Three steps to strategy

New approaches to risk management in the energy industry

frontier economics

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The risk characteristics of the energy industry have been fundamentally changed as the traditional utility model has been swept away by a wave of liberalisation across the world. The creation of spot and contract markets for electric power and gas production has transformed the way in which energy is traded. These new markets offer the opportunity to producers, traders, suppliers and consumers to manage the risks that they face in the market. This bulletin highlights the decisions they need to take.

Many energy players are responding to change in the industry's risk characteristics by building extensive IT systems. However, a successful risk management strategy depends on economic and financial analyses that do not necessarily imply major IT commitment, so it is essential to undertake these first. There are three steps to an effective risk management strategy.

- First, define your risk preferences. How do you want to trade off insurance and cost?
- Second, use fundamental modelling to improve your understanding of the market. This will help to define the likely price outcomes, and determine their probabilities.
- Third, decide on the processes, monitoring tools and hedging instruments that you wish to use.

Too often, we find that risk preferences are not sufficiently clearly defined, and inappropriate tools are being provided to risk managers.

Choose your risks

Take a simple example: the risks faced by regional distributor/supplier. Such a company may match its future sales obligations with contract purchases made today, or spot purchases made close to the time of delivery. How should it mix its purchasing portfolio?

The answer will, of course, depend in part on what the management knows about the opportunities in the contract market today, and those it expects to be available in the spot market later. The risk premium is the difference between the (higher) known contract price and the (lower) expected spot price. It represents the profit the distributor expects to forgo, in return for the security of fixing the price level today.

But how should the trader decide what the level of risk premium is acceptable? Institutional and legal arrangements and incentive structures within firms typically make decision-takers risk-averse. That is to say, they prefer a small return expected with a high degree of certainty to a higher return expected with a lower degree of certainty. How they value these two trading opportunities defines their degree of risk aversion.

The graph provides a simple illustration of the issues. Imagine that there are six contracts on the market (A-F), which can be ranked according to risk and expected pay-off. Suppose that three companies (1-3) have to choose between these contracts. All the companies can immediately eliminate contracts E and F. The other contracts would clearly all allow the companies to take on a lower level of risk for a higher expected return. Contracts A-D therefore define the efficiency curve illustrating the range of combinations of risk and expected returns from which the three companies can choose.

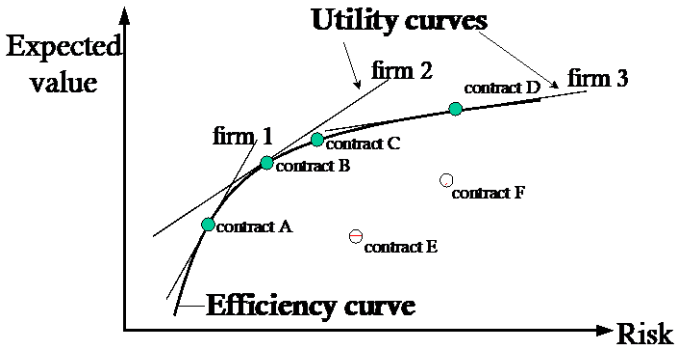
Contract C, for example, offers a higher expected pay-off than contract B, but only at increased risk. Contract D, the riskiest, might represent spot purchases, while contract A might represent a long-term fixed price contract.

The companies' risk preferences are shown by the three "utility curves". These curves are upward-sloping, since - whatever its preferences - every company expects a contract to provide a higher pay-off if the risk is greater. The slope of each utility curve reflects each company's degree of risk aversion. Company 1 is the most risk-averse, company 3 is the least.

Having defined its risk preferences, each company can now choose a contract – or portfolio of contracts - on the efficiency curve that best suits its requirements. Company 3, being the least risk-averse of the three, will tend to choose contract D, while Company 1, being the most risk averse, will tend to choose contract A.

The point illustrated by the graph is that in order to make the right choice, each company needs to define its risk references first. Unless senior management has set this strategic

Exemplified risk-yield curve and utility curves



objective, the trading department will not know which to choose of a range of equally efficient contracts, and the hedging policy of the company is likely to lack coherence.

Know your market

Energy practitioners have tried to learn from the risk management experience in financial and commodity markets. This experience gives an insight into the performance of various hedging tools, but not into the forecasting of future spot prices, against which contracts have to be evaluated.

Risk management in electricity trading faces challenges of its own, and complexities that need to be incorporated into the implementation plan. Most importantly, both the physical characteristics and structures of electricity markets create risk patterns that do not exist in atomistic financial markets. Notably:

- spot prices for electricity follow "mean-reverting" processes – through which prices systematically return to certain levels - not a "random walk";
- the pattern of prices follows a "skewed" rather than a "normal" statistical distribution; and
- price developments are subject to discrete regime shifts following regulatory intervention, or shifts in market structure as a result of mergers.

These features have implications for the tools to be used in analysing and evaluating energy market risk. In particular, the financial modelling tools that are currently available do not seem to be entirely appropriate. Simulation tools are more suitable, when markets are evolving, and where past price developments have little to tell us about the way prices will behave in the future.

The nature of price risk is best explored by analysing the forces that drive energy wholesale prices, namely

- the fundamentals of supply and demand;
- risks arising from strategic behaviour; and
- regulatory risk.

Each of these is equally important.

The fundamentals

As in commodity markets, prices in some highly competitive energy markets are largely driven by supply and demand – that is to say, by daily and seasonal consumption patterns (on the demand side) and such factors as fuel prices and plant availability (on the supply side). Weather may affect both demand and plant availability, particularly in hydro-generation.

Strategic risk

Most energy markets do not, however, correspond to the competitive ideal, and prices in electricity wholesale markets are only partly driven by fundamentals. For some of the time, larger players in the market can increase profits by raising prices (that is, any loss in market share is outweighed by the increase in price).

Price mark-ups may be largely unrelated to costs, but driven by market structure and the tightness of supply relative to demand. Price volatility induced by strategic behaviour may by far exceed underlying cost risks. While system marginal cost in developed thermal generation systems, such as those in Europe or many US states, can rise to a level of 60 USD/MWh at peak times, the actual market prices may be 500 USD/MWh or even higher. It is the need to identify forecast pricing behaviour that is the real challenge to energy price risk management.

Regulatory risk

Public authorities and regulators intervene frequently in energy markets, for two main reasons:

- to limit strategic behaviour – e.g., by setting price ceilings, as in various US electricity wholesale markets, or average price caps, as in the UK electricity markets; or
- to secure the use of certain fuels, for example to encourage low-emission production technologies or the use of domestic fuels.

These interventions may result in structural changes in the market, adding a layer of regulatory risk. Forecasting the area and degree of intervention is an essential element in risk management.

Pick your tools

Making good choices about a risk management strategy depends on information about the current market position of the company, the structure of its existing portfolio of contracts, their current and expected prices. An approach based upon simulating the effect of known risks is likely to be more robust than an extrapolation of historical trends.

Three types of modelling tools are important to risk management:

- price forecasting tools (simulation tools in particular);
- tools to structure the existing portfolio; and
- contract valuation tools that use the output of the first two as inputs; commonly used are value-at-risk (VAR) and mark-to-market (M-to-M) models.

In our experience many market participants have invested substantial resources in structuring tools while paying little attention to forecasting and contract valuation tools. Yet the most sophisticated structuring tool is worthless if it is not matched with a good market forecast, which is essential to the evaluation of the risks to which the existing portfolio is exposed.

The use of standard contract valuation tools brings further pitfalls. Models such as VAR or M-to-M often work on simplifying assumptions that ignore essential features of energy market risk. They may neglect the high positive or negative risk correlations between contracts in a portfolio. Further refinement of these tools is required to ensure that they capture typical risk patterns in energy markets appropriately. Fortunately, such development work is now proceeding apace.