# OLIVIER APPERT

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Now we will hand over to Olivier Appert for the subject of the scarcity of electricity.

**Olivier Appert**

Thank you for giving me the floor. The security of supply of electricity is becoming a highly topical issue. There were major blackouts in California in August 2020 and more recently in Texas in February 2021 and the European network was subjected to strong tensions last year following a problem of interconnection between Austria and Germany. There were power cuts for several hours in London in mid-2019 and the European network was put under pressure last January, on January 8, following the technical incident in Croatia that split the European synchronous grid in two. RTE, which is the French DSO, had to take all measures necessary to manage the industrial demand response and even issued recommendations to the final consumers to limit their consumption.

What are the challenges to ensure security of supply? In fact, the power system has to balance supply and demand in real time everywhere around the network, taking into account the fact that electricity storage is difficult and very expensive, especially on a large scale. The grid everywhere has been constructed with a top-down approach. Electricity is produced by large thermal (coal, gas nuclear) plants and delivered to the final consumer through high-voltage transport and distribution networks. This makes it possible to deal with the variable supply and demand over time in summer or winter, at day or night. However, the electric power system has been subject to considerable changes over the last 20 years following a major shift in policy in terms of economics and regulations. The electricity mix is developing fast with the move towards renewable energy: but renewable energy is by nature intermittent and does not have the inertia of thermal and nuclear power stations. Fewer emissions running in the system can generate a drop in frequency and voltage and lead to a significant supply/demand imbalance.

Another important factor is that grids are being decentralized with a sharp rise in self-consumption, creating new balance issues in the grid at local levels, which the distribution system operators have to deal with. For the first time in Europe, renewable energy became the first source of electricity supply, and it was the case specifically in Germany, Spain and the UK. Despite the pandemic, the growth of renewable energy remained strong. The market share is today over 38%, compared to 34.6% in 2019, and the share of fossil fuels in the electricity mix dropped below 37%. That is therefore an important increase of renewable

energy. However, on the other side, the European electricity sector will experience a structural decline of the flexibility of the network due to the growth of the market share of wind and solar, which are intermittent, as I have said, and do not bring the inertia of the thermal power plant which contributes to the stability of the grid.

On top of that, the decommissioning of many dispatchable power plants will happen in the next few years. I remind you that 22 gigawatts of thermal power plants – nuclear or coal – will be closed in Germany. Up to 2025, 6 gigawatts of nuclear plants will be closed in Belgium and 21 gigawatts of coal power plants will be closed in France, the UK, Spain and Italy. Therefore, the security of supply of the European electricity system will be at risk in the next few years and we should not underestimate the risk of a blackout.

Two years ago, the IEA highlighted this challenge everywhere in the world in the context of an increase everywhere of the share of electricity in the electricity mix. In terms of the adjustment required in different regions due to the variability of demand, and not dispatchable supply, for the time being, flexibility mechanisms in Europe can cope with the need of most European countries, thermal power plants and hydro representing the bulk of flexibility, but that will not be the case in the future. In fact, huge investments will be required to develop the flexibility of the electricity system. There are different solutions, but there is no silver bullet. Adjustment of conventional production is still the basic response. Interconnection is another solution for flexibility. In Europe, renewable energy fluctuation may be partly compensated by load balancing. This need for interconnection exists between European countries, but also within each country. Along with the high cost of high-tension lines, local acceptance is an issue. For example, in Germany, which has a considerable need to connect wind turbines in the north to the factories in the south of the country, they had only succeeded to set up 36 kilometers of high-tension lines by 2019. Another challenge is periods of cold and anticyclone weather all over Europe.

Storage technologies are characterized by different parameters in energy capacity in the charge and discharge time. The potentials of technologies are at different stages of maturity. For the storage of large quantities over a long period, the obvious solution is pump energy transfer stations. However, there are limited development potentials in Europe. The lower cost of lithium-ion batteries makes them a solution to compensate for the fluctuation of renewable energy and maintain frequency, but their storage is limited to only a few hours. Several solutions are being considered for long-term storage, but they are still very immature, costs are very high and no business model exists for the time being given that price signals on the market are too short term and too partial to provide any incentive. Capacity mechanisms aim to make up at least part of the lack of long-term signals. Demand response management has been developed at the industrial level in Europe for many years. The potential could be increased, but that would require costly investments from the industry and adapting the design of industrial tools, which is called flexible design.

Domestic hot water tanks are the primary means of managing demand response, but it is only for the very short term. There are other ways to improve the demand response for the final consumer and suppliers may help to manage to control at a distance heating, heat pumps and, in the future, electric vehicles via what we call vehicle-to-grid technology, and this may increase the demand response from the final consumers. However, on top of that, it will be

necessary to reconsider the regulation of the electricity sector in order to provide adequate long-term price signals which are essential to facilitate those investments in generation, in the network, in storage and in demand response. In a nutshell, in the context of a growing share of electricity in the energy mix, security of supply will become an increasing challenge and coping with this challenge will require a huge investment, but for the time being there is no clear price signal to develop these investments.

**Arnaud Breuillac**

Thank you, Olivier.