The “Budget Risk” Approach to Energy Portfolio Strategy

In its work with clients, Aegent stresses the need for energy buyers to consider their organizational objectives and tolerance for energy price risk as essential ingredients in formulating an energy supply strategy (see the brief, “Best Practices in Energy Price Risk Management”).

In our experience, the greatest challenges in establishing a supply strategy are:

- reaching agreement on the organization’s tolerance for risk, and
- knowing where the organization stands from time-to-time relative to its risk limit.

To meet these challenges, Aegent has developed a proprietary approach to risk assessment and portfolio development. The “Budget Risk” approach takes account of the volatility and unpredictability of prices, the buyer’s current portfolio, the budget period to be considered, and the organization’s “reaction time” – the time it would take the organization to respond to changes in the market with changes to its portfolio.

The Budget Risk approach gives people within the organization a common language for understanding and communicating the risk they are prepared to take, and for deciding whether their current portfolio falls within that risk limit. This makes it unambiguous when action is required. The Budget Risk approach also provides a means for assessing alternative portfolio strategies, to determine which alternatives provide the best chance for achieving lower energy costs without taking undue risk.

Foundations

The Budget Risk approach is developed on the basis of several assumptions and observations about how energy markets work.

Expectations for price behaviour

To make informed decisions about the risk inherent in energy price movement, the buyer needs to consider what prices are expected to do. The forward curve for prices reflects the current balance of the expectations of market participants for prices in the forward period. If we say that the forward price for gas for next summer is $5.27/GJ, we understand that that is current for the moment and it reflects the sentiment in the market, based on what buyers and sellers are prepared to transact today for gas to be delivered next summer.

Not all buyers think gas will be that price next summer. Those who think it will be higher are prepared to buy at that price. Those who think it will be lower are probably not buying at that price. Conversely, sellers who think it will be lower than $5.27 are prepared to sell at that price, while those who expect it to go higher would not sell.

The price of $5.27 represents the price where the volume that wants to be sold balances the volume that wants to be bought. This balancing point is constantly changing as the needs and expectations of market participants change from time to time.

Important to understanding the behaviour of prices, though, is the understanding that market participants are aware that the actual price for gas for next summer will likely be something other
than $5.27. In fact, one could say that there is a range of possible prices, some much higher and some much lower than $5.27. Based on what is known today, market participants believe that the price is most likely to be near $5.27, and that the likelihood of some other price diminishes as you get further away from $5.27. (There is a small chance it will be $8.00 and a small chance it will be $2.00, but these chances may not be zero.)

The diagram below illustrates one way of looking at the market’s expectations for prices. That is, as a probability distribution, where the current forward price is the “expected value” and the range of possible prices represents the dispersion of the probability distribution around that expected value.

Probability Distribution of Summer Gas Prices

% Probability

Expected Value

80% Confidence Value

$5.27/GJ

(The probability distribution in this diagram looks very much like the “normal” bell curve. We do not mean to imply that the possible prices necessarily are normally distributed. This is just a convenient way to illustrate the concept that possible prices are distributed in some probabilistic way around the price that the market considers the expected price.)

Looking at forward prices from this perspective makes a few things clear:

1. The possibility is high that the actual price for the summer will be some price higher than the current forward price. This is relevant for organizations that use the forward curve in their budget process. They may be ignoring the relatively high (~50%) chance that prices will be higher than assumed in the budget.

2. Higher price volatility will be reflected in a more widely dispersed probability distribution. (The distribution will have a higher “standard deviation”.) The likelihood of prices exceeding the expected value isn’t necessarily higher, but price outcomes that are farther from the expected value are more likely under these conditions. Risk is higher because the possible consequences of the bad outcomes are worse.

3. To have a greater probability that the actual price will be equal to or lower than some assumed price, a price further right on the distribution must be assumed. That is, if there is about a 50% chance that price will be $5.27/GJ or less, then there is a greater than 50% chance that price will be less than $5.50/GJ and an even greater chance that it will be less than $5.75/GJ.
In fact, a probability distribution like this can be developed, drawing on the forward price curve as an indication of the market’s expected value for the forward price, and using the observed volatility of prices or the market’s valuation of options contracts in order to assess the “standard deviation” of the distribution. Appropriate assumptions must also be made about the shape of the probability distribution (be it normal, log-normal, or something else).

Once a distribution has been constructed, the user can determine the “confidence level” that a certain price outcome will be seen. For example, the distribution may indicate an 80% probability that prices will be less than $5.60/GJ. This means that a buyer exposed to spot prices could set a budget of $5.60/GJ for next summer, and would expect to fall within budget 80% of the time (or 4 times out of five).

Objectivity in the model

The Budget Risk model is intended to provide an objective, dispassionate view of what prices could do. The statistics used to model the behaviour of prices are drawn from the market as a whole, and are not influenced by any single market participant’s view of what prices are going to do. While some assumptions are required to develop the model, these assumptions can be verified by testing the model’s performance. Testing results will be discussed in more detail later in this brief.

Effect of time

One of the key considerations in assessing the risk of price movements, and quantifying how much prices could move, is the consideration of the length of time they will be allowed to move. It makes intuitive sense that the potential price change over the next 3 three months is greater than the potential change over just one month.

In applying the Budget Risk model, the consideration is how often the organization is prepared to reassess its portfolio, and how long would it take to change the portfolio if it was determined that a change was warranted.

Applications of the Budget Risk model

Budgeting

Using the Budget Risk approach in setting an energy cost budget will enable the organization to strike a reasonable budget that takes into account the portfolio of contracts already in place (if any), and what is now known about the forward market. The assessment includes consideration of the confidence level that the organization will be able to meet its budget.

It is not appropriate to set the budget assuming that nothing will be changed in the portfolio for the whole budget year. Unless the organization has a large proportion of fixed prices in its portfolio, the budget price would have to be very high to reflect the degree to which price changes could affect an unmanaged portfolio.

One of the best practices in managing an energy supply portfolio is to conduct frequent reviews of the portfolio, including its expected performance in the future. This should be done quarterly or, better yet, monthly.

With this practice in place, the Budget Risk approach can be used to set a budget number that reflects, say, the 80% confidence level for the portfolio value over the next month. This approach accepts some risk that the budget could be exceeded, but allows the company to have components in its portfolio that will produce a lower price if the market declines. The approach assumes the company will act to limit the budget overrun if prices rise instead.
**Monitoring**

As mentioned, best practices would call for periodic reassessment of the portfolio in light of current market conditions. This reassessment confirms whether portfolio changes are needed to keep the portfolio within the acceptable risk tolerance.

A Budget Risk report takes the form summarized in the table below. In this example, the 2003 power cost budget was set in September. The budget was determined based on the contracts already in place for power in 2003, and the forward prices for power in 2003 that were available in September. Since that time, the forward price of power has risen, so that the current expected cost of power in 2003 has risen above budget. The budget variance that is now expected, based on current prices, is $853,000.

When the budget was set, some of the power supply portfolio was unhedged to allow for costs to go down if the market should decline. The buying organization acknowledged that this created a risk that prices could rise, and put their expected costs above budget. So a budget tolerance of 10% was added to the budget. That is, the organization was prepared to accept a cost overrun of up to 10% above budget, in return for the opportunity to see lower prices if the market should fall. Cost increases above this 10% overrun tolerance are considered unacceptable. The budget plus a 10% tolerance limit is $26,751,000.

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<th>October Power Budget Risk Report</th>
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<tbody>
<tr>
<td>2003 Power Budget</td>
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<tr>
<td>Current Expected Cost</td>
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<tr>
<td>Expected Budget Variance</td>
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<tr>
<td>Confidence Level for Budget</td>
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<tr>
<td>+ 10% Overrun Limit</td>
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<td>90% Confidence Value</td>
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The question facing the organization now is whether to make any changes to the portfolio. The expected power costs are still below the 10% overrun tolerance, which may imply that there is no need to act yet.

However, prices are volatile and can change quickly. Waiting until the “budget + 10%” overrun tolerance has been exceeded before acting will be closing the barn door after the horse is gone. A Budget Risk analysis performed on this portfolio showed only a 73% confidence level that prices would remain below the overrun limit over the next 30 days. In other words, there is a chance of about one in four that the tolerance will be exceeded if the portfolio is not changed.

The organization determined that it wanted to have a 90% confidence that it would remain within tolerance. The Budget Risk report shows that the 90% confidence level for this portfolio is reached at a much higher price.

Clearly, the current portfolio represents a bigger risk than this organization is prepared to take. Some hedging should be done to bring the 90% confidence value of the portfolio down to match the budget + 10% tolerance level.
The Budget Risk analysis can also show when a portfolio is too conservative. If the analysis shows that the chance of a budget overrun is only 5% while the organization is prepared to accept a 10% chance, then the analysis suggests that the portfolio can be made more aggressive. Doing so could increase the opportunity to achieve lower prices.

**Portfolio optimization**

Given that an organization wants to hedge its portfolio to reduce energy price risk, there is still a challenge to determine the amount of energy to hedge and the appropriate hedging instrument.

The goal of an energy buying organization is straightforward and pretty much universal: pursue the lowest possible expected cost, while remaining within acceptable risk limits. But what strategy will move us in this direction?

Consider the gas market. A gas buyer who determines that he needs to hedge some of his gas price risk could choose to hedge his winter purchases, or his summer purchases, or fix a price for one year. He could buy a price “cap” (a call option) or a “costless collar”. Should he hedge 20% or 50% of his volume?

These are difficult questions for an energy buyer. While energy prices are easy for a buyer to discover, energy price risk is not. The objective in hedging is to get rid of the greatest amount of risk at the lowest cost. How do you do that if you can’t quantify risk?

The Budget Risk approach solves this problem by taking price risk explicitly into account. The analytical techniques used in Budget Risk allow for systematic evaluation of different hedging strategies against the objectives of lower expected costs and controlled energy price risk. Using the Budget Risk approach, the buyer can determine the optimum hedges for achieving the desired results.

**Permission, not direction**

It is important to understand how the Budget Risk analysis interacts with other considerations, like market view, to help a buyer decide on an appropriate hedging strategy.

The Budget Risk analysis does not predict the future direction of prices. It will not tell a buyer the “perfect time” to put on or take off a hedge. Buyers still must make their own decisions on market view and the timing of changes in strategy.

The Budget Risk analysis determines only whether the buyer can afford to take the risk that the current portfolio represents (by measuring that portfolio against certain limits that have been predetermined by the organization). If the analysis indicates that the current portfolio is within acceptable risk limits, then no additional hedging is required. Nevertheless, the buyer may still choose to hedge if his market view tells him that this is the right strategy.

The Budget Risk analysis may even suggest that the portfolio is more conservative than required by the buying group’s risk tolerance. But the buyer will not swap some of his fixed price energy to floating price if he has reason to expect a price rise is imminent. Conversely, a buyer may be convinced that prices are set to decline substantially. The Budget Risk analysis will tell him whether he has room to play that hunch.

Used correctly, the Budget Risk analysis will prevent buyers from “betting the farm” on their market view, by ensuring that the cost of being wrong is contained within acceptable limits.
Results

Any analytical tool must be tested to be trusted. Provided in the chart below is an illustration of the performance of the Budget Risk analysis over several recent weeks with respect to the 2003 calendar year strip of NYMEX gas prices.

The objective of the analysis in this case is to determine the 10% and 90% confidence limit for weekly movements in the 12-month Calendar Year 2003 NYMEX strip. The analysis is performed once a week, and identifies the range within which the NYMEX strip is expected to fall when it is re-evaluated one week later. On the chart, the upper and lower confidence levels are illustrated in red lines. The green line tracks the week-to-week value of the NYMEX strip. The chart shows that Budget Risk analysis has been successful in identifying the range within which prices are expected to move.

![Budget Risk Model Performance Chart]

Summary

Budget Risk analysis is an important advance for energy buyers. Even buyers who have long understood that buying strategy involves balancing risk and return will find that the Budget Risk approach allows them to make risk considerations quantitative and objective. The Budget Risk approach helps decision-makers within an organization reach a common understanding about the risks they are prepared to take, and the risks they presently face in their energy supply portfolio.

The Budget Risk method communicates risk position unambiguously and in an easy to understand frame of reference. Once the buying organization determines the cost level it can tolerate, and the confidence level it wants to have for remaining within that cost level, then the Budget Risk report provides a clear indication of whether the current portfolio is acceptable or not. As well, the Budget Risk analysis offers energy buyers the invaluable capability to assess different portfolio options and identify the optimum portfolio for pursuing the lowest expected cost while remaining within acceptable risk limits.

Best practice in energy supply planning requires that explicit consideration be given to the organization’s tolerance for risk – and not merely its market view – when strategy is being formulated. Best practice also calls for a monitoring or feedback process, where strategies are re-evaluated in light of current information to ensure they are still appropriate. The Budget Risk method offers buyers a convenient and effective means to do both, putting risk assessment and energy price risk management on a sound footing.