

MANAGING CRITICAL GRID SITUATIONS – A MARKET ANALYSIS

MARKET ANALYSIS – ANNEX TO THE ENTSO-E MAY 2017 REPORT ON
MANAGING CRITICAL GRID SITUATIONS: SUCCESS AND CHALLENGES

NOVEMBER 2017



European Network of
Transmission System Operators
for Electricity



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1. INTRODUCTION

In January 2017, a cold spell caused extreme temperatures in eastern and western European countries. The core period of cold weather in Eastern Europe was observed in the second week, and it reached the western European countries in the third and fourth week of January 2017.

Extreme temperatures led to increased demand, unplanned outages of lines (e.g. in Italy) and tense electricity generation. Markets were tight and the remaining available firm capacity was low – or temporarily zero – in some countries. Emergency measures were taken by TSOs to ensure uninterrupted supply and secure system operations.

The following sections describe the market situation in France, Belgium, Germany, Switzerland, Italy, Greece, Romania and Bulgaria during the cold spell.



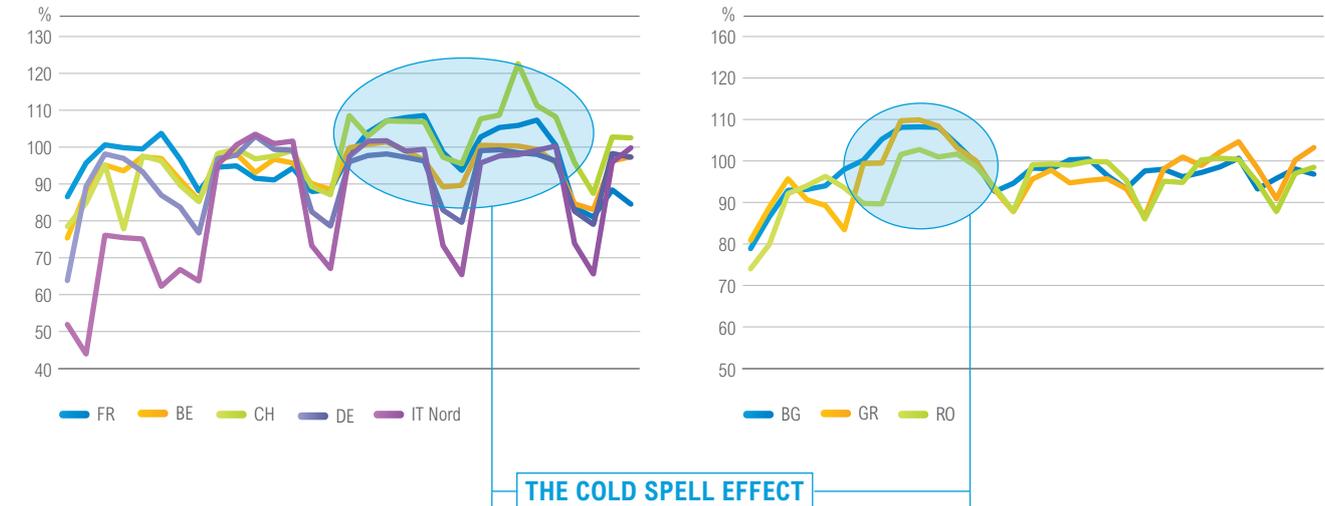
2. MARKET DEMAND

In almost all the considered countries, peak demand in certain hours exceeded, or was at least as high as, the peak demand observed in January 2016. In France, harsh winter weather drove the peak demand to more than 20% above last year's peak, whereas in Bulgaria and Greece, peak demand rose by more than 10% relative to 2016 (see figure 1).

The increasing demand for electricity resulted in higher prices on the wholesale market. Price movements were strongly correlated to demand. In western European countries, price peaks were triggered by the demand side as demand peaks correlated with price peaks. In eastern

European countries, price peaks were rather driven by the supply side, for example, due to the limited supply of gas in Greece right after the core of the cold weather period in the second week (see discussion on prices below).

DAILY MAXIMUM LOAD 2017 COMPARED TO PEAK LOAD IN JANUARY 2016



DA PRICE AT DAILY MAXIMUM LOAD

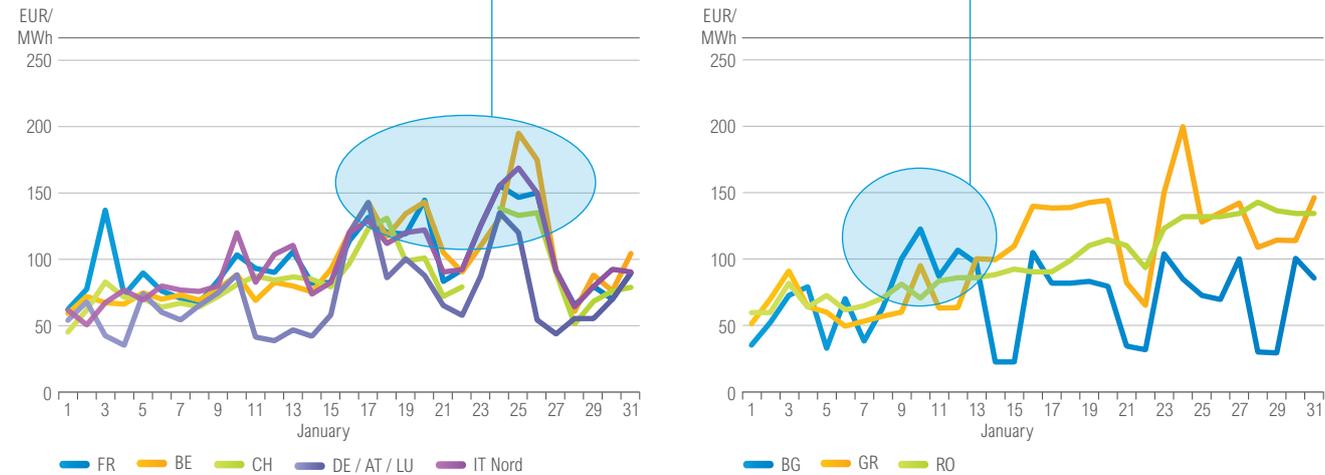
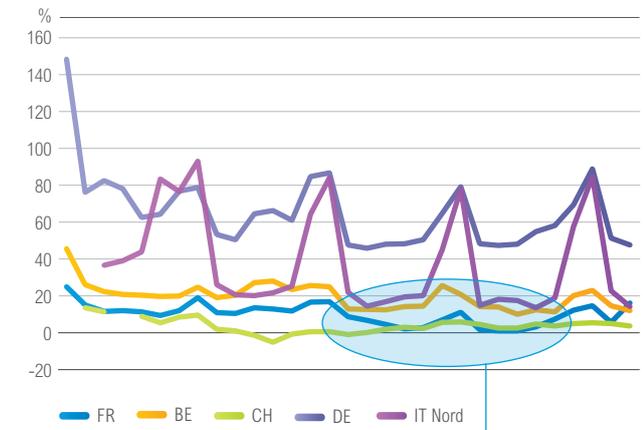


Figure 1: Overview demand conditions; Source Data: ENTSO-E Transparency Platform

3. MARKET SUPPLY

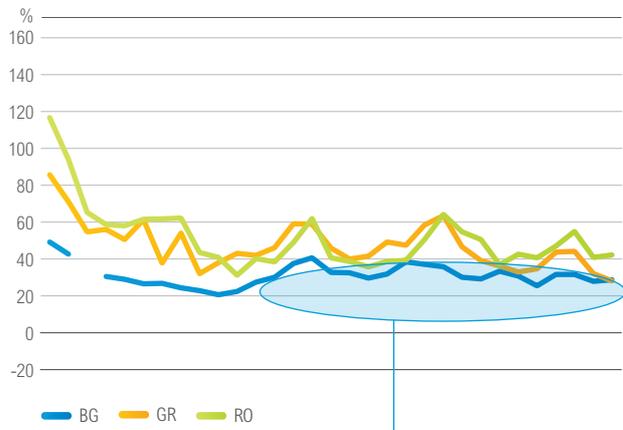
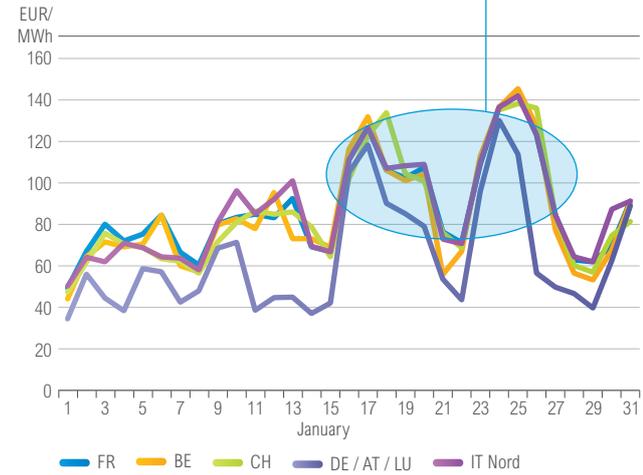
The supply side was driven to its limits in some countries, in particular, due to the unavailability of generation capacity. However, major supply disruptions or system issues did not occur.

SUPPLY MARGIN* (hourly 8h–20h)

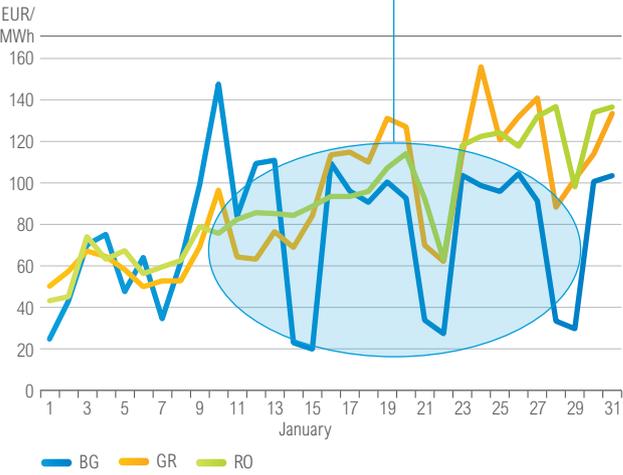


TIGHT SUPPLY SITUATION

DA PRICE (hourly 8h–20h)



SMALL CHANGES IN SUPPLY MARGIN LED TO STRONG PRICE REACTIONS



* $SM = \frac{\text{(installed capacity - installed non firm capacity - actual firm generation - outages - balancing reserves)}}{\text{load}}$
 Supply Margin indicates the "non-generating available firm capacity with respect to the actual load".

Figure 2: Overview supply conditions; Source Data: ENTSO-E Transparency Platform

The Supply Margin¹⁾ in Switzerland dropped to zero in certain hours in weeks 3 and 4. Switzerland relied strongly on imports (see figure 2). Additionally, in Italy, the Supply Margin would have been negative in certain hours if imports had been limited, which was not the case. Unfortunately, electricity transmission between different regions of Italy was hampered by snowfall and unplanned outages on the 380kV transmission lines between the north and the south of the country, resulting in system security issues in northern Italy. As severe supply conditions in Italy had already been foreseen in the ENTSO-E Winter Outlook Report, the TSO asked market participants for the return to operation of some mothballed plants.

France experienced low availability of nuclear power as it was impacted by the ongoing safety tests. The Supply Margin reached 0% in certain hours in weeks 3 and 4. However, the total unavailability was not as high as in October 2016 or February 2017.

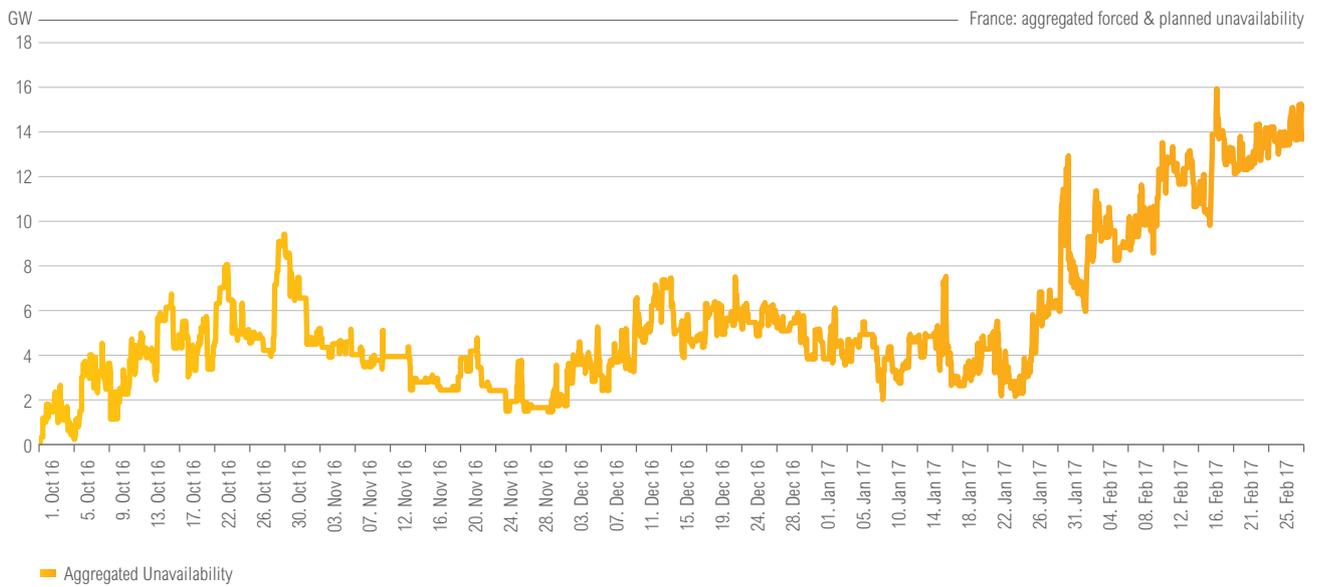


Figure 3: France: aggregated forced & planned unavailability; Source Data: ENTSO-E Transparency Platform

1) $SM = \frac{X}{Y}$ (installed capacity – installed non firm capacity – actual firm generation – outages – balancing reserves)
load

Supply Margin indicates the "non-generating available firm capacity with respect to the actual load".

In Belgium, the Supply Margin was low, but still sufficient to meet the increased demand. Germany faced low wind and solar feed-in, which was replaced by fossil fuel generation. The demand could thus be satisfied without imports.

The Supply Margins for eastern European countries were not as low as in western European countries during the core cold weather period. Due to extremely low temperatures, Bulgaria experienced high unavailability of coal/lignite and hydro generation.

Supply in Romania was characterised by low RES and low levels of hydro substituted by switching to oil, which caused a continued price increase. As in Bulgaria, problems with coal transport also played a role in the utilisation of power plants, which had an impact on market price.

Greece faced a gas shortage and had to increase the hydro reservoir generation and oil production, which drove up the wholesale price. Several outages were reported during the core period of the cold spell.

The analysis shows that in the eastern European countries considered, the supply of electricity generated from coal and gas was an issue.

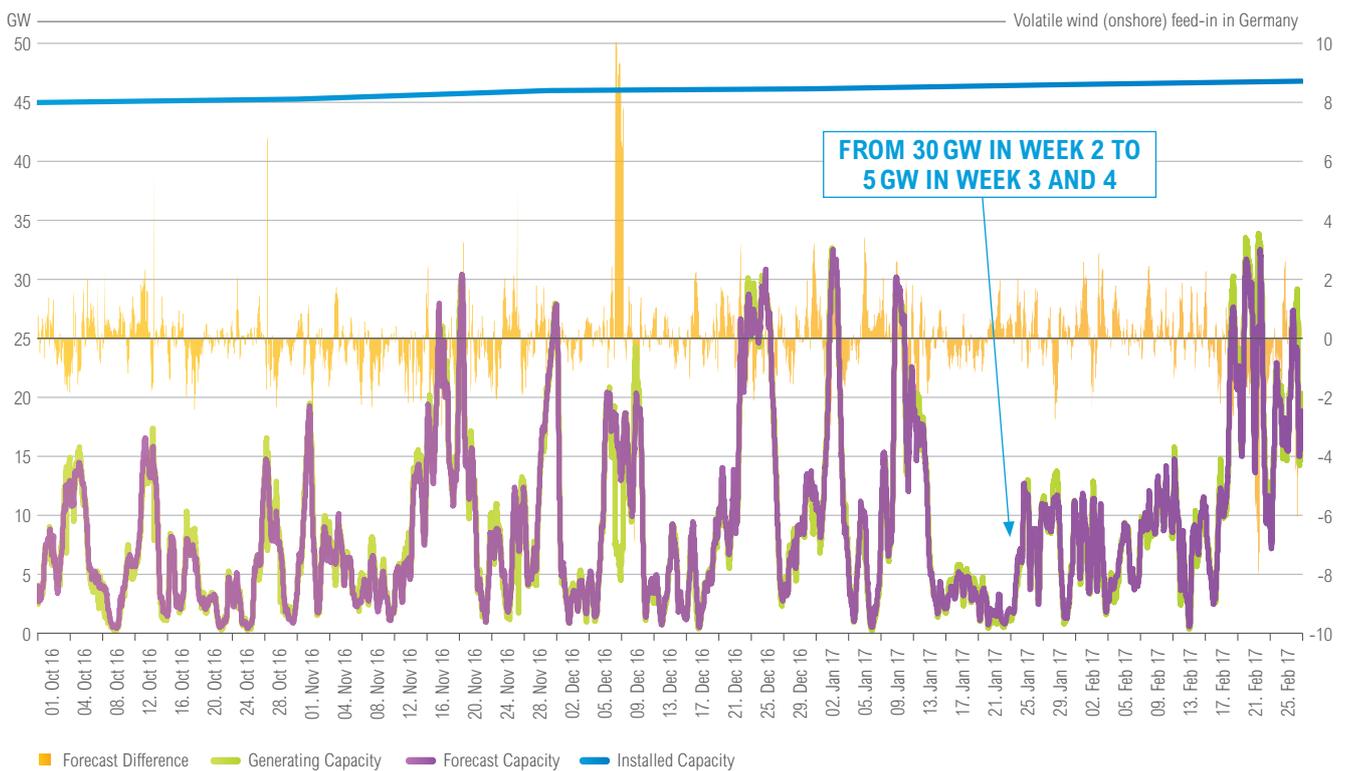


Figure 4: France: Volatile wind (onshore) feed-in in Germany; Source Data: ENTSO-E Transparency Platform

4. ELECTRICITY PRICING

In mature western European markets, prices clearly signalled the scarce situation and behaved as expected. Hourly spot prices of more than 100€/MWh were observed regularly in weeks 3 and 4 in all the countries considered. According to the data available, misbehaviour of market participants could not be observed. However, an assessment of market abuse was not within the scope of this study.

For the western European countries, except Germany and the Netherlands, wholesale prices converged strongly in January 2017. In many of the hours, the spot price in Germany was significantly lower, indicating constraints at the border. Without constraints, prices would have converged during the cold spell. By the end of the cold spell period (February/March), the prices converged again across the countries considered. Figure 5 shows the bidding curves for France between 9h and 10h over the last two Tuesdays in

January 2016 and 2017. The price elasticity of the hourly supply curve differs strongly. In January 2016, around 15 TWh was traded at a market clearing price of 40€/MWh. If the same amount of energy had been traded in that hour on 24 January 2017, the supply and demand would not even intersect. The traded volume in 2017 was only 11 TWh at a price of 155€/MWh. Marginal increases in that demand volume would have dramatically increased the price.

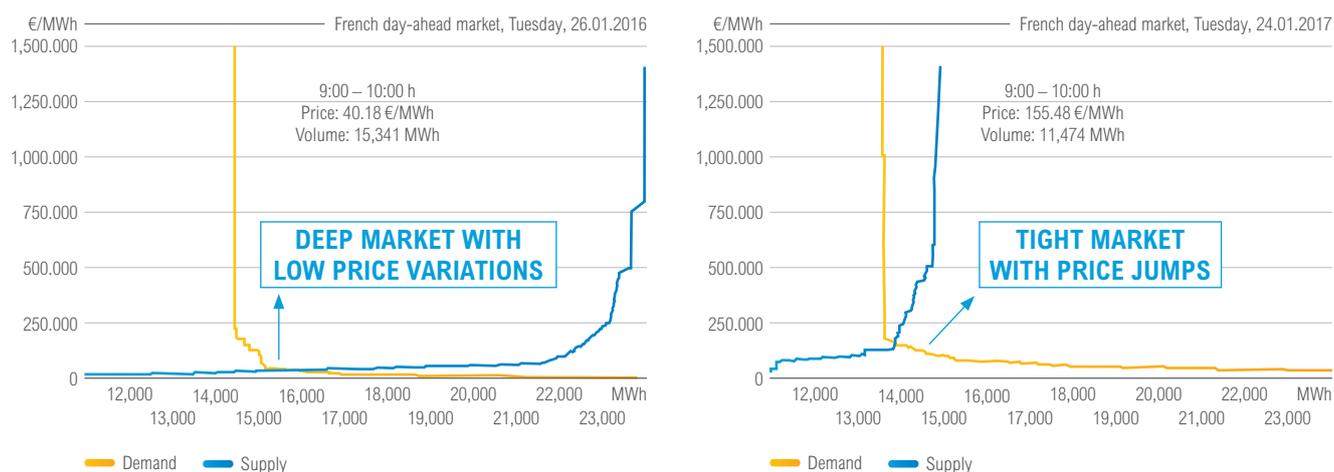


Figure 5: French day-ahead Market; Source Data: EPEX Market Data

Although the cold spell was unexpected, short-term forecasts helped to hedge the risk of volatile markets to some extent. Thanks to short-term (week-ahead) forecasts, market participants could anticipate a scarce situation. Week-ahead hedging activities in mature markets increased. In France, the week-ahead base load contract rose about 87.5% to 165€/MWh in the second week of January¹⁾. In week 3, peak contracts were traded several times at 325€/MWh. The highest spot price in France reached almost 210€/MWh and was observed in week 3²⁾.

In less mature markets in Eastern Europe, price signals did not always reflect market conditions sufficiently. Bulgaria, Romania and Greece showed a delayed reaction on tight market conditions. Prices started to increase after the core period of the cold spell, after switching to other generation technologies such as oil.

1) Source: Reuters "French baseload week ahead power prices surge"

2) Source: ICIS "France braced for power shortage as big freeze looms"

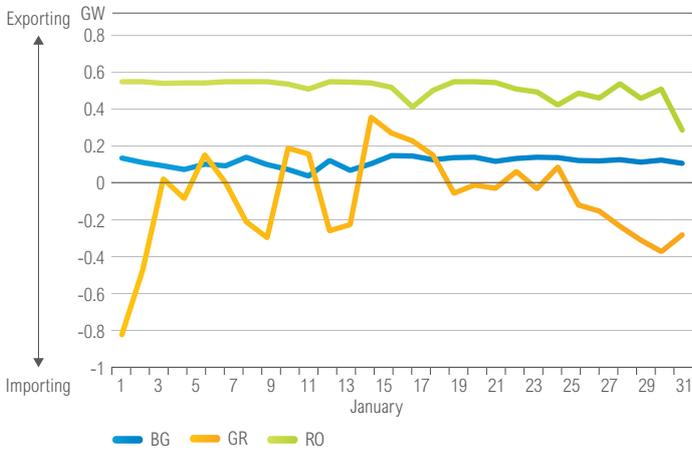
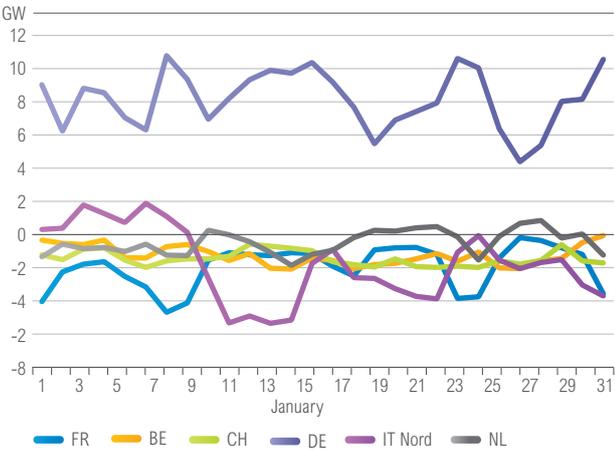
5. MARKET INTEGRATION

Market integration and coordinated actions among TSOs played a key role in dealing with extreme situations. Without cross-border exchanges, some countries, such as Belgium, Italy or Switzerland, might have faced shortages in supply.

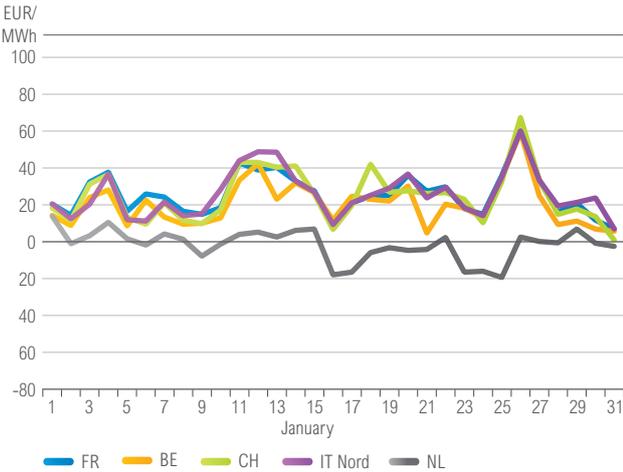
Supply Margin in Belgium, Italy and Switzerland would have dropped below zero if imports had been limited, i.e. imports ensured the security of supply.

France was exporting electricity in January 2016, whereas in January 2017 it relied on imports from Germany, Spain, and GB. At the same time, France exported to Italy and Switzerland.

AVERAGE NET TRANSFERS* AMONG CONSIDERED COUNTRIES



PRICE SPREAD* OVER GERMAN DA PRICE



PRICE SPREAD* OVER BULGARIAN DA PRICE



* For definitions of key figures see appendix

Figure 6: Overview supply conditions; Source Data: ENTSO-E Transparency Platform

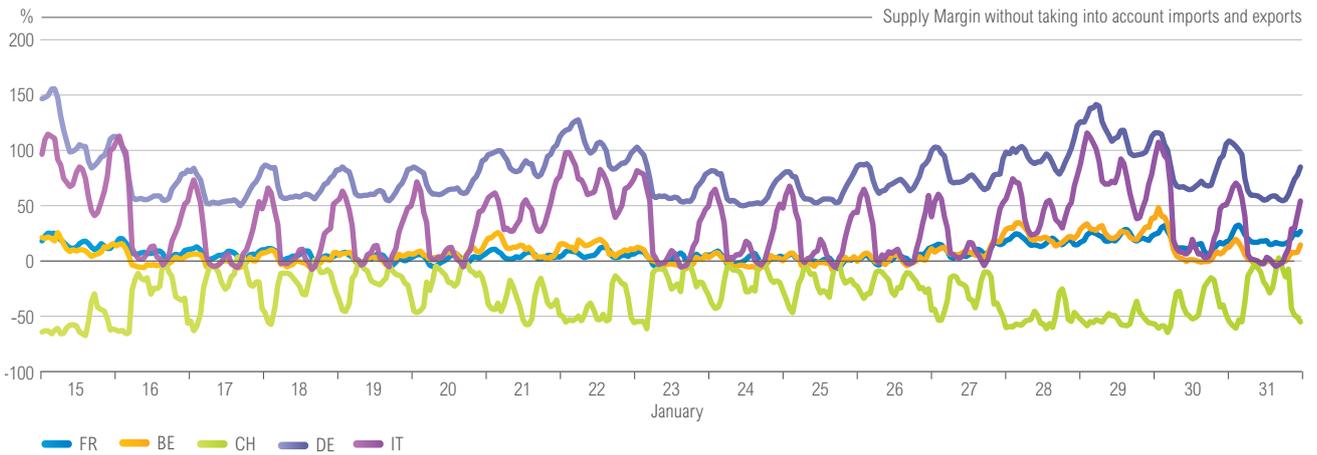


Figure 6: France: Supply margin without taking into account imports and exports; Source Data: ENTSO-E Transparency Platform

The strong price convergence between France, Italy, Switzerland and Belgium indicates that cross-border capacities were utilized accordingly.

Within the CWE, Germany and the Netherlands showed significant price spreads over France and Belgium in certain time periods. Price spreads, as an outcome of FBMC, indicate some limiting factors in the grid either within the bidding zone or cross-border. The exact cause of limitations in exports could not be identified with the data available.

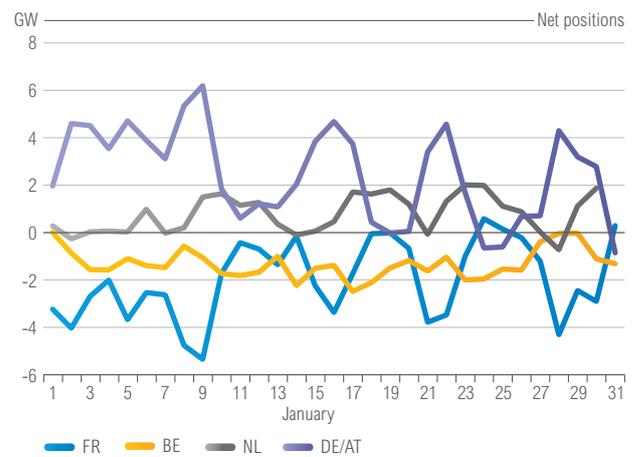
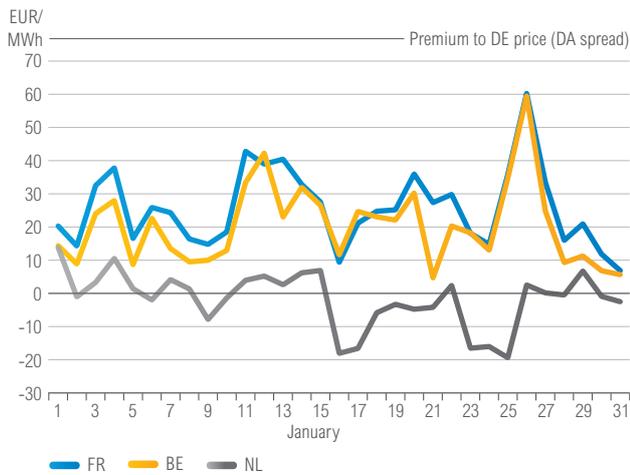


Figure 7: Results of FBMC within CWE; Source Data: ENTSO-E Transparency Platform

Bulgaria imposed a long-term export ban beginning on 13 January. It caused price deviations from neighbouring countries. While prices in Bulgaria stabilized, prices in Romania and Greece started to increase. Price spreads grew continuously throughout January 2017.

Acting on national interests, for example by implementing export bans, can lead to welfare losses in inter-connected

markets. Protectionism, through cutting exports, has the effect of lowering prices (i.e. higher consumer surplus) in the exporting bidding zone, but increases prices (i.e. lower consumer surplus) in importing bidding zones. At the same time, this can lead to lower producer surplus in the exporting bidding zone and higher producer surplus in the importing bidding zones. Furthermore, the grid capacity value drops to zero.

6. SYSTEM BALANCE

During the cold spell, system balance reserves were not activated to their limits (data are lacking for Eastern European Markets). This is a good sign as the market did not rely on the balancing system even during this scarce situation.

Generally, the imbalance price followed the wholesale price in the mature markets, which gave the right incentive for the market participants not to rely on the reserves of the TSOs.

Nevertheless, the negative imbalance volume dominated during the cold spell period in France, Germany, Belgium, Switzerland and Italy.

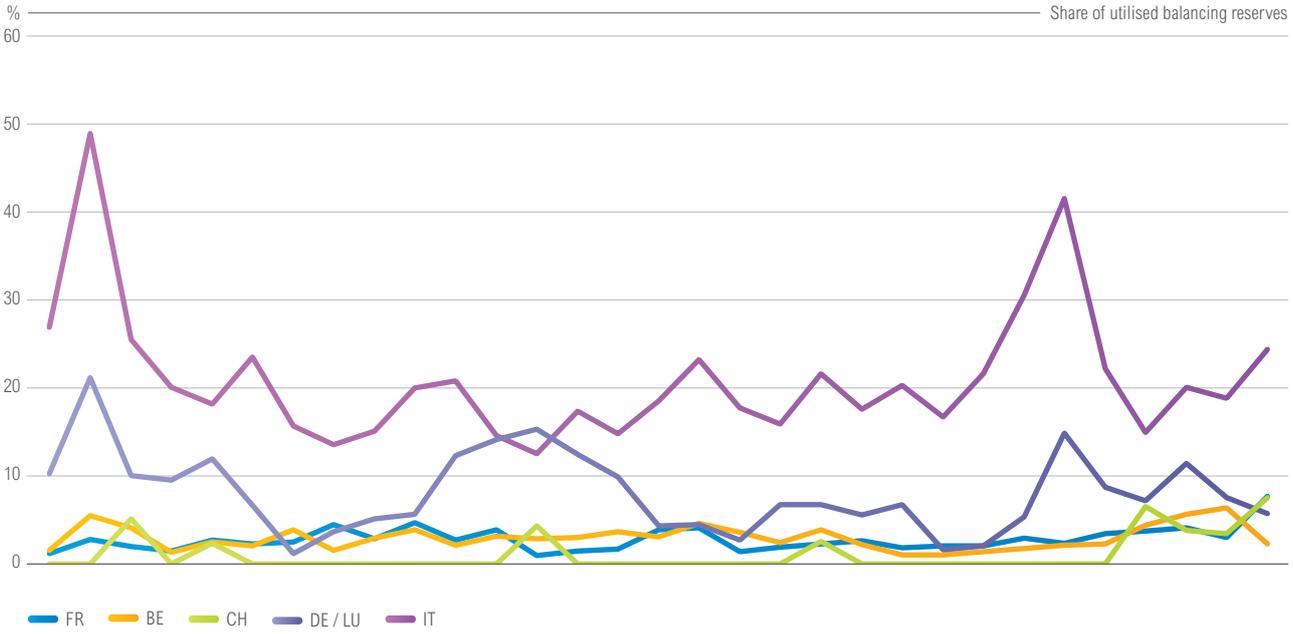


Figure 8: Share of utilised balancing reserves; Source Data: ENTSO-E Transparency Platform

7. RECOMMENDATIONS

MARKET DEMAND

- » Further development and coordination of European forecasting measures (e.g. week/intraweek forecasts) and information provision to market participants will help manage extreme situations. Some RSCs are already planning to introduce such further improvements.

MARKET SUPPLY

- » Supply adequacy, taking into account cross-border activities, has to be monitored. In case of inadequate supply conditions, further measures, such as reserves or capacity markets, are needed.
- » One measure to deal with short-term supply and demand conditions could be the introduction of a day- and week-ahead forecast of the Supply Margin by applying data available to the TSOs and publishing that forecast on the ENTSO-E Transparency Platform. This will facilitate all market participants to efficiently hedge positions and strengthen the forward markets.

ELECTRICITY PRICING

- » Further enhancing transparency and unconstrained price formation will improve financial market liquidity and the conditions for investments. These measures will contribute to helping the market participants.



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