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Strategic Reserves versus Market-wide Capacity Mechanisms

EPRG Working Paper 2109

Cambridge Working Paper in Economics 2132

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Many wholesale electricity markets use supplementary capacity mechanisms to ensure resource adequacy. We compare different designs and argue that a strategic reserve is a better choice than a market-wide capacity mechanism for electricity markets dominated by hydro power and intermittent renewables.

Many countries around the world have introduced capacity mechanisms to support the wholesale electricity market. Companies are then remunerated for providing a contracted amount of capacity over a given period. These capacity payments are made even if the capacity has not been utilized. A main purpose of capacity mechanisms is to ensure resource adequacy. In this paper, we compare market-wide mechanisms, known as a *capacity markets*, to directed mechanisms, known as *strategic reserves*.

In market-wide capacity mechanisms, such as those used in France, the UK and the US, (nearly) all plants receive capacity payments. To ensure that there are enough resources in the system and to avoid excessive compensation, capacity payments are based on each plant's *firm capacity*. This is the amount of electricity that a plant is likely to produce. Estimating firm capacity is straightforward for thermal production, which has a high and predictable availability. It is much harder to accurately estimate availability for intermittent production, such as solar and wind power. This task is also considerably more difficult for demand response and for production without a guaranteed fuel storage, such as hydro power.

A related issue is that owners can influence the availability of a plant by design, maintenance, and the preparations for extreme weather conditions. Experience from the US has shown that the latter is crucial, as much capacity tend to fail when the weather is extremely warm or extremely cold. A difficult challenge for capacity markets is to accurately estimate firm capacity for each plant and provide the right economic incentives to ensure that this capacity is available in crisis situations.

A fundamental problem of capacity markets is that the buyer procures nearly all available capacity and that the supply of capacity is limited in the short run. Many capacity markets in the US therefore struggle with excessive capacity prices because of imperfect competition.

Strategic reserves have the advantage that only a small part of the capacity in the system is procured, which improves competition. In practice, countries tend to impose excessive requirements for inclusion in the reserve. Such policies reduce efficiency, although the associated problems can be solved by imposing less stringent regulation. Firm capacity must be estimated also for plants in a strategic reserve, but this problem is smaller than for a capacity market because only the few plants in the reserve are eligible for capacity payments. Moreover, firm capacity is relatively easy to estimate because reserves mostly consist of thermal production.

An advantage of capacity markets is that all market participants face lower income risk when all plants receive fixed capacity payments. Another is that capacity markets, especially volume-based, better prevent investment cycles. Nevertheless, we conclude that a strategic reserve is a more suitable capacity mechanism than a capacity market for electricity systems dominated by hydro power and intermittent renewables, which is the case for instance in Sweden.

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Publication April 2021
Financial Support Svenskt Näringsliv, Swedish Energy Agency