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Strategic energy sourcing and management

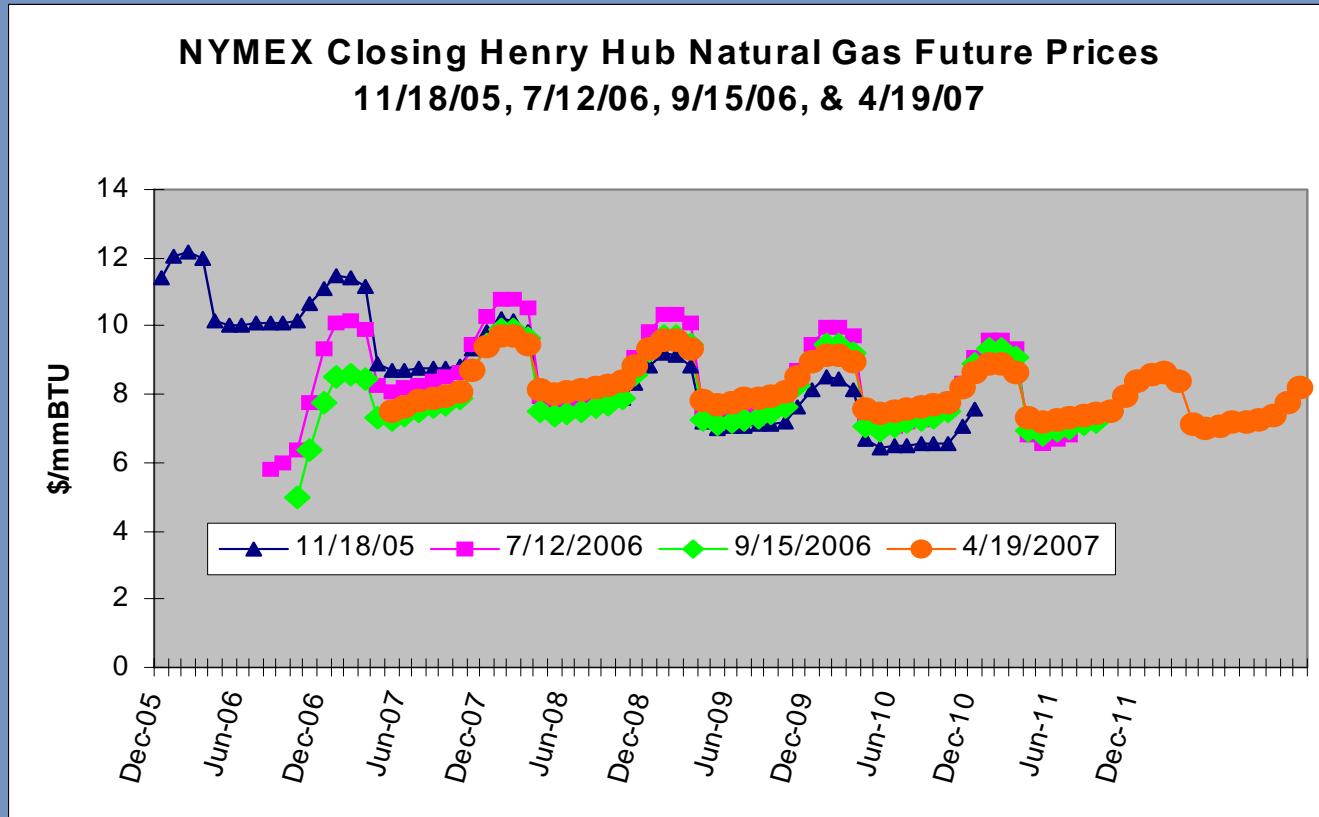
Natural Gas Price Trends: New Perspectives and Implications for Buyers

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National Accounts Conference &
Technology and Market Assessment Forum
St. Louis, Missouri
June 19, 2007

- Provide some analysis and observations about energy prices
 - ▶ *Historical*
 - ▶ *Over the next few years*
 - ▶ *For the longer term*
- Suggest possible implications and actions
- Let you “connect the dots”
- Not forecasting prices

- **Retail supply contract prices depend upon forward wholesale prices**
 - ▶ *Deregulated Markets*
 - *Default Rates*
 - *Competitive rates*
 - ▶ *Regulated market tariffs, albeit with delays*
- **Wholesale energy costs have risen over the last decade, with acceleration & more volatility recently, driven by:**
 - ▶ *Supply versus demand tightness*
 - ▶ *High reliance on natural gas to generate electricity*
 - ▶ *Crude oil prices to a lesser degree*
- **Conventional wisdom is less reliable**
 - ▶ *Impact of short term factors (storage, weather, etc.) less*
 - ▶ *Mean reversion, but to an overall upward trend line*
- **Hard to envision forces that will lessen tight supply/demand over the next 5 years, or longer**
 - ▶ *Perhaps a major global recession*



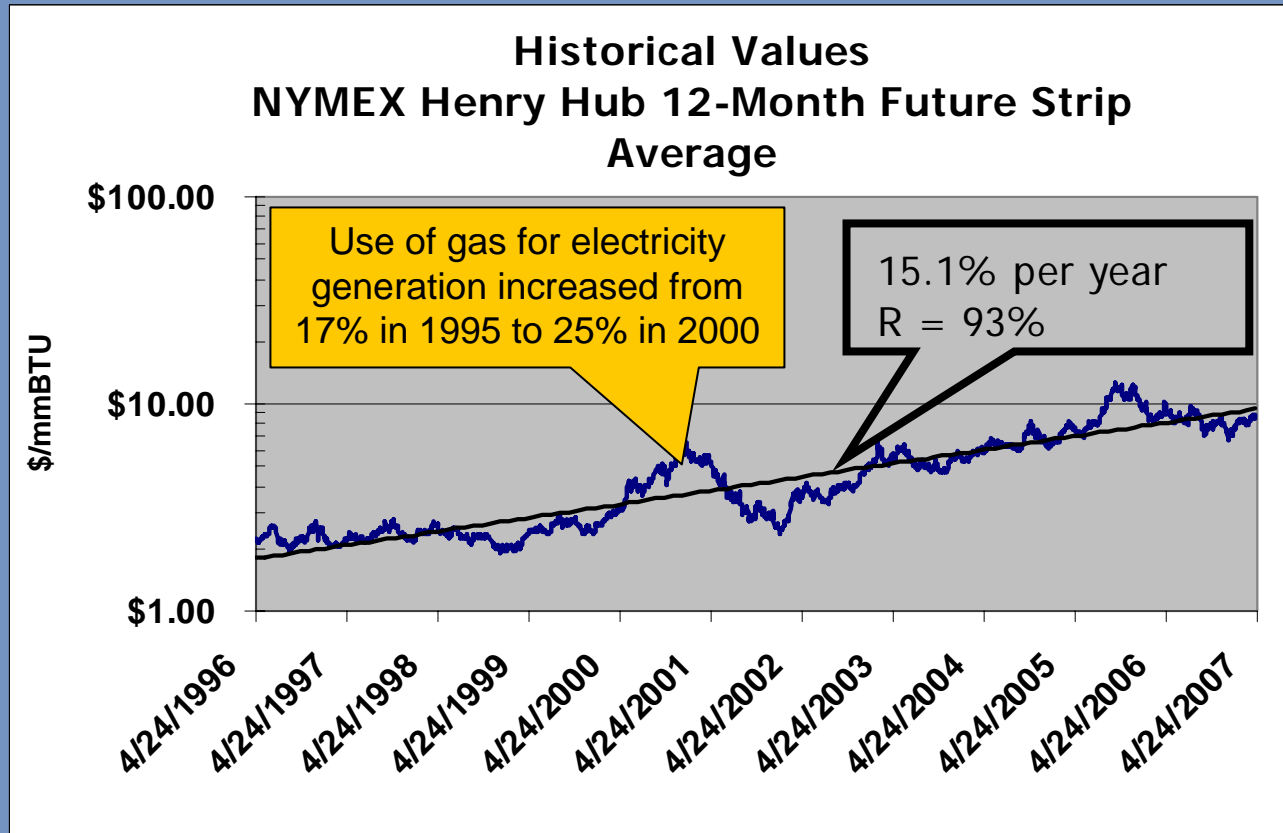
- ▶ *Greater movement of near months; lesser movement of far months*
- ▶ *General backwardation*



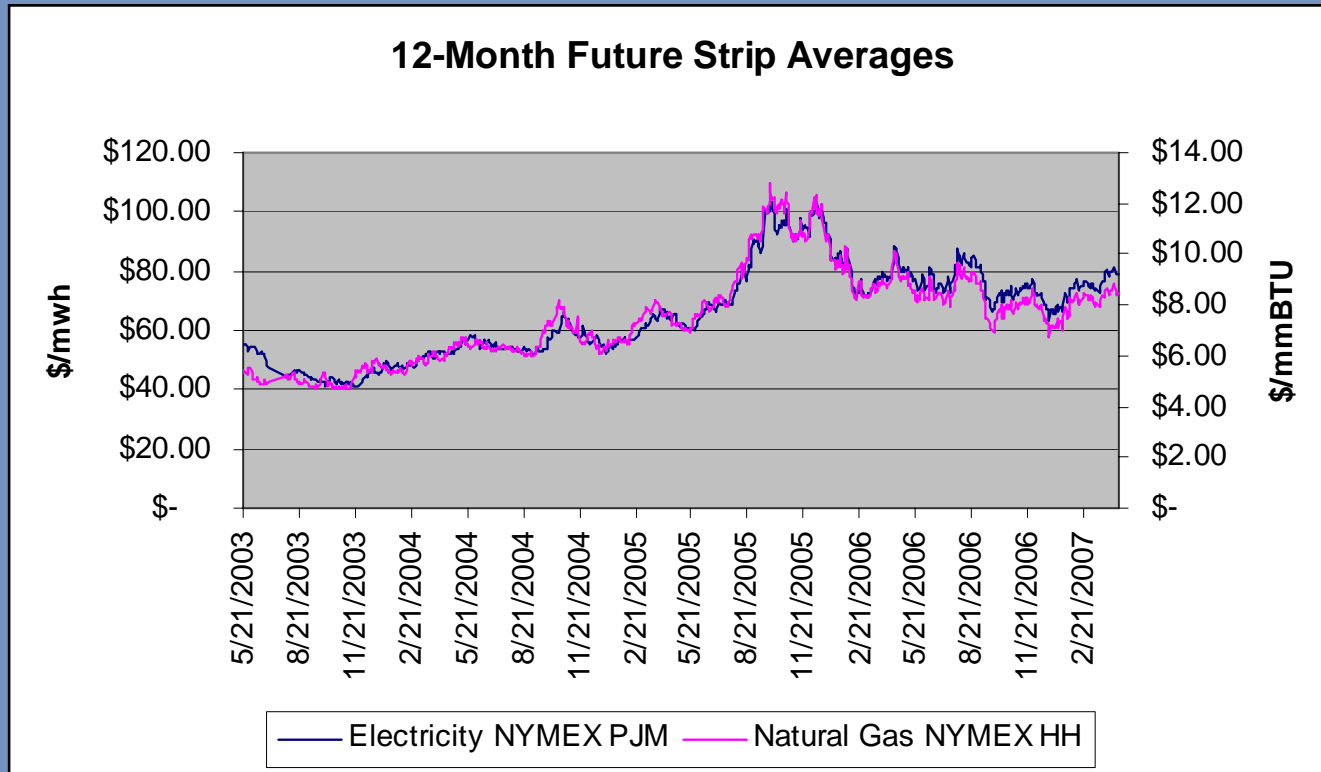
Natural Gas



- Average of 12-month NYMEX Henry Hub future strip
 - ▶ Good measure of wholesale market's effect on retail prices



- **Gas prices have generally increased over the decade**
 - ▶ *Best fit to constant rate of increase line using regression; $R = 93\%$*
 - ▶ *Resulting constant rate of increase = 15.1% per year for last 10+ years*
 - ▶ *Much like compound interest or long-term stock market behavior*

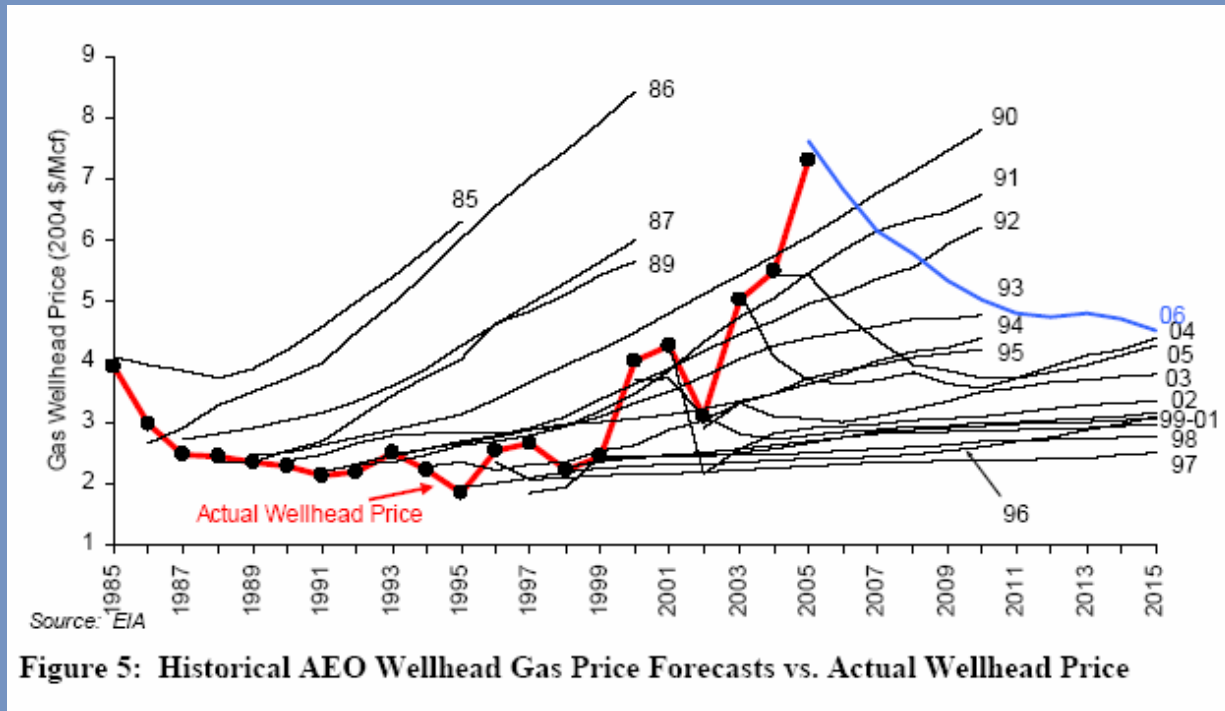


- Electricity and gas costs move together; they are highly correlated: Correlation (R) = 97%
- Causes
 - ▶ 25% of gas consumed in US is for electricity generation
 - ▶ Gas units are highest cost, dispatched last, and set marginal cost

- Most experts expect supply/demand to remain tight
- **Simmons International:**
 - ▶ *"...long-term challenges associated with falling domestic production, declining Canadian imports and limited ability to increase LNG imports will likely continue to support high natural gas prices."*
 - ▶ *"LNG import capacity, even if fully utilized, will likely struggle to offset declines in domestic production and Canadian imports."*
 - ▶ *Inverse price/storage relationship on longer always holds*
- **Chris McGill, Managing Director Policy Analysis, AGA**
 - ▶ *"North American supply/demand balance is and will remain tight"*
 - ▶ *Gas consumption grows*
 - ▶ *'New frontier' gas supplies are necessary and take time*
 - ▶ *Gas prices remain relatively high*
 - ▶ *High levels of gas price volatility continue*
 - ▶ *LNG imports become an important player in natural gas pricing"*



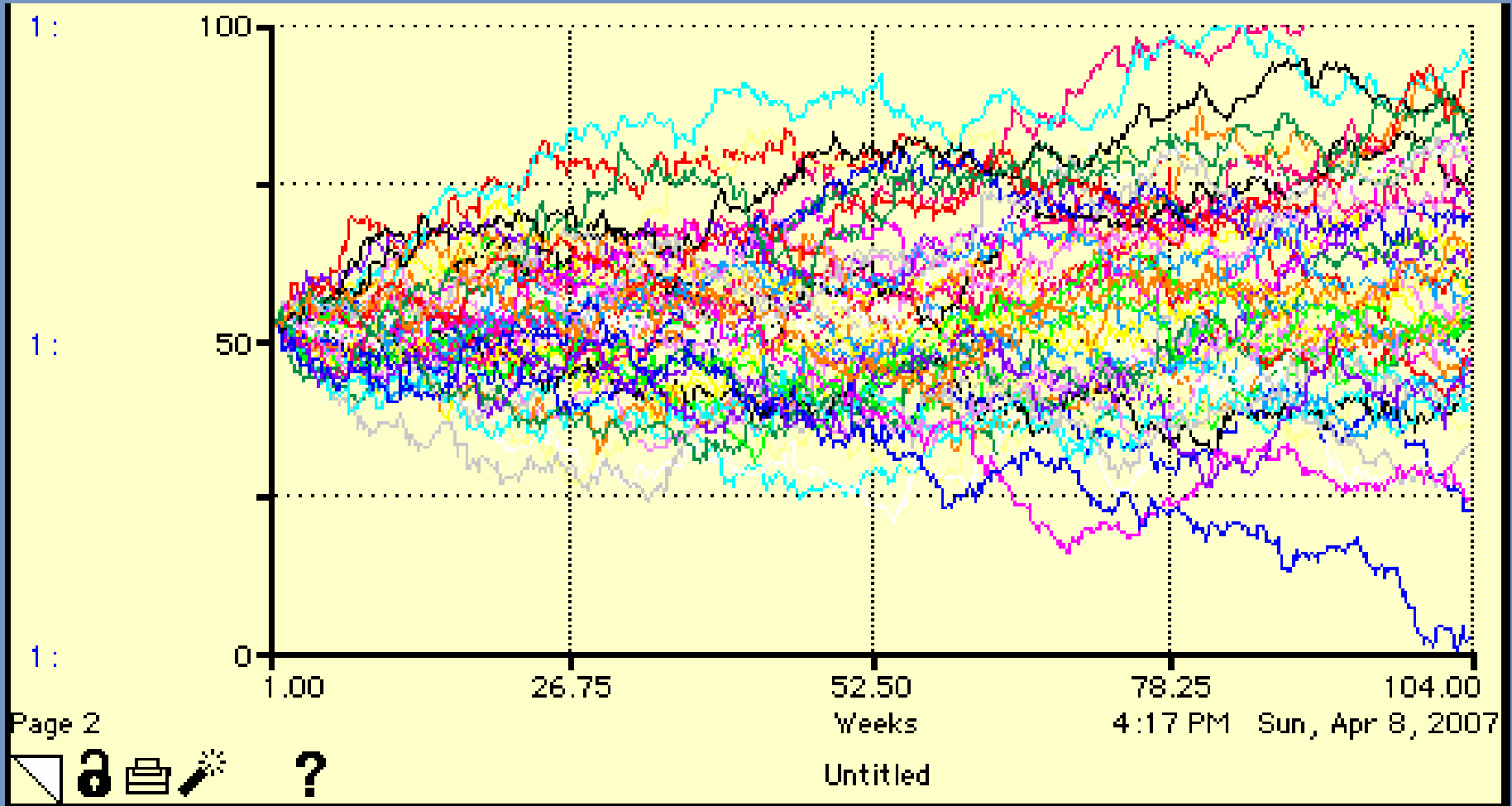
- **LNG**
 - ▶ *Currently import < 1.0 TCF of 23 TCF consumed annually*
 - ▶ *Optimistic projections suggest doubling in next 5 years*
- **Additional major fields and pipelines > 2014**
- **Nuclear Power > 2014**
- **Clean Coal technology? Similar**
- **Major recession? Maybe**
- **Environmental momentum will increase pressure**
- **Most alternatives offer floor for, not lower, prices**

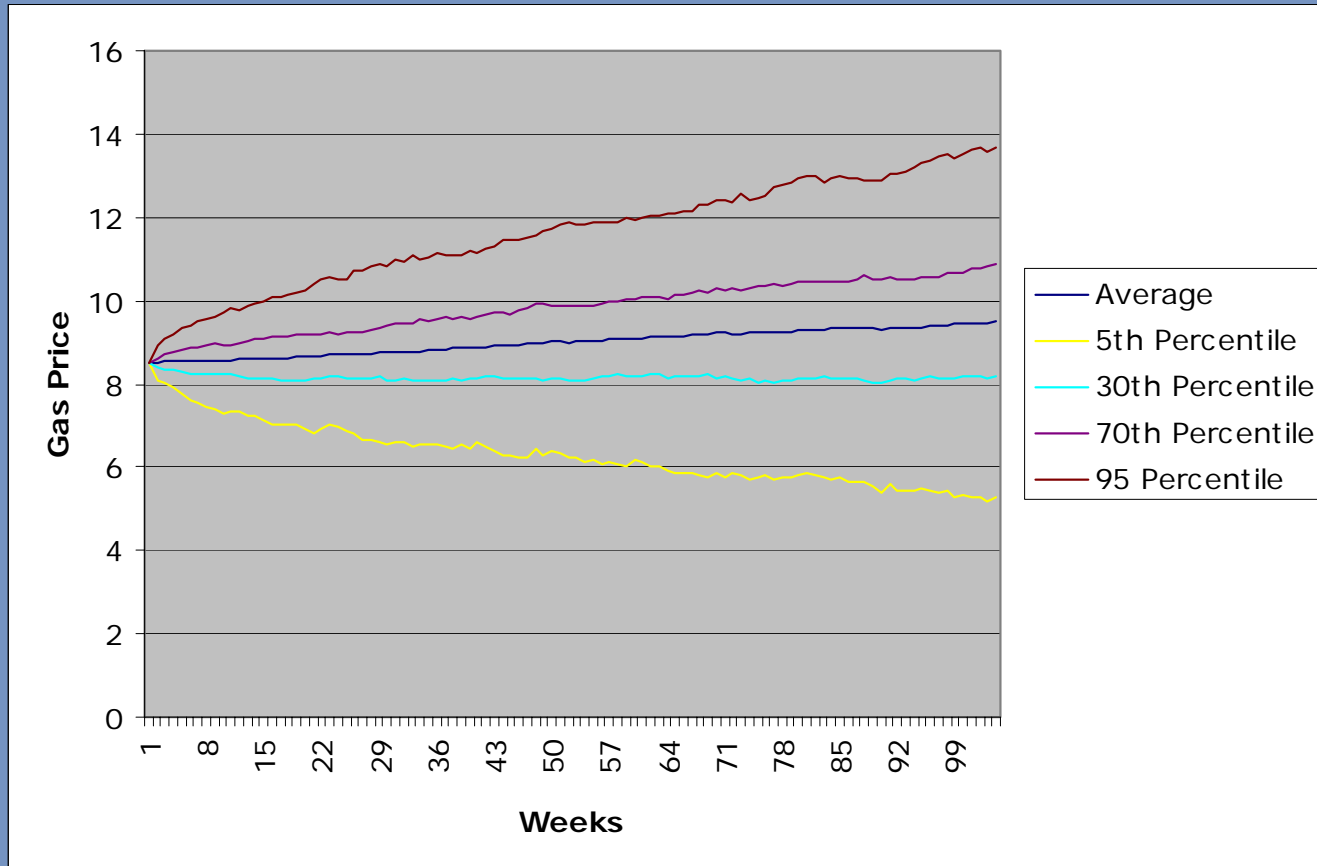


- EIA has been under-projecting prices for the last decade
- Lawrence Berkeley Laboratory analyzed EIA projections:
 - ▶ *“EIA grossly over-projected the price of gas in the late 1980s, and conversely has grossly under-projected the price of gas since the mid-1990s”*

- **Common myth: prevalent backwardation is market forecasts of lower prices**
- **Complete misunderstanding, even among experts**
- **Backwardation is caused by “Convenience Yield”**
- **Greater convenience and lower risk associated with nearer-term contract commitments mean:**
 - ▶ *Buyers willing to pay more*
 - ▶ *Suppliers expect more*
- **Same cause and underlying principal as interest rate yield curve**
 - ▶ *Greater risk in future requires greater returns*
 - ▶ *Effect is opposite*
 - ▶ *Greater risk means energy prices are discounted*

- Simulation for future gas prices based on historical price strip for natural gas at the Henry Hub.
 - ▶ Key Assumption: *historical behavior continues*
- Ten year data for daily average 12-month future prices of natural gas
- Decompose gas price behavior into key components and represent with appropriate data sets and statistical functions
- Two years (104 weeks) simulation period; daily calculations
- Starting price: \$8.50/mmBtu (4/19/07 close)





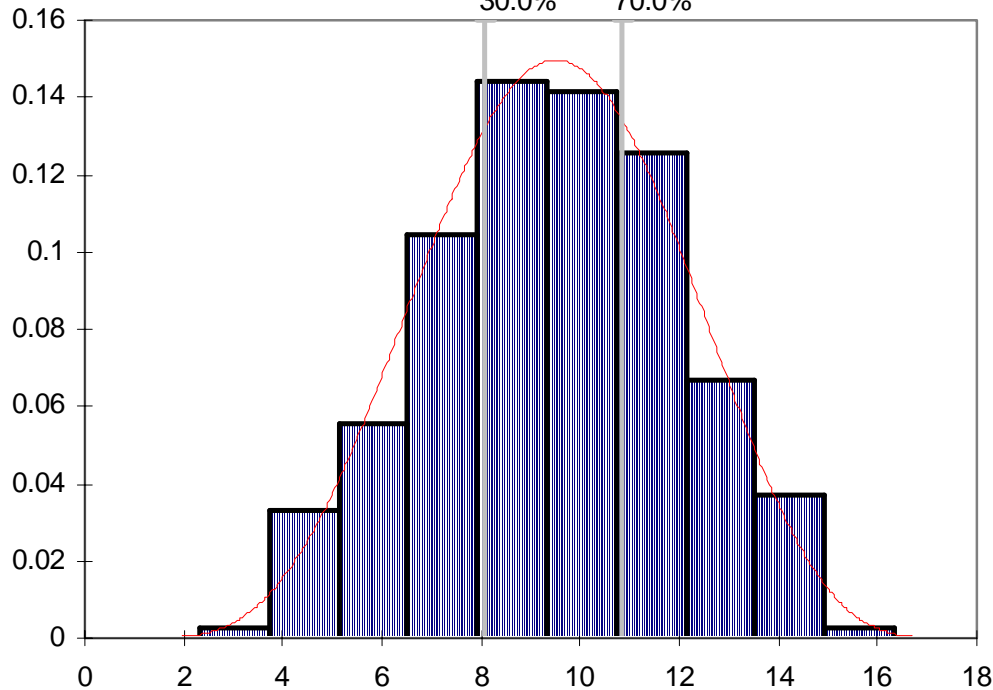
- **Convergence: mean end price changed only \$0.01 from 400 to 500 runs**



BetaGeneral(5.3888, 5.0750, 0.77463, 17.624)

$X \leq 8.075$ $X \leq 10.852$

30.0% 70.0%

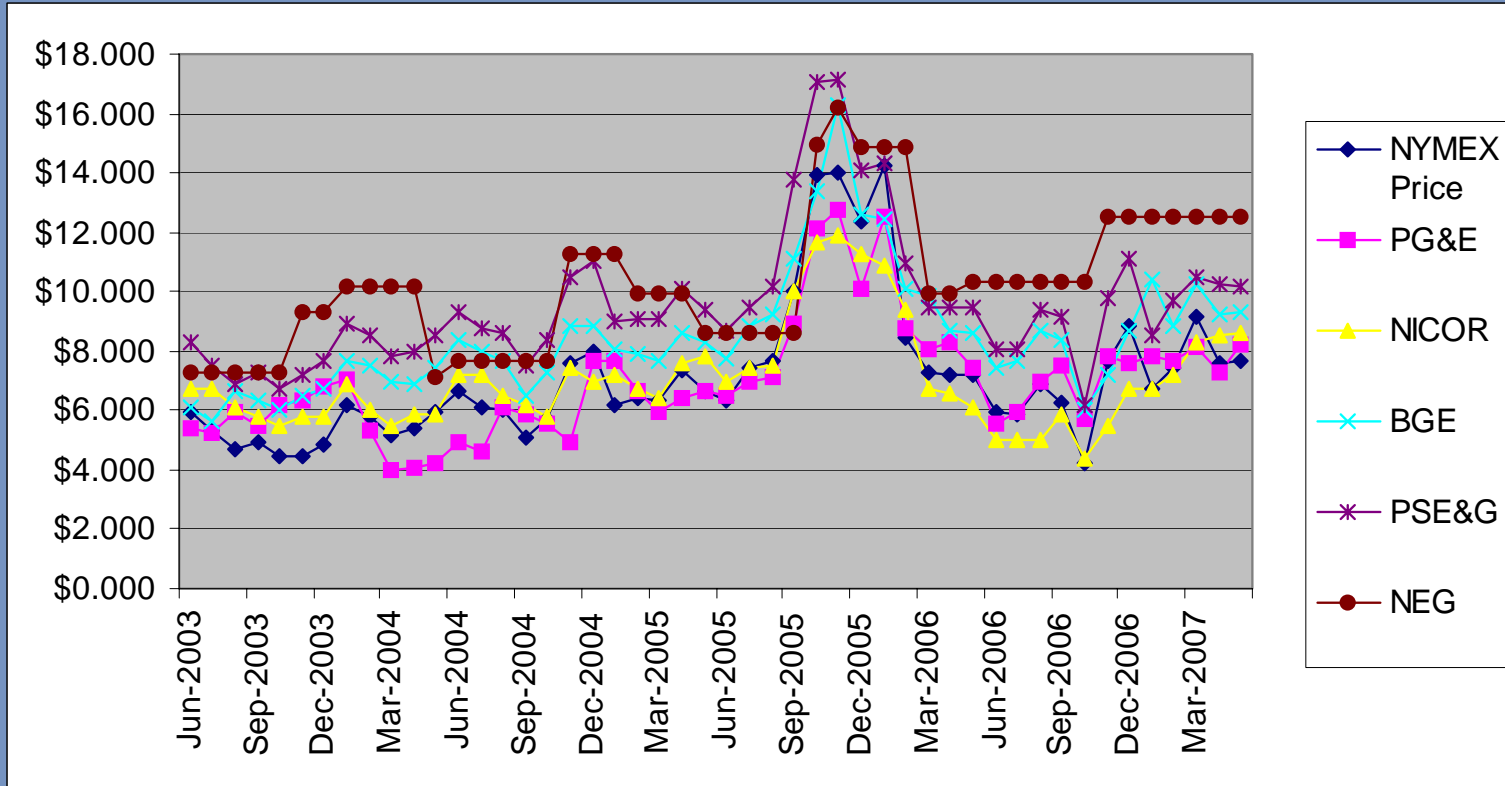


- Starting Price = \$8.50
- Mean end price = \$9.45
- Confidence levels:
 - 5% = \$5.32
 - 30% = \$8.08
 - 64%: prices go up
 - 70% = \$10.85
 - 95% = \$13.53
- Per mmBTU

- Best Fit analysis of the ending prices over two year period, 500 runs.

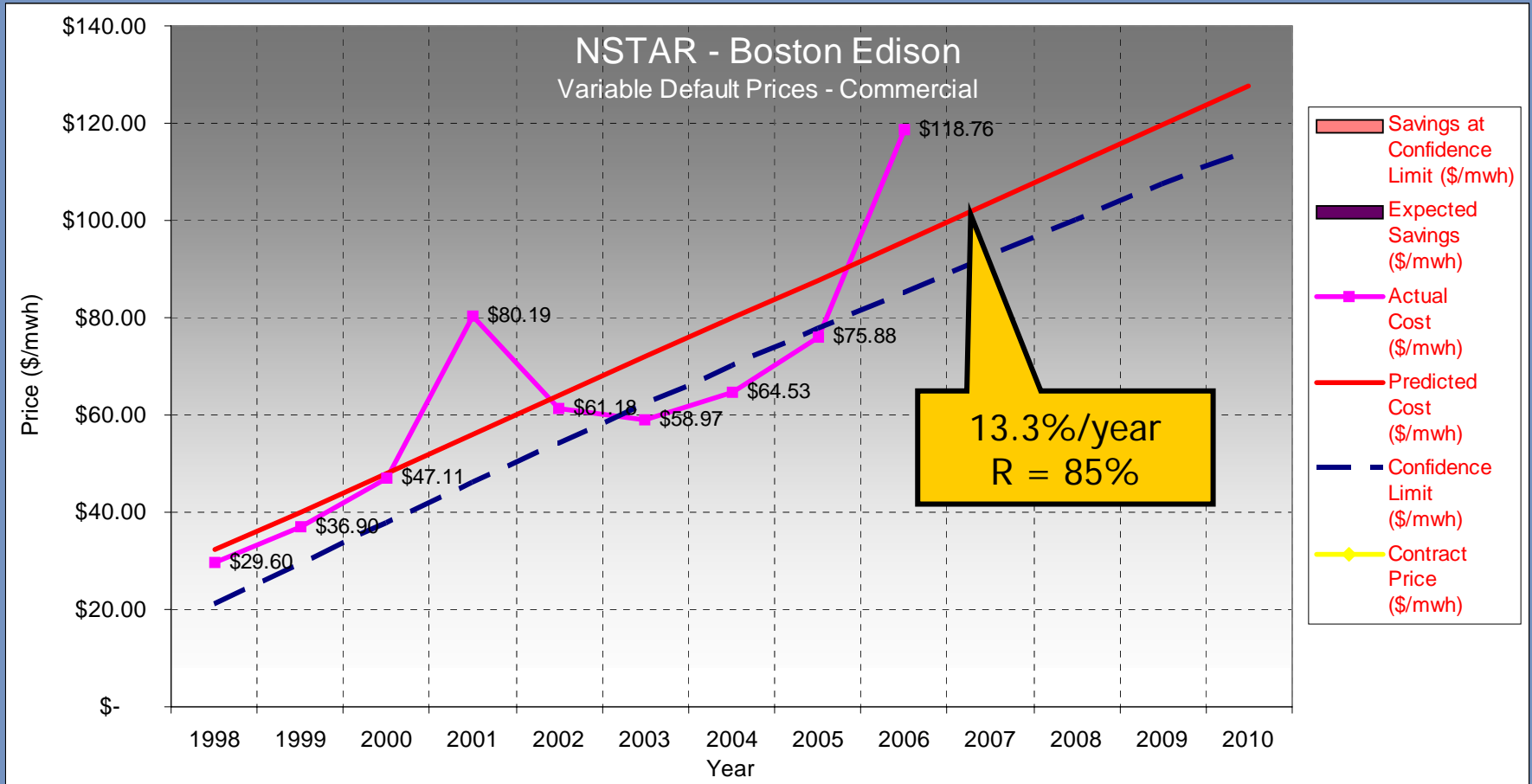


EnergyWindow Retail LDC Default Gas Prices



Correlations	PG&E	Nicor	BG&E	PSE&G	NEG
to NYMEX	91%	89%	92%	97%	72%

- Local utility default gas prices set monthly/quarterly based on wholesale costs; trend is very similar to NYMEX trend



- Natural gas prices have increased ~15% per year for 10+ years
- Natural Gas and Electric Prices highly correlated
- Wholesale and retail energy prices highly correlated
- Average of 12-month Henry Hub natural gas strip is a useful gauge of wholesale prices as they affect retail prices
- Few experts offer opinions or rationale for diminishing supply/demand tightness in next 5-10 years
- May want to consider longer term fixed price contracts for significant fraction of your energy supply portfolio
- But don't bet the farm on analysis of history
- May need to reset expectations for your stakeholders

- **Beware of “outlier” risks & understand impact**
 - ▶ *Conceivable low probability, high impact events*
 - ▶ *Unimagined high impact events*
(Read The Black Swan by Nassim N. Taleb)

- **Limit risk of outliers to what you can afford**

- **Risks are not symmetric**
 - ▶ *Risk of unexpectedly high prices if prices are indexed*
 - ▶ *Risk of unexpectedly low prices if prices are fixed*

- **Utility default prices = indexed prices (most cases)**