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## **EMPIRICAL ANALYSIS OF THE AGGREGATE OFFERS TO BUY OR SELL ELECTRICITY ON THE FRENCH DAY-AHEAD MARKET FROM 2002 TO 2005**

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### **Overview**

In most European countries the price of electricity in day-ahead markets is determined by an auction system in which the offers to buy or sell power are aggregated for each 1 hour time slice, and the price is given by the intersection of the two curves. Despite the importance of understanding the behaviour of the two curves when modelling deregulated markets, very few empirical studies seem to have been published on this subject. This paper analyses the shape of these two curves on the French bourse, Powernext, over the period from 2002 to 2005 (that is, from soon after its creation until a few months before the coupling of the French, Belgian and Dutch markets).

### **Methods**

As this work was carried out as part of a research consortium on modelling electricity prices funded by 7 groups<sup>1</sup> actively involved in the French electricity market, Powernext provided the aggregated curves of offers to buy & sell power for each 1 hour time slice, every day of the week, for the period from 2002 to 2005. The sheer size of the files made the computer analysis of the data a daunting task. Standard techniques in exploratory data analysis did not give much insight into market structure. The key to understanding this data turned out to be in finding a suitable way of displaying it graphically. Intuitions which could be discerned graphically could then be tested statistically.

### **Results**

We show

- The impact of the virtual power plants (VPP), a measure imposed on the EDF by the European Union
- How the curves during peak hours (from 8am to 8pm on weekdays) differ those during off-peak periods
- How these curves have evolved as the market has matured and the volume of transactions has increased
- How these curves react during and just after periods of “stress” (i.e. when the demand for power approaches the available supply)

Finally after a detailed statistical analysis of the parameters of these curves we have found a variable that is strongly correlated with price; its value changes rapidly when the market starts to become “stressed”.

### **Conclusions**

This work provided a detailed empirical analysis of the real structure of the aggregated buy & sell curves for the French market; it showed that their shapes are not the simplistic supply & demand curves seen in economic textbooks. The paper shows how they evolved over time from 2002 (soon after Powernext started operating) until 2005 (not long before

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<sup>1</sup> Cap Gemini, Electricité de France, Electrabel, Gaz de France, Powernext, Poweo and RTE

the French, Belgian & Dutch markets were coupled). Most importantly, the paper gives new insights into what happens during periods when the demand approaches the available supply.

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