ENERGY TRANSITION AND THE NEED FOR CAPACITY MARKETS

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Overview

This paper deals with the concern that an Energy Only Market (EOM) is not able to deliver a sufficient level of generation adequacy in case of a strong increase of renewable energy. We show that, theoretically, an EOM combined with VoLL pricing results in the optimal portfolio of generation capacity, but that in practice a number of factors hinders this situation to emerge. Determining the appropriate VoLL price is a complicated matter, electricity producers may face restrictions to bid significantly above their marginal costs, while also societal pressure may prevent prices to become too high. Hence, the ability of EOM with VoLL pricing to deliver reliable supply of energy depends on the institutional circumstances. The surge in renewable energy may reduce this ability because of the sudden change in the energy mix and the higher level of uncertainty about the situation of scarcity and loss of load expectations. Capacity remuneration mechanisms may solve these failures of an EOM. In several European countries, different types of such mechanisms have been implemented, varying from strategic reserves (e.g. Germany) to market-wide mechanisms (e.g. UK). The performance of these schemes is highly sensitive to the precise design. The benefits for reliability need to be assessed against the risk of moral hazard (i.e. crowding out of other investments) and overinvestments.

Methods

Both conceptually and empirically, we analyse to what extent the concern regarding the ability of the EOM to deliver sufficient level of generation capacity in case of a high share of intermittent, zero-marginal cost renewables is valid. In addition, we analyse whether capacity remuneration mechanisms are effective and efficient solutions to deal with this concern. These mechanisms, such as strategic reserves or market-wide capacity mechanisms, are meant to give a revenues for having capacity available, which is an additional revenue stream for electricity producers next to the revenue coming from selling electricity. After analysing these mechanisms from a theoretical perspective, we will go into actual experiences with such mechanisms in a number of European countries. Finally, we answer the key question of this paper, which is to what extent does an increase in the share of intermittent, zero-marginal cost renewables change the need for implementing a capacity mechanism.

Results

In an EOM a missing money problem may occur if the power price is not able to reflect the value of lost load in cases of scarcity. If one assumes that the power price is set at the Value of Lost Load (VoLL) for those hours when the available generation capacity cannot meet demand, however, this problem does not need to occur. In practice, we see a number of factors hindering the price to raise to the level of VoLL, which may call for additional instruments, such as a capacity market. In order to analyse the imparct of renewable energy on this debate, we distinguish two different mechanisms: a) the impact of renewable supply on the merit order and b) the way investments in renewables are incentivized.

Because of the negligible marginal costs of renewable-electricity production, an increase in the share of renewables reduces the electricity price (assuming that the short run marginal costs determine the price). As a result, the inframarginal rents decrease as well, which has an impact on the optimal portfolio of power plants. More specifically, baseload plants will be increasingly replaced by plants with relatively low fixed costs and higher marginal costs. As long as these plants determine the system-marginal plant, a positive electricity price emerges. In this situation, the need for VoLL pricing does not change.

The fast growing share of subsidised renewables in combination with the economic crisis over the last years, has resulted in overcapacities in many EU countries. The question here is whether the market will be able to deliver such transition towards a new optimal mix. In particular, medium and peak load plants have strongly reduced operating hours and are basically price setting when operating. Therefore such plants are only able to recover variable OPEX and have no coverage for fixed OPEX. Baseload plants still generate inframarginal rents that might suffice to cover their fixed OPEX. The larger CAPEX of such baseload plants do not play a role in closure decisions. As a result, baseload plants that should be replaced, remain in operation and mostly gas-fired stations are being retired or mothballed, which may be needed in the long run for a transition to a low-carbon power sector. (See also CEPS, 2015; pages 29-30). And this also might hinder investments in new peak load plants and DSM options. A capacity mechanism may overcome this problem.

In practice, however, investments in renewables are often (partly) financed by subsidies, such as feed-in-tariffs or feed-in-premiums. Hence, for the return on capital of these investments VoLL pricing is not needed. For other, conventional plants which are needed in times when renewable capacity cannot produce because of weather conditions, VoLL pricing remains to be needed. If however, the subsidy is only covering the part of the investment that cannot be recovered in the market, VoLL pricing remains necessary also for renewables.

The adequacy of a new optimal portfolio of power plants with a large share of renewables, will be more heavily influenced by weather circumstances. It seems logical to expect that the distribution of the likelihood of a scarcity (loss of load) event will be more extreme. Only in rather extreme weather scenarios (with a combination of little wind, little solar, low temperatures (high demand) and little precipitation in earlier months (low hydro reservoir levels) will trigger such scarcity events. However, if the average LOLE (Loss of Load Expectation) that determines the optimal portfolio of plants, remains unchanged (e.g. 2.5 hours per year), these extreme weather scenarios will have to result in rather long periods with load shedding / VoLL pricing. This would mean an increased risk of political driven market interventions and thus a higher risk that the EOM would fail to deliver a proper level of adequacy.

As a result, there may be some additional reasons to implement a capacity mechanism in case of a strong increase of renewable energy. In the recent past, a number of European countries have decided to implement one or another form of capacity remuneration mechanism. Germany has recently decided to implement a Strategic Reserve solution, while the UK implemented a market-wide capacity mechanism. The UK scheme is a centralised volume based mechanism in which the total required capacity is set in advance of supply and procured through an auction. In France, a decentralised volume based system has been introduced. In this scheme, obligations are imposed on suppliers to contract certain capacity including a reserve margin for cold winters, with penalties for non-availability and with a market for capacity certificates. In Italy, decentralized volume mechanisms has been implemented, which is based on an auction system using reliability options. We assess these different mechanisms in terms of risks, effectiveness and costs.

Conclusions

Theoretically, a EOM combined with VoLL pricing results in the optimal portfolio of generation capacity, but in practice a number of factors hinders this situation to emerge: determining the VoLL price is a complicated matter, electricity producers may face restrictions to bid significantly above their marginal costs, while also societal pressure may prevent prices to become too high. Hence, the ability of EOM with VoLL pricing to deliver reliable supply of energy depends on the institutional circumstances.

The surge in renewable energy may reduce the ability of EOM to realise a reliable supply of electricity because of a) the sudden change in the energy mix resulting in suboptimal generation portfolios and b) the higher level of uncertainty about the situation of scarcity and loss of load expectations.

Capacity remuneration mechanisms may solve these failures of an EOM. The performance of these mechanisms are highly sensitive to the precise design. The benefits for reliability need to be assessed against the risk of moral hazard (i.e. crowding out of other investments) and overinvestments.

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