

AIEE

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Assesement on the first years of functioning of the French capacity mechanism

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A market device introduced to ensure security of supply

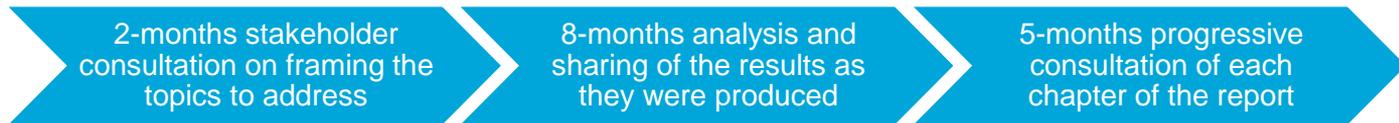
- In France, the economic difficulties met by generation technology (CCGT for example) in the beginning of the 2010s, at a time when the security of supply indicators was deteriorating, triggered the debate on **the imperfection of the “energy-only” market design**.
- This context led to the introduction of a **capacity mechanism, a power market regulatory framework** whose principle was instituted by law in 2010 **to guarantee the French power security of supply within the European internal market of electricity**. The capacity mechanism provides capacity owners with a revenue complementing the income generated by the usual electricity markets. This additional remuneration is designed to maintain existing units necessary for the security of supply or develop new capacities (generation or demand-response) if needed.
- The French capacity mechanism is calibrated so that the **loss of load expectation is lower than 3 hours per year** (this criteria is called “*Reliability standard*”). After years dedicated to decide upon its appropriate design and fine-tune its features with both the national stakeholders and the European authorities, the French capacity mechanism was implemented in 2017.

Context of the study

From January 2020 to June 2021, we led, as RTE experts, an assessment on the actual functioning of this market device, which:

- addresses numerous requests from the French stakeholders (both market players and public authorities, incl. the NRA);
- was **foreseen by the** market rules of the capacity mechanism through a review clause based on a full-fledged overview which aimed at assessing its actual functioning and its efficiency after 3 years of operation.

Stakeholders of the French power system were closely involved in the assessment throughout its elaboration:



- The submitted paper is derived from this work and aim at addressing the following questions:
 - **Addressing the policy objective:** Did the capacity mechanism enable the respect of the security of supply criteria (the actual purpose for its introduction) ?
 - **Economic relevance:** Is the economic value provided by the French capacity mechanism sufficient to exceed the actual cost incurred by its implementation.



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Addressing the policy objective

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Establishing capacity at risk without a capacity mechanism

Determining whether the French capacity mechanism has been useful in reaching the security of supply criteria, requires **reconstituting the evolution of the French power system in a counterfactual situation in which no capacity mechanism would have been in place.**



Input data



Market revenues of existing capacities:

- Revenues from flexibility services (ancillary services, balancing)
- Net revenues from energy markets (revenues less variable costs of production)



Fixed operation and maintenance costs



Model

An **economic viability assessment** was carried out on each relevant technology constituting the French electricity mix, by comparing for each technology the operation fixed costs with all energy revenues perceived.

When costs are perceived higher than revenues, the technology is defined « at risk ».



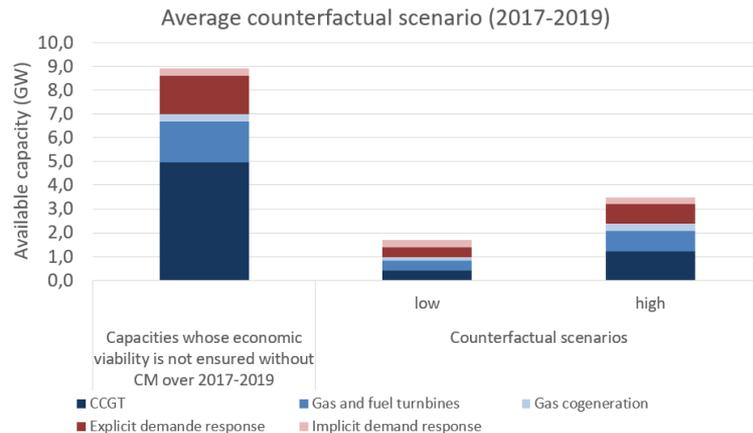
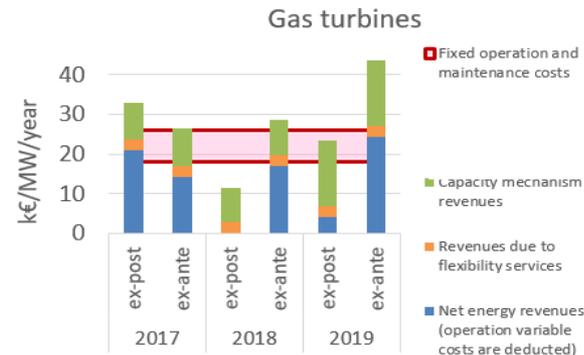
Expected outcome

→ Build counterfactual trajectories of the French power system without CM

→ Based of this mix, conclude whether the reliability standard was respected over the period

Several technologies would have been at risk without a capacity mechanism in France

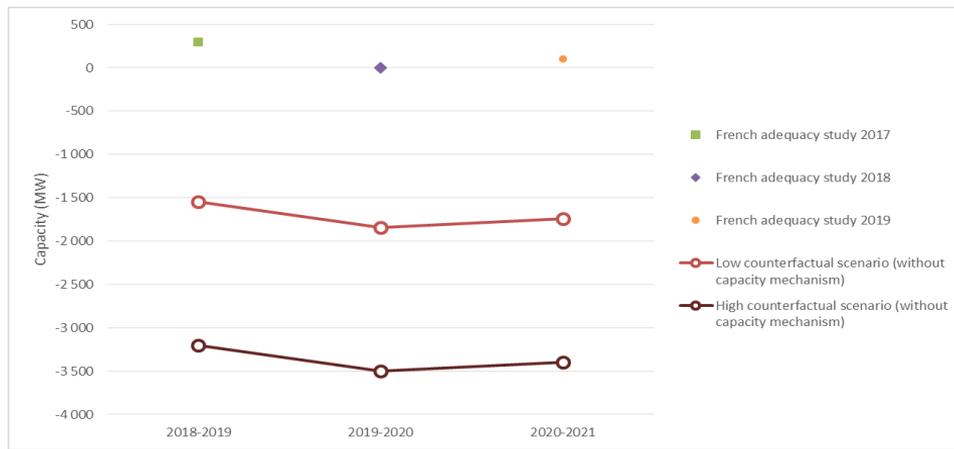
- As an illustration of the results obtained, the economic viability assessment of gas turbines provides that gas turbines hardly covered their costs in 2018 and 2019 without the remuneration of the capacity mechanism (green).
- In details, the analysis concluded that some semi-base (Combined cycle gas turbine) and peak units (mainly gas and fuel turbines, demand side response – DSR) were at risk without capacity mechanism.
- The 2 counterfactual scenarios have been established considering that the portion of mothballed or decommissioned capacities would have been higher the larger the deficit between electricity market revenues and functioning costs or the more substantial the share represented by the capacity mechanism revenues.
- Two counterfactual scenarios resulted from this analysis, representing that, in the absence of capacity mechanism, the French power system would have been deprived of between 1,8 GW and 3,5 GW of available capacity over the 2017-2019 period.



Counterfactual scenarios resulting from the analysis

The CM has been indispensable to fulfill the French reliability standard during its first years of operation

- The gradual decommissioning of 10 GW of thermal power plants since 2010 resulted in a French power system with no margin regarding the reliability standard (3 hours of loss of load expectation in France) from winter 2017-2018 onwards. In the presence of the capacity mechanism, the French security of supply level as remained slightly above the security of supply criteria, according to yearly adequacy studies led by RTE [Bilan Prévisionnel, RTE].
- However, in whichever aforementioned counterfactual scenario without capacity mechanism, the reliability standard would not have been met over the 2017-2019 period (between 5,5 hours and 10 hours of loss of load expectation).
- **The French capacity mechanism was thus crucial to reach the policy objective for which it was instituted:** it enabled to reach the reliability standard which would not have been the case in an “energy-only” market design. Nevertheless, it did not overreach this target as it did not delay the closure of the fuel power plan (2017-2018) – which were no more useful to security of supply.



Evolution of capacity margins in France with and without capacity mechanism

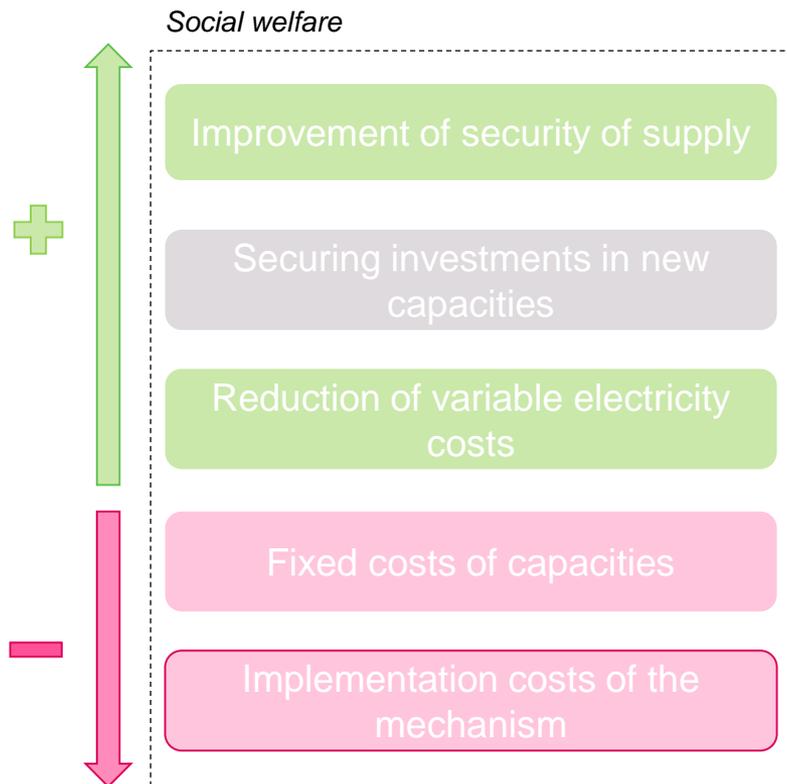


02

Economic relevance



A cost-benefit analysis to determine the economic relevance of the French CM



- By reducing the Energy Not Served (or undistributed energy) which create socio-economic cost (detailed next slide)
- Neglected in the current economic analysis due to the low volume of new generation capacities
- Increased availability of semi-base capacities which reduces the use of more expensive peak generation resources
- Fixed costs of capacities that would not be maintained without capacity mechanism
- Total cost incurred by all the stakeholders for the implementation of the mechanism

To our knowledge, this is the first economic assessment of a capacity mechanism carried out ex-post taking into account the implementation cost

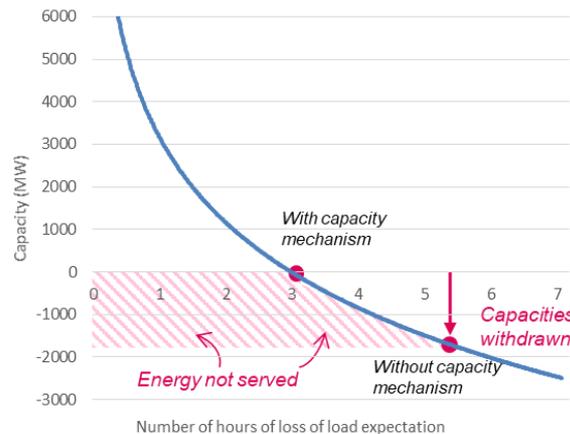
Methodology to determine the gain associated to the improvement of the security of supply

1 Assessing the capacity maintained by the capacity mechanism

2 Estimate the additional undistributed energy associated with the loss of these capacities in counterfactual scenarios

3 Translate this volume of energy not served into socio-economic value using the Value of Lost Load (VoLL)

Done in the previous part : between 1,8 GW and 3,5 GW would have left the French electricity system without the capacity mechanism



Link between capacity and undistributed energy

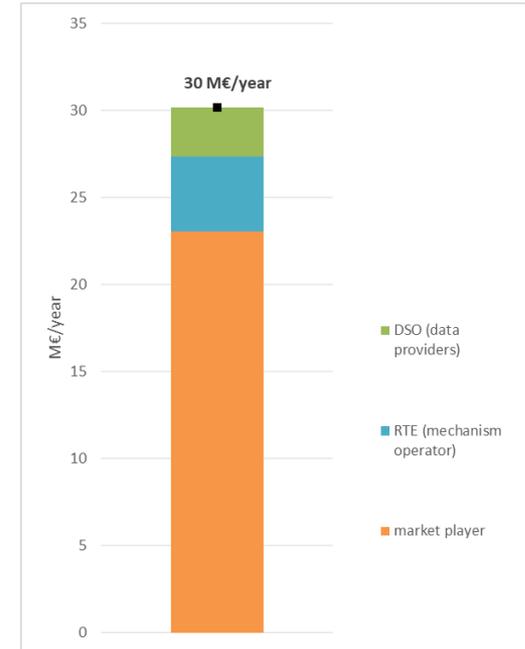
The capacity mechanism have reduced the expected energy not served by between 6 GWh/year and 20 GWh/year

The VoLL is estimated at 20 000 €/MWh in France

The socio-economic gain associated to the reduction of energy not served is estimated between 150 and 400 M€/year

Implementation cost of the french capacity mechanism

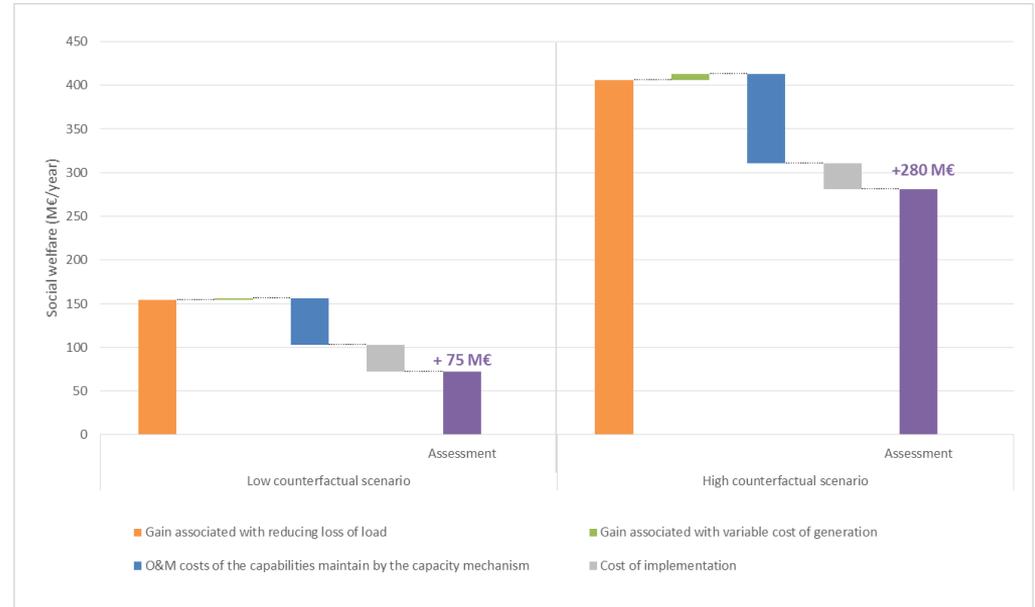
- The French capacity mechanism is decentralized, which means that all players in the electricity system play an active role in it. In particular, each bears implementation costs linked to the deployment of the capacity mechanism since 2017
- These costs were estimated on the basis of an internal study concerning the costs of RTE and surveys for other stakeholders
- In order to have an exhaustive estimate of the total costs borne by all the actors and thus guarantee the robustness of the conclusions of the cost-benefit analysis, for the actors who did not respond, an extrapolation was carried out
- The cost-benefit analysis carried out thus takes into account all of these operating and investment expenses linked to the operational management of the mechanism.
- The total cost incurred by all the stakeholders (suppliers, generators, DSR and network operators) for the implementation of the mechanism is estimated at around 100M€ at the end of 2019, or around 30M€/year (due to the existence of investment costs, amortized on more than three years).



Annualized implementation costs borne by the actors of the capacity mechanism

The CM has brought a net social welfare gain

- Taken into account other benefit and costs (from social welfare point of view) of the implementation of the capacity mechanism in France :
 - Gain associated with the variable cost of generation appears negligible (~10 M€/year)
 - Additional cost corresponding to the fixed costs of capacities that would not be maintained without capacity mechanism is estimated between 50 and 100 M€/year
- Although the implementation costs of the capacity mechanism are not negligible, they appear to be lower than the benefits brought to the power system and consumers (in terms of security of supply according to an insurance logic).



Result of the cost-benefit analysis ex-post of the French capacity mechanism

- The capacity mechanism creates value for the social welfare, between 75 M€/year and 280 M€/year
- These net benefits provided by the capacity mechanism turn out to be less than those anticipated ex-ante which were estimated at 400 M€/year