EnergyWindow
Strategic energy sourcing and management

Black Mondays, Black Thursdays, 9-11, and Hedge Fund Failures: How "Black Swan" Events Impact Your Energy Supply Portfolio

By Dr. Jack Mason

As we move into peak hurricane season and summer energy demand levels persist in many regions of the US, it's a good time to pause and reflect on how unanticipated events can affect your energy supply portfolio. While energy managers are accustomed to responding to unanticipated events of the weather variety, the havoc Hurricane Katrina wreaked on energy markets and the recent travails of a number of hedge funds attributed to "unprecedented market events" and departures from "normal" market behavior suggest that business at large may need to look more closely at the potential effects of highly improbable events. Certainly, these events can dramatically alter risk exposure when it comes to your energy portfolio.

The views expressed in a recently published book, The Black Swan, (Random House, New York, 2007) might be enlightening and particularly relevant to the current energy environment. The book's author, Nassim Taleb, is a former derivatives trader and commodities trader in the Chicago pits. He earned his MBA from Wharton and his PhD from the University of Paris. Taleb is currently a faculty member at the University of Massachusetts at Amherst and at the University of New York.

In his book, Taleb points out the limitations of applicability of statistical analysis in general and the oft-used normal distribution (Bell curve), in particular. Most significantly, he warns of the importance of "Black Swan" market events characterized by: 1) nothing in the past pointing to their possibility (hence extremely low probability); 2) extreme impact; and, 3) being explicable only after the fact. The name stems from the widespread preconception that all swans are white; that is, until black swans were discovered in Australia.

The importance of outlier events in evaluating risk associated with energy supply portfolios is crucial. Extreme events to be considered in managing your energy supply portfolio include the conceivable: low probability, high impact events, such as hurricanes, other severe weather, energy facility or pipeline closures, major political events, and/or other force majeure events. It also extends to inconceivable: unanticipated or unimagined Black Swan events, like market failures (Amaranth or Long-term Capital Management) the 1987 stock market collapse (Black Monday), the 1929 stock market crash (Black Thursday), 9-11, increasingly unpredictable weather patterns, and recent hedge fund failures.

But realistically, how can one possibly consider the impact of events that are, by definition, beyond imagination? A quick review of historical energy cost behavior might serve as useful background.

Wholesale electricity and natural gas prices (as measured by either prompt monthly settlement or 12-month futures strip values) are highly correlated (97% over the past 5 years). Their behavior has been characterized by: 1) a 15% per year upward trend over the last 10 years or more; and, 2) significant volatility. See *Figure 1* for the historical behavior of the NYMEX Henry Hub natural gas 12-month strip.

The NYMEX PJM electricity 12-month strip is highly correlated to the gas strip. And, most retail natural gas and electricity supply prices – whether from competitive suppliers, default utility service, or regulated markets across North America – are highly correlated to these “wholesale” prices.

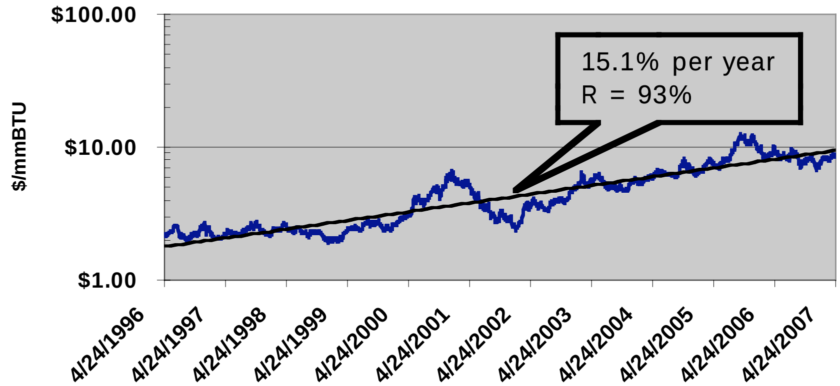

Figure 1: NYMEX Henry Hub 12-Month Strip Prices over Ten Years

Examples of periods of extreme volatility in prices, which can be seen in *Figure 1*, include:

- NYMEX Henry Hub Gas Price, April 2000 to April 2001: $2.82 to $10.04 per mmBTU (3.56 x)
- NYMEX Gas Price, Jan 2005 to Dec 2005: $6.05 to $12.30 per mmBTU (2.03 x)
- NYMEX PJM Electricity Price, Jan 2005 to Dec 2005: $52.38 to $103.35 per MWH (1.97 x)

The prevailing outlook for the future according to many experts is for continued tightness between supply and demand and, as a result, continued upward pressure on prices and significant volatility when markets are perturbed. See

Outlook for Natural Gas: 2005 and Beyond, January 18, 2005, Simmons International, Jeff Dietert, Robert Kessler, and Molly Morris;

America’s Natural Gas Market Challenge, National Gas Accounts Conference, June 19, 2007 St. Louis, by Chris McGill (Managing Director Policy Analysis, American Gas Association); and

Medium-term Oil Market Report, International Energy Agency, July 2007.

In addition, new technologies and developments such as liquefied natural gas imports, new gas pipelines or fields, nuclear power, or clean coal technology are unlikely to have significant impact before 2015. And the increased focus and concern about global warming issues seem more likely to increase the pressure on supply and demand than to diminish it, at least for the next decade or so.

One approach to characterizing or quantifying the risk of extreme behavior is to use simple statistical analysis of historical behavior. For example, in *Figure 2* on the following page, some extreme probability, in this case 5%, can be calculated based on historical data that prices will be above a certain value. In the chart, the probability that prices will be above $11.98 at a given point in time (1.65 x the closing value of $7.25 on August 24, 2007) is 5%.

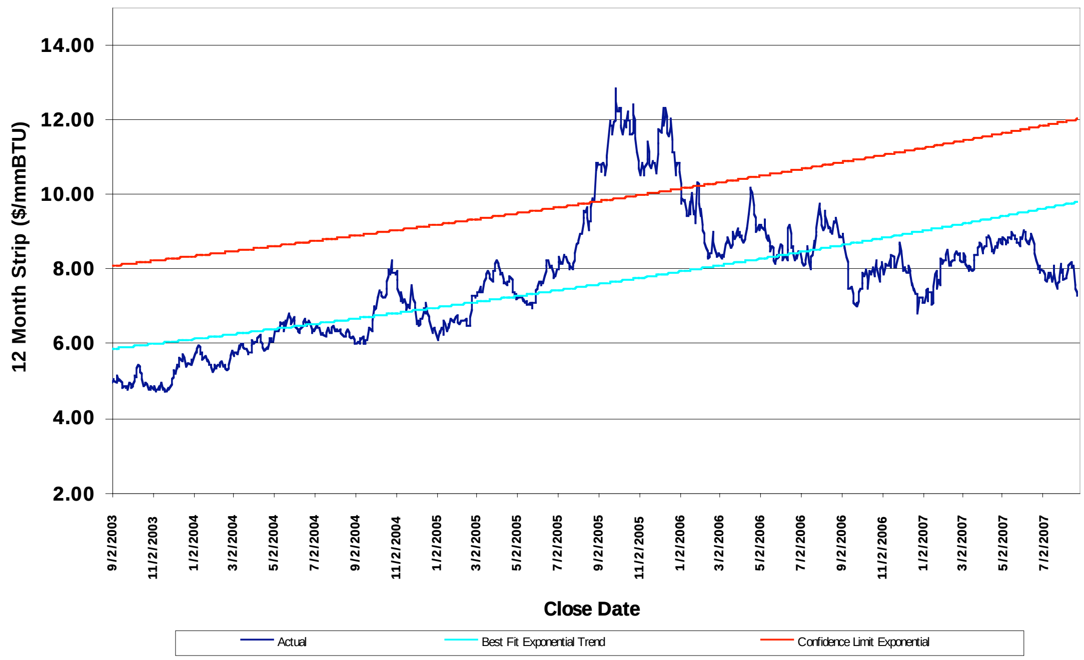

Figure 2: NYMEX Natural Gas 5% Probability Relative to Constant Rate (Exponential) Trend

Another method frequently used in value-at-risk analysis to gauge extremes of price behavior is simulation (Monte Carlo method). EnergyWindow analysts undertook such an experiment. They characterized 10 years of history of the natural gas 12-month strip in terms of daily behavior (up or down), magnitude of change, persistence of changes, and volatility. They then sampled random variables to construct scenarios day by day, over a three-year period. By running a sufficient number (hundreds) of scenarios, they were able to envelop the scenarios and fit a probability distribution to the end point results. The results of these simulations were a 67% probability prices would increase over the 3 years and an extreme – 5% – case probability (frequently cited as the extreme of possible outcomes in value-at-risk analysis) prices would increase to as high as $13.50 per mmBTU from an initial value of $8.50 (1.59 x). Refer to *Figures 3 and 4* on the following page.

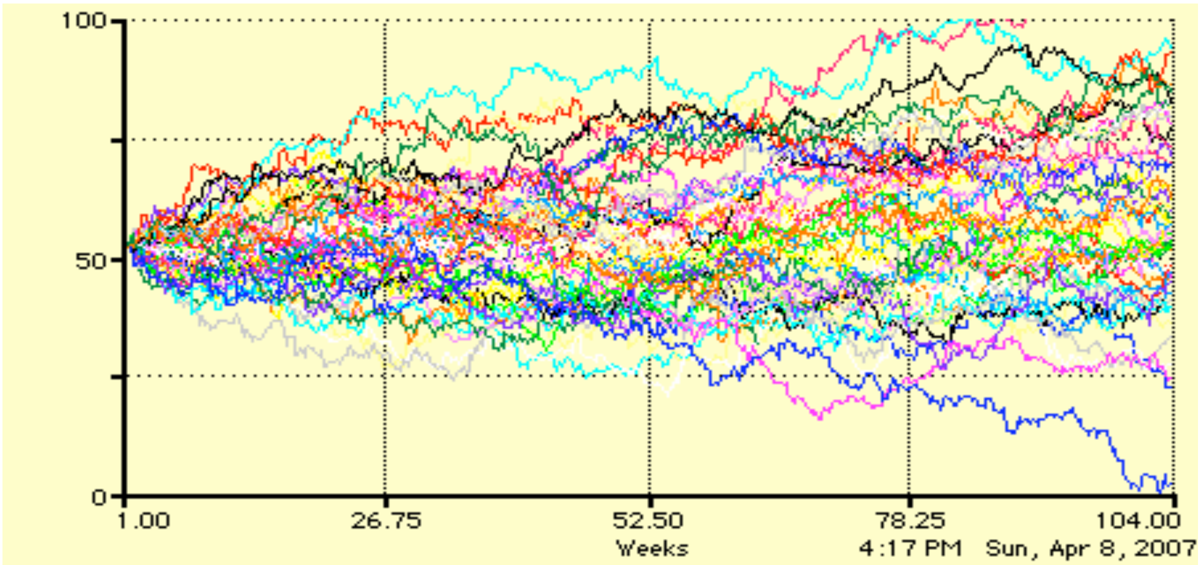

Figure 3: Example Multiple Scenario Simulations

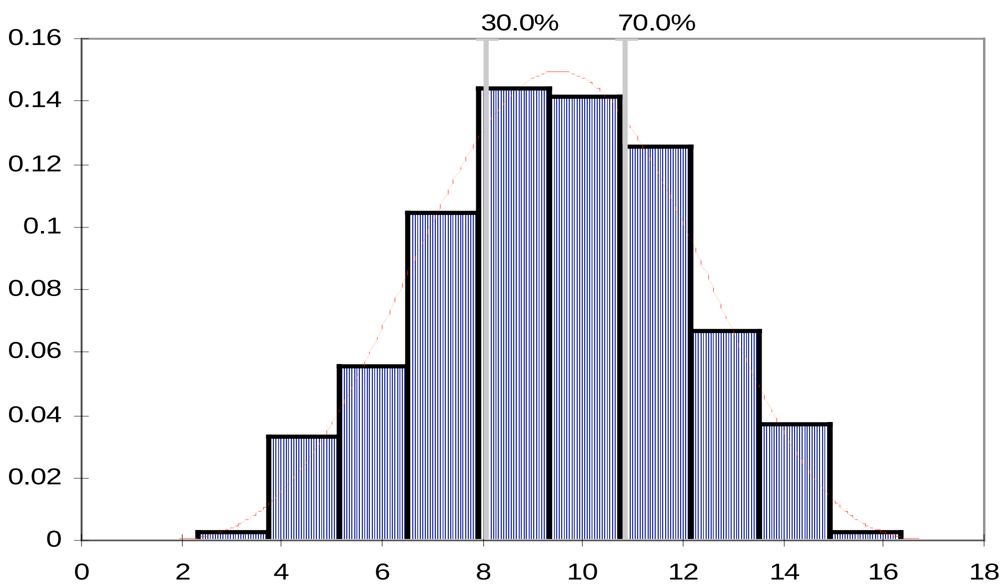

Figure 4: Probability Distribution: Possible Simulation Outcomes

With the data in hand, the question now becomes what to do with the information. Fundamentally, the most effective and least costly defense strategy against extreme changes in wholesale and, as a result, retail prices, (aside from financial derivatives, with their limited availability and applicability, price premium, and FAS 133 accounting requirements) is to limit the fraction of the energy spend that is not fixed and is exposed to market fluctuations.

Simple, approximate value-at-risk analysis can help you estimate the potential impact of extreme price fluctuations on energy spend. But remember, it is not only indexed price contracts in deregulated energy markets that create exposure. Other portions of your spend can also be exposed:

- Most default local utility gas supply prices in North American utility territories vary monthly, quarterly, or annually and are highly correlated with wholesale prices.
- Default electric supply prices in most deregulated electric markets, vary as frequently as monthly to as infrequently as annually and are also driven strongly by wholesale market prices.
- Electric supply prices in regulated markets can vary substantively over periods less than a year, to a lesser extent for those few utilities that have long term (multi-year) supply contracts and price caps and to a greater extent for the many utilities that have relatively automatic fuel adjustment clauses (often triggered if input prices vary more than a few per cent from base case input rates) or recourse to interim rate increased more frequent than annually (often triggered if input prices vary more than a few percent from base case input rates) if special or extreme circumstance warrant.

While regulated electric supply rates may not vary continuously by as much as the 15% increase in wholesale prices—the number is more like 5-10% per year on average—remember that we are evaluating the effect of unusually high impact infrequent events or circumstances. This overall increase is ameliorated somewhat by the historically lower rate of increase (1-3%) of delivery and transportation or transmission costs.

Still, it's worth noting that in 2006, many electric utilities with a history of modest rate increases requested and were granted dramatically higher increases following the spike in wholesale gas and electric prices in the fall of 2005. Ultimately, wholesale energy and fuel prices must eventually push regulated prices higher. Furthermore, infrastructure costs in other regions, most notably the Mid-Atlantic and New England, are on the rise and may add to overall increases in regulated markets in the future.

For example, consider a $50 million energy spend portfolio with the distribution illustrated below, in *Figure 5*.

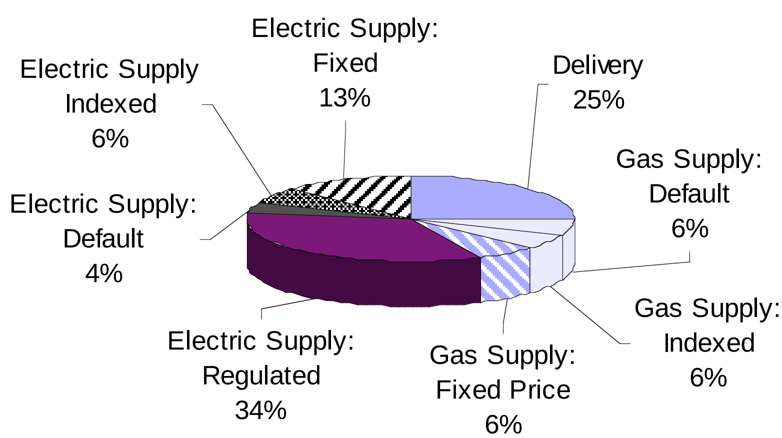

Figure 5: Example Portfolio Allocation

Fixed contracts represent 19% (or $9.5 million) of this company's spend. Default and indexed gas and electric supply costs constitute 22% ($11 million) of the total and float roughly in correlation to NYMEX wholesale prices. Regulated electric supply and delivery costs move at more moderate rates; but the latter can be driven strongly by fuel adjustments and interim rate increases when fuel and wholesale energy costs move extremely.

The impacts of extreme wholesale prices swings on floating gas and electric prices in regulated and deregulated markets for the example portfolio are shown in *Table 1*. The specific historical events, statistical characterization of historical behavior, and the simulation results described above have been taken into account.

	Percent Change	**Impact in Millions $**
Gas price, April 2000 – April 2001	256	15.36
Gas price, January 2005 – December 2005	103	6.18
Electricity Price, January 2005 – December 2005	97	4.85
Combined Electric & Gas Price, Jan. 2005 – Dec. 2005	100	11.03
Historical 5% level (Gas & Electric)	65	7.15
Simulation 5% level (Gas & Electric)	59	6.49

Table 1: Impacts of Wholesale Price Swings on Floating Gas and Electric Prices

Note: the impact values in the table do not take into account emergency or interim changes in regulated rates resulting from extreme events.

The defensive options are:

- Minimize the portion of your energy portfolio on index price contracts.
- Increase the portion on fixed price contracts.
- In some limited additional markets (where product availability and nature of the market support development of underlying statistical analysis) use derivative products, but with significant, additional premium and administrative (FAS 133) costs.

Of course, fixed price contracts come with risk, too. Many risks of fixed price contracts and indexed contracts are the same. We have discussed above the risks of indexed or floating prices that differ from those for fixed prices.

The most significant different risk unique to fixed price contracts is volume risk, the risk that the buyer will have to cover the difference between contract and market prices for any unused energy volumes. For most contracts, suppliers resell any unused volume and buyers must pay the difference in price between the contract price and the resale price for the unused volume. This may result from lower production volume than estimated in manufacturing facilities or the closure of a significant number of stores, restaurants, or hotels in multi-facility commercial operations. The range of allowable variances is wide, but has narrowed in past years, as suppliers become more risk averse. For electric contracts, the range is currently typically 10-25% (for some contracts, the volume is a relatively ill-defined "material change;' but the implicit differences tend to be on the order of 25%). For most natural gas contracts, the ranges are narrower – often as narrow as exact contract quantities.

So, the principal risk associated with fixed contracts can be expressed as the consequences multiplied by the product of two probabilities:

Risk = Probability x Consequences
Probability = Probability (volume < contract volume) x Probability (prices lower)
Consequences = [Contract Price – Market Price] x Unused volume

The probability of the need to close facilities or to reduce production substantively and without warning, combined with the probability that at the same time, prices will be lower is quite small, given the historical trend and projected outlook.

Another oft cited, so-called risk is actually less a risk and more a regret: the problem of fixing prices and then discovering (or your boss discovering) that you might have realized a lower price at some point other than when you actually fixed. It seems, however, that this type of event has no real impact. Presumably, budgets and expectations have been set. So, no harm done, provided you have established a logical strategy and basis for your decisions and have informed and obtained buy-in from the various stakeholders.

Finally, the other frequently touted disadvantage of fixed price contracts is a presumed price premium associated with fixed prices. We have both anecdotal and explicit examples, however. that suggest that the premium may be small or even negative (e.g., indexed prices may be lower than fixed). For example, in one recent online auction for a relatively large load in Texas, EnergyWindow obtained bids for both fixed and indexed prices for various terms and was able to convert, using the wholesale future price values on the day of the auction, the indexed prices to comparable fixed prices (*Table 2*).

$/MWH	Lowest Bid			
Term (Months)	Fixed	Indexed	Premium	%
12	$ 82.60	$ 82.75	$ (0.15)	-0.2%
24	$ 83.33	$ 82.60	$ 0.73	0.9%
36	$ 82.20	$ 80.95	$ 1.25	1.5%
48	$ 79.63	$ 78.68	$ 0.95	1.2%
60	$ 77.02	$ 76.19	$ 0.83	1.1%

Table 2: Comparison of Fixed and Indexed Bids

We also have numerous, anecdotal examples that run counter to conventional wisdom. While none of these examples provide comprehensive proof, they certainly suggest that the fixed price premium may be small, non-existent, or even negative.

In summary, effective energy supply portfolio management should consider:

- The risk of high impact, low probability – even unimaginable – events
- Limitation of the portion of your portfolio on floating or indexed prices, for which you can withstand the impact of extreme events

- The fact that prices in regulated markets are uncontrollable, but not constant, and can move significantly (due to fuel adjustments and interim rate increases) as a result of extreme events
- The real risk of fixed price contracts due to the requirement to cover the cost differences for unused energy
- The unrealistic expectation that anyone can speculate and "out-guess" the market with any degree of confidence, in hopes of buying at the lowest point.

About EnergyWindow

EnergyWindow is a Boulder, Colorado-based company that offers a comprehensive suite of information technology-based tools and energy industry expertise to help businesses manage every aspect of their energy supply cycle (natural gas and electricity). EnergyWindow offers four key areas of products and services: 1) PowerQuote® online sourcing tool for energy procurement; 2) PowerScape real-time, online energy market knowledgebase; 3) PowerMonitor® and PowerTrac® energy management information system that tracks a company's energy management performance and contracts; and 4) PowerStrategy® proprietary consulting-based planning process for energy supply strategy and management. The company was founded in 1999 by Dr. Jack Mason, a long-time energy industry veteran. To date, the company has successfully closed approximately 9,700 transactions for energy purchases, resulting in savings of more than $115 million on $630 million in energy supply costs. The company can be reached at: www.energywindow.com, or (303) 444-2366.