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Report

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Design Options for a Strategic Reserve for the German Power Market and International Coordination

Report from workshop with invited experts from governmental institutions, academia and industry, held at DIW Berlin on 17/10/2014

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Summary

Strategic reserves are in principle well suited to address both generation adequacy and system security in power markets. Depending on the power system and on the network topology, a strategic reserve has to be designed to fulfill both objectives. For the design of a strategic reserve (SR) in the German context, this implies that the strategic reserve should be able to deal with local scarcities in the south arising from network constraints that threaten system security, as well as to maintain generation adequacy at the system-wide level. This distinction will be of particular importance for a German strategic reserve that could either replace or run in parallel to the current 'Netzreserve'. Policymakers also will have to decide on the degree to which additional policy goals such as strategies for coal-fired plants may be reflected in the overall power market design and hence also within a strategic reserve.

International coordination for the design of any capacity remuneration mechanisms (CRMs) offers the potential of cost-reductions as the size of coordinated reserve capacities may decrease. If a reserve can deliver value and serve critical load in neighboring countries, coordinated CRMs, especially in central Europe should be further explored. At the same time, the role of interconnectors and the role of international re-dispatch after SR activation have to be taken into account. While technical factors have to be considered yet, many lessons for implementing a strategic reserve exist, as for example relying on experiences in Belgium, Sweden, Poland and Finland.

Policy objectives for a strategic reserve

The primary objective in the discussion on introducing a CRM in Germany is, as in many other countries, to maintain generation adequacy and system security. Strategic reserves are not only known from European power systems such as Sweden, Finland, Poland and Belgium but also from oil markets. In the international oil market, respective public entities control last-reserve resources that are used to satisfy demand during high scarcity situations, often caused by political rather than economic fundamentals.

With a similar reasoning, for power markets the primary goal is to avoid involuntary load shedding. This goal is especially relevant in today's power markets with increasing, but limited reliance on demand response and voluntary load reduction. In guaranteeing a steady generation and load balance, the two

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related objectives of generation adequacy and system security reveal however different implications, and accordingly both related objectives are weighted or interpreted differently in different national power market contexts. For example, in Poland sizable closure of generation units is expected due to the European ‘large combustion plants directive’ that forces highly polluting coal-fired units to exit the market. Thus here the emphasis is on generation adequacy and the Polish reserve aims at smoothing and backing up the transition phase to a more modern power generating fleet, providing an insurance to contribute to generation adequacy until new generation capacity is in place. In the Belgian case, the government was concerned about closure of peaking capacity in the system and designed a strategic reserve in spring 2014. It turned out that this strategic reserve provided a very timely support for the power system when in summer 2014 major failures implied that three major nuclear plants were not available for generation (one of them expected to be online again late 2014 / early 2015; for the two others it remains unclear whether and when they will come back online again).

As for Germany however, generation adequacy is not the only motivation. In fact, generation adequacy at the national level is so far not a concern (ENTSO-E in its ‘Scenario Outlook and Adequacy Forecast’ from 2014 estimates German overcapacity to be around 8 GW in 2014, around 10% of peak demand). Availability of sufficient generation capacity is however of concern in the Southern part of Germany. As the single pricing zone does not provide price signals to market participants to reward availability of generation capacity in the south, a network reserve has been designed to secure continued availability of such capacity. This illustrates how generation adequacy in one pricing zone is not sufficient for system security, as local constraints, but also voltage and dynamic constraints need to be considered. Hence CRMs might be specifically designed to address generation adequacy and/or system security, as can be seen with the German ‘Netzreserve’ that solely focusses on the latter. Whether a SR can be designed in the light of local scarcity while still addressing system-wide adequacy was found to be of major importance for the debate.

Choices and challenges for implementing a strategic reserve

When implementing a strategic reserve, many design parameters have to be carefully evaluated – not only against their effects on the costs and benefits of the SR itself, but also against their impact on the power market as a whole. Three main design elements were discussed, relating to i) the (potentially internationally coordinated) calculation of the adequate size of the reserve ii) the procurement rules for the tender of capacities that form the reserve and iii) the dispatch rules for the strategic reserve.³

Calculation of strategic reserve capacity: The calculation of reserve capacities entails several tasks. In general, one country can calculate needed strategic reserves with the goal to maintain an ex ante defined “loss-of-load-expectation” (LOLE). A similar approach was reported to be taken for the design of the Belgian reserve. However, such calculations may also involve neighboring systems. Therefore the degree to which the reserve can actually help neighboring systems has to be taken into account. If a reserve, dispatched in Germany, may in particular situations be of value for maintaining system

³ A fourth element is the allocation of costs (potentially profits) incurred by the reserve among generation and load. This element has been noted as an important factor, however, most discussion took place on the three elements mentioned above.

adequacy, say, in the Netherlands and Belgium, or vice versa, the required size of *combined* reserves can potentially be smaller and thus cheaper compared to a situation in which each country calculates reserve amounts that are solely based on matching national maximum demand estimates with national capacities. However this does require confidence in the availability of transmission capacity between countries. If inefficient congestion management systems result in limitations of available capacity for commercial transactions (e.g. in response to transmission constraints within pricing zones), then this might not have been anticipated in generation adequacy assessments.

Typically the top peak demand occurs not simultaneously in neighboring systems. Thus over all systems less capacity is needed to satisfy load: when demand peaks in one country A there still is spare capacity in another country B. However, before such international coordination and calculation of reserves can be undertaken, several requirements are to be met: first, at least two neighboring systems both need to decide for a SR (a case given in the current context with Belgium and Poland having opted for a SR, and other systems such as Denmark considering a CRM and potentially a SR); second, the degree according to which foreign capacity is available through each respective interconnector has to be assessed. Allocating interconnector capacity for activating the SR is challenging, however, because the activating country likely will already be importing to its limit. Only in intraday or balancing timeframes, more interconnection capacity could be found. Thus, while a proper calculation of a coordinated reserve appears challenging, still low hanging fruits are to be gained, possibly initially at smaller scale between neighboring countries like e.g. in the penta-lateral forum.

Procurement of strategic reserves: Choices and likewise challenges for the procurement relate foremost to the precise auction mechanism employed. In Belgium, while 1.2 GW were initially sought to be procured, only 850 MW were “found” during the procurement process. The reason was that the supply for reserves was small, because only power plants that would otherwise mothball or close down (mandatory participation to SR) or demand response were taken into account. The motivation for this restriction was to not draw capacity and further decrease supply on the actual energy market.

Scarce supply is challenging both in terms of maintaining adequacy but also to avoid expensive procurement. For the two Belgian plants, the individual cost components of bids were both monitored and approved by the regulator. If with larger markets and more players the level of competition increases, tenders could be used to procure plants based on different auction formats. For example a number of lowest costs offers could be found to match the size of the SR. Then, payments to each procured plant could be based on the last bid needed to complement the full reserve capacity, a mechanism referred to as uniform-pricing auction.

Another choice for the procurement is the time-horizon in which i) the procured units have to stand available as part of the SR and ii) if they are allowed to re-enter the energy market again after this time passed. This procedure secures that viability of reinvestment in existing plants and investment in new plants outside of the strategic reserve will not be jeopardized by sudden competition from units that re-enter. In the context of timing, participants also mentioned that a well-trained labor force is needed to operate generation units in the reserve. This requires early decisions on continued operation of power stations in a strategic reserve to ensure staff will continue to be available.

A major question for the procurement of reserves relates to prequalification issues: What units are allowed to enter the SR? If only certain technologies are envisaged in the SR, the SR auction mechanism may directly entail prequalification standards for participating units. For questions regarding prequalification not only supply security but also additional policies such as for climate policy but may be relevant, as discussed further below in more detail.

Dispatch rules for the strategic reserve: Dispatch rules for the SR need to be carefully designed to avoid undue distortions of the energy market. This has two related dimensions: the dispatch criteria, so the decision of whether or not the SR is to be activated, and second the timing of this decision.

As for the criteria that decide on whether the SR will be activated or not, a price may suffice, for example a strike price of, say 3000 EUR/MWh (day-ahead or intraday). Alternatively, what is considered as a scarcity situation may be technically defined by the TSO ex ante. In the Belgian case, the SR is started if there are not enough (supply) offers to match all price taking bids (demand) (at 3000€/MWh) or if the TSO anticipates potential shortage in real time. In both cases, and if a structural shortage is confirmed the activation of SR automatically leads to an imbalance tariff of 4500 €/MWh.

For a fixed and ex ante determined strike price of the SR, it is important that this strike price (respectively imbalance tariff) is not too low and thereby renders investments in peaking units unprofitable. With more demand response in the system that sets the price in peak hours and thus revenues for thermal units, the main criteria will thus be to not crowd out flexible demand rather than thermal units. At what prices exactly flexible demand will participate in the market has yet to be proven.

Also the role of foreign supply and demand bids during scarcity and the dispatch of SR units was debated. It was asked if, for instance, TSOs can supply foreign demand bids in times of scarcity. Should they start the strategic reserve to do so or leave this responsibility to neighboring TSOs? Likewise, it is debated yet what protocols to follow if the SR in one country leads to re-dispatch intraday in a second country. In general, many cross border issues remain to be solved: How can different neighboring CRMs interact with each other, as the French capacity market with a potential German reserve? While free-riding on foreign payments for generation adequacy might be possible, still most national governments pursue CRMs and hence this question will draw much attention in the future.

Last, if the decision for the use of the SR is made close to real time, units still have to be informed early enough in the process (usually several hours ahead) to have sufficient response time for start-up, following procedures that can built on experience from re-dispatch procedures.

In particular, if inflexible units, say coal-units, are used as part of the strategic reserve, they might have to be warmed up and started in anticipation of a potential generation inadequacy as indicated e.g. by spot prices exceeding the trigger price. One option to avoid distortions of the energy market in this case could be a contract with corresponding volumes of power from flexible (non-reserve) generation capacity for the reduction of power infeed. This reduction would equal the volume given to the system from the ramped-up reserve unit so as to ensure that market prices are not distorted. If then the (market) trigger point for the strategic reserve is indeed reached, the inflexible reserve, say coal-fired, plant can be further ramped up from part load, and in addition the flexible plants that had previously been contracted to reduce production, could be asked to increase production again.

Other policy objectives interacting with generation adequacy

In Europe, many member states such as France, UK and Italy decided for a unilateral CRM. The design of each of the systems reflected member state specific preferences – focusing in France on a framework to facilitate demand side response and enhance revenue for generation assets, while in the UK the focus was on allocating long-term contracts to facilitate the investment in generation assets. In this vein, it was debated during the workshop if also in Germany additional policy objectives may play a role in the design of a strategic reserve. Additional policy objectives in the German context could be the achievement of greenhouse gas emission reductions – for example to achieve the national policy objective of 40% emission reductions by 2020.

There exist different policy tools to address this additional objective of emission reductions, such as the ETS. While the ETS in theory offers a first-best solution to an efficient abatement, the current ETS price does only pose little incentives, not sufficient for example for fuel switching from coal to gas and hence market externalities remain partially unpriced. As second-best policy tools need to be considered, so also can be the use of one policy instrument such as the SR to address several policy objectives. A SR could thus be used to implement objectives for shifting production away from coal power stations – as a side effect of the primary objective of maintaining generation adequacy and system security. If this is an alternative for policymakers, coal units could be a major part of the strategic reserve and prequalification for the SR procurement and early warning to guarantee timely ramping as discussed earlier become essential.