Union Française de l'Électricité

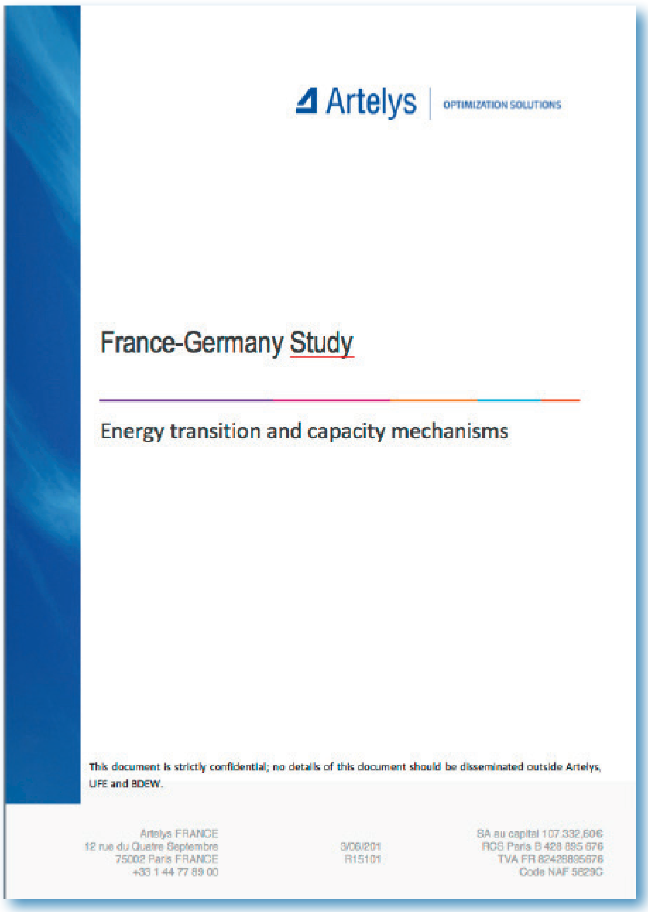
German Association of Energy and Water Industries

France-Germany Study

Energy transition and capacity mechanisms

A contribution to the European debate with a view to 2030

Executive Summary


Artelys | OPTIMIZATION SOLUTIONS

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A FRANCO-GERMAN INDUSTRIAL PARTNERSHIP TO PREPARE TODAY FOR TOMORROW'S SECURITY OF ELECTRICITY SUPPLY

Ongoing ambitious and necessary energy transitions in Europe are questioning the security of electricity supply. With the steady growth of intermittent renewable energies, weather will play an increasingly important role being itself a source of uncertainty.

Aware of this change, UFE and BDEW, professional associations of the **two largest power markets in Europe, together representing over a third of the electricity consumed and produced in the European Union,** have decided to join their efforts to carry out a study on security of supply in a 2030 energy transition context.

Industrials from either side of the Rhine share two strong convictions that have deeply shaped the work performed in this study. First, in years to come, security of supply will be tackled more and more transnationally at the regional level and France and Germany will have a key part to play in this regard. Indeed, the two countries are at the core of the European Energy Union. Because of their central geographical situation, they are a bridge between Western and Eastern European countries and between Southern and Northern Europe. Assessing the level of security of supply reached in 2030 at the Franco-German level – as it is done in this study - is therefore a meaningful approach. Second, in today's liberalized power sector, security of supply issues cannot be discussed without considering market incentives. In the past, the level of installed capacities and their technical lifespan have been considered as key indicators for security of electricity supply. From now on, the level of security of supply delivered to European citizens will be more and more the result of decentralized investments and decommissioning decisions taken by market parties. These decisions are very much impacted by the power market design.

In this context, this **quantitative study** aims at answering two essential questions at the Franco-German level :

- **In 2030, will security of supply in an energy transition context be ensured at the desired level, by an energy only market - even an improved one (=without price cap[1])? What will be the effects of introducing a capacity mechanism, from the investor's point of view? From the community's point of view?**
- **What will be the consequences of a coordinated introduction of similar capacity mechanisms in France and Germany?**

Proactive hypothesis have been taken for 2030 in order to reflect a low carbon electricity system and a major part for demand side management (DSM):

- **40% renewables in both countries**
- **50% nuclear in France**
- **An important DSM volume: 11 GW in France (= 4 times the current volume) ; 7,5 GW in Germany (= 5 times[2] the current volume)**
- **An optimized France-Germany interconnection: 7GW (=doubling of 2015 capacity)**

Thus, by modelling the investment behavior of market parties in several market frameworks and by assessing what would be the consequences of such market designs in terms of security of supply for the two countries, this study delivers unique insight for the current European debate on the electricity market design reform.

1. Today, in France and in Germany, prices in the electricity day ahead market cannot exceed 3000 €/MWh.
2. The current DSM volume in Germany is supposed to be 1.3 GW.

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2030: WEATHER RISKS CHALLENGE INVESTMENT DECISIONS

In 2030 and beyond, investments in conventional generation and DSM will still be needed but investment conditions will be uncertain. With the growing importance of renewable energies (RES) in European electricity mixes, weather uncertainties will play an even greater role than today for the power sector. Not only will demand continue to highly depend on temperatures, particularly in France, but generation from renewable assets will also vary greatly because of the variability of wind and solar resources. As a consequence, the net demand to be satisfied by conventional plants and DSM will show very random evolutions. From one year to another, the net peak demand will be very different. Similarly, the number of hours during which back-up assets will be needed and scarcity prices occur will also fluctuate significantly. Many capacities will not be used to their full extent or not at all in ordinary years, thus playing an insurance role.

Unfortunately, the majority of studies performed on market-design and security of supply issues neglects this fundamental weather dimension and therefore come to incorrect conclusions. To avoid this pitfall, this weather dimension has been fully integrated in this study and 50 representative weather scenarios have been used (referring to 30 years of historical data). Each of these scenarios represents possible demand and RES generation time series for all the hours of a given year. They illustrate the link between temperature, wind and solar radiation, and therefore the link between consumption and RES production. They clearly show that, in 2030, weather uncertainties would be one of the main stakes that the power system will have to cope with.

By integrating this weather uncertainty, the study evaluates whether actors are rather willing or reluctant to invest, depending on the market design studied :

- **Energy only market[3] (EOM) with de facto price cap**
- **Energy only market (EOM) without price cap**
- **Energy market (with or without price cap) + capacity mechanism only in France**
- **Energy market (with or without price cap) + capacity mechanisms in France and in Germany**

For each market design scenario, the model simulates investors' behaviors resulting into a new power mix with specific characteristics, namely:

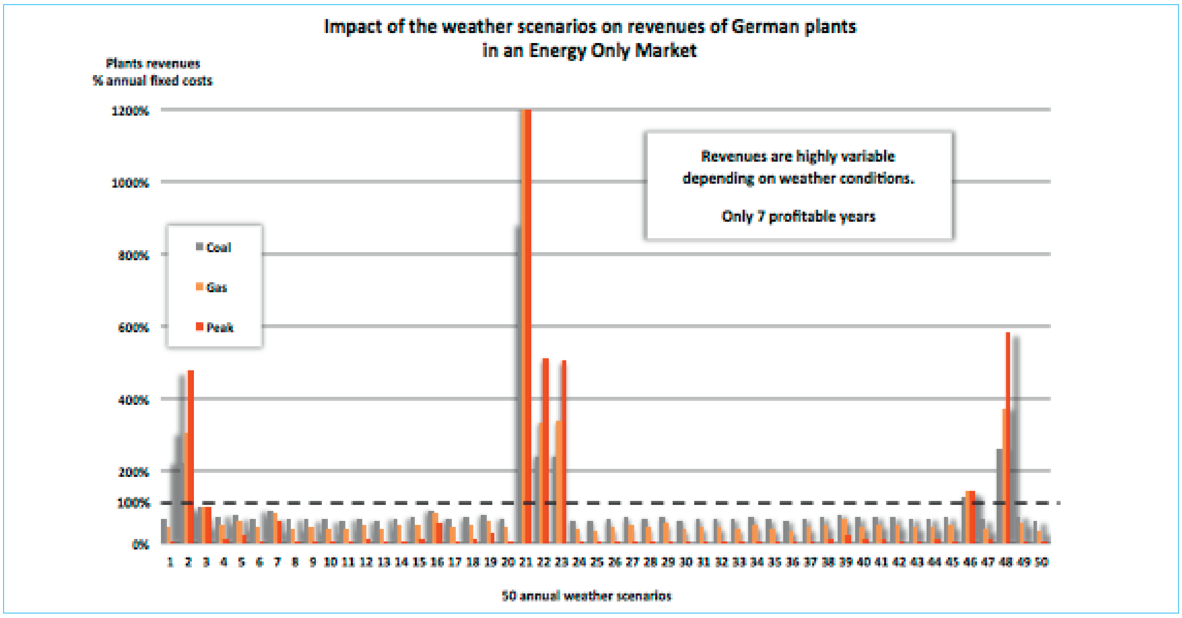
- **the level of security of supply**
- **the overall economic efficiency**
- **the cost for consumers**

FREE PRICING IN AN EOM (=WITHOUT PRICE CAP) UNABLE TO ENSURE SECURITY OF SUPPLY

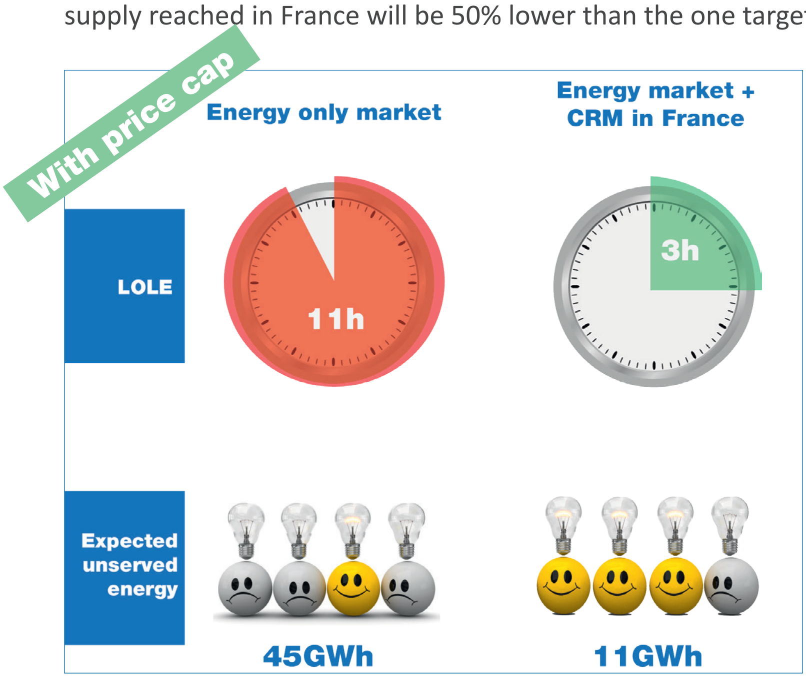
With regard to these ever-growing weather uncertainties, the results of the simulations performed in the study underline that the current energy market framework appears to be maladjusted.

In an Energy Only Market, with or without price cap, generators, in particular peak generators, as well as demand response, need to rely on a few years with high scarcity rents for their plants to recover their costs.

3. The model does not simulate the current market organization since some existing additional schemes haven't been modelled, such as the current reserves in Germany.



Indeed, among the 50 possible climatic years modelled in the study, benefits for market parties would arise in only seven years which would be very profitable. Even if one assumes that price spikes will be socially and politically accepted, this gives rise to two main uncertainties for investors. First: will these tense climatic - and thus profitable - years actually materialize during the lifetime of their assets? Second: when will these years occur? Will it be during the first years following their investments or will it be later? The study demonstrates that because of these uncertainties, investors will find themselves in a very risky environment. For instance, if France and Germany were to rely exclusively on an EOM, peak plants needed to ensure security of supply would bear a risk of 25 % in France and 23% in Germany to recover less than half of the initial investment and a risk of 40 % in France and 39 % in Germany to recover less than 75% of it. This level of risk is unbearable for investors and the study demonstrates that it will result in an overall underinvestment situation and failing to ensure security of supply. As a matter of fact, with just an EOM (free pricing scenario), the level of security of supply reached in France will be 50% lower than the one targeted by French public authorities



Moreover, in addition to this under-capacity situation, market parties will tend to prefer comparatively less risky investments such as baseload assets rather than more risky assets such as DSM and peak plants. DSM would then lack incentives to develop. Thus, **the resulting power mix will not be optimal, neither in terms of overall capacity nor in terms of its composition.**

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A CAPACITY MECHANISM SECURES THE ENERGY TRANSITION

By contrast, the introduction of a (market-wide) capacity mechanism reduces the exposure of investors to the uncertainty associated to weather conditions and consequently remedies the underinvestment shortfall associated with an EOM framework.

Indeed, **by balancing the risks linked to variability of wind and PV production, and to thermo-sensitivity of demand, such a capacity mechanism acts as an insurance mechanism.**

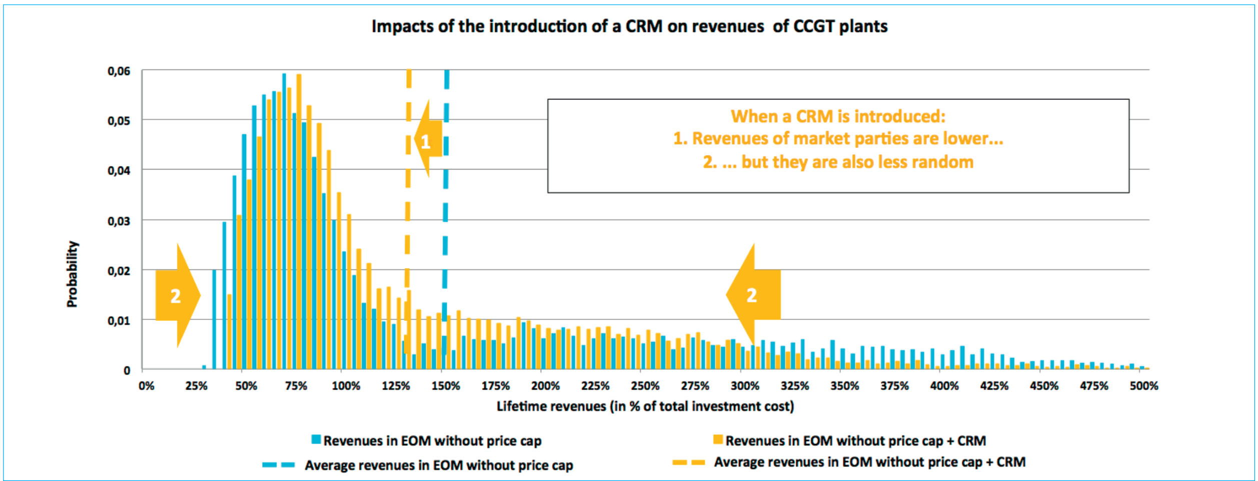
The capacity mechanism provides greater predictability on long term revenues and therefore spurs on investment in generation and in demand response, without discrimination. In doing so, **a capacity mechanism allows to achieve the required level of security of supply** even with a high level of renewable energy. It therefore ensures a safe and sustainable energy transition.

However, such a capacity mechanism does not eliminate the uncertainty on revenues: this mechanism is neither a subsidy nor a long-term income guarantee. Market parties still have to face price and volume risks.

A CAPACITY MECHANISM SECURES THE ENERGY TRANSITION AT A LOWER COST

Contrary to a common belief, adding a capacity mechanism to the energy market leads to cost reductions in the long term:

- **As security of supply is improved, the cost of loss of load is reduced**
- **In comparison with an EOM framework, the investment risk premium is lower with a capacity mechanism. Indeed, producers earn less in average but their incomes are also less random (reduction of the mathematical revenues expectation together with a reduction of their variance – see graphic)**
- **Eventually, in a market design with a capacity mechanism, the electricity mix will be more adjusted and DSM will find new incentives to develop**



The capacity mechanism thus reduces the loss of load expectation and provides security of supply without overcompensating assets.

Introducing a capacity mechanism leads to an improvement of the social welfare in the best case scenario. For instance, **an increase in social welfare of 370 m€ per year can be achieved thanks to the implementation of a capacity mechanism in France, by comparison with an EOM with price cap.** Furthermore, costs do not differ much, regardless of whether the market design is complemented by a capacity mechanism or consists in an EOM without any price cap.

Besides, a capacity mechanism in France leads French consumers to save[4] around 87 M€ on their electricity bills, in comparison to free pricing in the energy only market scenario. The introduction of such a mechanism also benefits to German consumers who save around 82 M€ per year. If Germany were to introduce also a capacity mechanism, French and German consumers would respectively realize additional savings around 180 M€ for French consumers and 225 M€ for German consumers

As a consequence and contrary to conventional wisdom, the introduction of a capacity mechanism brings about a higher level of security of supply thus benefiting consumers without inflicting additional costs and even resulting in gains.

A CAPACITY MECHANISM SECURES THE ENERGY TRANSITION AND FOSTERS FLEXIBILITY AND DEMAND RESPONSE

Our study also shows that a capacity mechanism makes the transformation of the energy system easier. Indeed, complementing the market design with such a tool leads to a mix which better meets the future needs of consumers and issues of the electric system. In particular:

- **a capacity mechanism ensures security of supply of a renewable and low-carbon mix**
- **a capacity mechanism provides incentives for demand response**
- **a capacity mechanism provides incentives for flexible assets**

A REGIONAL COORDINATED APPROACH ON CAPACITY MECHANISMS ENHANCES BENEFITS FOR ALL

A simultaneous introduction of similar capacity mechanisms in France and Germany would result in efficiency benefits for all. It is by far more efficient to deliver security of supply on a bilateral and regional basis rather than on a purely national basis: the total capacity is optimized to ensure security of supply, the structure of the mix evolves as a result of the reduced risk, and last, the global welfare is increased across the whole zone.

Compared to the scenario were a capacity mechanism would be introduced only in France, in complement to the electricity market without price cap, the introduction of coordinated capacity mechanisms in 2030 in France and in Germany (provided they respect some fundamental principles: market-wide, market-based and technology neutral) would reduce the expected unserved energy by 35% for the two countries and would increase additional savings by €405 million per year for both German and French consumers.

To open up this bilateral approach within a wider regional scope and to give a new European dimension to security of supply will definitely enhance these benefit

for consumers :
A cheaper, safer, and sustainable electricity supply

for investors :
A greater predictability and an innovation booster

Benefits for all

for the internal market :
A significant step towards the achievement of a competitive and efficient market in respect of the energy policy objectives

for public authorities :
a guaranteed security of supply for all citizens, at the lower cost

4. These results were computed by comparing risk premiums reduction costs calculated for investments on optimized capacity, to which security of supply improvement gains/losses are added.

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