Energy Potential Value-at-Risk

Energy Potential have created a modern, flexible risk measurement and reporting system designed for use by Energy Professionals. It is specifically designed to avoid costly IT integration. Energy Potential supply the market data to risk your portfolio from our own data warehouse, so there is no requirement for you to create and manage your own risk data, which can be an additional significant cost. To become operational in your business we simply define mappings of your risk data into our standard format and you are good to go. The methodology is proven and is used actively within top-tier risk taking organisations.

The system can be used through an Excel spreadsheet, and offers all the functionality of a 'heavyweight' IT solution. For example, as well as performing Value-at-Risk calculations, you can perform risk back-testing, slice and dice risk results, and perform what-if and scenario analysis. You can save your risk information into a database for future analysis, creating a robust environment for analysis and management information.

This note uses our risk system to perform some simple calculations and introduces the Value-at-Risk concept.

UK Energy and Value-at-Risk

- How do you quantify the risks that are present in your energy commitments?
- How do you create a hedging program to mitigate your risks?
- How do you make sure the risks in your business are balanced against their potential rewards?

This short note introduces the idea of '**value-at-risk'** and provides some answers to these questions. We also introduce some important risk management concepts like **hedging, hedge ratio,** and **market volatility.**

What Is Value-at-risk

Value-at-risk it is a standard financial method used to estimate the potential losses you could experience as market prices move. Its strength lies in its ability to aggregate risks, so that you can assess the total risk of many separate risks at the same time.

The calculation process is surprisingly straightforward:

1. makes many forecasts of future prices

2. prices your commitments for each future price forecast

When you reprice your commitments there will be scenarios where your profits increase, and some where your profits are reduced. VaR focusses on how bad the losing scenarios can be

The rest of this note discusses some risky scenarios against which we calculate the VaR, and show how we can use the VaR estimate to define a simple, fixed hedging strategy. The final part of this looks at how risks change over time, and introduces the idea of a dynamic hedging strategy.

A Sales Commitment

We look at 2 stylised examples:

1. you have sold fixed price power to a customer for the next **month**
2. you have sold fixed price power to a customer for the next **season**

Some Risk Management Strategies

There are a variety of strategies to manage these risks, here are 3 simple candidates

1. 'lock in' your margin straight away
    a. go into the wholesale market straight away and buy the power that you have sold to a customer

2. 'partially hedge' your commitments
    a. You think prices might move in your favour, but want to reduce market risks by 'some amount'

3. Do not hedge the commitments
    a. You think prices will move in you favour and you want to take all the benefit of such moves – you do not buy any wholesale power

Risk Assessments

Scenario 1 has the lowest risk. Assuming you can action the full market hedge, you would carry minimal risks, and, timing issues aside, should be able to lock in 100% of the margin.

Scenario 2 is a risky scenario, with the risks depending on the amount of hedging; the margin is not locked in and prices could move against you, reducing and possibly creating a negative profit on the deal. How do you determine the 'correct' hedge for this scenario, so that you risk and reward is aligned?

Scenario 3 is the most risky scenario; the margin is not locked in and prices could move against you. Is this really a credible scenario? Could you lose all the margin profit on the deal? Could this deal turn into a net losing transaction?

Risk Quantification

Value-at-risk allows us to create quantitative estimate of potential loss: it will put a hard £ number against the risk that market prices move against us. If the potential of loss is too high, we can calculate the amount of hedging required so as to mitigate the loss.

Importantly value-at-risk gives you a loss estimate *and* a chance that this loss might happen.

This is a very important concept in risk management. You assign an amount of risk and the chance that this might happen. This gives you a very powerful and general way to compare 2 risks; for the same £ amount of risk, you would prefer the risk with the lower chance of occurring.

Calculation

We need to calculate a scenario of value 'tomorrow'. To do this we will use the most recent 250 market prices for each product. We can easily create the daily changes in those prices and those changes define our price change 'simulations'. The figure below shows the one-day changes we are using.

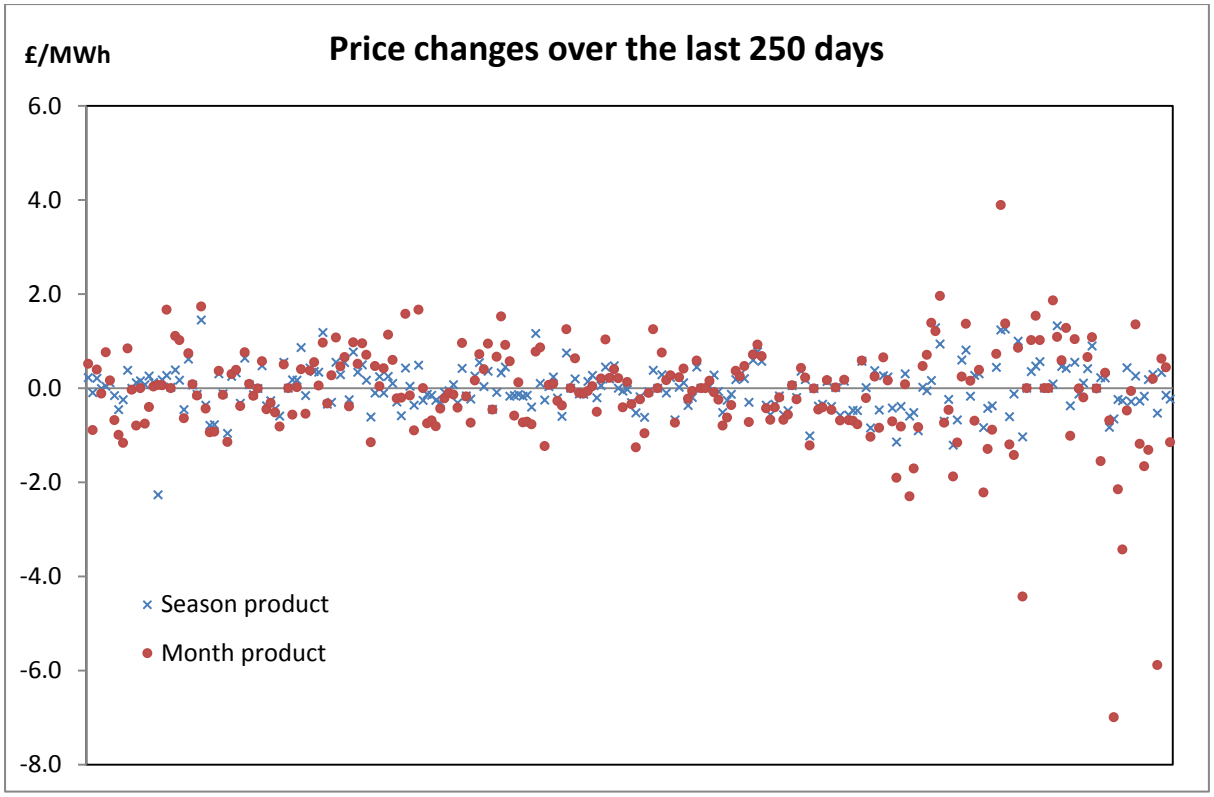

Figure 1 - Daily price changes: Season and Month Products. Price moves for monthly products are generally larger than the season product, implying that the month product is of relatively higher risk.

This chart is interesting in itself. The red circles (price changes for the month product) are much more scattered than the blue crosses (the changes for the season product); that would suggest that the monthly product is more risk than the seasonal one: this is exactly the case, as we will see.

Risk estimates

Value-at-risk doesn't look at the worst possible case, but uses a threshold to define the risk estimate. It is common to look at the '95%' risk; this means that in 95% of the cases you will not lose more than the risk estimate (but in 5% of cases you will).

We performed the Value-at-risk calculations using our risk engine for 31st October 2017, and found:

	Season Product	Month Product
Downside GBP per MWh	**-0.69**	**-1.37**
Downside in %	**-1.7%**	**-3.2%**

Table 1- 1-day risk estimates per MWh of product

This says we estimate that tomorrow, **95% of the time we will not lose more than**

- 0.69 £ on the season product
- 1.37 £ on the month product

Our comments made about the relative risk of the month product and the season product are fully justified. The month product carries close to twice the risk per unit as the season product. In market language the monthly product has higher **volatility** compared to the season product.

These results also tell you about the **order** in which you should manage your risks: for the same MWh exposure, you should manage your month exposure first.

The initial hedging strategy

Let's assume that

+ **you price customers at 5% margin**

Let's assume that you want to take some risk but based on the above estimates the no-hedge strategy is too risky. You sit down and think about the risks you want to take on your commitments and come to the view that the business is viable with a sales margin of 3%. You conclude that

+ **you are comfortable placing 2% of your margin at risk**

In financial language you have now defined your **'risk tolerance'**.

We use the data in Table 1. For the season product our risk estimate is less than the 2% 'at risk'; threshold, so according to our **hedge strategy** there is no need to hedge any of this product at the point of sale.

For the month product the risk estimate is 3.2% which is greater than the 2% threshold; so we need to hedge a fraction (also known as the **hedge ratio**) $f = (1 - \frac{2\%}{3.2\%})$ at the point of sale; that will leave a residual fraction $(1 - f)$ of the month product at risk (with risk exactly at the 2% threshold).

We conclude that we need to execute these hedging amounts at the point of sale.

	Season Product	Month Product
Hedge ratio	**0%**	**37.5%**

Table 2 – day-1 hedge ratios to achieve target risk exposures

The ongoing hedging strategy

So far we have discussed the initial hedging strategy. But as time moves on prices change, and so will the risk. If prices move in your favour you may choose to 'take profits', which would require additional hedging. If market prices move against you may decide to reduce or remove your risks, which would involve additional hedging.

Generally, each day you will need to

- calculate the risk
- assess you desired risk exposure
- compare the risk to the desired exposure
- adjust the hedges to deliver the target risk exposure

Hedging strategy over time

We can run the risk process not just for 'today' but over other periods, and see how the risk for the product would have appeared in those periods.

In the chart below we have performed exactly the same calculation as for the 31st October, but in each instance we move the date back 22 trading days (which is about 1 calendar month). It's clear that the risk assessment for the same commitments can vary significantly**.**

Looking at the month product in more detail, it seems that the risk estimate can be as low as £1/MWh, and as high as £3/MWh. That is a wide range of risk, and the width is driven by changing market conditions. **Making the same sales commitment at different times can involve committing to very different levels of risk**.

This introduces a final and very important idea: **the risk of a product changes over time**. Because of that it is very important that risks are measured, reported, and actioned against frequently, with daily being an ideal timescale.

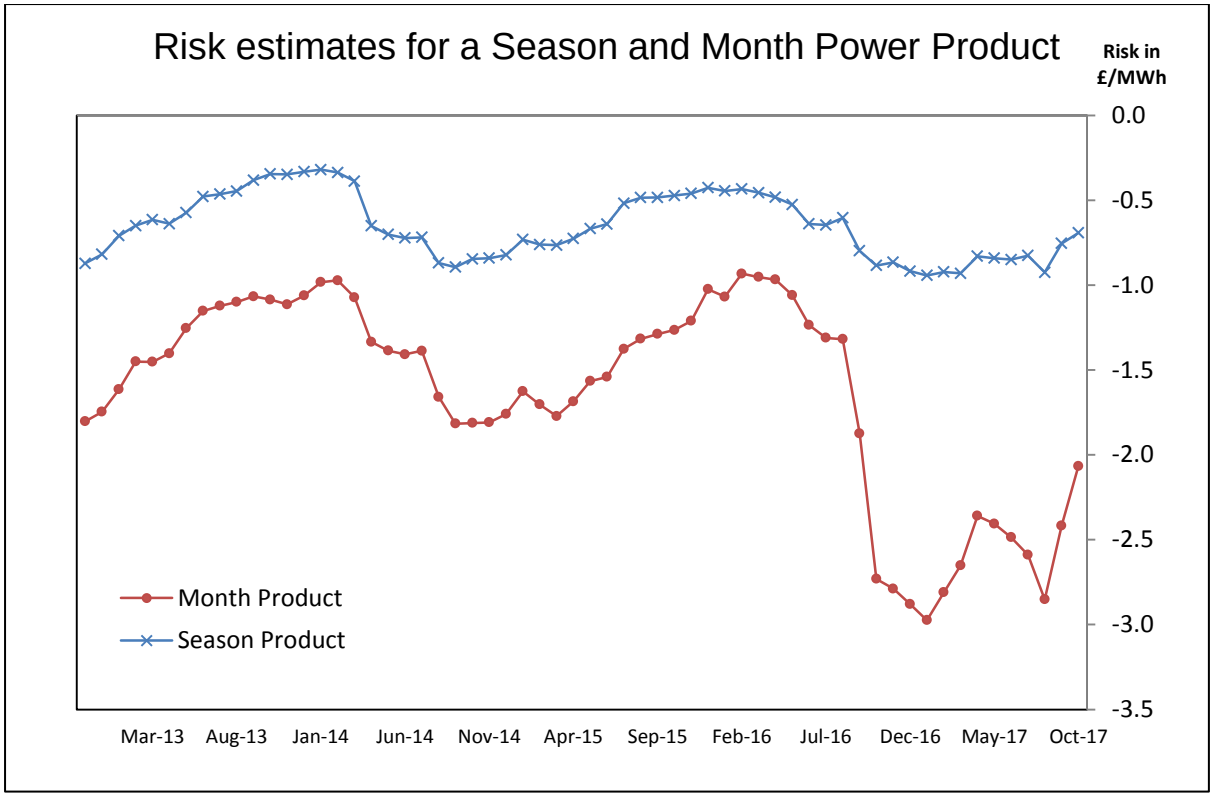

Figure 2 – VaR risk over time per MWh: Season and Month Products. The risk for a product is not constant, but changes with market conditions. This implies that the way risks are managed should be dynamic and should adjust as the estimate of risk changes.