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## Power play

### THE IMPACT OF CAPACITY CHANGES ON ELECTRICITY PRICES

*By early 2003, wholesale market prices for electricity in England and Wales had fallen to levels well below the long term cost of production. What will it take to drive them up again? Modelling work by Frontier Economics enables market participants, and those considering the purchase of the many generating assets currently up for sale, to arrive at answers to this big question - by estimating the impact of future capacity changes on both costs and prices.*

Electricity prices in England and Wales fell by 40% between 1998 and early 2003. British Energy became probably the most high-profile example of the financial distress amongst generators that has followed this decline, and had it not been for government support, its assets would now probably be in the hands of its creditors. In November 2002 TXU (Europe) disappeared from the market after its US parent cut off funding, and in February this year Edison Mission Energy reported that its purchase of generating assets in England and Wales cost the company almost \$1.3 billion over the past two years. It has been reported in recent months in the trade press that a number →

of companies intend to mothball or close down some of their generating assets unless the market begins to turn.

**HOW DID WE GET HERE?**

The primary cause of the collapse in prices has been the continued level of excess capacity on the system, combined with the increasing fragmentation of capacity ownership. No single player (or small group of players) has the ability any longer to sustain market prices above the marginal cost of producing electricity.

The charts below illustrate this fragmentation of ownership. Back in 1990, National Power and PowerGen owned over 70% of the capacity between them. Even when demand was at its lowest, at least one of these needed to be generating electricity. They were therefore pivotal on the system, and the market power they enjoyed was sufficient to enable them to keep prices above the marginal costs of generation.

By 2003, as a consequence of the combination of the major players divesting plant and new entry, no player controlled sufficient capacity to be able to engage in this strategy, and prices were barely above the marginal cost of producing electricity. This means that prices did not provide a sufficient return on the capacity already installed, still less provide a signal to invest in more.

**FROM DUOPOLY TO COMPETITION**

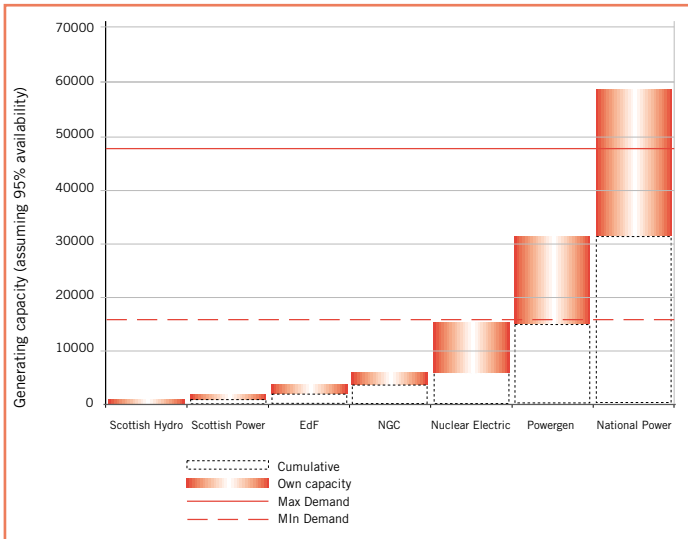


Figure 1: Capacity shares in 1990

Source: Estimates by Frontier Economics

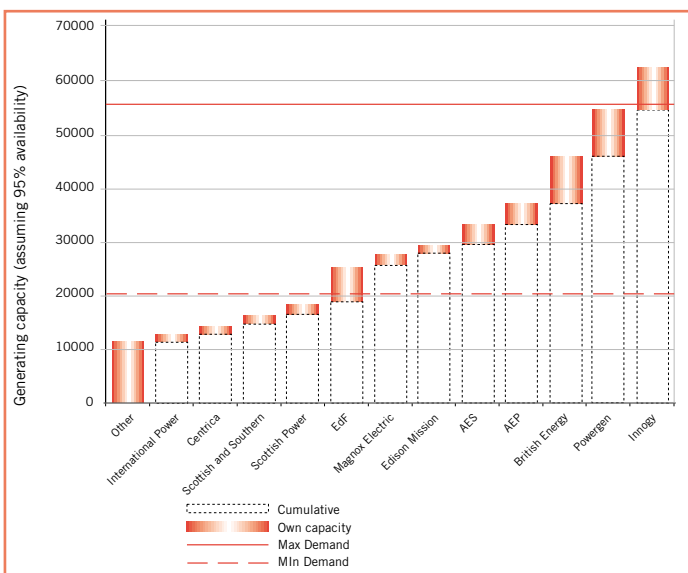


Figure 2: Capacity shares in 2003

Source: Estimates by Frontier Economics

### HOW DO WE GET THERE?

By the spring of 2003, it was clear that the current low level of wholesale energy prices was unsustainable. Since prices were too low to encourage investment, the prospect of capacity shortages as old plant was retired or mothballed would tend to drive prices up again. The key issue is: at what point could that be expected to happen?

Frontier Economics has undertaken some analysis using our in-house wholesale market simulation tool, SPARK, to identify the conditions in which prices might move back to the point at which they would stimulate new entry. SPARK is ideally suited to this task: it can be used to calculate not only how the costs of generation change as capacity is added or taken off the system, but also how prices may move as capacity changes. This distinction is crucial, because a reduction in capacity might have only a modest impact on overall generation costs, but a significant impact on prices. If the demand-supply balance tightens to the point where one or two players have significant market power at times of peak demand, prices may be driven sharply higher through either unilateral action or the possibility of coordinated behaviour.

SPARK combines standard electricity despatch modelling with game-theoretic analysis to investigate the ability of key players to mark up prices over cost.

We have examined two scenarios. In the first, our “base case”, we assume that there are no plant closures and no new entry over the next two to three years. In the second, we assume that capacity is withdrawn on the scale envisaged in recent industry announcements. Specifically, we examined the impact of the withdrawal of High Marnham and Drakelow C (as announced by Powergen on 9th January 2003), together with the possible withdrawal of Fiddlers Ferry and Ferrybridge by AEP, closures which were reported to be under consideration as early as the February 2003 edition of UK Powerfocus.

For each scenario we have derived results for eight representative days: four mid-week and four at weekends (the first Wednesday and Saturday of February, May, August and November). Using results for these eight representative days we have derived demand-weighted and time-weighted average annual prices. These are presented in the table.

Plainly some uncertainty surrounds these point estimates of prices, which would need to be subjected to sensitivity analysis before placing reliance on the absolute numbers. Equally clearly, the analysis can be extended, using more representative days to obtain a richer picture of price developments. However, this would be unlikely to affect the broad thrust of the results, which indicate that plant closure would have a material effect on prices.

	Volume weighted average (£/MWh)	Time weighted average (£/MWh)
2003 – static installed capacity	15.5	13.8
2003 – with plant closures	21.5	17.6
2005 – static installed capacity	16.1	14.1
2005 – with plant closures	23.6	19.0

Table 1: Prospects for wholesale energy prices

*Source: Estimates by Frontier Economics*

Our analysis suggests that the capacity withdrawals described above would increase time-weighted average prices by 28% compared to our base case, to levels that would partially remunerate the capacity that is already in place, and would be likely to relieve current levels of financial distress. The results also indicate that without plant closures, prices are likely to remain in the doldrums until 2005 and beyond. In short, demand growth alone would be insufficient to boost prices substantially.

Our analysis suggests that the changes we model would have only a modest impact on the cost of generating electricity. Instead, the impact on prices is driven by a tightening of the capacity margin on the system, increasing substantially the proportion of the year during which one or more players are able to raise prices above cost. Using SPARK we are able to model this, identifying the Static Nash Equilibrium prices that might exist at different levels of demand. It is possible that prices may go even higher as a consequence of coordinated behaviour (i.e., Dynamic Nash Equilibria), although we do not model that here.

#### INCENTIVES TO CONSOLIDATE

The assumed withdrawal of plant by Powergen has already, in fact, taken place. Moreover, it makes commercial sense. By closing High Marnham and Drakelow C, Powergen has helped reduce the surplus of plant on the system, thereby increasing the proportion of the year in which prices might rise above costs, and its other generating plant remains in the market to benefit from any price increase. Whether it would make sense for AEP to withdraw Fiddlers Ferry and Ferrybridge is less clear. Further analysis would be needed to identify which generators have the most to gain from withdrawing their own capacity.

What if no generator stands to benefit from withdrawing its own capacity? Then any generator with units currently operating at a loss might be well advised to withdraw those units rather than wait for someone else to make the sacrifice. However, the pattern of advantage could easily be changed by acquisition, for which new scenarios could be constructed and tested using SPARK. Plainly, such a powerful tool for estimating the relationship between closures and prices is of particular use to those considering market entry or consolidation. SPARK can be used to assess the value of plant remaining on the system to the existing owner, and compare this with the value of the plant to another owner - who might choose to withdraw some of its output from the market.

What about market entry? Estimates of the costs faced by new entrants depend on a wide range of assumptions, and are particularly sensitive to load factors. With that caveat, we estimate average new entry cost to be £22-23 per MWh. Even in our “withdrawal scenario”, prices do not quite rise to this level. So they are unlikely to provide a strong signal to enter the market, particularly since some of the withdrawn capacity will simply be mothballed, with a view to re-introducing it to the system once prices firm up.

#### REGULATORY RISK

How far could capacity withdrawal or consolidation go before attracting the interest of the regulator and/or the competition authorities? Ofgem (and Offer before) has devoted considerable effort to encouraging the reduction of capacity concentration - in particular, by securing the release of capacity by both National Power and Powergen. However, Ofgem and the competition authorities have signalled that the purchase of plant by large players would not automatically be opposed (as witness their reaction to the purchase of TXU’s assets by Powergen). Clearly the simulation techniques described above can be used to assess whether a particular transaction would lead to a significant lessening of competition. Frontier has carried out such work for companies involved in several European power industry merger inquiries.

#### CONCLUSION

While the wholesale energy market in England and Wales is weak, the present situation in fact offers opportunities to those who can make reliable estimates of the relationship between capacity, costs and prices. Financial difficulties might encourage generators to part with assets at a relatively low price, allowing others to build up valuable portfolios.

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