How Effective are the Capacity Mechanism Designs in Enhancing the Security of the Electricity Supplies in Europe and the USA?

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Overview

The primary objective of a capacity mechanism is to contract capacity resources to maintain an adequate and reliable supply, during the peak demand hours, by remunerating the capacity providers. The reliability of supplies is negatively impacted, firstly, by the exit of a non-intermittent capacity resource due to the missing money problem arising out of price caps in the energy only market and emission taxes imposed on fossil fuel based power generations; secondly, due to the potential aperiodicity in the supplies from the intermittent resources on the system; and thirdly due to the incremental growth in the peak demand due to price inelastic and income elastic consumption of the electricity. Therefore, a capacity mechanism may have these four key objectives:

1. It provides for economic procurement of the non-intermittent generation capacity resources that could be dispatched in stress events.

2. It enhances the procurement of demand side resources to aid in elastic consumption during the stress events.

3. It encourages the recognition of the capacity contributions from the renewable generation at the system level, during different procurement periods, through a time series analysis; and adequately compensates them.

4. It provides for efficient intervention to meet the goals mentioned at 1, 2 and 3 through capacity mechanism.

Given these four key objectives, firstly, limited discussions are contained in the existing literature to asses if the capacity mechanism designs aim at these key goals. Secondly, even though separate qualitative and simulation based studies have been published to assess the effectiveness of capacity mechanisms in Europe and in the USA, limited number of studies have been carried out to compare the learning from the Europe and USA on these key objectives. And thirdly, since the capacity mechanisms in Europe are still being introduced, only a limited literature have captured the discussions on the mechanisms which are proposed in recent years (till 2019). Given these three important research gaps, my research fills the identified gaps by answering the following research question: How effective are the capacity mechanism designs in enhancing the security of the electricity supplies in Europe and the USA?

Methods

The 18 System Operator (SO) regions, that are reviewed for capacity mechanisms, are as follows: Belgium, Finland, France, Germany, Greece, Ireland and Northern Ireland, Italy, Poland, Spain, Sweden, United Kingdom; the six SO regions of the USA namely CAISO, ISO-NE, MISO, NYISO, PJM and SPP. The SO regions are compared on the basis of the capacity market designs and their abilities to recognise the reliability gains from the generating, demand side and intermittent resources with limited market distortation.

Results

Firstly, the capacity market design may like to address the following four issues: the SOs should focus on designing their capacity demand curve to reflect the marginal reliability gains, first. Second, a move towards the competitive procurement of capacity resources and a move away from the regulated tariff may help in getting closer to economically efficient costs of the reliability. Third, the SOs may regularly determine their “de minimis” capacity

requirements to reflect the impacts of innovation and technological progress on the capacity resources. And, fourth, the SOs may like to schedule main auctions sufficiently in advance of the first delivery year to encourage those generation technologies, to construct and commission their plants, that have been considered in CONE calculations; and the contract lengths of the DSR providers may either be increased or DSR providers may be encouraged in the ancillary services market without any discrimination.

Secondly, the SOs may like to allow the existing generating plants to secure a similar length contract, compared to that of a new plant, to bring in efficiencies in the market without distorting the market outcomes, first; and, second, they should strive to reduce the administrative determination of the PTTR or MOPR that are subject to regulators.

Thirdly, the participation of the DSR, may be encouraged by linking their capacity payments either to ancillary services market or to their respective bid prices. Further, SOs with the inputs from the LSEs to provide access to the BTMG DSR resources to the energy and the balancing markets. Also, the SO regions may expedite their implementation and completion of the smart meter projects. In addition, the dynamic pricing schemes may be expanded, along with the participation of the DSR providers in the energy markets, after addressing the legitimate concerns of the consumers on privacy and security.

Finally, the SO regions may initiate programmes to determine the capacity contributions from the intermittent resources through time series method instead of simple de-rating

Conclusions

The question is systematically answered by comparing the lessons learnt from the 18 SO regions in Europe and the USA based on a framework that tries to achieve the key objectives of a capacity market. The two important areas of further research include the assessment of potential capacity credit from the intermittent resources using the time series regression analysis; and assessing the impacts of smart meters (with dynamic prices) on the quantum & prices of the capacity resources.

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