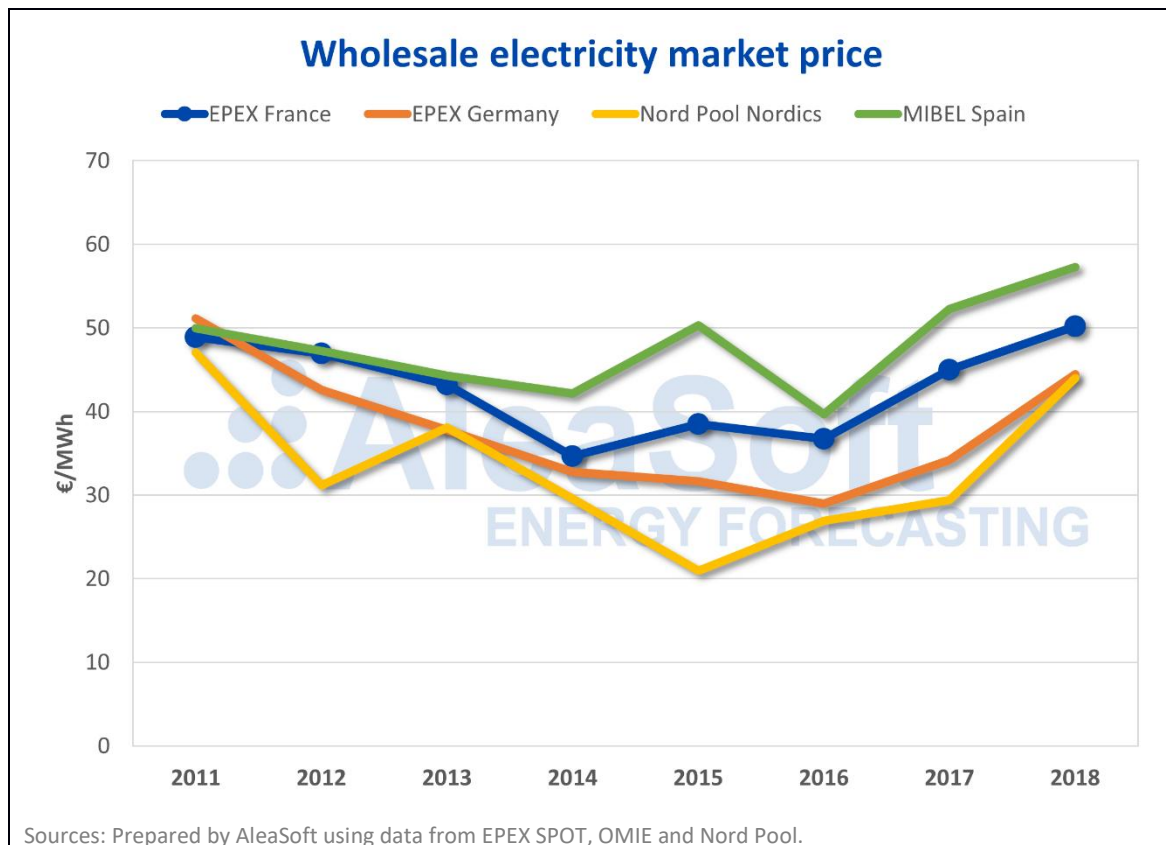


EUROPEAN ELECTRICITY MARKETS PANORAMA: FRANCE

AleaSoft, March 12, 2019. France is a country that bases the security of its supply on nuclear production. Just wanting to halve the share of nuclear production in the electricity mix is already a major challenge that will test the country's energy transition.

As already discussed in a [special article by AleaSoft on the German electricity market](#), Germany and France are the two main electricity markets in Central Europe. Both are large markets with large production that export electricity to all the countries around them, and with that, they usually set the lowest prices in the markets of the Central-West of the continent. But, as mentioned in the special article, Germany and France have a very different energy mix. While Germany has a lot of renewable production and covers its thermal gap mainly with coal, France generates three quarters of its electricity from nuclear energy.

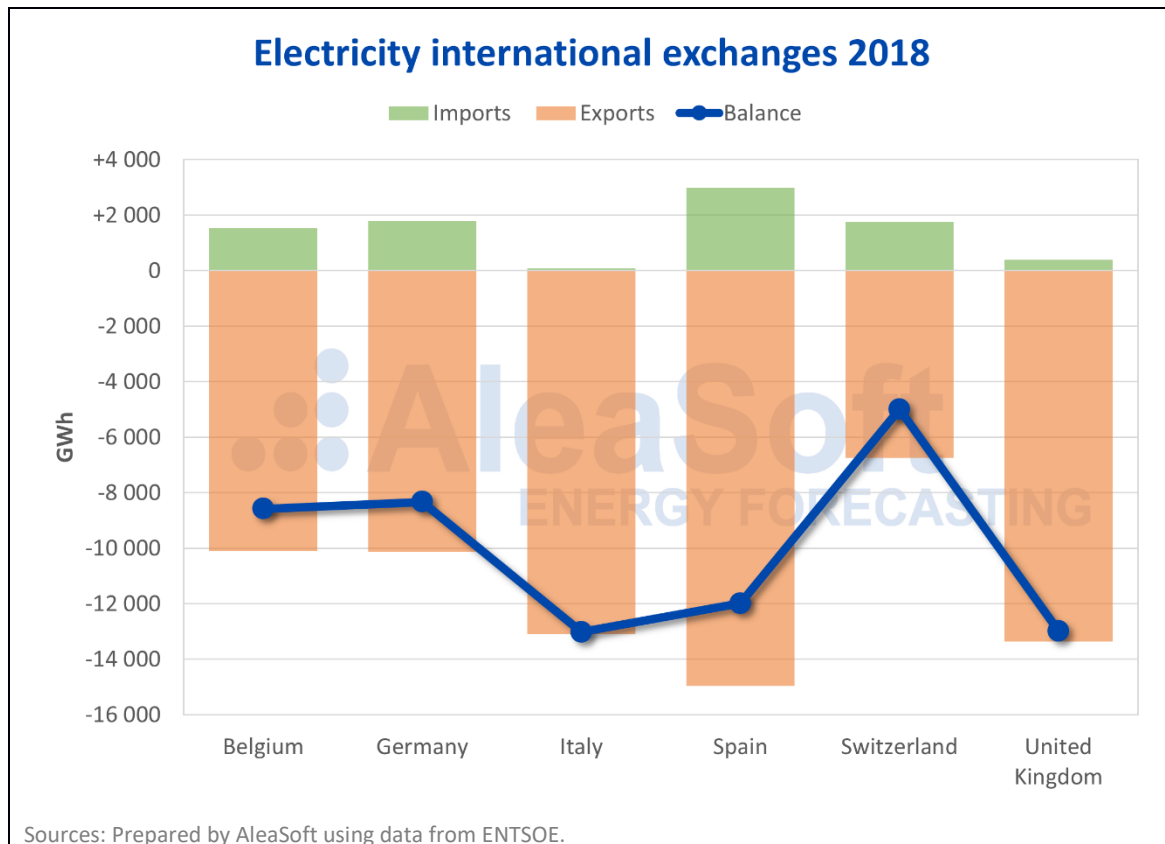
The price of the French electricity wholesale market **EPEX SPOT** in recent years followed the trend of the rest of the European markets. During 2018, the average market price was 50.20 €/MWh, with a rise of 12% compared to 2017, and an accumulated increase of 37% since 2016. According to **AleaSoft**, the upward trend of the price in the French market shares the causes with the rest of European markets, basically the rise in thermal generation cost due to the increase of the price of gas and coal and the CO₂ emissions rights. Since 2016, the price of **EUA CO₂ emission rights** multiplied by five, and between 2017 and 2018 the price of **API 2 coal** increased by 10% and that of **TTF gas**, by 32%.



The price of the electricity market in France has been characterised by suffering several **nuclear crises** in recent winters that have put security of supply at risk and prices skyrocketed in the electricity market. Security problems in a large number of French reactors caused the shutdown of half of the nuclear park coinciding with cold snaps and electricity demand peaks. The most serious crisis was the one of January 2017 when the system's stability was jeopardised and the risk of blackouts was present. The hourly prices reached over 200 €/MWh in the French market and dragged half of Europe with them. In the Iberian market MIBEL the prices exceeded 100 €/MWh, values that are unusual in this market.

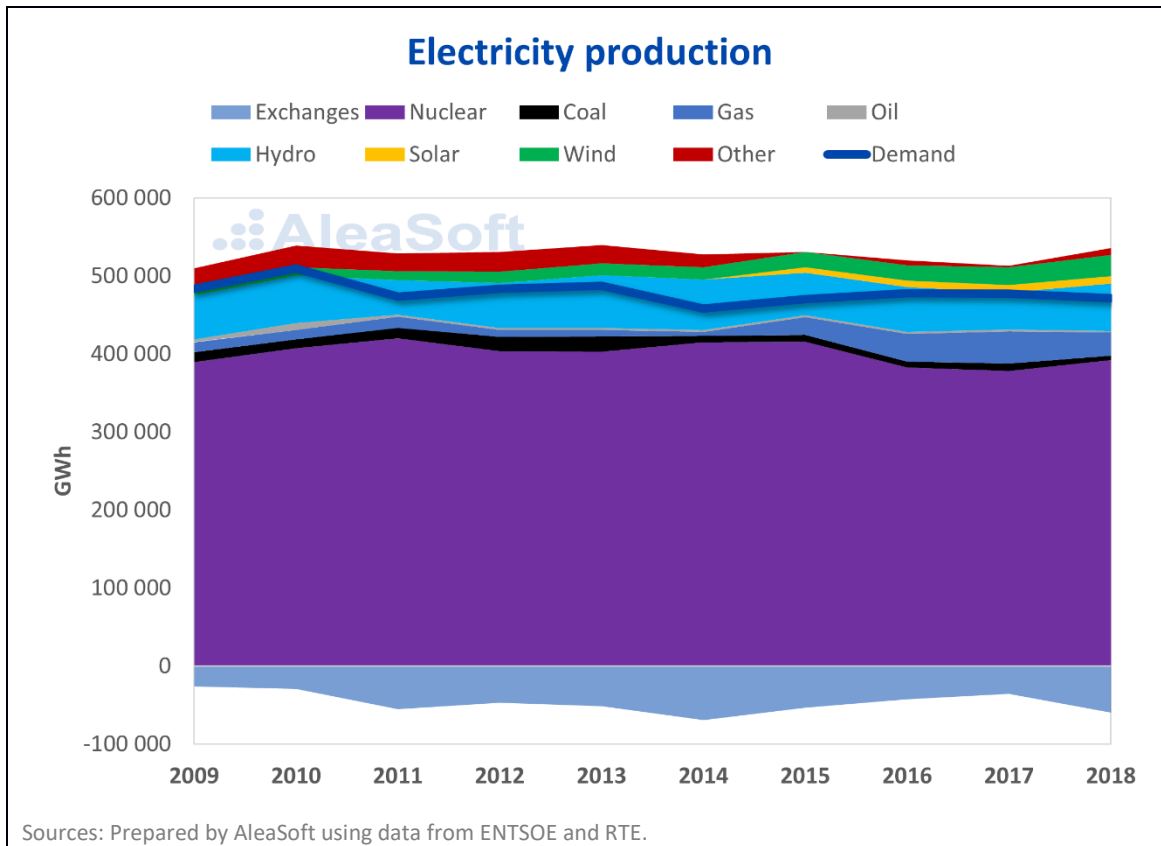
But the maximum historical prices of the French electricity market have been much more severe. On October 19, 2009, the price reached the market limit, 3000 €/MWh, for several hours. At the opposite end, on June 16, 2013, for three consecutive hours, the price recorded was -200 €/MWh. France has traditionally been the most volatile market in Europe. According to **AleaSoft**, the cause is that the large nuclear production leaves a very small **thermal gap** where small variations in its composition can bring large fluctuations in the marginal price. The thermal gap in France is on average less than 10% of total production, while in other countries such as Spain it is around 30%, or 50% in Germany.

As mentioned before, France is a large exporter of electricity. In 2018 the balance of **international exchanges** of France was in the exporting direction with all its neighbouring markets. The French country exported 68 408 GWh and imported 8529 GWh, that is, a net balance of 59 878 GWh exported. The market with the most electricity exchanged with France in both import and export directions was the Spanish market with 2984 GWh imported and 14 963 GWh exported, and a balance of almost 12 000 GWh exported to the Iberian Peninsula.



These numbers place France as the second largest exporter of electricity in Western Europe in 2018 just behind, and very close to, Germany. In any case, we can consider the French market as the market with the largest exporting balance in this part of the continent last year.

The French production mix is very peculiar and unique in the world as the country generates three quarters of its electricity production with **nuclear energy** that covers more than 80% of its demand. Nuclear generation in France is more flexible than in many other countries such as Spain and allows it to work in load-following mode. Since 2016, nuclear generation has a share close to 74% of the mix, but until 2015 the values were notably higher, around 80% of the total national production. This decrease in the share of nuclear energy has been covered by the **gas combined cycles** that gained prominence in recent years and in 2018 represented 5.6% of all electricity production.



The rest of the production mix is completed with **hydroelectric production**, with just over 10%, **wind energy production**, which in 2018 reached 5.0% and an incipient **solar energy production** that does not reach 2%. Production with other fossil fuels, coal and fuel oil, has been reduced considerably in recent years, as renewable wind and solar and gas production increased. In 2018 production with coal had a share of 1.1% and production with fuel oil, 0.4%.

Electricity demand in 2018 fell by 1.2% and follows a clear downward trend during the last decade. Since the peak registered in 2010 of 509 TWh, the demand has already fallen by 7.5%.

The electricity generation park is dominated by 58 nuclear reactors totalling 63 130 MW, 48% of the installed capacity in the French territory. Nuclear power is followed by hydroelectric power with 17%, wind power with 10%, gas plants with 9.1% and in the fifth position, the solar power with 6.3% of total capacity. Overall, renewable power in France represents 37% of the total, and low-emitting technologies power reaches 85%.

Precisely the fact of having a lot of nuclear power and an electricity mix with very low CO₂ emissions is probably one of the factors for not having already a renewable revolution in France as in most of the surrounding countries. Unlike in Spain or Germany, in France there is nobody talking of **nuclear shutdown**, because a complete nuclear shutdown is unthinkable and impossible in the medium and long term.

The challenge that the French **energy transition** is facing is enormous. Replacing a base load production, such as the nuclear production, with renewable production, which is intermittent, is complicated if it is not desired that CO₂ and other greenhouse gas emissions increase due to the necessary increase in the thermal production backup. The French government plans are to reduce the participation of the nuclear energy in the mix down to a 50% share in 2035, which would mean shutting down 14 of the current 58 reactors, but with the commissioning of a new reactor in the Flamanville power plant.

Meanwhile, renewable production should increase from the current 20% to 40% by 2030. To achieve these goals, it is planned to increase hydroelectric power, but also mainly wind power, both onshore

and offshore, and solar power. But, according to **AleaSoft**, the increase of the **energy efficiency** and the reduction of the demand are going to be indispensable for the success of the French energy transition.

Source: **AleaSoft Energy Forecasting**.

Keywords: **energy transition, energy efficiency, wind energy, hydroelectric energy, nuclear energy, nuclear shutdown, gas combined cycles, electricity demand, international exchanges, nuclear crisis, thermal gap, EPEX SPOT, EUA CO₂ emissions rights, API 2 coal, TTF gas.**