TOWERS PERRIN

Financial Issues Confronting Nuclear Construction

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What Would You Do With Your 401(K) or Kids' College Fund?

I have an investment opportunity in addition to all your other potential investments available.

You can take an equity position in this opportunity or simply loan some money.

The opportunity involves a new technology.

The company has no staff or experience supervising the construction of the new technology.

If the project does not go well, the company may be bankrupted and you will probably lose all your money.

The last time the company tried something like this was 25-years ago and that project blew the estimate 3-5 times.

What Would You Do With Your 401(K) or Kids' College Fund?

The project will not start to generate any revenue for 7-10 years.

If you loan money, you may see a return over that period. And one company previously defaulted on its bonds and (for its time) was the largest default in US history.

If you invest in the opportunity you may see a return if elected officials decide your investment:

- **is determined to be "least cost",**
- **provides energy security,**
- **counters homogenic global warming,**
- **gets the Boston Red Sox a reliable centerfielder, or**
- **whatever motivates elected officials to do what they do.**

Otherwise, you won't begin to see a return for at least 7-10 years.

What Would You Do With Your 401(K) or Kids' College Fund?

What return would you expect to see for your investment?

What guarantees would you demand?

How attractive is this investment compared to your other options (including, say, keeping the cash in the "First National Bank of Tempurpedic")?

Remember the Sharpe Ratio

- Investment options can be ranked by the anticipated “Sharpe Ratio”

- Investment attractiveness is:
  - directly proportional to the potential for excess returns
  - inversely proportional to risk (uncertainty)

$$SR = \frac{r - \mu}{\sigma}$$

Take-away Message

- **Energy Markets**
  - **Demand for power is uncertain**
  - **Long-term energy prices show no clear evidence of upward drift**
  - **Exceptionally volatile**

Take-away Message

- **Utility Market Caps**
  - **Notwithstanding the free-fall, equity markets are STILL expensive for the earnings they generate (currently price to earnings ratio or P/E is ~14, the historic average):**
    - **DJIA is where it was a decade ago, yet**
    - **Household debt is double what it was a decade ago.**
  - **And, downward pressures continue – remember that utility P/E ratios correlate with LT Treasury yield. Low yield generally means low stock price.**
  - **While utility P/Es will probably fair better than the DJIA, their earnings are likely to also be suppressed.**
  - **Combined effects of lower earnings and lower P/E ratios signal the potential for still lower market caps as utilities continue to deleverage balance sheets.**
  - **Lower market caps limit a company's ability to invest.**

Take-away Message

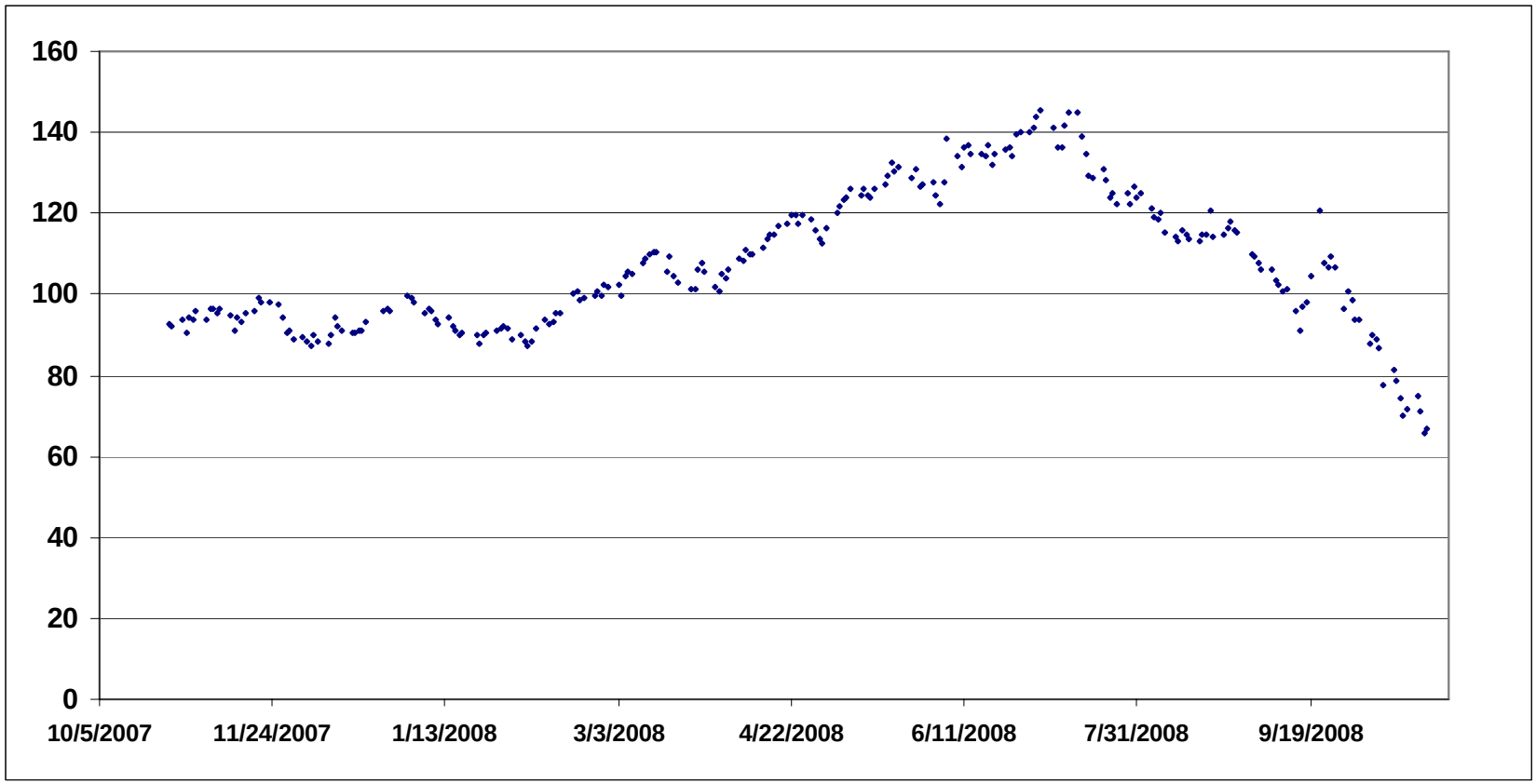
- **Credit**
  - **Credit markets are placing a high premium on risk.**
  - **Even highly rated companies face high capital costs (due to expensive capital and expensive risk premiums on that capital).**
  - **Current Fed policies may be distorting capital markets during this uncertain period:**
    - **(1) the Fed's window is putting out cash on a short-term basis at "teaser" rates (not unlike the subprime mortgages that undermined the investment banks), while (or, conceivably, "therefore")**
    - **(2) long-term debt is starting to price at full market risk premiums floating on top of the LIBOR.**
  - **Yield curves suggest future cost of capital will be high.**
  - **In this environment, long-term debt burdens will be expensive compared to recent history.**

Take-away Message

- **Long-term investments with deferred payouts are competing for capital with investments with a shorter payout (i.e., less risky investments).**
  - **On average, an investment with a 7-year payout will be ~2.6 times riskier than a comparable investment with a 1-year payout.**
  - **In the case of construction projects, the risk faces significant skew with a very measurable "fat tail" of potential losses.**

Energy Markets

- **WTI Prices (Oct 2007 – Oct 2008):**

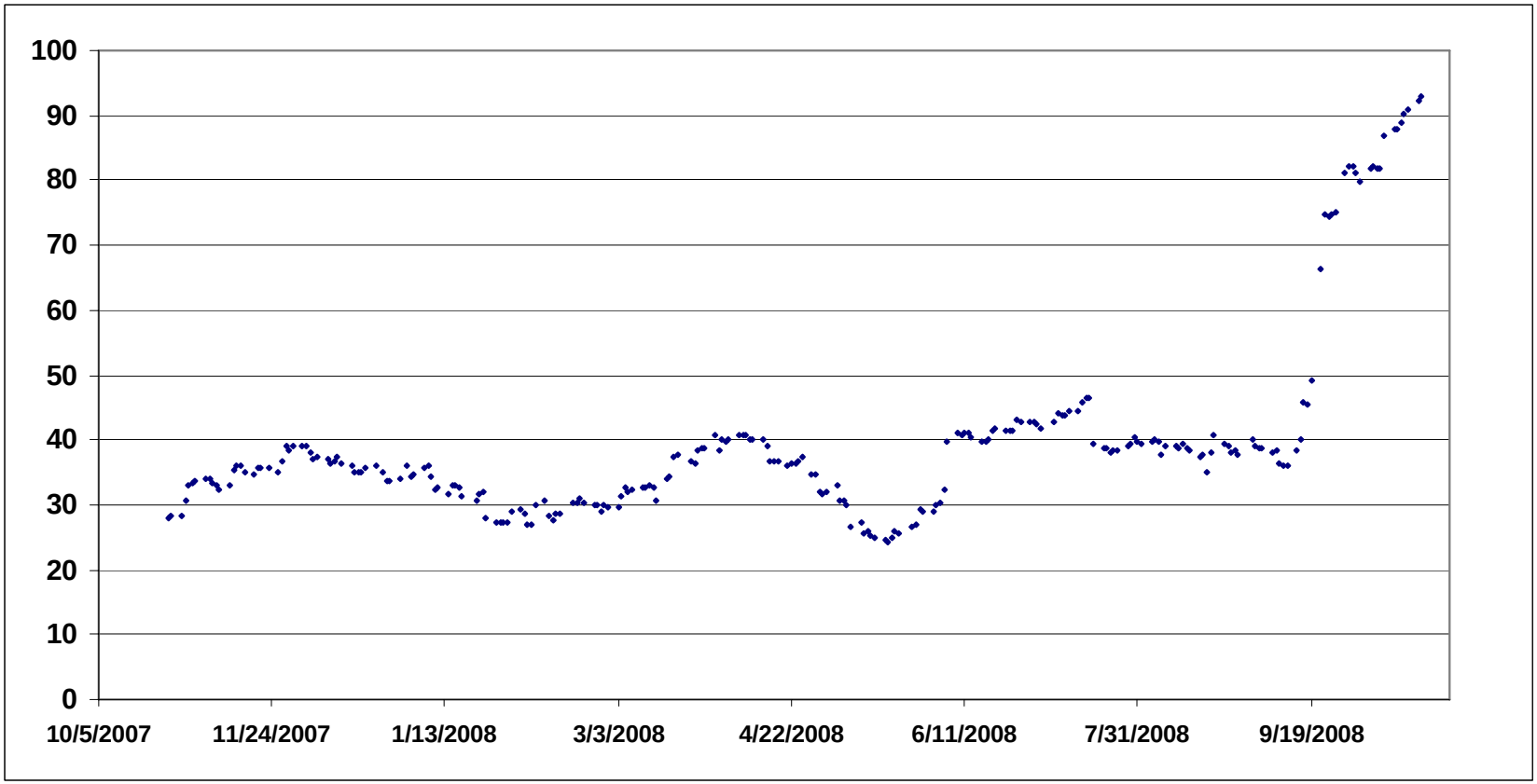


Energy Markets

- **Oil Markets:**
  - **WTI**
    - — **Interest rate and FX effects evident in the price run-up earlier this yea**
    - — **High volatility in the current oversupplied market**
    - — **High risk premium built into prices**
  - **Brent**
    - — **Recoupling with WTI in a weakening global economy**
  - **Saudis cannot throttle back fast enough**
  - **So, market fundamentals suggest prices will likely hover in the $45-$55 range for some time, with occasional spikes (e.g., Gulf tensions, dollar weakness)**

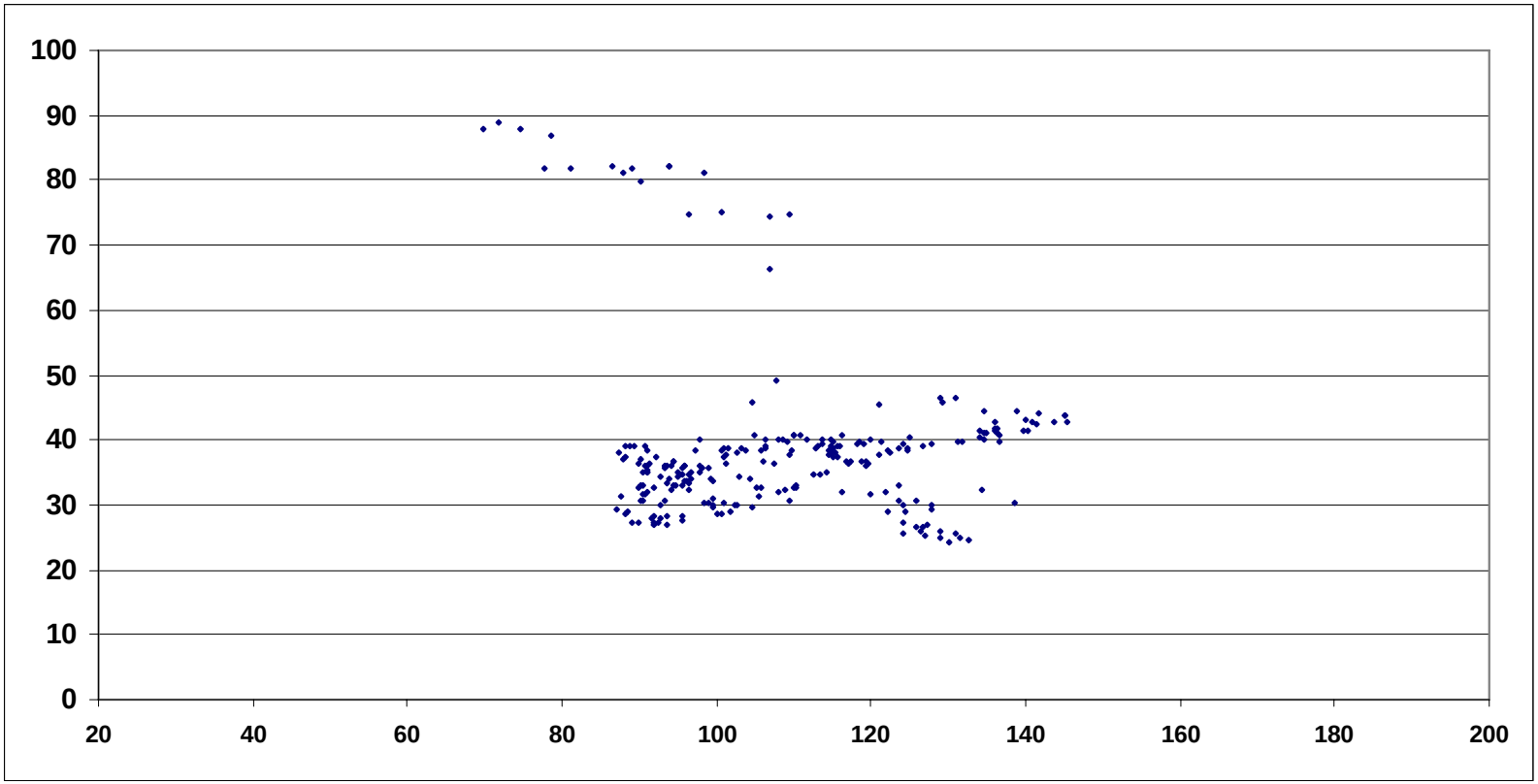
Energy Risk Metrics

- **WTI Volatilities (Oct 2007 – Oct 2008):**



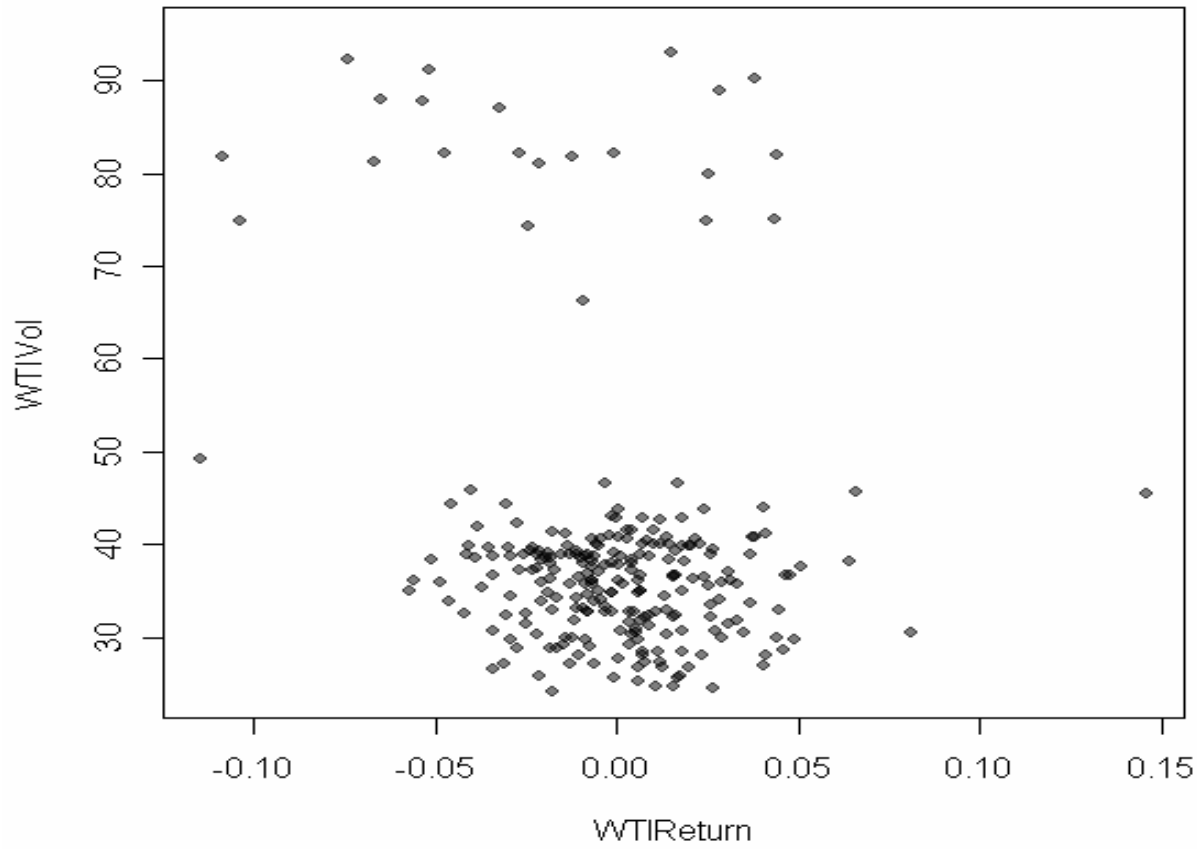
Energy Risk Metrics

- **WTI Volatilities and Price (Oct 2007 – Oct 2008):**



Energy Risk Metrics

- **WTI Volatilities and Returns (Oct 2007 – Oct 2008):**



Energy Markets

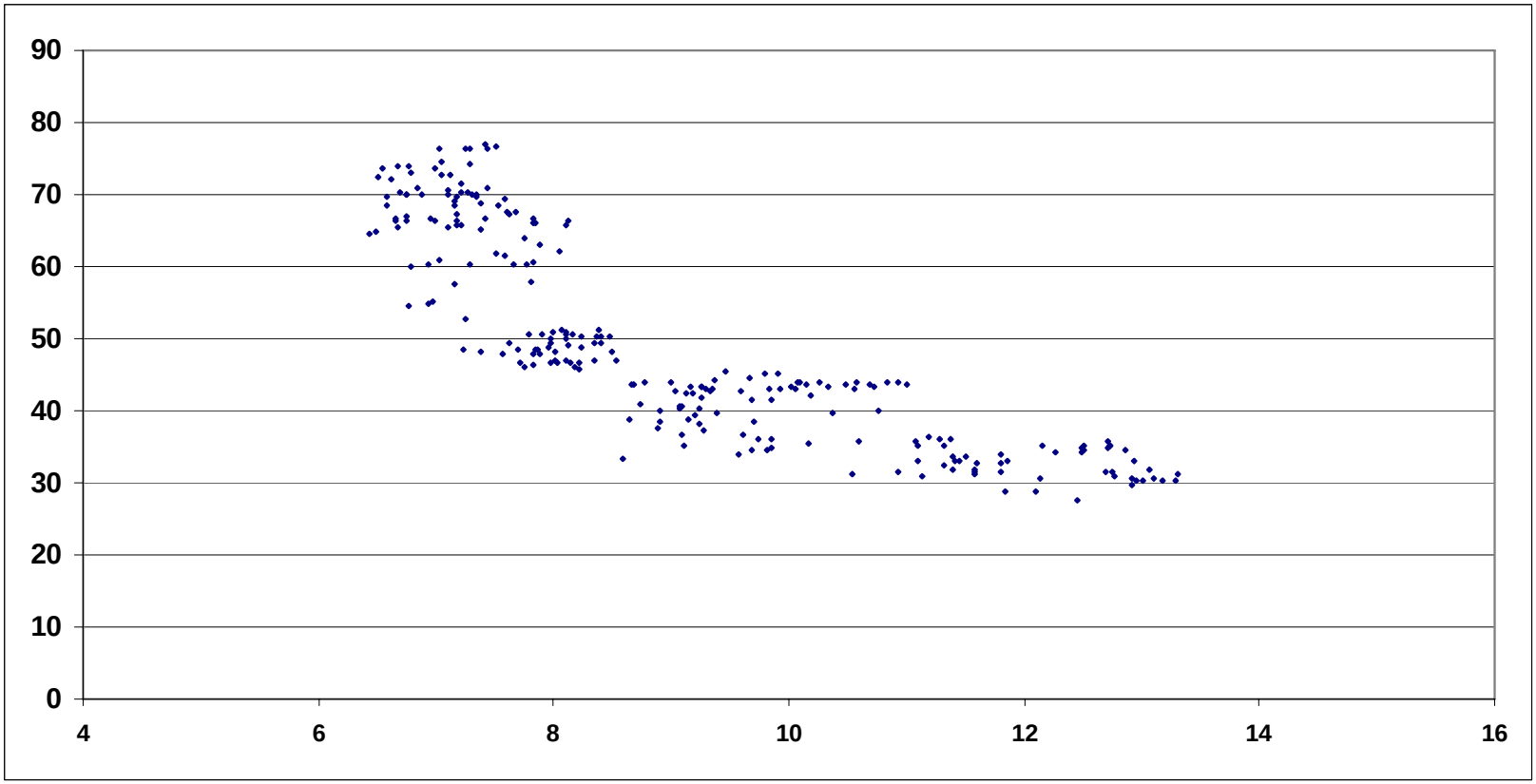
- **Natural Gas Markets:**
  - **Henry Hub**
    - **Volatility associated with low prices and supply chain effects**
  - **NBP**
    - **Volatility unrelated to performance**
  - **We're likely to be in the world of $6/MMBtu gas for some time to come, with occasional spikes, of course, caused by the "usual suspects" (international crisis, dollar weakness, BRIC)**

Energy Markets

- **Natural Gas Prices**

Energy Risk Metrics

- **Henry Hub Volatilities and Price (Oct 2007 – Oct 2008):**



Building a Nuke

- **Financing – challenging under most circumstances**
- **Construction risk – demonstrable and known to kill companies**

Nuclear Power Plant Financing Requirements

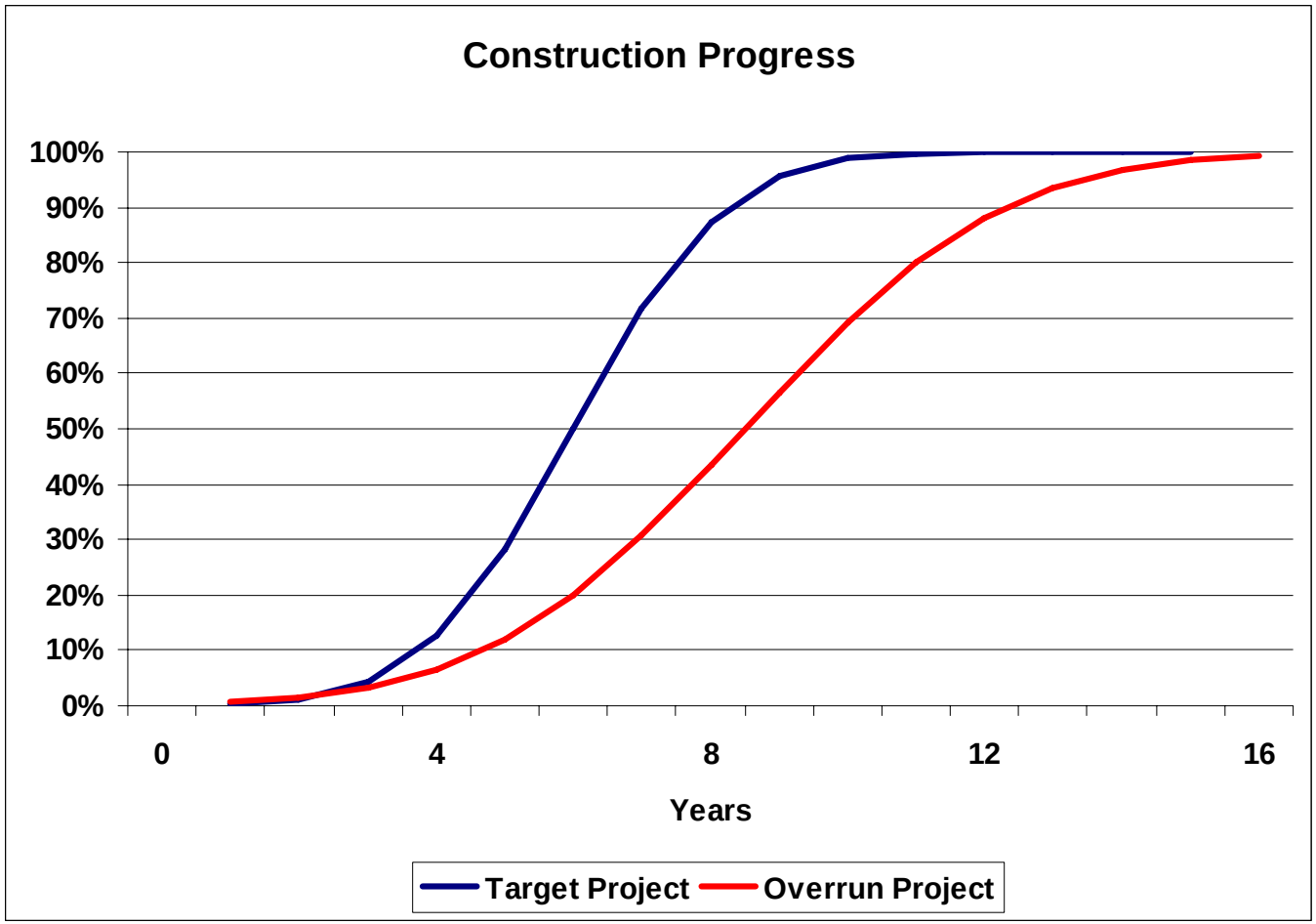
- **Traditional Thumbrules for Financing Generation**
  - Debt-equity mix about equal (50-50, though may vary through the construction phase with greater capital at risk).
  - Generally backed by the owner's balance sheet (i.e., recourse financing) which is typically on the low end of investment quality (BBB->A rated)
  - If a "rate base plant", presumed to satisfy need for power and will have a secure revenue stream sufficient for cost recovery and a "reasonable" return on capital.
  - If "merchant plant," generally some security is provided by a multi-year power purchase agreement (PPA).

Nuclear Power Plant Financing Requirements

- **Financial Considerations**
  - Capital will be at risk for about 7 years before the first dollar of revenue is ever generated from a nuke.
  - Throughout that period of time, the project will be exposed to commodity price risk, vendor credit risk, E&C contract performance risk, sovereign risk, and regulatory risk.
  - Companies building “rate base” plants have taken haircuts and defaulted on their construction bonds.

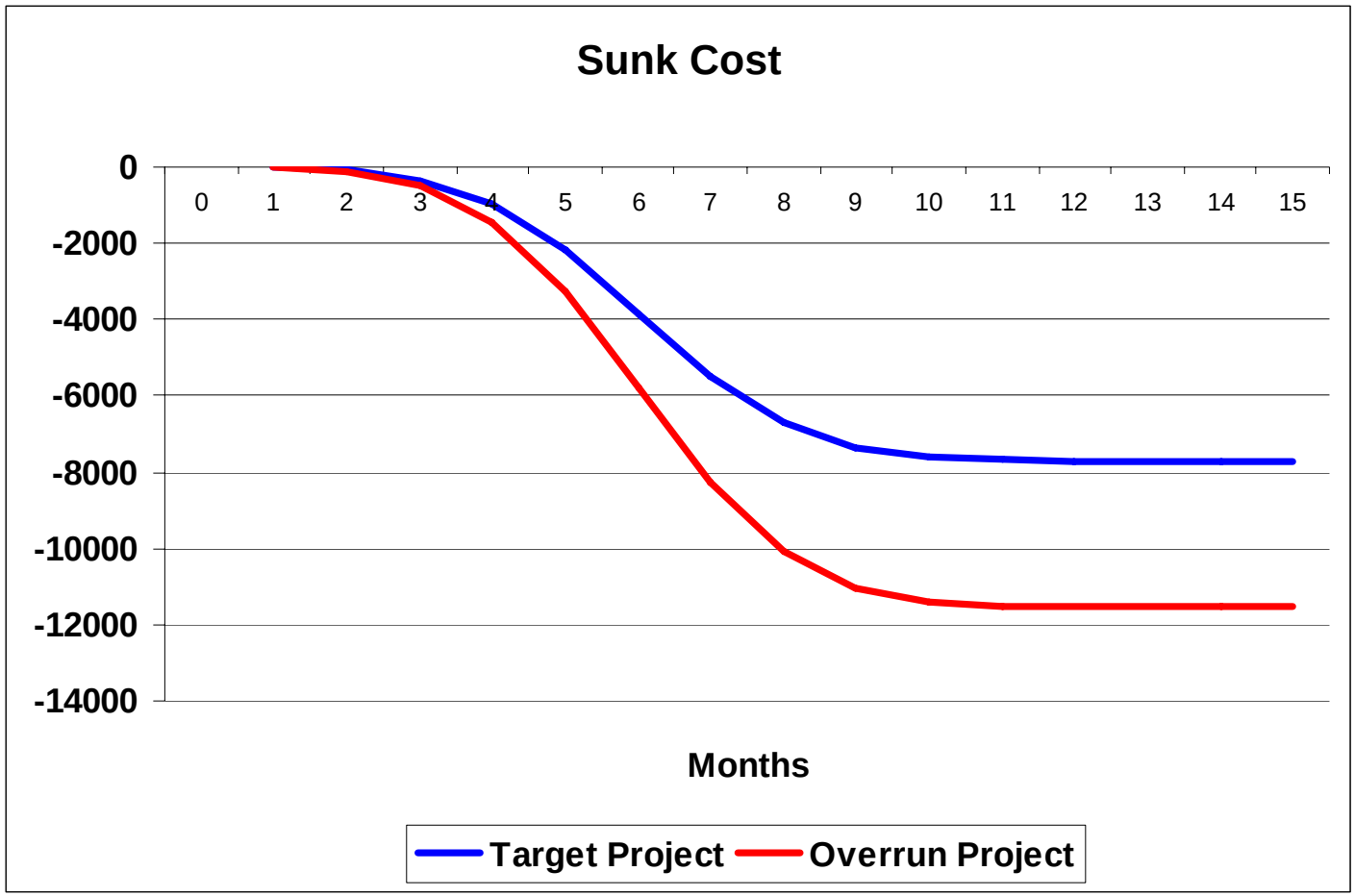
Nuclear Power Plant Financing Requirements

- **Nuclear Construction Curve Trajectories**



Nuclear Power Plant Financing Requirements

- **Nuclear Construction Cost Trajectories**



Nuclear Power Plant Financing Requirements

- **Construction Risk**
  - For the first few years into a project, an overrun trajectory is often hard to distinguish from the trajectory of a plant on schedule.
  - Should a project overrun, the magnitude of the overrun is often difficult to estimate while construction proceeds and even more difficult to rein in.
  - Sunk costs in a nuke can rise faster than schedule delays.

Nuclear Power Plant Financing Requirements

- Target Project
  - Duration: 7.5 years
  - Sunk Cost: $7.9 billion
- Overrun Project
  - Duration: 10-13 years
  - Cost: $11.8-$15 billion

The Companies

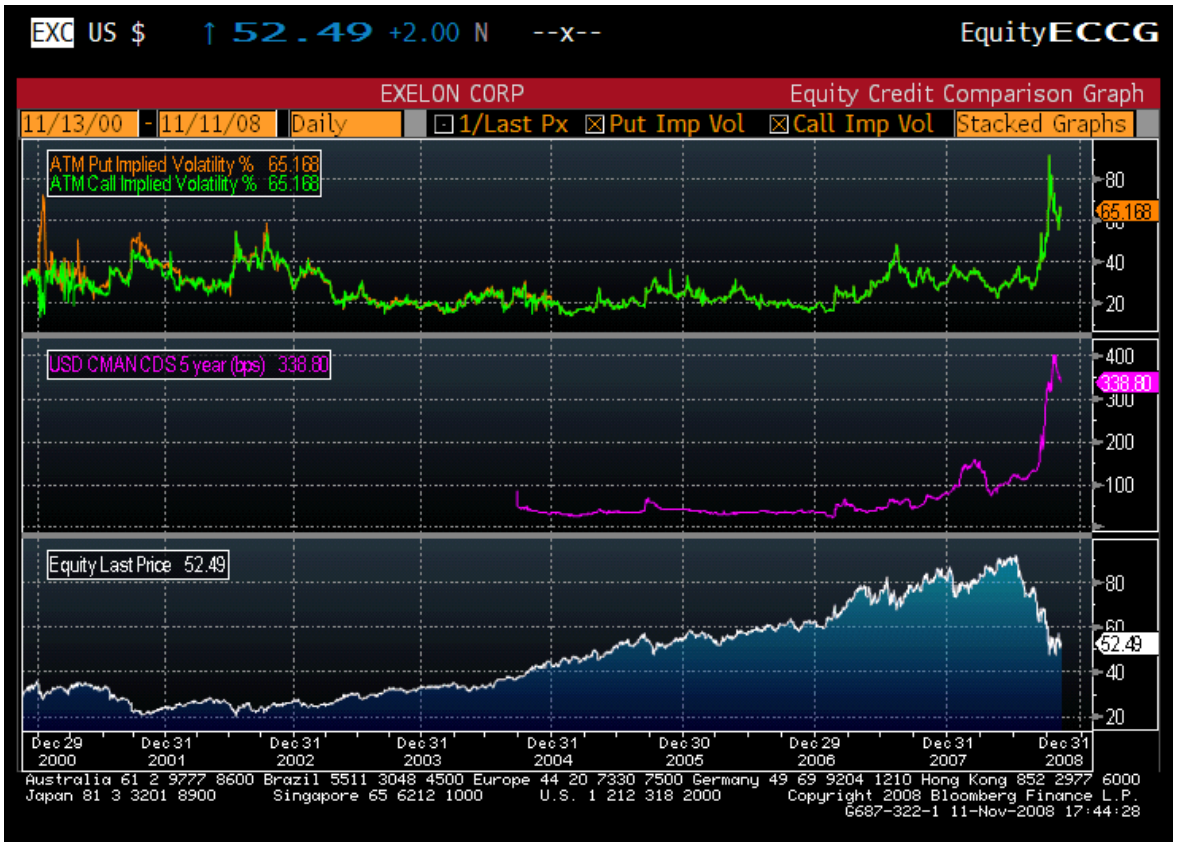
- Do they have what it takes?
  - Equity?
  - Access to capital markets?
  - In-house expertise to “collar” the tail events?

Utility Status

- Market Valuations – “call the bottom”
  - Exelon - down 50% from recent peaks

Current Market Conditions

- Volatility (perceived risk or uncertainty in market capital)
  - Exelon – experiencing increased volatility



Current Market Conditions

- Volatility (perceived risk or uncertainty in market capital)
  - Dominion

Credit Markets

- **Rising risk premiums on short term debt**

Credit Markets

- Recent volatility is evidence of the back-spatter from central banks actions
- Banks are realigning total spreads payable on loans to relevant credit default swaps rates (in contrast to traditional NSRO metrics)
- GE (AAA-rated)
  - Sells commercial paper to the Fed at the overnight indexed swap rate plus 100 bps
  - Yet, long-dated bonds trade at spreads 350-400 bps above treasuries (consistent with utility grades)
  - So, GE can borrow short-term from the Fed at “teaser” rates (~1.7%), while default swap credit lines are running several hundred bps above the LIBOR – essentially a variable rate

Credit Markets

- First Energy is facing a circumstance similar to GE
  - Currently, has access to $4 billion of liquidity.
  - In early October 2008, entered a $300 million, 364-day secured term loan that set interest rates on its $300 million credit line to at least 300 bps over the LIBOR, plus the sum of the spread on credit default swaps (CDS) for both First Energy and the lending bank (Credit Suisse).
  - Bottom Line: ratings are currently less important to pricing credit risk than the more volatile CDS valuations.

Current Market Conditions

- First Energy

Bottom Line

- We may have gone from a FNMA distorting mortgage markets to a Federal Reserve Bank distorting credit markets
- At the moment, money velocity has gone to zero – arguably the “cure” of central bank intervention may be generating unintended consequences.
- One upshot is long-term debt is now priced at market rates for risk premiums.
- For companies facing an investment decision, it’s not a good time to be committing to a risky construction program of any kind.

What Would You Do With Your 401(K) or Kids' College Fund?

What return would you expect to see from a nuclear construction investment?

What guarantees would you demand?

How attractive is this investment compared to your other options for meeting any shortfalls in generation (including, say, the "First National Bank of Tempurpedic")?

Thank you

- **Contact details concerning follow-on questions or comments:**

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