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Investigation by CRE into record high electricity prices on Powernext Day-ahead Auction in October and November 2007

Analysis report

17 avril 2008

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Introduction

In October and November 2007, electricity prices hit record highs on the Powernext Day-Ahead Auction trading platform. While, during the first nine months of the year, prices for delivery between 6pm and 8pm averaged €36 /MWh, rising to a maximum of €118 /MWh, they spiked at:

- €1,236 /MWh for delivery on Monday, 29th October 2007 between 6pm and 7pm;
- €2,500 /MWh for delivery on Monday, 12th November 2007 between 8pm and 9pm;
- €1,762 /MWh for delivery on Thursday, 15th November 2007 between 6pm and 7pm.

Day ahead prices of electricity have a major effect on the procurement costs of suppliers, and consequently on the formation of selling prices to end consumers.

Article 28 of French Act No.2000-108 of 10 February 2000 stipulates that CRE "*shall monitor, for electricity and natural gas, all transactions made between suppliers, brokers and producers, all transactions made on the organised markets and cross-border trading. It shall ensure that bids made by suppliers, brokers and producers are consistent with their financial and technical requirements*."

Article 33 of the same Act specifies that, "*In performing the tasks entrusted to it, the French Energy Regulatory Commission (CRE) may gather any information it requires from the Ministers for the Economy and for Energy, from public electricity transmission and distribution system operators, from operators of infrastructures for the natural gas transmission and distribution networks and operators of liquefied natural gas facilities, as well as from any other company involved in the electricity and natural gas market. It may also call upon any person whose evidence it deems necessary for the purposes of its investigations*."

In this context, and in application of its duty to monitor the electricity wholesale markets, CRE has undertaken an investigation to analyse the mechanisms underlying the formation of such high prices. To this end, CRE gathered information relative to decisions taken by the companies in the French wholesale market and questioned seven companies with regard to their actions during the period in question.

This report sets out the CRE's conclusions of its investigation.

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Summary

1. PRESSURE ON SUPPLY AND DEMAND EQUILIBRIUM AND UNCERTAINTY REGARDING ITS DEVELOPMENTS WERE FACTORS CONDUCIVE TO THE HIGH PRICE SPIKES

Between 22nd October and 23rd November 2007, supply and demand on the French market was under great pressure.

Due to temperatures falling lower than the seasonal average, domestic consumption was high, reaching levels well above those for the previous year. Between the beginning of October and mid-November 2007, demand was, on average, 10% higher than that observed for the same period in 2006.

In addition, generation capacities were under pressure: the availability of nuclear power capacities was minimal and subject to serious uncertainty, and the hydraulic situation was particularly unfavourable.

Lastly, on the 15th November, notification of strike action at EDF amplified market concerns about the availability of France's production facilities.

The high price of supplies activated by RTE in the Balancing Mechanism, together with messages sent out by RTE, relative to a shortfall in supply for the three days in question, confirm the pressure on the French market over the period.

The situation was also under pressure in neighbouring countries, notably in Germany and the United Kingdom.

The overall situation in the French market was therefore favourable to the occurrence of high prices.

Nonetheless, while the price spikes of 29th October and 15th November occurred at the daily peak of consumption, that of 12th November was observed for an off-peak hour, during which the physical market situation was not especially tense.

2. THE RECORD PRICE HIGHS WERE CAUSED BY A COMBINATION OF VARIATIONS OF REDUCED SUPPLY AND/OR INCREASED DEMAND ON POWERNEXT DAY-AHEAD AUCTION

On 29th October and 15th November, expectations of high tension of the supply and demand physical balance of the French system, shared by all market players, led to the creation of price spikes.

On the other hand, the price spike of 12th November, which occurred for an off-peak hour, seems to have been caused by incorrect expectations. Market players do not appear to have anticipated that the physical balance of the French system would be under strain. This led them to sell large quantities on the futures markets of neighbouring countries: they thought that they would be able to procure energy for delivery on the French day ahead market, at moderate prices. This behaviour led to a significant increase in demand without price conditions on Powernext Day-ahead Auction and generated the price spike. Furthermore, it appears that because of the non expectation of very high prices during off-peak hours, the usual practices of some producers did not lead them to offer all their production on the market, which thus also contributed to the appearance of tension on Powernext Day-ahead Auction, unconnected with the true situation in the French electricity system.

However the CRE did not identify any culpable individual behaviour aimed at causing these price spikes.

3. THE PRINCIPLE OF VALUING EDF'S HYDRAULIC GENERATION CAPACITY WAS A FACTOR IN PUSHING UP THE PRICE ON 12TH NOVEMBER 2007

EDF Group, through the interventions of EDF Trading, did not offer the totality of its available production capacities, especially hydraulic, on Powernext Day-ahead Auction on 12th November 2007 between 8 pm and 9 pm.

The analysis conducted by the CRE shows that this situation has its origins in the EDF Group's daily decision-making process. When EDF anticipates especially low prices, the producer does not offer, outside peak periods, all its generation capacities that might be demanded if prices were higher. For 12th November at the hour of the price spike, EDF teams did not think it was useful to offer on the market all the hydraulic production available.

Simulations prove that if all EDF production capacity which was offered at the daily consumption peak had also been offered on Powernext Day-ahead Auction at the hour of the price spike, the price spike would have been avoided.

4. THE OPERATING PROCEDURES OF CERTAIN MEMBERS OF POWERNEXT DAY-AHEAD AUCTION ARE NOT OPTIMAL AND CAN AFFECT PRICE FORMATION, ESPECIALLY AT WEEKENDS

At weekends, the low numbers of market players' trading personnel can affect market prices for the following Monday, as personnel may be more likely to take the wrong decisions or fail to respond adequately to changes in the market situation.

In addition, constituting and closing the order book and setting the price is part of a daily operational sequence subject to numerous constraints related to time: cross-border nominations, price fixing on European exchanges, closing for VPPs declarations, etc. These constraints mean that members have to enter complex order data in a matter of minutes. Notwithstanding, CRE observes that orders sent to Powernext by certain market players during the fixing days dealt with in the analysis contained some obvious errors. These errors have been detected by Powernext as part of its control procedure and have since been corrected. If this were not the case, they may have affected price formation.

5. FORECAST NUCLEAR PRODUCTION INFORMATION PUBLISHED BY UFE DID NOT MAKE IT POSSIBLE TO RELIABLY PREDICT THE MARKET SITUATION

Forecast information relative to availability of nuclear generation capacities issued by EDF and published on the RTE website since mid-August 2007 for the three days on which prices hit record highs were consistent with the information in EDF's possession at the time of publication.

Nonetheless, the forecast data did not enable the players to accurately predict the risk relative to unplanned unavailability. In fact, in application of the rules adopted by UFE, forecast availability published for thermic power production facilities only factors in plant outages which are known in advance. This principle is designed to make the published data as objective as possible, but results in systematically overestimating forecast availability compared with actual availability.

In addition, the occurrence of an obvious data entry error made by EDF on one of the days during the period in question, together with the occasional absence of data furnished by certain producers, indicates that UFE's publication process is not reliable enough.

Lastly, the data published, and especially data relative to levels of hydraulic reservoirs, are not supported by records that are detailed enough to be used in forecasting pressure on the French electric power system.

6. THE PROCEDURES LAUNCHED BY POWERNEXT TO ENCOURAGE ADDITIONAL OFFERS (REQUEST FOR QUOTES – RFQ) WERE NOT IMPLEMENTED IN THE MOST EFFICIENT MANNER

When there is any risk that orders transmitted by members of the Powernext Day-Ahead Auction will lead to a price that will not reflect the market situation accurately, Powernext initiates a "Request For Quotes" (RFQ) procedure. Powernext then informs the members of the situation for the hours in question and allows them to change their order books after the normal order-closing deadline. This is a highly sensitive procedure, since it provides market members with privileged information.

Analysis of the procedure applied by Powernext on 11th November 2007 shows that its implementation was inappropriate given the market situation: the formalities of the procedure were barely respected and insufficient numbers of market players were contacted.

Furthermore, the preliminary test performed by Powernext to decide whether or not to launch an RFQ needs to be improved. The fact that certain members only submitted their order books at the last moment, together with the potential impact of imports related to market coupling, seem to have been inadequately taken into account.

Lastly, the RFQ procedure was not organised in conjunction with other energy exchanges involved in the market coupling, whereas there was available import capacity from Belgium. Only certain members of the French exchange were contacted, thereby reducing the potential impact of the procedure.

7. THE PRICE SPIKES MAY HAVE BEEN AVOIDED IF THE METHODS USED TO ALLOCATE INTERCONNECTION CAPACITY WERE MORE EFFICIENT

The mechanisms currently used to allocate interconnection capacity are not conducive to effective management of all interconnections. As highlighted in the CRE's first report on management of the use of grid interconnection in 2006, published in May 2007, these methods result both in underused interconnection capacity and also, occasionally, use that counteracts the price differential between interconnected markets.

For example, at the time of the three price spikes on the French market, while prices on the neighbouring organised markets were all, except for Belgium, much lower than on Powernext, a substantial volume of import capacity remained unused at the borders (a total of 8,324 MW on 29th October, 6,624 MW on 12th November and 2,925 MW on 15th November).

Establishing efficient allocation methods, and, in particular, market coupling for all French interconnections, would have made it possible to take advantage of cheaper supplies from abroad and thus kept prices on the French market down.

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Detailed Conclusions

1. PRESSURE ON SUPPLY AND DEMAND AND UNCERTAINTY REGARDING ITS DEVELOPMENT WERE FACTORS CONDUCIVE TO THE HIGH PRICE RISES

Between 22nd October and 23rd November 2007, supply and demand on the French market was under great pressure.

Due to temperatures falling lower than the seasonal average, domestic consumption was high, reaching levels well above those for the previous year. Between the beginning of October and mid-November 2007, demand was, on average, 10% higher than that observed for the same period in 2006.

In addition, generation capacities were under pressure: the availability of nuclear power capacities was minimal and subject to serious uncertainty, and the hydraulic situation was particularly unfavourable.

Lastly, on the 15th November, notification of strike action at EDF amplified market concerns about the availability of France's production facilities.

The high price of supplies activated by RTE in the framework of the balancing mechanism, together with messages sent out by RTE, relative to a shortfall in supply for the three days in question, confirm the pressure on the French market over the period.

The situation was also under pressure in neighbouring countries, notably in Germany and the United Kingdom.

The overall situation in the French market was therefore favourable to the occurrence of high prices.

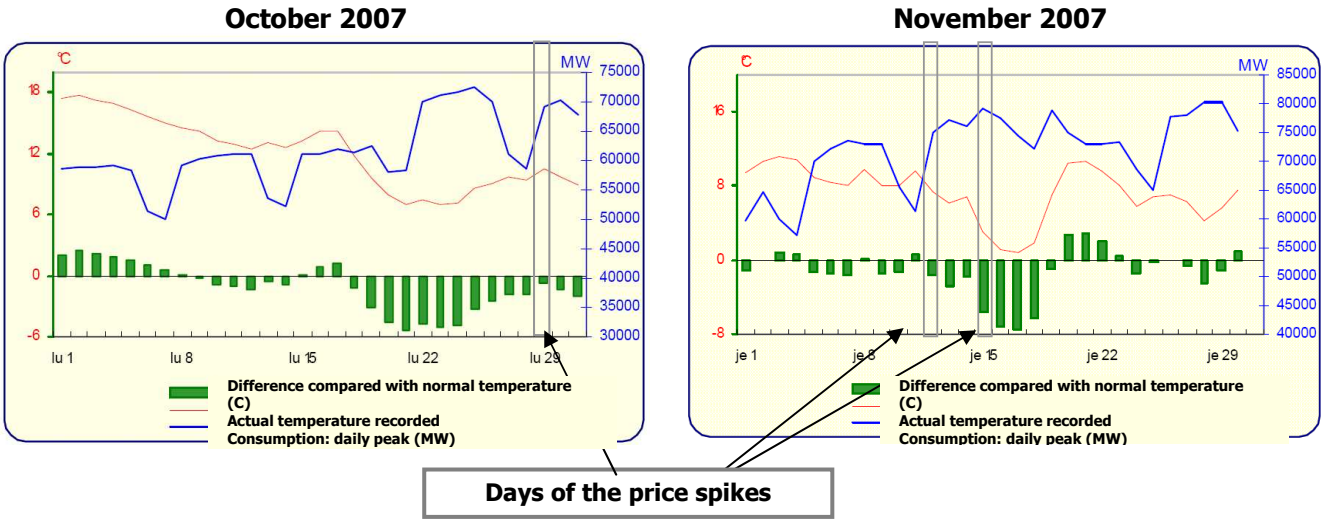
Nonetheless, while the price spikes of 29th October and 15th November occurred at the daily peak of consumption, that of 12th November was observed for an off-peak hour, during which the physical market situation was not especially tense.

A. Domestic consumption was high due to cold weather

- Temperatures were much lower than normal for the time of year

Prices reached record highs during the weeks following a cold spell that occurred across France, and while temperatures were still much lower than normal for the time of year. In particular, on 15th November, average temperatures were exceptionally low.

Consumption and temperatures
- Values recorded and variation from seasonal norms -

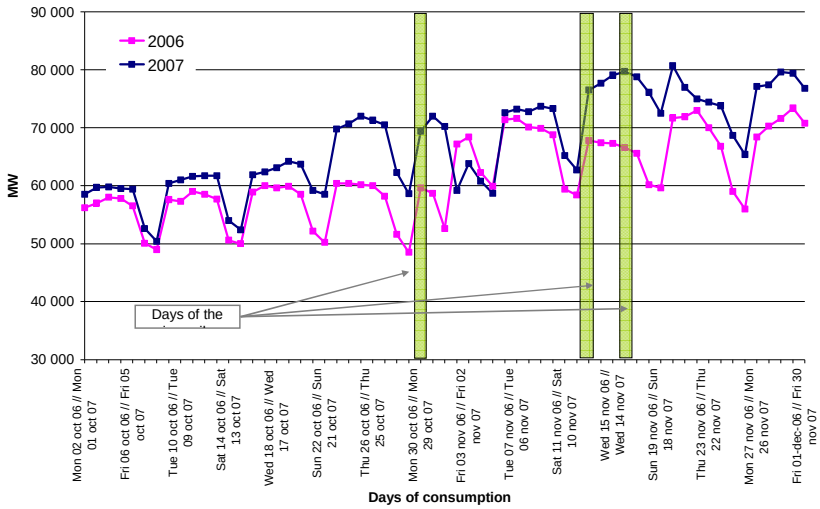


Source: RTE – "Aperçu sur l'énergie électrique"

- Consumption was significantly higher than that recorded for the same dates the previous year

On average, peak consumption (the day's maximum) between the beginning of October and mid-November 2007 rose by 5.8 GW compared with the same period in 2006, i.e. an average increase of 10%. Demand was particularly high on 12th and 15th November.

Electricity consumption in France: October and November 2007 compared with 2006
- Daily maximums -



Source: RTE

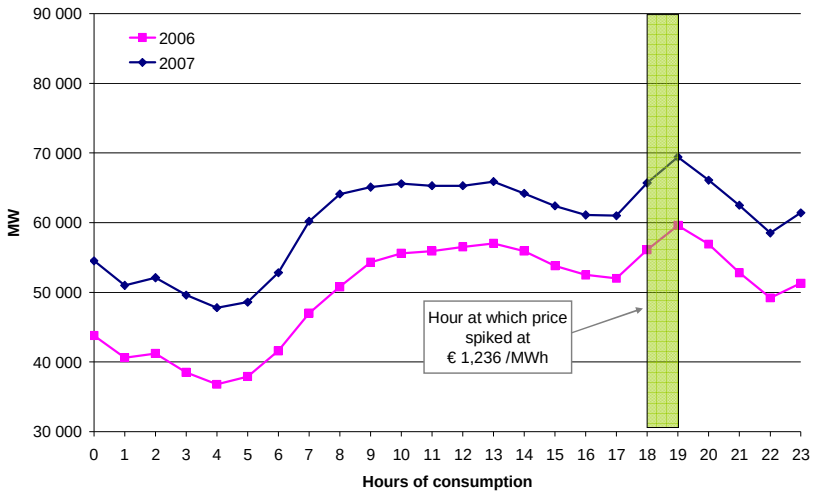
- The record high prices occurred at peak hours of daily consumption, except on 12th November

On 29th October and 15th November, the record high prices occurred for price fixing for peak consumption hours (between 18:00 and 19:00).

The clocks went back during the night of 27th to 28th October. 29th October was therefore the first working day after setting the clocks back to Winter Time. The relative uncertainty regarding the shape of the consumption curve, notably at peak hours, may have been another factor in increasing pressure on the market.

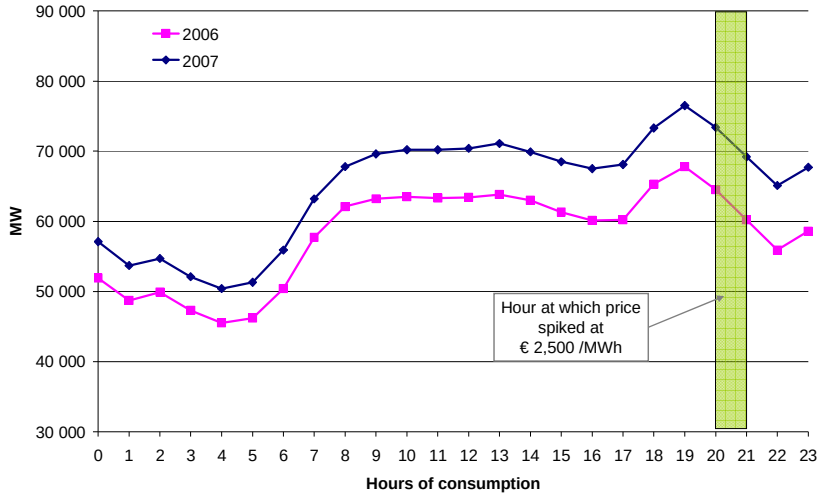
However, the record high of 12th November was related to power delivery between 20:00 and 21:00, an hour during which demand was lower, by around 3,600 MW, than the day's maximum observed two hours before.

Electricity consumption in France on Monday, 29th October 2007 compared with Monday, 30th October 2006



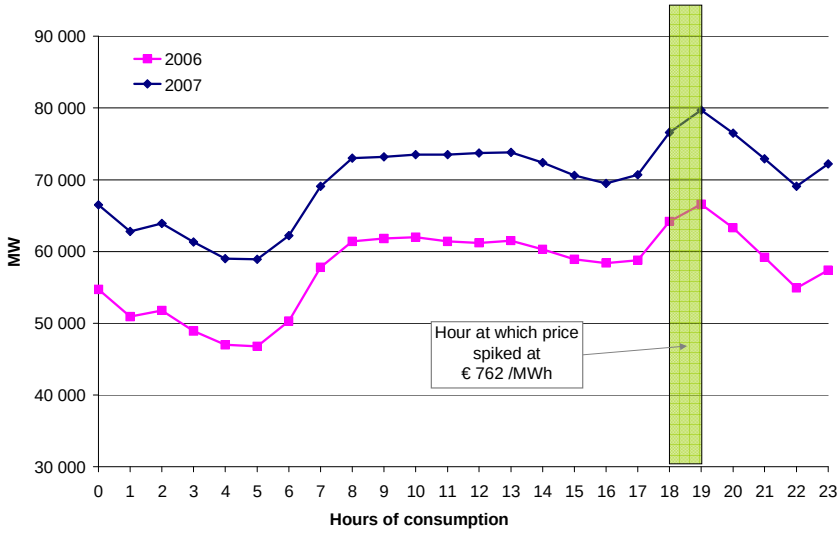
Source: RTE

Electricity consumption in France on Monday, 12th November 2007 compared with Monday, 13th November 2006



Source: RTE

Electricity consumption in France on Thursday, 15th November 2007 compared with Thursday, 16th November 2006



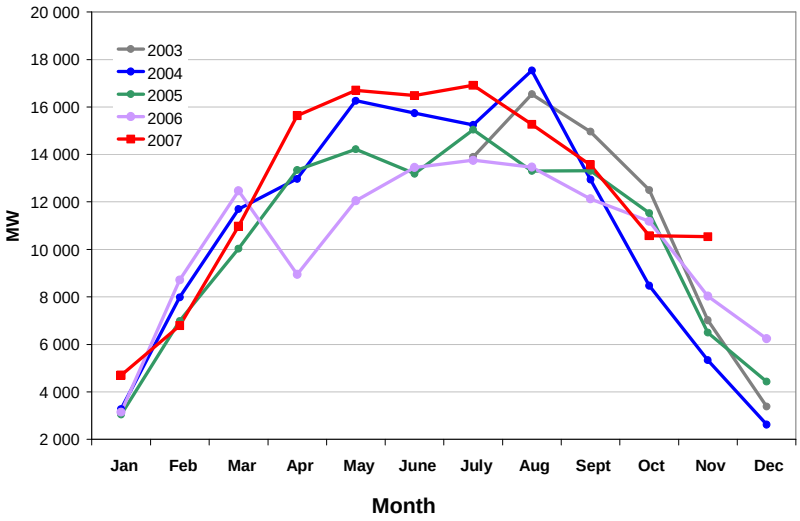
Source: RTE

B. <u>The situation regarding production facilities was unfavourable</u>

- Levels of unavailability of nuclear power production capacities were extremely high in November 2007

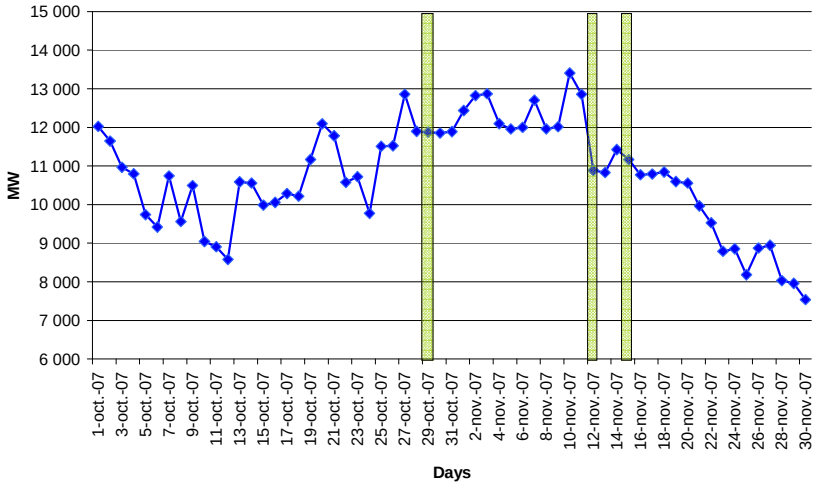
The level of unavailability was high for the period in question, particularly from 27th October to 20th November 2007. In November, an average of over 10 GW was unavailable, i.e. nearly 17% of installed capacity. For the purposes of comparison, the level of unavailability of nuclear production facilities was 6.7 GW on average during the same period for the preceding four years.

Monthly unavailability of nuclear production facilities
- Monthly average -



Source: RTE data and CRE calculations

Daily unavailability of nuclear production facilities



Source: RTE data and CRE calculations

- There was a great deal of uncertainty regarding the availability of nuclear production facilities

The level of unavailability of nuclear-generated electricity was not only particularly high during the period in question, but was also seen by market players as extremely uncertain, as reflected in comments published in the specialized press. This uncertainty might be partly explained by the major differences, noted at the time by the market, between forecast availability published on the RTE website and actual availability (see Chapter 4).

"European Daily Electricity Markets", Heren Energy, Monday 29/10/07

Traders said that the main reason for the unprecedented bull-run was production in France. Estimates varied as to how much nuclear capacity had come offline over the weekend and late in Week 43, but several traders felt it was "around the 10,000 MW mark." Hence the entire front-end was very well supported.

"European Power Daily", Platts, Friday 02/11/07

"But with such tight reserve margins, especially in France, people have included a 'spike risk' which is legitimate in view of the cold weather ahead."

Traders noted that French grid operator RTE had pushed back the date of the expected return of currently offline capacity by two weeks to week 47.

"If prompt is this tight you will put a risk premium into the weeks behind that," a trader said, adding, "Prices are fair as they take account of any further unplanned outages."

"European Daily Electricity Markets", Heren Energy, Friday 9/11/07

Trading levels for next week soared on Friday in France and Germany as supply fears combined with the threat of strike action sent bullish waves through the market.

Although many traders left their desk early on Friday due to an industry event in Amsterdam, sentiment remained firmly bullish throughout the session on both the spot and curve with France yet again leading the way.

- The announcement of strike action planned for Wednesday 14th and Thursday 15th November, particularly in the energy sector, raised market fears of increased unavailability.

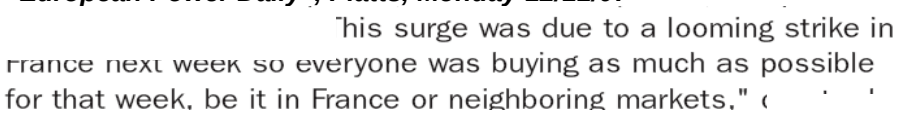
The market players expected that the situation would be under a great deal of pressure on 15th November in light of the announced strike by EDF employees in France.

"European Daily Electricity Markets", Heren Energy, Friday 09/11/07

French unions are threatening next week to create havoc for the country's main producer EDF and hope to go beyond the 10,000 MW cut made during the strike held last month. *Heren Energy* understands the majority of union workers are envisaging a rolling strike but it was uncertain at the time of going to press whether next Wednesday's strike would spill into Thursday.

The market was taking the strike threat extremely seriously with Wednesday Peaks trading at EUR 225.00/MWh in France. Not only were there concerns in the market over supply cuts in France, French peak demand was expected to rise an average 3,000 MW per day next week, relative to Week 45. The supply, however, was not expected to rise to the same extent with traders on Friday saying the French system would remain short.

"European Power Daily", Platts, Monday 12/11/07


his surge was due to a looming strike in
rrance next week so everyone was buying as much as possible
for that week, be it in France or neighboring markets."

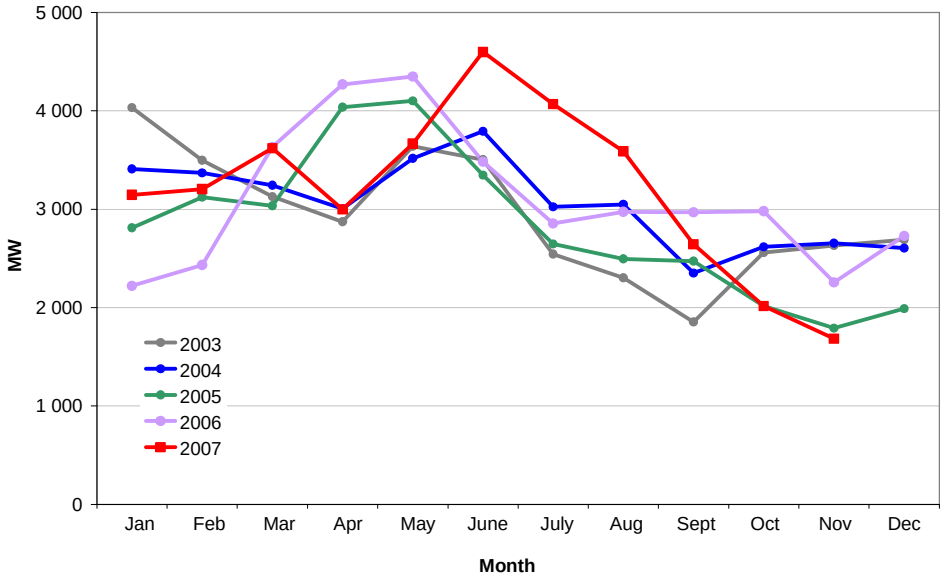
"European Daily Electricity Markets", Heren Energy, Wednesday 14/11/07

"There was a little bit of panicking on the market," one player noted. The bulls took command when the Powernext clearing prices came in unexpectedly high at EUR 314.27/MWh on Baseload and EUR 551.40/MWh on the Peaks. The country's supply situation was aggravated on Wednesday by an energy strike, which deprived the market of about 7,600 MW of power.

- The hydraulic power situation was discouraging

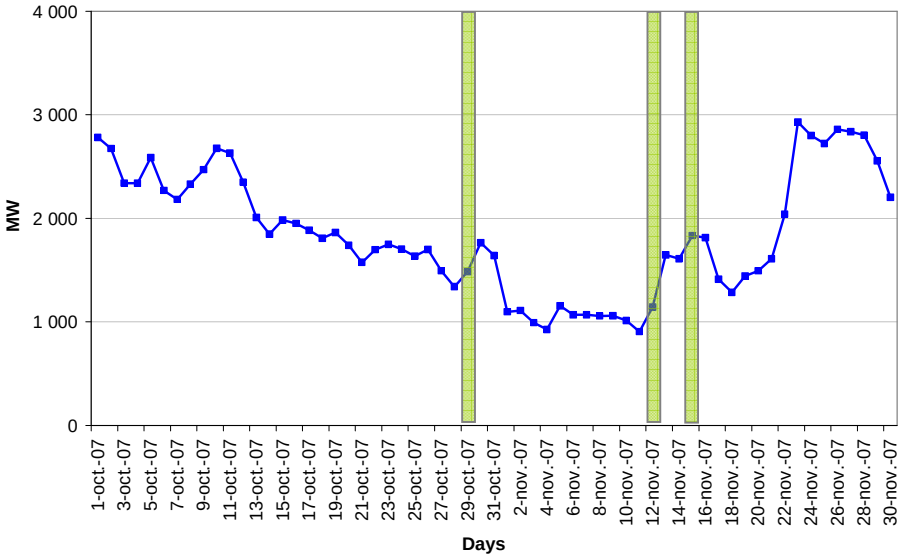
Due to low rainfall, run-of-river hydro production was particularly low in October and November 2007. During November, this type of production dropped to record low levels.

Monthly production for "run-of-river" hydroelectric dams
- Monthly averages -



Source: RTE data, CRE calculations

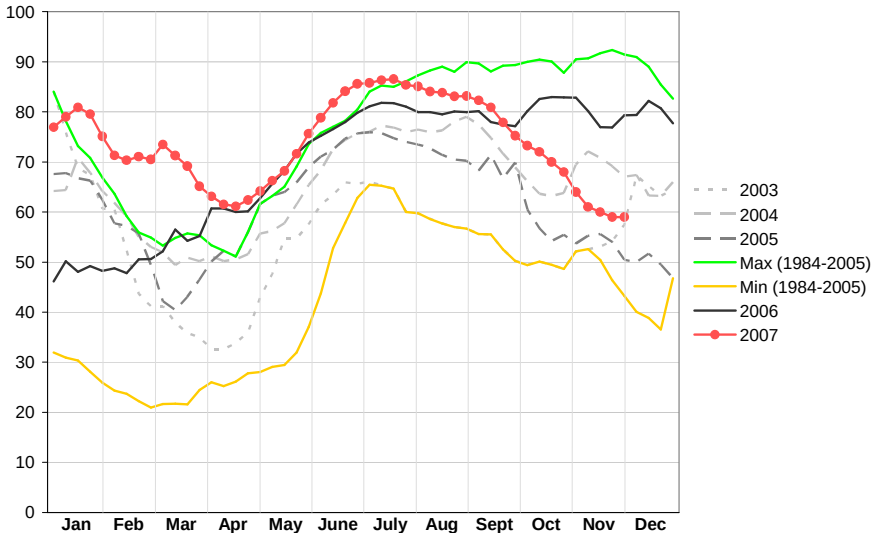
Daily production for "run-of-river" hydroelectric dams



Source: RTE data, CRE calculations

Low rainfall also meant that hydroelectric dam reservoir levels were particularly low. Thus, during the first 15 days of November, reservoir levels dropped close to the lowest levels recorded for the same period over the last 20 years.

Weekly filling rate of dam reservoirs
- % -



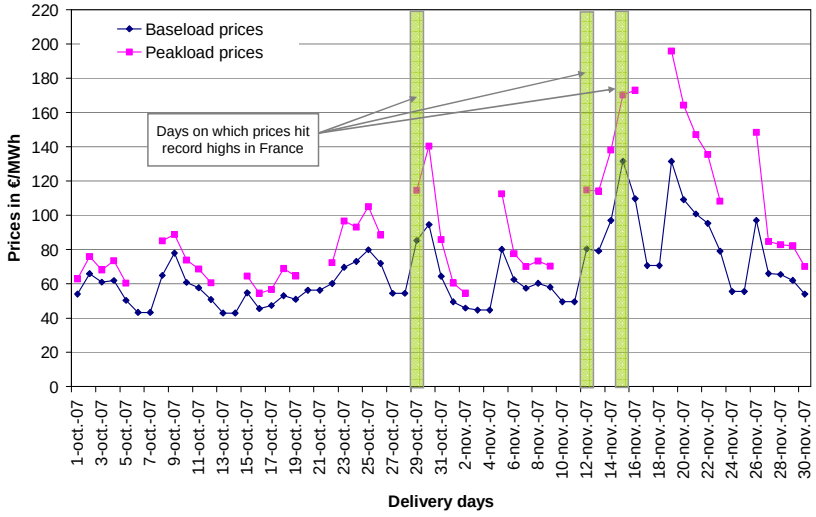
Source: EDF, UFE

C. Pressure on the British and German markets

- In the United Kingdom, supply margins were tight

The prices seen in the United Kingdom during the same period as the price spikes in France illustrate the pressure on the British market at the time.

Daily Day-Ahead prices for the United Kingdom
- From 1st October to 30th November 2007 -



Source: Platts

Comments in the specialized press confirm this feeling of strong pressure:

"European Daily Electricity Markets", Heren Energy, Friday 26/10/07

UK power Day-ahead Baseload prices leapt up markedly against the rest of the prompt as continuing concerns over system tightness during peak demand periods supported prices for Monday delivery power. The curve reacted positively to another session of higher NBP gas prices and firmer Brent Crude oil futures contracts. French and German power curves also posted day-on-day gains, lending further support to UK prices.

Four more outages on Friday increased worries about supply, knocking the confidence brought by Thursday's restarts. Gas fired plant, Barking Power, and three coal plants; British Energy's Eggborough 2, Eon's Ratcliffe 3 and Scottish Power's Longannet 1 were all off line.

"European Power Daily", Platts, Monday 29/10/07

UK prompt power prices surged higher Friday as the market reacted to revised system margins from National Grid, forecasting Monday to be tighter than expected, traders said. The UK generation output looked at full stretch for Monday and Tuesday with the margin down to as much as 1,000 MW at peak times, participants said. The significantly dented output of British Energy's nuclear plants was still keeping prices up, traders said. Monday baseload started at GBP56/MWh and traded to a high of GBP60/MWh before closing the morning session at GBP59.50/MWh. Peaks for that day were heard traded last in the morning at GBP80/MWh. Such a tight system meant that if plants do not return over the weekend, a period which typically requires less plants to run, prices could rocket next week, traders said. "If anything doesn't come back [prices are] going to be flying," said one. With such serious concerns on prompt margins, November prices moved up on market participants thinking that there may not be any improved situation as the market moves into winter and temperatures get colder. November started at GBP50.50/MWh and traded up to close at around GBP52/MWh, almost GBP3/MWh up on the day. The front-month baseload contract has closed higher day on day for four days in a row.

"European Daily Electricity Markets", Heren Energy, Wednesday 14/11/07

> Tightness in the UK system was another factor in the strong prompt. Tight supply margins for Block 5 were anticipated by National Grid, who issued a NISM - at midday the anticipated shortfall was at 300 MW during the peak demand period - but the NISM was then cancelled at 16:30 GMT.
>
> Fears that the French strike will carry on during Thursday, combined with continued supply tightness, led National Grid to issue a NISM for Thursday warning of a margin shortfall of 900 MW, from 16:00-20:00, at the time of going to press.

- In Germany the balance between supply and demand was also under pressure

Power prices in Germany during the period of price spikes seen in France illustrate the pressure felt on the German market, especially on 29th October and 15th November.

Daily Day-Ahead prices for Germany
- Daily averages from 1st October to 30th November 2007 -

Source: EEX

Comments in the trade press seem to indicate that pressure on the French market had a knock-on effect on the German market. However, the German market seems to have been under pressure too, due, according to some market players, to wind forecasts being revised downwards over the weekend, and unforeseen outages affecting facilities in Germany.

"European Power Daily", Platts, Wednesday 07/11/07

"Given that they are buying 3,000 MW in Germany every day and that nobody knows what's going on with their nukes, France must be the driving factor for prices at the moment." Further out on the curve, Cal 08 prices initially fell along with emissions. "There are nukes coming back in Germany and France so traders are hedging themselves against nuclear," s

"European Power Daily", Platts, Monday 12/11/07

German power prices were influenced by a bullish and a bearish factor Friday. Fears in France of a strike next week meant that French traders bought as much week-ahead peak power in Germany as they could, traders said. Compared with a day earlier

D. <u>The price spike of 12th November does not, however, seem to be solely related to pressure on supply and demand in France</u>

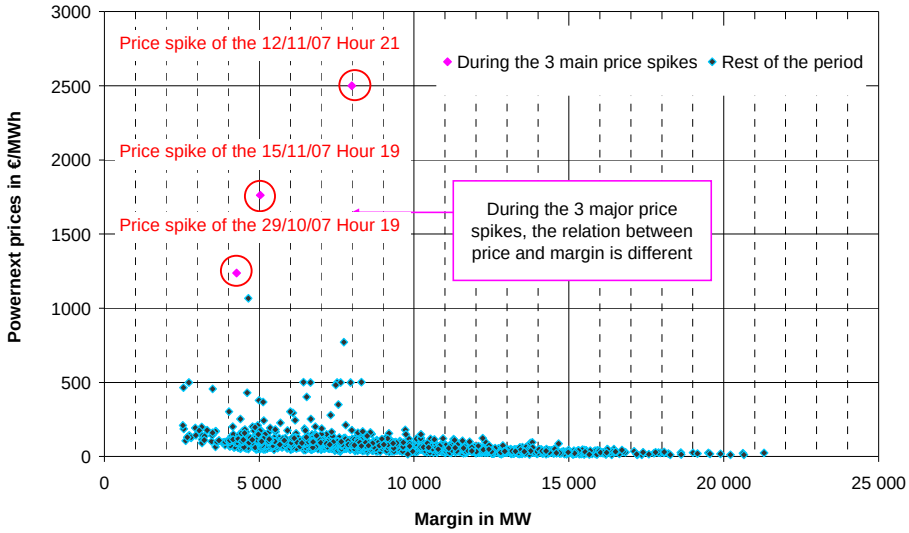
The price spikes recorded for 29th October and 15th November occurred at times when the balance between supply and demand was very tight on the French market.

On the other hand, on 12th November between 20:00 and 21:00, physical pressure on the French market was not especially strong; the situation of the French system was much tighter for the previous hours, as well as for other hours during the preceding and following weeks, without this pushing up prices to such high levels.

The figure below shows the lack of any relation, on 12th November, between the price level quoted between 20:00 and 21:00 and the available generation margin, as observed in day ahead. The remaining production margin was significantly higher on 12th November between 20:00 and 21:00 than for the other hours for which prices spiked.

Prices on Powernext in relation to the margin (production power available in the generation programme submitted to RTE)

- From 1st October to 30th November 2007



Source: RTE and Powernext data and CRE calculations

2. PRICES SPIKED AS A RESULT OF MARKET PLAYERS' EXPECTATIONS OF PRESSURE ON THE FRENCH SYSTEM

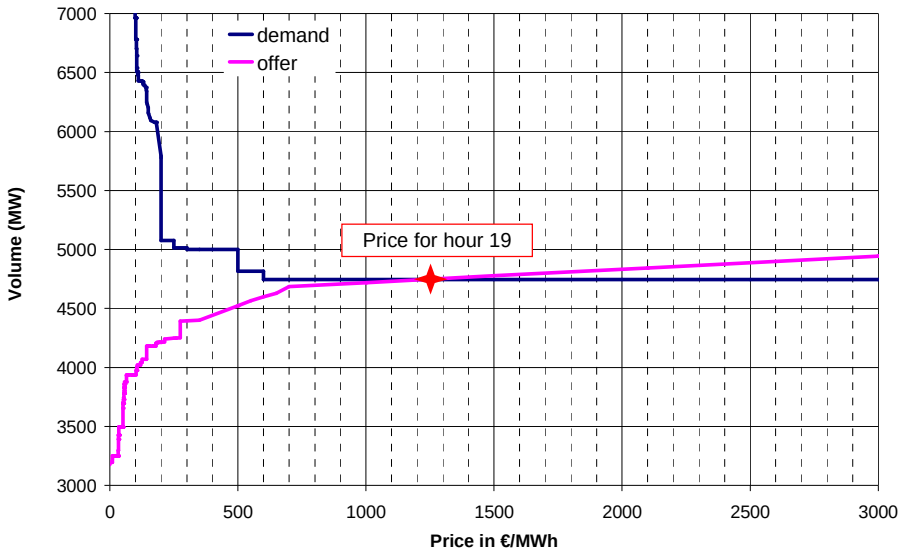
On 29th October and 15th November, expectations of high tension of the supply and demand physical balance of the French system, shared by all market players, led to the creation of price spikes.

On the other hand, the price spike of 12th November, which occurred for an off-peak hour, seems to have been caused by incorrect expectations. Market players do not appear to have anticipated that the physical balance of the French system would be under strain. This led them to sell large quantities on the futures markets of neighbouring countries: they thought that they would be able to procure energy for delivery on the French day ahead market, at moderate prices. This behaviour led to a significant increase in demand without price conditions on Powernext Day-ahead Auction and generated the price spike. Furthermore, it appears that because of the non expectation of very high prices during off-peak hours, the usual practices of some producers did not lead them to offer all their production on the market, which thus also contributed to the appearance of tension on Powernext Day-ahead Auction, unconnected with the true situation in the French electricity system.

However the CRE did not identify any individual behaviour aimed at causing these price spikes.

A. On 29th October, aggregate supply was particularly low on the Powernext Day-Ahead Auction, which is consistent with pressure observed on the French electricity system

Aggregate supply and demand curves on Powernext Day-Ahead Auction for 29th October at Hour 19



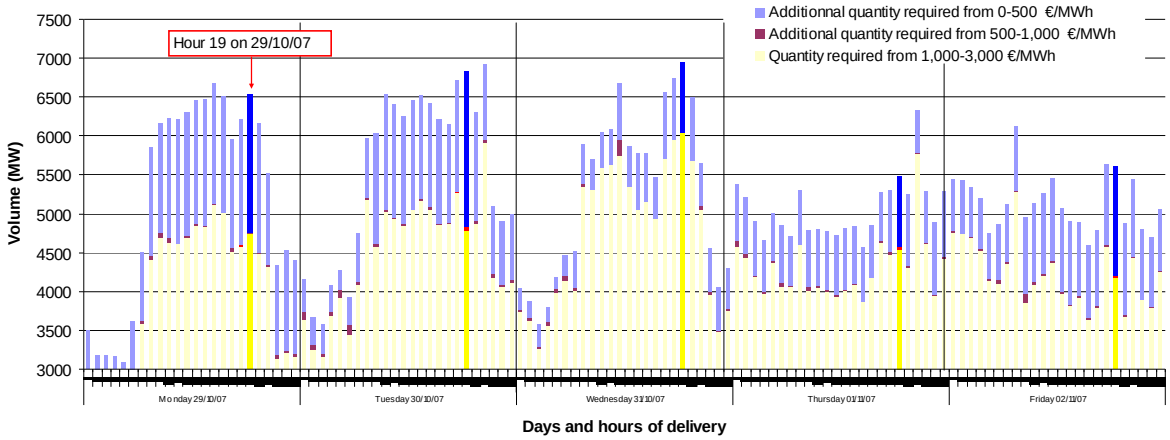
Source: Powernext

- Aggregate demand

For 29th October at Hour 19, aggregate demand increased diffusely among the members in comparison with the preceding hours. Demand increased above all for prices between €100 and €200/MWh. There is nothing unusual about an increase in demand on Powernext for Hour 19 given that 18:00 to-19:00 is the peak consumption hour in France.

Average level of demand on Powernext Day-Ahead Auction according to the price

- Week of 29th October to 2nd November 2007 -



Source: Powernext data, CRE calculations

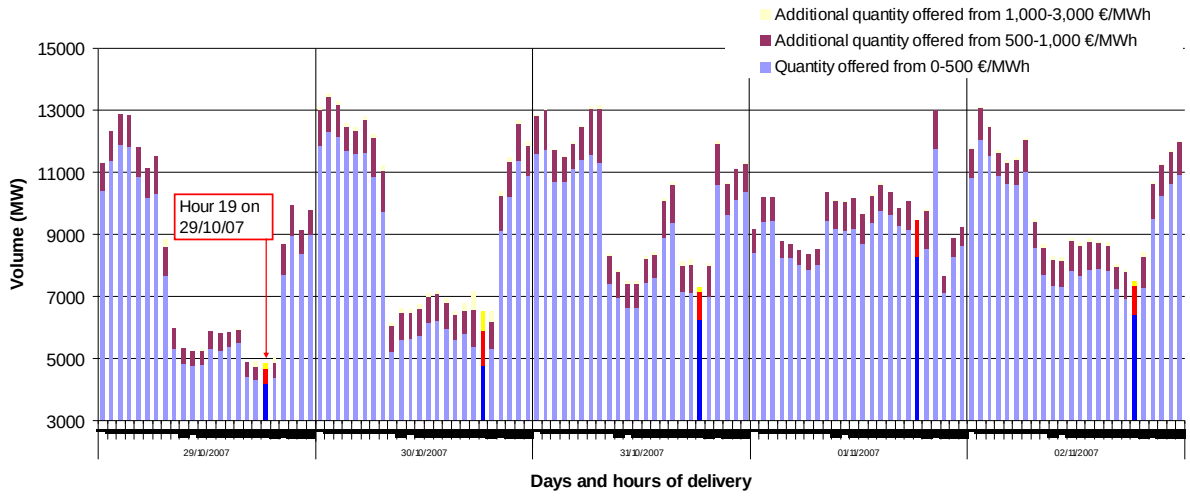
- Aggregate supply

The level of aggregate supply for Hour 19 was lower than the levels observed for the preceding and following days and hours. Members were particularly short for the 29th October, especially for delivery for Hour 19, the peak consumption hour in France. In particular, supply was significantly low for prices under €700 /MWh.

The offers of some players which do not have their own production capacities increase for prices above €700 /MWh. This strategy would imply power supply, by certain companies not covered by a long position. The risks related to such a position justify the fact that this power only be supplied at extremely high prices.

Average level of supply on the Powernext Day-Ahead Auction according to the price

- Week of 29th October to 2nd November 2007 -



Source: Powernext data, CRE calculations

- A price spike caused by collective behaviour

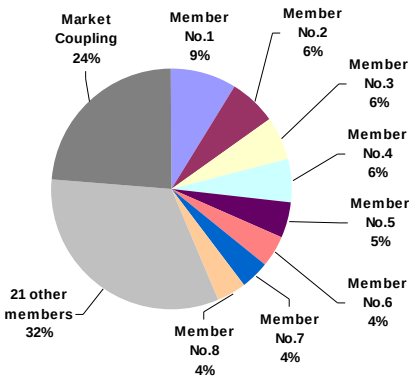
CRE has not identified any individual behaviour which would have caused the price spike on 29th October. The levels of aggregate supply and demand are the result of concomitant behaviour and expectations shared widely across the market. No player seems to have displayed any significantly different behaviour to that shown at other periods.

Two members of Powernext alone accounted for nearly half the net purchased volumes. However, sales were not particularly concentrated for the hour of the price spike on 29th October.

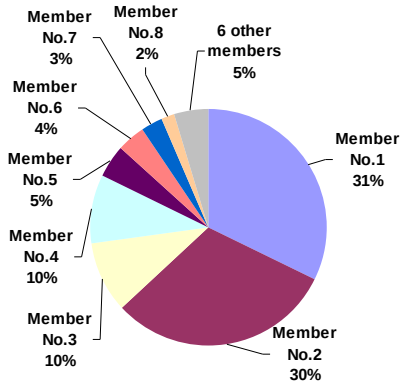
Market shares on Powernext Day-Ahead Auction for 29th October for Hour 19

- Market shares of net purchases and sales for the 8 major members -

Net sales



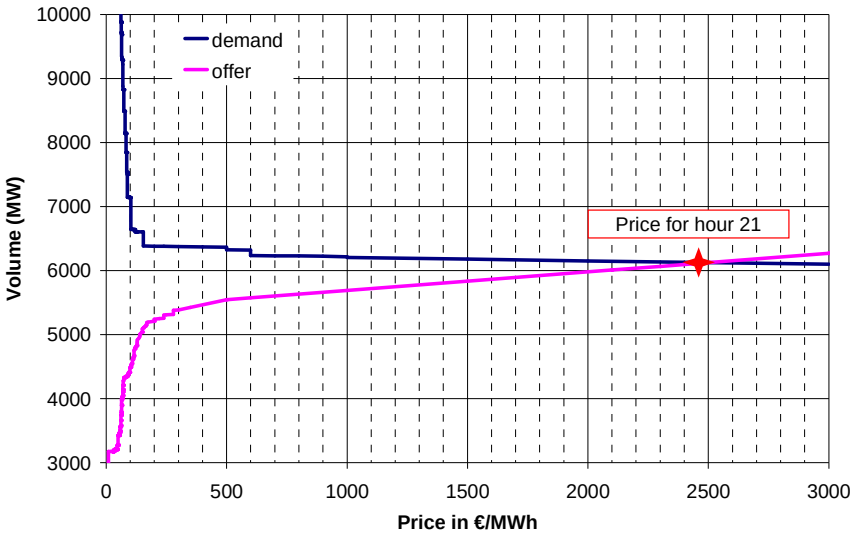
Net purchases



Source: Powernext data, CRE calculations

B. On 12th November, the price spike was linked to all players having mistaken expectations of pressure on the French market

Aggregate supply and demand curves on Powernext Day-Ahead Auction for 12th November at Hour 21



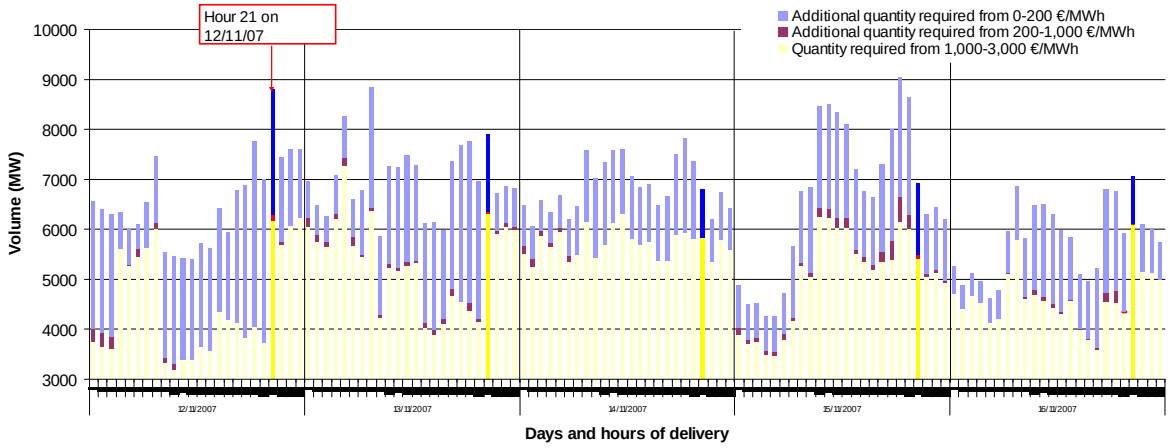
Source: Powernext

➢ Aggregate demand

For 12th November at Hour 21, aggregate demand increased substantially. In particular, demand at any price was very high, especially in comparison with the preceding hour. This surge in demand does not correspond to an increase in end-user consumption in France.

Average levels of demand on Powernext Day-Ahead Auction according to the price

- Week of 12th to 16th November -



Source: Powernext data, CRE calculations

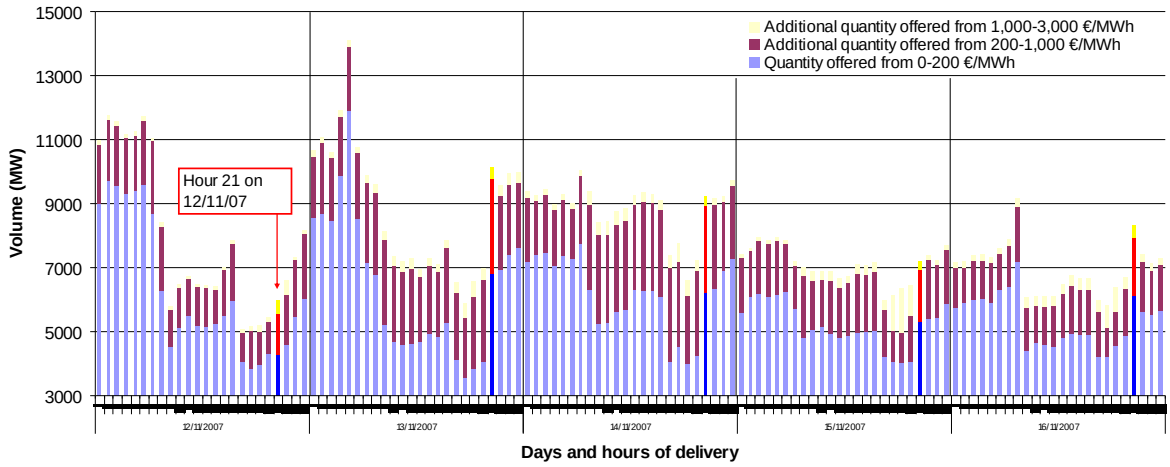
➢ Aggregate supply

The level of aggregate supply was lower than the supply levels for the same hours on the previous and following days, but was comparable to the levels proposed for the preceding hours.

Nonetheless, unlike the preceding hours, the supply increased as the price increased to extremely high levels for Hour 21. It seems that, for Hour 21, certain French producers or producers in bordering countries only began to offer substantial quantities of power when the price was very high. This strategy relates to the sale of energy that they were not sure that they would be able to produce, and which they therefore only offered at high prices, as part of a strategy of arbitrage offsetting the level of risk involved against potential income.

Average levels of supplies on Powernext Day-Ahead Auction according to the price

- Week of 12th to 16th November -



Source: Powernext data, CRE calculations

➢ The price spike of 12th November was possible caused by collective mistaken expectations of the market situation

All the players on the market seem to have been surprised by the pressure on the market on 12 November during off-peak hours. This mistaken expectation seems to be what caused the price to spike.
Expectations of little pressure on the market led the players to forward sell substantial quantities of energy, especially for off-peak hours, and, in particular, on the cross-border markets, in the hope of procuring energy at lower prices on Powernext. Increased demand at any price recorded in orders submitted for Hour 21 was the result of these sales on the futures market. The substantial increase in exports, at Hour 21, to countries with which it is not possible to alter daily nominations after the Powernext auction, seems to support this explanation.

These expectations that the price would not be very high also seems to have discouraged certain producers from offering all their available power on the market: expecting that energy at high prices would not be purchased in any case, it appears that they did not bother to put it up for sale on the market. In particular, as described in more detail in the following chapter, it seems that EDF did not offer all its hydraulic power on the market.

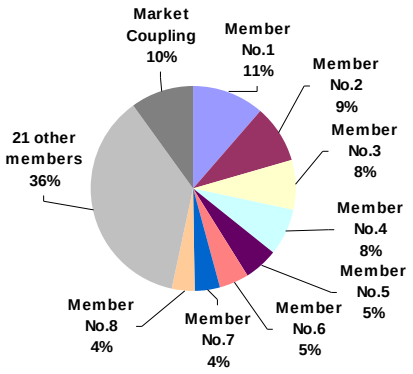
Moreover, on the day before 12th November:

- "incompressible" demand related to forward selling on the futures markets, notably the foreign futures markets, was high;
- supply made available by producers was lower than it could have been for Hour 21;
- aggregate demand proved to be higher than expected.

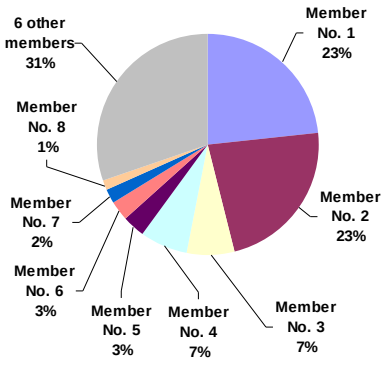
This series of events seems to have produced the particularly high price spike.

Two members of Powernext alone purchase more than half the net volumes sold for the hour for which the price spiked on 12th November. Sales were not particularly concentrated.

Net sales



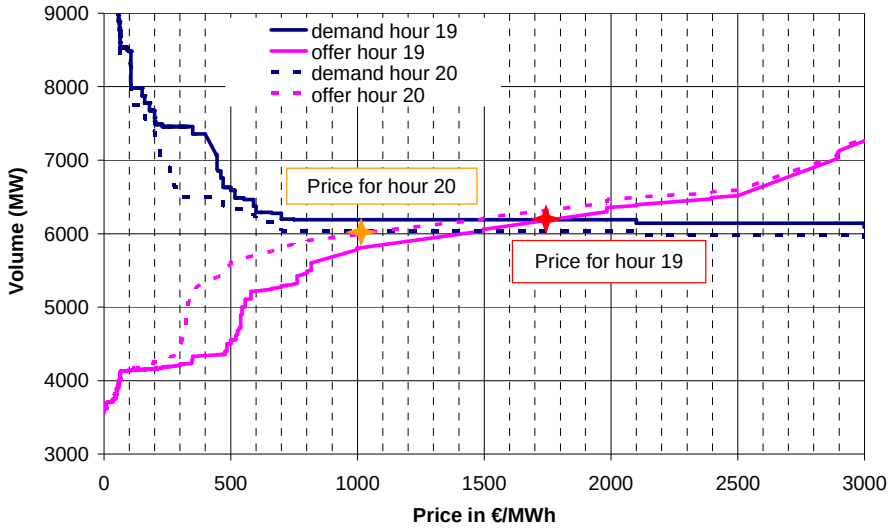
Net purchases



Source: Powernext data, CRE calculations

C. On 15th November, demand on Powernext was high and supply was low, in line with the physical situation in the market.

Aggregated supply and demand curves on Powernext Day-Ahead Auction for 15th November for Hours 19 and 20



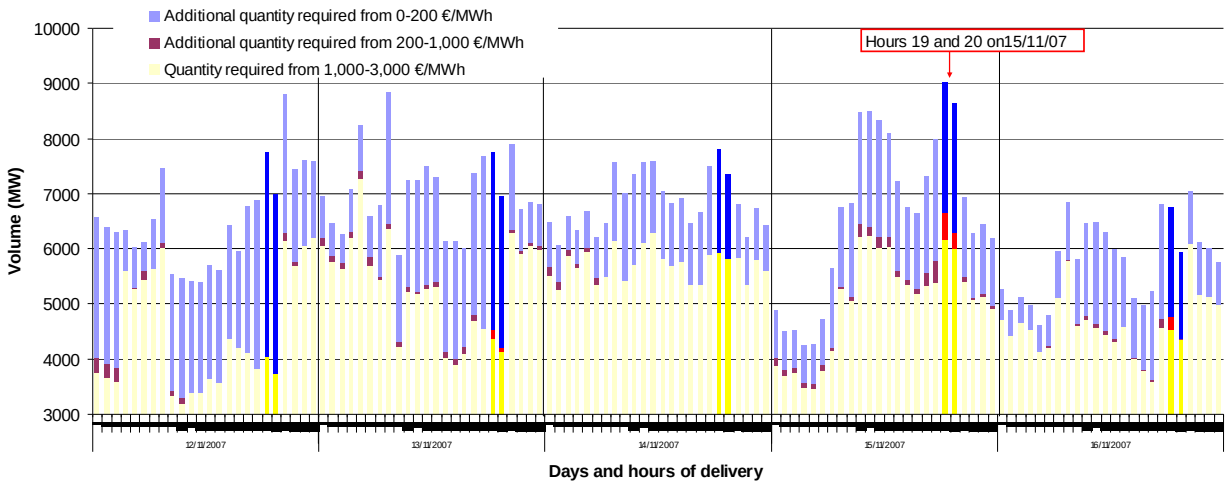
Source: Powernext

- Aggregate demand

For 15th November at Hour 19 – as well as for Hour 20, aggregate demand on Powernext Day-Ahead Auction increased. This increase in demand on Powernext is consistent with the daily consumption peaks on 15th November.

Average levels of demand on Powernext Day-Ahead Auction according to the price

- Week of 12th to 16th November -



Source: Powernext data, CRE calculations

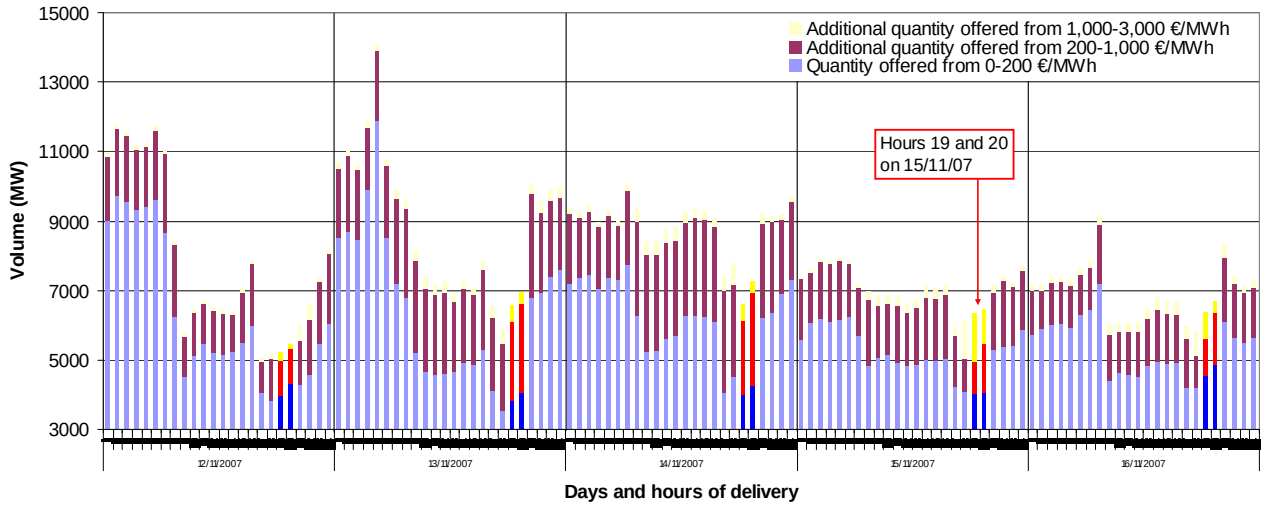
- Aggregate supply

Supply was extremely low, particularly for prices under €1,000 /MWh.

Supply subsequently rose for prices over €1,000 /MWh.

Average levels of supply on Powernext Day-Ahead Auction according to the price

- Week of 12th to 16th November -



Source: Powernext data, CRE calculations

- The price spike on 15th November reflects pressure on the physical balance of the French system and was expected by the market. It occurred as a result of market players' expectations.

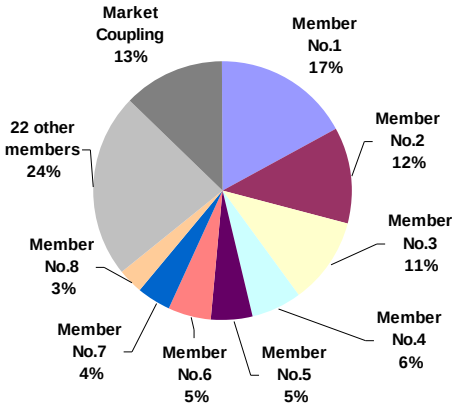
CRE has not identified any individual behaviour which, alone, would have caused the price spike on 15th November. Moreover, supply and demand behaviours are consistent with the pressure and physical constraints affecting the market on the quotation day.

One member of Powernext Day-Ahead Auction found that was particularly short of capacity, bought half the power sold for the hour of the price spike. On the other hand, sales were not particularly concentrated.

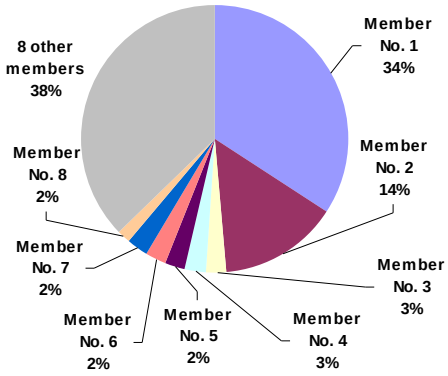
Market shares on Powernext Day-Ahead Auction for 15th November for Hour 19

- Market shares of net purchases and sales for the 8 major members -

Net sales



Net purchases



Source: Powernext data, CRE calculations

3. THE PRINCIPLE OF VALUING EDF'S HYDRAULIC GENERATION CAPACITY WAS A FACTOR IN PUSHING UP THE PRICE ON 12TH NOVEMBER 2007

EDF Group, through the interventions of EDF Trading, did not offer the totality of its available production capacities, especially hydraulic, on Powernext Day-ahead Auction on 12th November 2007 between 8 pm and 9 pm.

The analysis conducted by the CRE shows that this situation has its origins in the EDF Group's daily decision-making process. When EDF anticipates especially low prices, the producer does not offer, outside peak periods, all its generation capacities that might be demanded if prices were higher. For 12th November at the hour of the price spike, EDF teams did not think it was useful to offer on the market all the hydraulic production available.

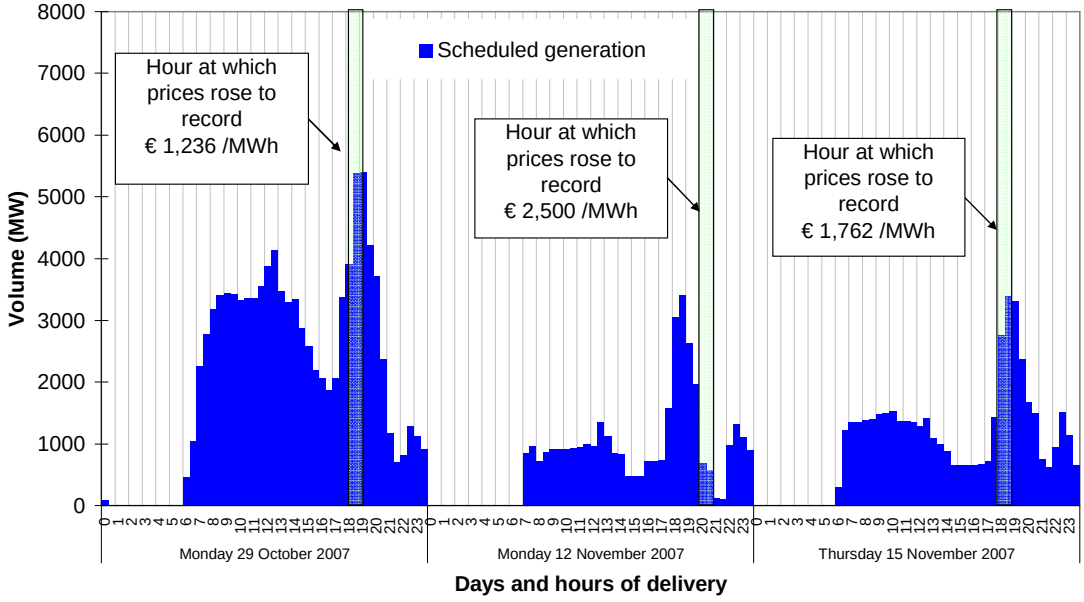
Simulations prove that if all EDF production capacity which was offered at the daily consumption peak had also been offered on Powernext Day-ahead Auction at the hour of the price spike, the price spike would have been avoided.

A. On 12th November, EDF did not value all its hydraulic production at Hour 21

The production programmes prepared by EDF before 16:00 on 11th November 2007 revealed a much lower level of hydraulic production for 12th November from 20:00 to 21:00 pm than during the previous hours. Thus, two hours earlier, 2,700 MW of additional production had been programmed.

Use of hydraulic production from EDF lake on the days of the price spikes

- Half-hourly production programmes transmitted to RTE the day before at 16:00 -



Source: RTE data, CRE calculations

The constraints related to hydraulic production facilities and EDF's commitments with regard to the supply of system-services and rapid reserves to RTE make it impossible in practice for the producer to schedule a level of production equal to the theoretical power capacity of his facilities. Consequently the power actually available is always very much lower than the theoretical power of the plants. However, the low level of scheduled generation, compared with other periods in the day, for an hour when the price reached a historical record, shows that EDF's available production capacity was not all being offered on the market, even at high prices.

B. The principles of the valuing process for EDF's hydraulic capacity display shortcomings

Analysis of the daily procedure implemented by EDF to valorise the flexibility of its hydraulic production capacity on the day ahead market reveals shortcomings.

The usual procedure implemented by EDF aims to value EDF production at best, and concentrates hydraulic production scheduling, especially for constrained or low capacity reserves, as far as possible on the peak of consumption. For other periods, offers which may be associated with hydraulic production are only prepared for volume brackets which are estimated to be realistic and price levels likely to be absorbed economically in the market.

As the price spike was unexpected, this usual procedure did not lead EDF teams to propose all the hydraulic capacity available (irrespective of its mobilisation cost) on the market at Hour 21.

This shortcoming appears to have its origin in the operational procedures applied by the agents, and the relative complexity of the daily optimisation tools used.

C. A more thorough optimisation of the EDF offer in the markets would have prevented the appearance of such a high price spike

The absence of the offer of part of the production on the market, by creating an artificial shortage, amplified the price increase.

EDF states that the value given to the hydraulic energy stocked in its reservoirs was, for some units, between €100 and €200 /MWh. Without prejudging the justification for these values, a simulation shows that if EDF had offered a hydraulic power production at least equal to that scheduled two hours earlier for the period of the daily consumption peak, for an offer price between €100 and €200 /MWh, the Powernext fixing would have settled at this price.

Even if a more thorough optimisation outside the peak consumption periods would not necessarily have led to moving the production scheduling for constrained or low capacity reserves (lacking a complementary signal from Powernext), a more optimal valuing by EDF of its hydraulic production capacity available on the market for all the periods of 12th November would have prevented the appearance of such a high price spike.

4. THE OPERATING PROCEDURES OF CERTAIN MEMBERS OF POWERNEXT DAY-AHEAD AUCTION ARE NOT OPTIMAL AND CAN AFFECT PRICE FORMATION, ESPECIALLY AT WEEKENDS

At weekends, the low numbers of market players' trading personnel can affect market prices for the following Monday, as personnel may be more likely to take the wrong decisions or fail to respond adequately to changes in the market situation.

In addition, constituting and closing the order book and setting the price is part of a daily operational sequence subject to numerous constraints related to time: cross-border nominations, price fixing on European exchanges, closing for VPPs declarations, etc. These constraints mean that members have to enter complex order data in a matter of minutes. Notwithstanding, CRE observes that orders sent to Powernext by certain market players during the fixing days dealt with in the analysis contained some obvious errors. These errors have been detected by Powernext as part of its control procedure and have since been corrected. If this were not the case, they may have affected price formation.

A. Many operators are absent from the market or are not responsive enough at weekends, when the day ahead prices for Monday are quoted on Powernext

Powernext Day-ahead Auction quotation for Monday prices takes place on Sundays at 11h00. Nonetheless, numerous traders send their orders on Friday evenings and close their offices on Saturdays and Sundays. This phenomenon is amplified by the fact that on EEX the quotations for Sundays and Mondays are made on Fridays.

Because of this, the majority of members of the wholesale market, including the biggest, are not in a position to modify their expectations made on Fridays during the weekend, and do not react to market signals which may emerge after Friday afternoon.

B. The errors or delays by members in sending their order books are likely to create unbalances and result in prices which are disconnected from the reality of the market.

The usual time for closing Powernext order book is 11h00. But some players only send their orders a few minutes before the closing time. It even happens that some members make modifications to their order books after 11h00, which usually cannot be taken into account by Powernext to calculate the fixing prices.

The CRE observed that on the days when the price spikes occurred, some of the most important members of the platform only sent their orders at the last minute. For example, on 11th November, two of the most important members only sent their orders between 11h00 and 11h02. Their orders represented about 19% of the sales and 9% of purchases (not net) at the fixing price for hour 21.

In addition, constituting and closing the order book and setting the price is part of a daily operational sequence subject to numerous constraints related to time: cross-border nominations, price fixing on European exchanges, closing for VPPs declarations, etc. These constraints mean that members have to enter complex order data in a matter of minutes.

Nevertheless, some members send order books which are obviously incorrect, that they have not had time to correct. For example on 14th November, it was only thanks to extra time provided by the RFQ procedure that a member was able to correct errors in the first order book sent. This modification allowed an increase in the offer of around 10% at € 3,000 /MWh. If Powernext had not allowed its

members to modify their order books on 14th November, the Powernext price would have been higher than it should have been, simply due to this sending error.

This lack of rigor in players' operational procedures creates both individual risks for players whose market positions may not reflect their wishes, and risks of price alterations, which may no longer correspond to the fundamentals of the French electricity system.

5. FORECAST NUCLEAR PRODUCTION INFORMATION PUBLISHED BY UFE DID NOT MAKE IT POSSIBLE TO RELIABLY PREDICT THE MARKET SITUATION

Forecast information relative to availability of nuclear generation capacities issued by EDF and published on the RTE website since mid-August 2007 for the three days on which prices hit record highs were consistent with the information EDF had at the time of publication.

Nonetheless, the forecast data did not enable the players to accurately predict the risk relative to unplanned unavailability. In fact, in application of the rules adopted by UFE, forecast availability published for thermic power production facilities only factors in plant outages which are known in advance. This principle is designed to make the published data as objective as possible, but results in systematically overestimating forecast availability compared with actual availability.

In addition, the occurrence of an obvious data entry error made by EDF on one of the days during the period in question, together with the occasional absence of data furnished by certain producers, indicates that UFE's publication process is not reliable enough.

Lastly, the data published, and especially data relative to levels of hydraulic reservoirs, are not supported by records that are detailed enough to be used in forecasting pressure on the French electric power system.

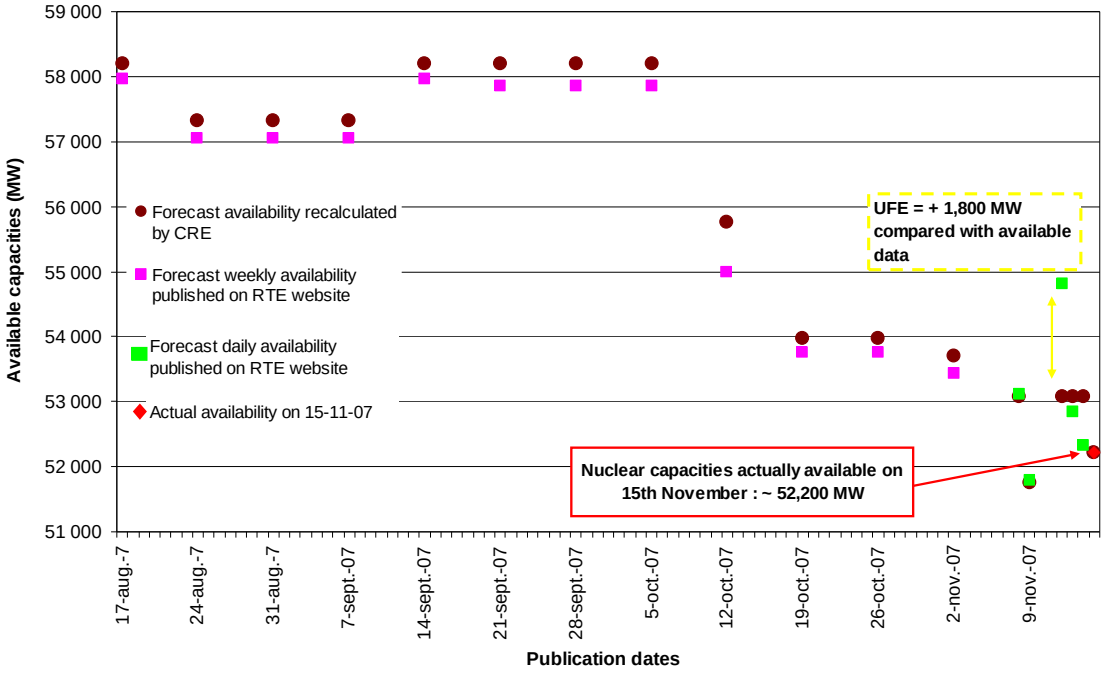
A. Forecast data relative to nuclear production were, overall, consistent with the data in EDF's possession at the time of publication

CRE has found that the forecast data relative to the availability of nuclear capacities published by EDF on RTE website were consistent with the information in EDF's possession at the time of publication.

CRE nonetheless pinpointed an anomaly in the publication on 12th November concerning availability for 15th November. The producer forecast, was 2,000 MW higher than the availability EDF was able to calculate. EDF stated that a data entry error, which was corrected the next day, lay behind this error.

Forecast data relative to availability of French nuclear production facilities for 15th November 2007

- Comparing data published on RTE website with the data in EDF's possession at the time of publication -



Source: CRE, UFE

B. <u>Given the method of calculation, the data published (especially the weekly data) distinctly overestimate the likely availability of nuclear production facilities</u>

In application of the rules adopted by UFE, the forecast availability information published only factors in plant outages which are known with certainty in advance. Outages and extended outages which are only likely or possible are not taken into account, even on a partial basis, unless they are absolutely definite.

As a result, forecast availability published is systematically higher than actual availability.

This principle is designed to make the published data as objective as possible, avoiding the possibility of subjective judgement entering into the calculation, performed by the producer, of the probable availability of its production facilities. Nonetheless, the lack of data that would allow the players to quantify the risks related to unplanned unavailability seriously impairs the pertinence of the published data.

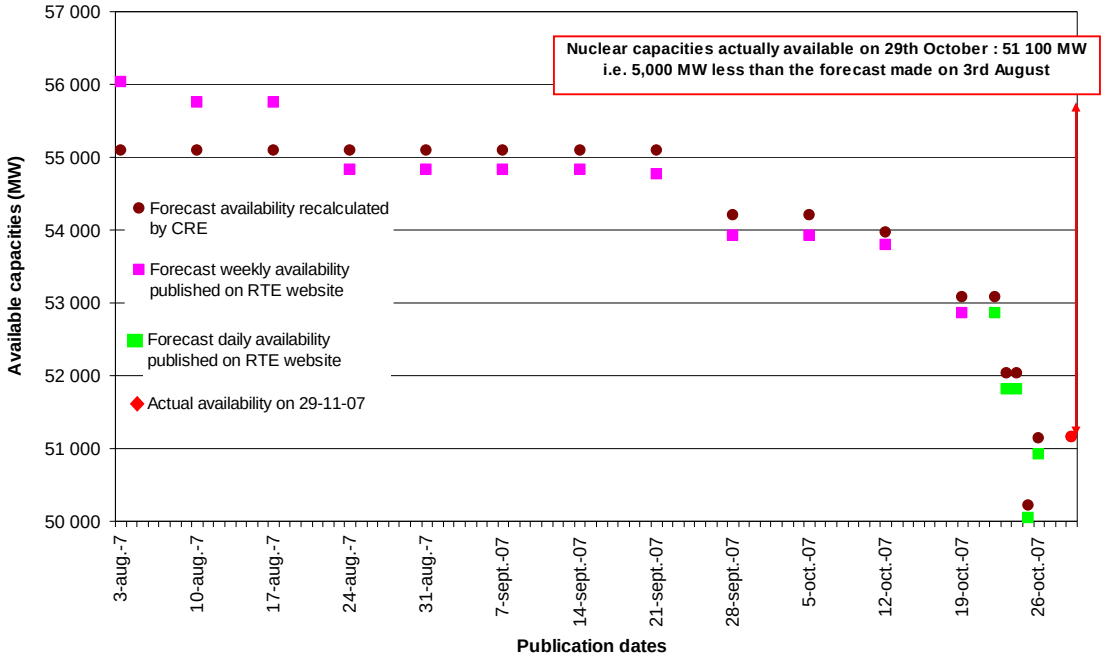
As a result, for the period in question, forecast availability, especially the weekly forecasts, differed greatly from actual availability. Thus, for the days on which the prices spiked, the availability levels forecast a few weeks prior to the deadline were, in some instances, higher by more than 10,000 MW

than actual availability, with no way for market players to evaluate the extent of this difference in advance.

The graph below shows the extent to which forecast availability based on weekly forecasts was overestimated for the 29th October. The values of forecast data are closer to the values regarding actual availability when forecasts are made closer to the auction date, although there is still a large difference, even when made a few days prior to the auction.

Forecast data relative to availability of French nuclear production facilities for 29th October 2007

- Comparing data published on RTE website with the data in EDF's possession at the time of publication -



Source: CRE, UFE

It should be noted that this systematic overestimation of announced availability, which is tied to the way in which UFE establishes the data it publishes, is not exclusive to the three price spikes investigated here, nor to the period October-November 2007.

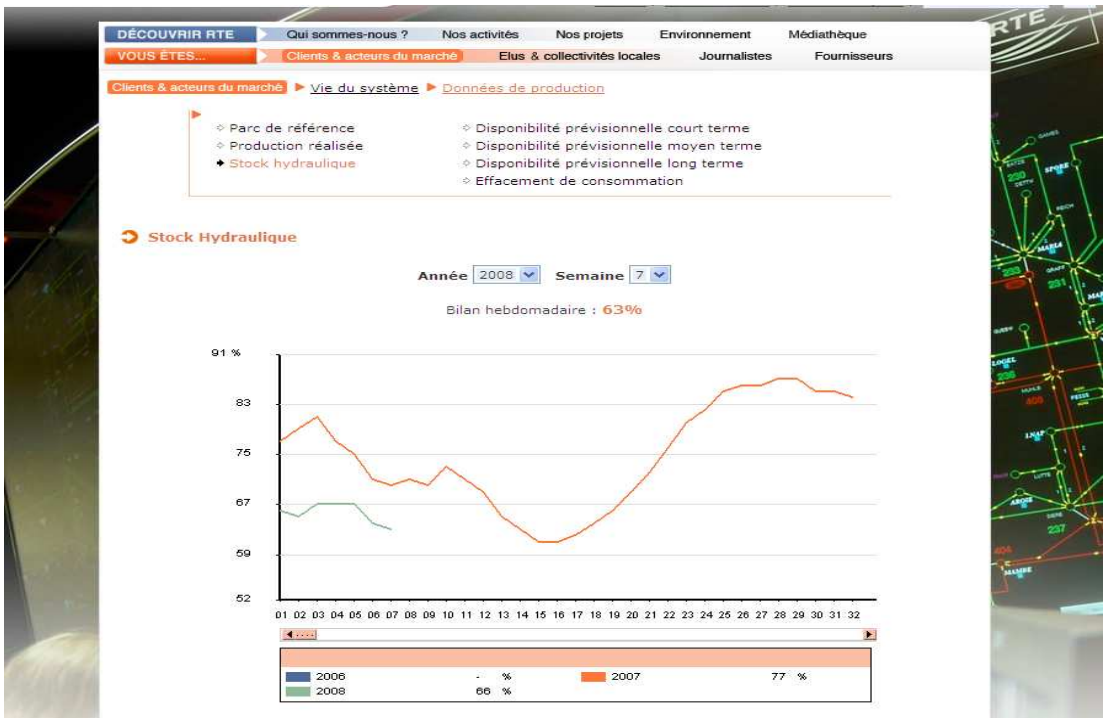
C. Data relative to hydraulic stocks cannot be used effectively given the lack of background records

Data relative to fill levels in hydraulic reservoirs does not include any records prior to publication of the data, in other words, 15th November 2006.

Data relative to reservoir levels on a given day cannot be used in isolation. This data can only be interpreted correctly if it can be compared with the levels recorded for the same period during a significant number of years in the past. The data published today by UFE therefore serve no practical purpose for market players.

Records of hydraulic stocks published on RTE website

- Weekly filling coefficients as a % -



Source: RTE website

6. THE PROCEDURES LAUNCHED BY POWERNEXT TO ENCOURAGE ADDITIONAL OFFERS (REQUEST FOR QUOTES – RFQ) WERE NOT IMPLEMENTED IN THE MOST EFFICIENT MANNER

When there is any risk that orders transmitted by members of the Powernext Day-Ahead Auction will lead to a price that will not reflect the market situation accurately, Powernext initiates a "Request For Quotes" (RFQ) procedure. Powernext then informs the members of the situation for the hours in question and allows them to change their order books after the normal order-closing deadline. This is a highly sensitive procedure, since it provides market members with privileged information.

Analysis of the procedure applied by Powernext on 11th November 2007 shows that its implementation was inappropriate given the market situation: the formalities of the procedure were barely respected and insufficient numbers of market players were contacted.

Furthermore, the preliminary test performed by Powernext to decide whether or not to launch an RFQ needs to be improved. The fact that certain members only submitted their order books at the last moment, together with the potential impact of imports related to market coupling, seem to have been inadequately taken into account.

Lastly, the RFQ procedure was not organised in conjunction with other energy exchanges involved in the market coupling, whereas there was available import capacity from Belgium. Only certain members of the French exchange were contacted, thereby reducing the potential impact of the procedure.

Every day, Powernext performs tests before the closing of the order books, to assess hourly prices resulting from the auction. In cases where prices cannot go higher than €0 /MWh or lower that €3,000 /MWh, or when it seems that prices do not accurately reflect the market situation, Powernext may launch a "Request For Quotes" (RFQ) procedure, which entails alerting the market members to the situation for the hours in question. Powernext then allows the players the option of modifying their order books after the normal closing deadline.

This procedure provides the players contacted with highly sensitive information regarding the market situation, and may result in unexpected reactions. Thus, the information furnished within the framework of the procedures initiated on 11th and 14th November occasionally resulted in consequences that defeated the object of the procedure, with a sentiment of "panic" generated in the market causing some players to reduce their supply offers instead of increasing them. This procedure should therefore only be used in the event of a crisis and, even then, should be implemented more efficiently.

Moreover, tests performed prior to launching an RFQ, together with the way in which the RFQs launched on 11th and 14th November were handled, were not implemented in the most effective conditions.

A. The lack of formality of the procedure launched on 11th November 2007 is not satisfactory

On 11th November, Powernext did not inform all the members of the market platform of the imbalance revealed by the tests performed.

Moreover, this "informal RFQ" procedure was carried out by telephone at very short notice and the three members who were contacted were not clearly informed of the nature of the request nor, in particular, of the additional time before definitively closing the order books.

B. Tests performed prior to closing the order books could be improved

On 14th November, several hours for the quotation for 15th November were subject to an imbalance (with prices higher than €3,000 /MWh). In addition, at the time when the pre-RFQ test was carried out (11a.m., the time when the order books are normally closed), several of the major members of Powernext had not yet submitted their orders. If the test had taken theses members' definite orders into account, the RFQ would not have been launched.

Furthermore, imports that could have been made as a result of coupling the trading platform with the Belgian and Dutch exchanges were not taken into account in the test results. Yet, volumes from market coupling, which can often be substantial, can restore the balance to the French order books: if these volumes are taken into account, this would avoid the need to launch certain RFQ procedures.

C. The lack of coordination between the "Request For Quotes" procedure and the Belgian and Dutch power exchanges makes the procedure less efficient

On 11th and 14th November, Powernext's RFQ was not notified to the exchanges coupled with Powernext, namely Belpex and APX. Or, import capacities available from the Netherlands and Belgium for coupling were not saturated at the hours for which prices spiked. If the members of the three power exchanges had all been alerted to the tightness relative to certain hours, supply could have been increased on the Belgian and Dutch marketplaces, thereby keeping prices down.

7. THE PRICE SPIKES MAY HAVE BEEN AVOIDED IF THE METHODS USED TO ALLOCATE INTERCONNECTION CAPACITIES WERE MORE EFFICIENT

The mechanisms currently used to allocate interconnection capacity are not conducive to effective management of all interconnections. As highlighted in the CRE's first report on management of the use of grid interconnection in 2006, published in May 2007, these methods result both in underused interconnection capacity and also, occasionally, use that counteracts the price differential between interconnected markets.

For example, at the time of the three price spikes on the French market, while prices on the neighbouring organised markets were all, except for Belgium, much lower than on Powernext, a substantial volume of import capacity remained unused at the borders (a total of 8,324 MW on 29th October, 6,624 MW on 12th November and 2,925 MW on 15th November).

Establishing efficient allocation methods, and, in particular, market coupling for all French interconnections, would have made it possible to take advantage of cheaper supplies from abroad and thus kept prices on the French market down.

In spite of major improvements implemented by RTE in recent years, the mechanisms currently used to allocate interconnection capacity still fail to ensure effective management of interconnection. Indeed, these mechanisms result in:

- use of interconnection capacity that counteracts the price differential between organised "day-ahead" markets;
- and underused interconnection capacity.

For each price spike, the tables below[1] highlight the transactions that took place and the import capacity that could have been used at each French interconnection point if efficient methods had been implemented.

[1] The tables do not show records for Belgium since, although there is no netting on cross-border interconnection with Belgium, implementation would not have resulted in additional imports.

Price spike on 29th October

		Periodic nominations (MW)	Daily nominations (MW)	Unused import capacity (MW)	Price on organised markets in neighbouring countries (€/MWh)	Price differential (€/MWh)
Germany	Export	0	301	**1750**	198	(1236-198=) 1038
	Import	583	1957			
Spain	Export	0	230	**230**	54	(1236-54) 1182
	Import	181	119			
Italy	Export	2077	95	**2997**	174	(1236-174=) 1062
	Import	0	75			
England	Export	1398	500	**3347**	110	(1236-110=) 1126
	Import	0	51			

Price spike on 12th November

		Periodic nominations (MW)	Daily nominations (MW)	Unused import capacity (MW)	Price on organised markets in neighbouring countries (€/MWh)	Price differential (€/MWh)
Germany	Export	0	0	**0**	71	(2500-71=) 2429
	Import	1207	1290			
Spain	Export	0	300	**300**	68	(2500-68=) 2432
	Import	184	116			
Italy	Export	1124	665	**2049**	97	(2500-97=) 2403
	Import	0	70			
England	Export	11	0	**1275**	74	(2500-74=) 2426
	Import	636	100			

Price spike on 15th November

		Periodic nominations (MW)	Daily nominations (MW)	Unused import capacity (MW)	Price on organised markets in neighbouring countries (€/MWh)	Price differential (€/MWh)
Germany	Export	0	0	**463**	701	(1762-701=)
	Import	660	3746			1061
Spain	Export	0	300	**300**	52	(1762-52=)
	Import	0	0			1710
Italy	Export	511	2201	**512**	193	(1762-193=)
	Import	0	994			1569
England	Export	0	0	**1650**	520	(1762-520=)
	Import	300	50			1242

Tables above show that at all cross-border points, there were very large volumes of unused import capacity, even though the price differential was very favourable for selling to the French market. On 29th October, although the price had risen to €1,236 /MWh, 8,324 MW of interconnection capacity remained unused. On 12th November and 15th November, unused import capacity stood at 6,624 MW and 2,924 MW respectively.

Implementation of market coupling for allocating daily products would therefore have made it possible to take advantage of cheaper supply from neighbouring countries. This would have increased offers for low prices on Powernext, which would undoubtedly have prevented these price spikes.

For example, for the 29th October a « simple » market coupling with Spain[2] would have halved the price on Powernext (from €1,236 /MWh to €600 /MWh). It is also interesting to note that unused import capacity on the Spanish cross-border point was the lowest of all the countries taken into consideration, which makes it more than likely that a market coupling with Germany, Italy or England would have had an even greater impact on keeping the price down on Powernext.

At the same time, we note that a substantial volume was traded, inversely to the price differential between the different markets. This counter-productive trading reflects the inefficient management of production resources in France and its neighbouring countries.

Implementing efficient mechanisms for allocating interconnection capacity thus proves essential in order to manage the interconnection between production facilities effectively and to avoid such spikes in the price. Grid operators are therefore invited to speed up implementation of such mechanisms.

[2] It was only possible to carry out this analysis with the Spanish market because the supply curves for other countries' power exchanges were not made public for the dates in question.