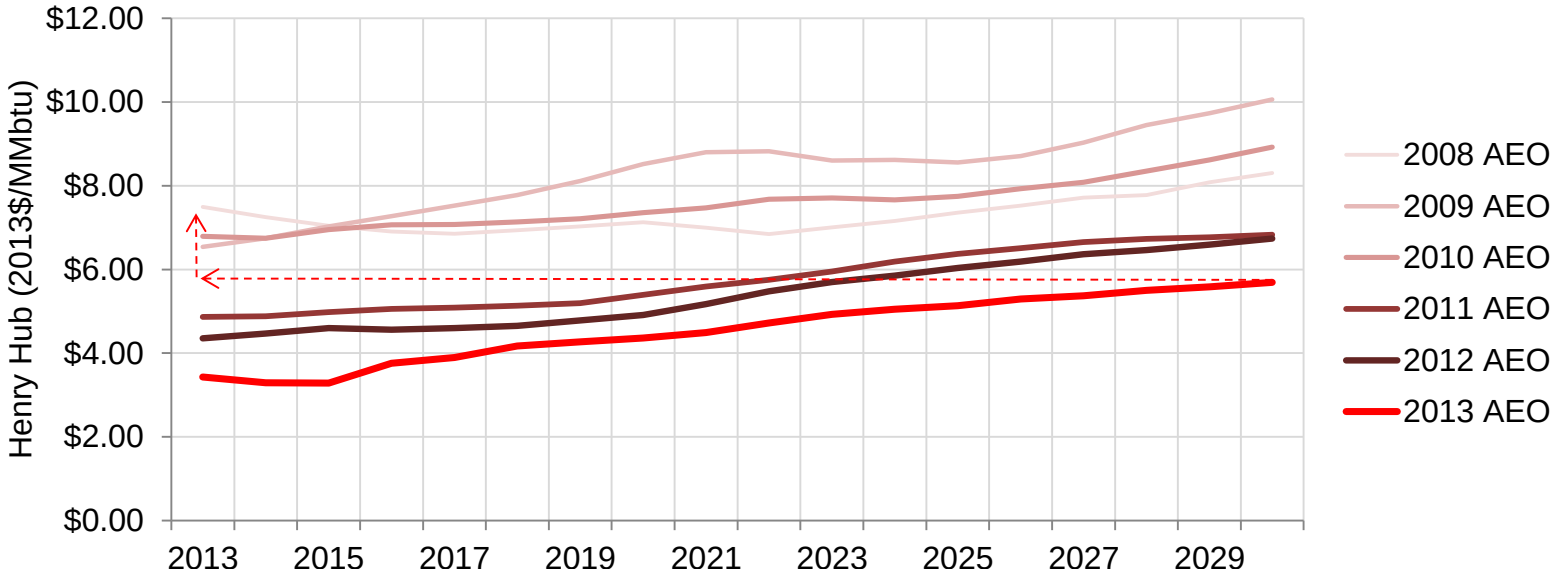
- As a result, demand has not increased.
- Further, demand was depressed during the Great Recession, prompting on-going energy efficiency efforts:
  - Energy efficiency
  - Demand response
  - Distributed generation



- Falling demand and slowing demand growth have played a huge role for (wholesale) energy prices – perhaps second only to new natural gas supplies.

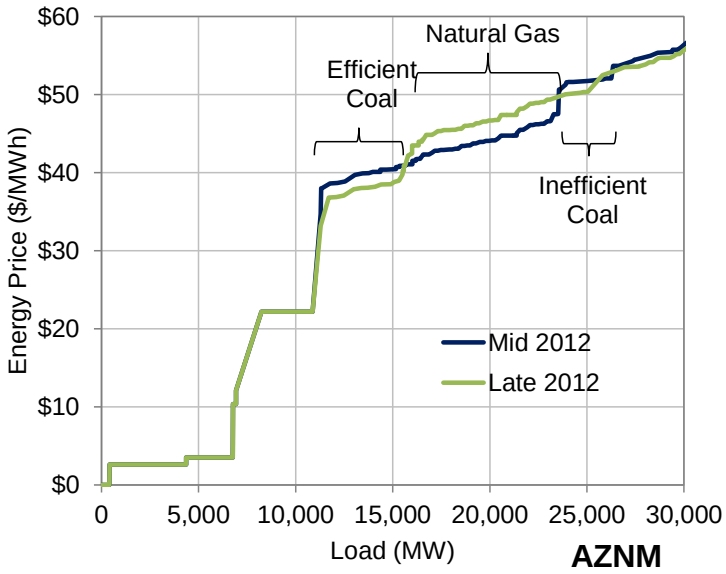
The Impact of the Decline is Extraordinary

- Vast increases in low-cost fuel supply, coupled with an historically unprecedented slowing of consumption, have precipitated some unusual energy market behavior.
- First: expectations have shifted dramatically, coloring capacity planning decisions. Long-term forecasts of NG prices have plunged, with current forecasts of 2030 prices that are *lower* than the 2008 forecast of 2013 prices.



The Impact of the Decline is Extraordinary

- Second, natural gas variable costs have fallen so much they have begun to intersect the coal portion of the supply curve, splitting the coal tier into two portions.
- As a result, in some regions we are observing the unusual phenomenon of *rising* marginal heat rates, as the marginal unit at certain times becomes a higher-cost coal-fired unit, rather than a gas-fired unit – even though the heat rate is always calculated relative to gas prices.



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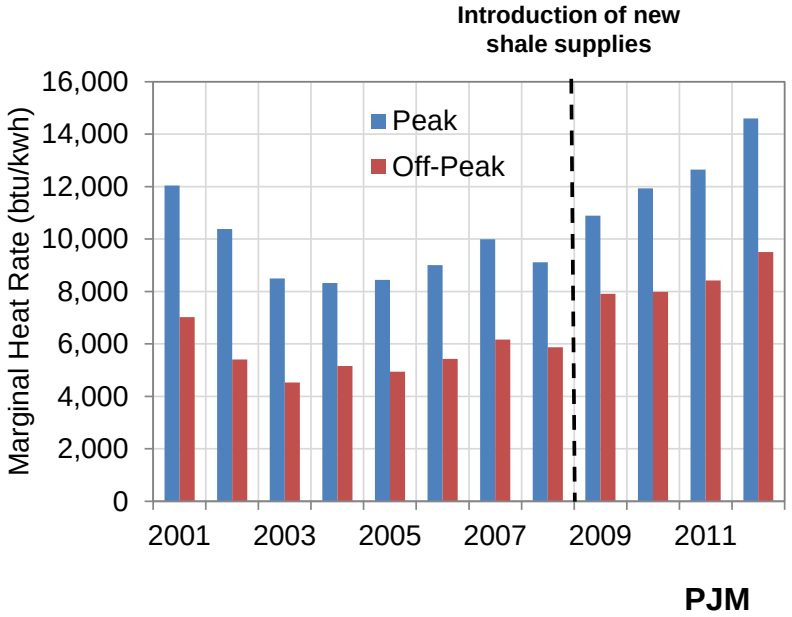


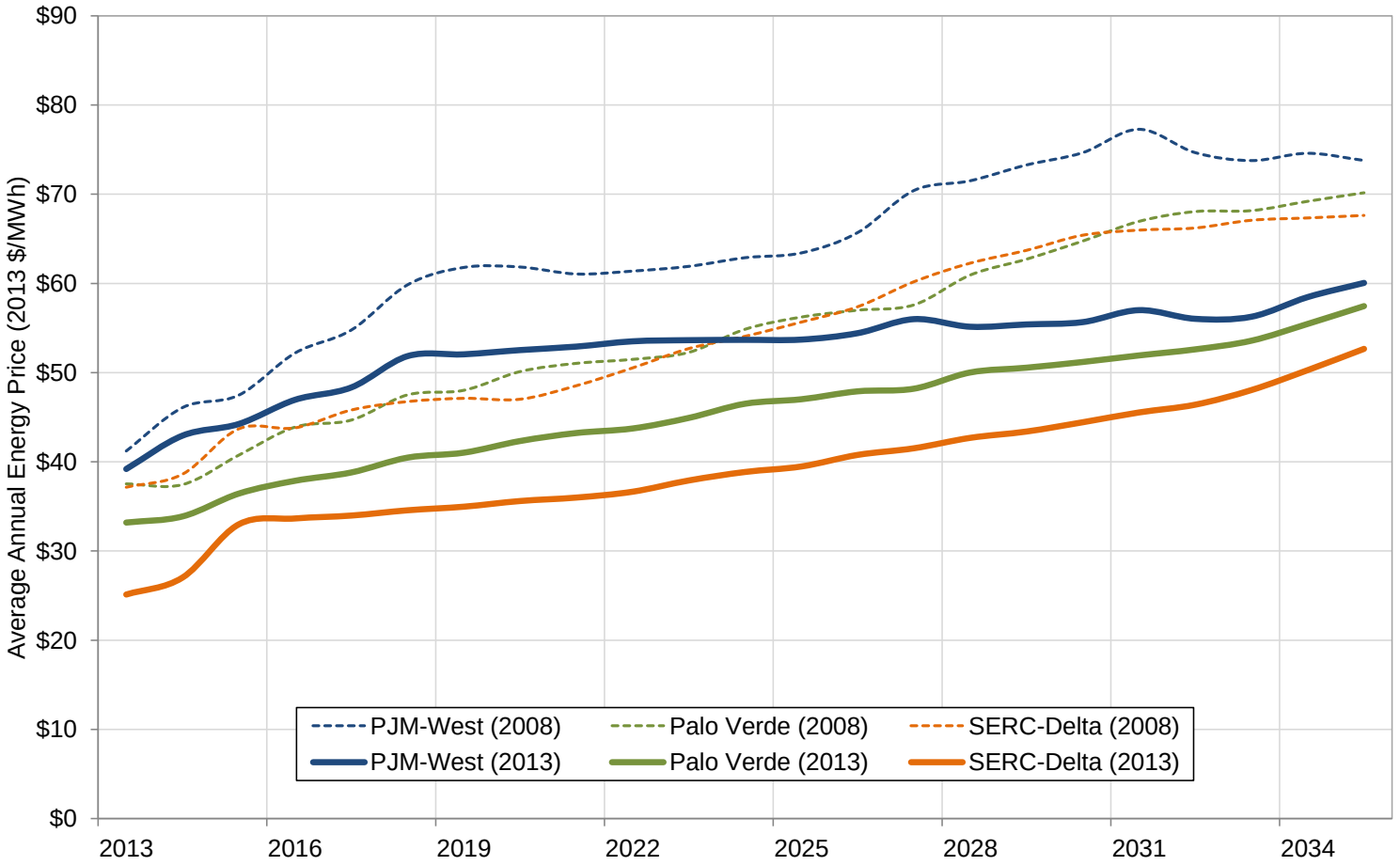
PJM

Implications for Valuation

- Power generator values have declined across the board, with declines especially large among non-gas capacity (*i.e.*, coal, nuclear).
- This decline is not likely to be reversed quickly; it is an enduring shift barring further intervention.
  - CO_2 legislation
  - Restrictions on fracking, water usage
- Based on DAI's proprietary market equilibrium model, we have prepared representative forecasts for three diverse markets:
  - Palo Verde
  - PJM-West
  - SERC-Delta (MISO-South)
- In each case, we present the forward price curve with 2008 NG price expectations and current NG price expectations to illustrate the impact of new shale supplies.

The Energy Outlook for Selected Markets

- Palo Verde, PJM-West, SERC, using both 2008 natural gas price forecasts and current forecasts (there is no CO_2 policy in effect for these forecasts)



Capacity Market Trends

• Trend #1: Auction dysfunction. Capacity auction results appear to be below replacement cost for new capacity, but don't appear to be limiting capacity additions.

• Trend #2: Capacity markets are heavily influenced by extra-market sources of compensation that selectively influence bids.

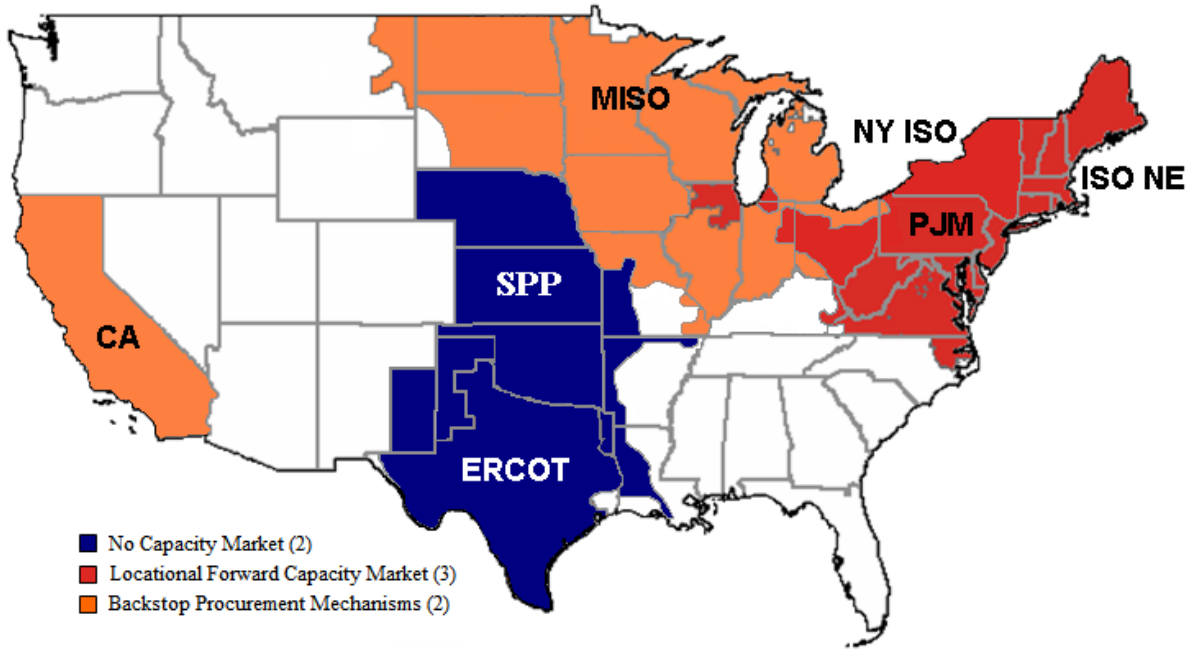
• Trend #3: Developers have benefitted in recent years from unusually cheap capital thanks to Fed policy.

Capacity Market Overview

• In power markets, energy prices reflect the cost of wholesale energy actually delivered. Capacity markets, however, reflect the cost of the *ability* to deliver energy.

• The U.S. power market is divided into three types of capacity markets:

- Centralized: PJM's Reliability Pricing Model ("RPM"), ISO-NE's Forward Capacity Market ("FCM"). Centralized markets run by ISOs that produce localized market clearing prices.
- Transitional: MISO's Voluntary Capacity Auction, CAISO's resource adequacy. These mechanisms tend to be more "ad hoc" and often have very limited participation. As a result, they are not necessarily indicators of the marginal market price of capacity.
- Bilateral: The rest of the country, which procures capacity bilaterally via contract. Pricing is often project-specific and can vary significantly.



Centralized Capacity Market Behavior

• Focus on the 2 centralized markets for the sake of clarity. Here are the results for the last five capacity auctions:

	PJM (RTO)	ISO-NE (RoP)
2012-13	$ 6.01	$ 35.40
2013-14	$ 10.12	$ 35.40
2014-15	$ 45.99	$ 38.52
2015-16	$ 49.64	$ 41.16
2016-17	$ 21.67	$ 37.80

All prices are in $/kw-year

The ISO-NE auctions have cleared at the price floor every year except for one region (Boston) in 2016-17.

• To put these results into perspective, consider the following replacement cost example:

	$/kw-year	Notes
Capital Cost	$ 167	New GTCC, $2,068/kw at 7% WACC
Fixed O&M	$ 30	
Variable O&M	$ 41	
Fuel	$ 311	7,000 btu/kwh, levelized across life
Revenue Requirement	$ 550	
Energy Revenue	$ (394)	Levelized across life (PJM), 65% capacity factor
Residual Fixed Cost	$ 157	

• The residual fixed cost is well above the recent capacity auction results, suggesting that capacity should exit, but in reality that developers have received extra-market compensation (PPAs, tax benefits, state-level incentives, etc) or have more optimistic views of future energy market revenue.

A Few Words About the Recent RPM Auction

- Since it was much in the news recently, consider the recent RPM auction as a microcosm of the issues facing all regions.
- Results were much lower than virtually everyone expected. Why?
  - CONE escalation limited by settlement to a fraction of actual costs
  - Load growth was flat on a comparable territory basis.
  - Many anticipated retirements have not actually occurred. Further, half of the 2015-16 announced retirements *retracted* their retirement announcements and bid into the 2016-17 auction.
  - Imports from MISO soared to nearly 4 GW. This is pure beggar-thy-neighbor, given MISO's lack of an equivalent capacity market.

- How sustainable are *any* of these factors?

The Market for Power-Generating Capacity

• Inferring value via the sales comparison approach proved challenging in 2012, and 2013 does not appear all that different.

• Large bid-ask spreads, few transactions.

• Since 2011 to June 2013, there have been 43 completed transactions (not including corporate-level M&A) covering 91 plants and 32 GW of capacity:

	Number of Transactions	Capacity (MW)	Average Transaction Value ($/kw) 2011	2012	2013
Natural Gas	26	21,734	$ 450	$ 392	$ 464
Coal	5	5,685	$ 197	$ 166	N/A
Oil	3	2,620	N/A	$ 82	$ 16
Hydro	3	851	$ 393	$ 1,667	$ 2,165
Nuclear	-	-	N/A	N/A	N/A
Wind	6	753	N/A	$ 744	$ 1,360
Solar	1	48	N/A	$ 1,052	N/A
Biomass	2	266	$ 500	$ 1,175	N/A

• The vast majority of transacted capacity over the past several years has been natural gas-fired capacity, for which average prices have remained relatively steady. In contrast, there has been very limited liquidity for other fuel types.

• In addition, extreme caution is warranted, since many of the sales (particularly for coal-fired plants) occurred under special conditions (e.g., required divestiture, bankruptcy) that make them generally ill-suited for use as sales comparison data points.

- Brandon Shores, Wagner, Crane (required divestiture)
- AES Eastern (bankruptcy)
- Roseton, Danskammer (bankruptcy auction)

Limitations to Inferring Value from Recent Transactions: The Case of Brandon Shores

- The most notable event of 2012 was the low price received by Exelon for Constellation's three coal-fired plants: Brandon Shores, Warner, and Crane.
  - Exelon was required to divest the 3 plants as a result of its merger with Constellation.
  - The final sales price was $400 million for 2,648 MW ($151/kw).
  - But what does this mean? **Did this sale set the price for coal-fired capacity?**
- Numerous limitations on the sale process substantially limit the usefulness of the transaction as an indicator of the market value of coal assets:
  - Brandon Shores was the "poster child" for retrofit coal plants; Wagner and Crane were older, unscrubbed facilities.
  - The three plants were required to be sold together (which was probably the only way to sell Wagner and Crane).
  - The plants could not be sold to the other major participants in the region (AEP, GenOn, FirstEnergy, PPL, Calpine).
  - The plants were required to be sold within 150 days.
  - The buyer was required to maintain employment at the plants for >2 years.
- **It was hardly an example of an unforced, clean transaction.**

Market Trends

- The overarching trend of the last several years has been one of very limited data.
- Few transactions (outside of natural gas) occurred, and those that occurred were often subject to unique circumstances that limit their comparability.
- The lack of appropriately-comparable data suggests that the sales comparison approach may have limited value at this time for many power assets.
- At the same time, these conditions do tell us a great deal about the current state of the power markets:
    - Disagreement over values is at an elevated level
    - Often, what is not traded is just as informative (*e.g.*, no stand-alone unscrubbed plant sales)
    - Appraisers must carefully assess the circumstances of each transaction to evaluate its comparability to any particular valuation

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