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Analysis of the European energy system

Policy Brief

Capacity remuneration mechanisms in Europe

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Abstract

The introduction of capacity remuneration mechanisms is being intensively discussed among European decision makers, as concerns about generation adequacy in the electricity sector are growing among stakeholders. Different mechanisms have already been implemented or will be introduced in the near future in several European countries. This policy brief focuses on selected experiences in Belgium, France, Spain, Sweden and the UK. The implementation of capacity remuneration mechanisms yielded mixed experiences so far, thus making them subject to repeated adjustments. Although the mechanisms seem to have achieved their goal of purchasing the targeted capacity volumes in different auctions, their efficiency has not yet been sufficiently assessed. While on the one hand some mechanisms are removed again (eg. capacity payments in Spain or the strategic reserve in Sweden), on the other hand new mechanisms are introduced (e.g. decentral obligation in France). The introduction of capacity remuneration mechanisms, however, should go alongside a Europe-wide coordination to avoid market distortions, as the introduction of a mechanism can interfere with the ongoing process of an integrated European electricity market and hinder cross-border electricity trading. At least the participation of interconnectors or capacities from non-domestic areas should be admitted within national mechanisms.

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1 Introduction

As concerns about the adequacy of electricity generation are rising in Europe, decision makers try to support new investments in generating capacities and incentivize demand side flexibility (e.g. demand response or storages). As this process is still ongoing and there exists a broad variety of options, the goal of this document is to provide an up-to-date overview of currently implemented or proposed market design options in European electricity markets and other already established design options outside Europe.

Large shares of volatile energy production from wind power and photovoltaics are challenging the electricity system and lead to decreasing electricity wholesale prices. Due to the merit-order-effect, in hours with electricity feed-in from renewable energy sources wholesale prices decline significantly. Additionally, electricity generation from renewable energy sources leads to fewer full-load hours of conventional power plants. The liberalized market combined with the European market coupling increases the efficient use of generation resources and reduces returns for power generators in times without scarcity. However, returns above variable costs are necessary to cover fixed costs, otherwise, power plants will be decommissioned for economic reasons. But flexible power plants in combination with other flexibility options, such as demand response or storages, are important for ensuring generation adequacy during scarcity situations.

Energy policy and market design in the countries considered in this report are subject to frequent adaptations. However, in this document, only the states of the markets are described at the time of writing. The report is structured as follows: first, in Section 2, a general short overview of different capacity remuneration mechanisms is given. Afterward, selected experiences from electricity markets with established or planned capacity remuneration mechanisms are described in Section 3. A short conclusion finalizes the report.

2 Capacity remuneration options

Capacity remuneration options can be grouped into different categories. A mechanism can be either targeted, i.e. either only apply to selected technologies or to new investments, or market-wide, i.e. all technologies are able to participate. Furthermore, one can distinguish between volume-based mechanisms, i.e. a certain level of capacity is required, or price-based mechanisms, which can steer the amount of procured capacity based on a target price. The resulting classification of different capacity mechanisms is shown in Table 1.

Table 1: Classification of capacity mechanisms [1]

	Targeted	**Market-wide**
Volume-based	Tender for new capacity	Central buyer
	Strategic reserve	De-central obligation
Price-based	Targeted capacity payment	Market-wide capacity payment

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The basic principles of the different mechanisms are as follows [1]:

- *Tender for new capacity*: Financial support is provided in order to establish the required additional capacity. Different variations are possible, e.g. public financing for the construction of new capacity or long-term power purchase agreements.
- *Strategic reserve*: The required additional capacity is contracted and held in reserve outside the energy-only-market. Reserve capacity is only operated when specific conditions are met, such as a shortage of capacity in the market or a price settlement above a certain electricity price.
- *Targeted capacity payment*: A central regulator sets the price of capacity, which is then paid to a subset of the capacity operating in the market, e.g. only to selected technology types.
- *Central buyer*: The total amount of required capacity is set centrally and procured through a central bidding process so that supply bids determine the price.
- *De-central obligation*: An obligation is placed on electricity suppliers to individually secure the total capacity they need to meet their consumers' demand. In contrast to the central buyer model, there is no central bidding process. Instead, individual contracts between electricity suppliers and capacity providers are used.
- *Market-wide capacity payment*: The price of capacity is set centrally, based on estimates of the level of capacity payment needed to bring forward sufficient total capacity. This price is then paid to all capacity providers in the market.

3 Selected experiences

Recently, capacity remuneration mechanisms have been implemented in several European countries. In the following paragraphs, selected experiences with a central capacity market, a de-central obligation, a strategic reserve and a targeted capacity payment are presented.

Belgium/Strategic reserve [2–6]

As a back-up for demand peaks during winter, Belgium implemented a strategic reserve in 2014. The size of the reserve is dimensioned so that the loss of load expectation (LOLE) is less than 3 hours on average and less than 20 hours in 95 percent of the cases. The LOLE is analyzed via a probabilistic market model that takes into account outages, demand thermosensitivity, such as high electricity consumption on cold winter days, and neighboring countries as foreign power plants are not allowed to take part in the reserve. The capacity is procured in a competitive tendering process, but if offered prices are regarded as clearly unreasonable, a Royal Decree can impose prices and volumes. Market participants that plan to shut down capacities are obliged to take part in the tendering process of the strategic reserve that can be split into a “Strategic Generation Reserve” (SGR) and a “Strategic Demand Reserve” (SDR). For the first period (2014/2015), a total capacity of 846.7 MW (SGR 750.0 MW/SDR 96.7 MW) was contracted, increasing to 1535.5 MW (SGR 1177.1 MW/SDR: 358.4 MW) for the subsequent period (2015/2016). The activation is determined via economic (shortage of energy in the day-ahead market) or technical (shortage risk) triggers, yet the reserve has not been activated to this day (12/20/2016).

France/De-central obligation [5, 7, 8]

France implemented a de-central obligation in 2015 with the first delivery to take place in 2017. All electricity suppliers are obliged to hold a certain number of certificates reflecting the share

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of electricity consumption of their consumers during peak periods. These peak periods are determined by a security and temperature factor. The security factor takes into account the margins required to cover residual contingencies and the contribution of interconnections to security of supply. For the temperature factor, it is assumed that one-in-ten-year cold conditions occur every year. Certificates can either be purchased or obtained by certifying own generation and demand-side capacities. Foreign capacities located in neighboring countries are allowed to participate in consideration of the expected capacity of the respective interconnector at peak times.

Sweden/Strategic reserve [9–13]

Sweden established a strategic reserve already in 2003. Capacities are contracted on a yearly basis and need to be available from November 16 to March 15. Between 2009 and 2015, the reserve has been activated a total of nine times. Yearly costs for the reserve in 2013 and 2014 amount to about 13 respectively 14 million EUR, which is significantly lower than the estimated costs of a shortage situation (90 million EUR). Plans to gradually phase-out thermal capacities in the strategic reserve by 2020 currently seem to be infeasible due to the large-scale phase-out of nuclear capacities.

Spain/Targeted capacity payment [1, 5, 14]

Already in 1997, Spain introduced its first capacity remuneration mechanism. Major changes were made in 2007 when the mechanism was redesigned to adapt to the European law then in force. On the one hand, the new system should incentivize new investments by providing fixed capacity payments for 10 years, thus reducing investment risk. On the other hand, generation adequacy should be secured in the medium term (availability service) by establishing contracts with e.g. peak load power plants of a duration of one year or shorter. However, unforeseen events made it difficult to estimate the required generation capacity and long-term capacity payments. Due to the economic crisis and the resulting low electricity demand, in 2012 long-term capacity payments for investments were lowered and in 2013 completely abolished. However, the availability service to prevent existing units from mothballing is still in place.

United Kingdom/Central buyer [15–18]

In order to maintain sufficient capacity helping to ensure security of supply, in 2014 the UK introduced centralized capacity auctions. The first delivery will take place in 2018, as the procurement is carried out 4 years in advance. In 2014, a capacity of 49.3 GW at a price of 19.40 GBP/kW/year has been procured and in 2015, 46.4 GW at a price of 18.00 GBP/kW/year. In 2016, the capacity and the price increased to 52.4 GW and 22.50 GBP/kW/year respectively. So far, a total of 4.8 billion GBP have been paid to all participants, however, however, incentives for demand response and new investments have been limited. For example, of the total contracted capacity in 2015 less than 1% came from demand response and less than 2% from new investments. Additionally, despite being highly emission intensive, 650 MW of new diesel-fueled capacity were awarded contracts resulting in payments of 176 million GBP. Currently, foreign capacities are not allowed to participate in the auctions, however, cross-border transmission flows are considered in the calculation of the target capacity, which is determined by the Secretary of State for Business, Energy and Industrial Strategy after consultation with the transmission system operator.

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4 Conclusions

One major goal of capacity remuneration mechanisms is to incentivize investments in secured capacity to ensure generation adequacy. In order to classify the mechanisms, a matrix with two dimensions is used. The first dimension distinguishes between market-wide or targeted mechanisms, which focus on specific technologies or criteria. In the second dimension, the way of allocating the capacity amount is differentiated. Price-based mechanisms set a target price and purchase the offered volume whereas volume-based approaches target a certain predefined capacity volume that results in an equilibrium price.

Different mechanisms have been implemented in several European countries or will be introduced in the near future. This policy brief focuses on the strategic reserves in Belgium and Sweden, the de-central obligation in France, the targeted capacity payments in Spain and the central buyer mechanism in the UK. Generally, a strategic reserve is primarily implemented to guarantee generation adequacy, while a capacity market should particularly incentivize investments.

The implementation of capacity remuneration mechanisms yielded mixed experiences so far. Weaknesses of the initial implementations lead to adjustments. As the prognosis of the required future capacity is highly complex, forecast errors could occur. In general, the implemented mechanisms, however, seem to have guaranteed a certain level of generation adequacy, as for instance in the UK the targeted capacity volumes could be purchased in the capacity auction. But the efficiency of installed capacity mechanisms in the market areas has not been sufficiently assessed yet. While on the one hand new mechanisms are introduced (e.g. decentral obligation in France), on the other hand, some mechanisms were already or are planned to be removed (e.g. capacity payments in Spain or the strategic reserve in Sweden). Hence, it can be concluded that in these countries capacity remuneration mechanisms are not required at this stage of structural changes in the electricity sector. This may change once volatile renewable energies reach a dominant share in electricity generation.

Several measures could improve the political framework. Up to now, no EU-wide target for generation adequacy (or security of supply) has been defined. However, for assessing the need for capacity mechanisms, a specified target level could be advantageous. Besides, consistent methods and coordination on a European level are required to reduce uncertainties and inefficiencies. Capacity markets could have negative spillover effects on coupled markets due to lower prices induced by high capacity volumes. The generation adequacy level may then be lower in neighboring countries caused by missing investment incentives. So cross-border effects have to be considered [19].

The introduction of a mechanism can hinder cross-border electricity exchange and interfere with the process of an integrated European electricity market. The participation of interconnectors or capacities from non-domestic markets varies among countries and should be guaranteed to comply with the European Internal Market Directive. Therefore, improving transparency regarding procurement would be advantageous.

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