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Capacity mechanisms:

Revived interest in capacity mechanisms throughout Europe in the face of high volumes of intermittent generation

Will the present (and proposed) design of the European electricity markets create incentives for sufficient capacity, assuming large volumes of intermittent generation, and as a consequence, a less stable framework for investors? Periods of severe shortage and hence very high prices often lead to calls for price caps and regulatory intervention. There are, growing concerns with the ability of competitive energy-only markets to function economically with significant amounts of intermittent generation. A higher level of intermittent generation will influence spot prices, plant operation and investments prospects. The question therefore arises whether it is necessary and desirable to introduce additional instruments, such as capacity mechanisms, to contract for the necessary amount of capacity.

At present there are no clear answers to these questions, but whatever will be decided, the choices made here will have great impact on the development of the market and the system as such. It is therefore central for the NEPP-project to understand the consequences of different choices and possible contribute to reasonable decisions by the politicians.

Price spikes are necessary in an energy-only market

Following liberalization, European electricity markets adopted an "energy-only" market design. In energy-only markets, generators only get paid for the energy they deliver. Thus, it is the expectations about spot price that is the primary drivers of investment decisions. Because high spot prices indicate that the supply/demand balance is strained, the spot price must be allowed to increase unconstrained – sometimes to very high levels – to signal capacity shortage. Investment in peak capacity (i.e. units with the highest marginal costs) is therefore heavily influenced by expectations of price spikes. Without these high prices, generators that only run a few hours each year will not make sufficient returns. Price spikes are therefore essential for system adequacy.

One more dilemma associated with relying on an energy-only market design is that the market needs to have a short-run price sensitive demand in order to work well. During periods of capacity shortage and high prices consumers must be prepared to reduce consumption, or tomove consumption to hours when the system is less constrained. Without short run price elasticity the market does not even work in theory! Spot price linked contracts, smart metering and installation of new technology are all measures that will increase demand response in the market.Experience so far also tells us that consumers as well as suppliers need to experience severe price spikes to make the necessary preparations – the risk of high prices is not enough.

Experience also tells us that demand response is much easier to develop in an environment with capacity markets. The reason is that consumer like to have an upfront payment for their flexibility rather than the uncertainty of getting paid only when activated. In some markets in the USA so called "aggregators" have been very successful in contracting flexible consumers and compete with generation in the various capacity markets. The irony in this is that while demand response is essential in energy-only markets it is hard to get. On the other hand - capacity markets attract demand response but in this design it is not critical.

Why capacity payment?

Large amounts of electricity generation from renewable energy will introduce new challenges for the energy-only market design. Firstly, electricity generation from renewable energy is subsidized –this capacity is not necessarily the best choice from a market perspective and the economic balance between base load, intermediate generation and peak load may be distorted. Secondly, renewable generation bids at zero or low marginal cost. An increased proportion of wind simultaneously generating high volumes of zero (or negative) marginal cost electricity will increase the risk that the wholesale price for electricity is driven down; making it more difficult to recover fixed costs. At the same time, the distribution of the spot price will become more extreme, with short periods of very low prices when wind dominates the market to periods of very high prices when wind output is low. Lower spot prices will make investment in new capacity less attractive and increased spot price volatility will make investment in conventional technologies riskier. In Spain, were wind accounted for 20% of installed capacity in 2010, wind coverage of demand varied between less than

1% to over 45% during the same year. The spot price hit the market floor in 335 hours.

Furthermore, intermittent generation has no correlation with demand and as such has a low "capacity value". The probability of intermittent generation operating fully when the system peaks is low for wind andnegligible for sun.

Two ways to go

Broadly speaking, a capacity mechanism requires an assessment of an appropriate level of capacity (for example 115% above expected peak demand) and an incentive to deliver this capacity. Generators receive revenues both for the energy they deliver and the capacity they have installed. Flexible consumers get paid for the electricity they promise not to consume. Capacity mechanisms can be implemented in many different ways, some relatively simple, some very complex. Despite the large number of capacity mechanisms, each of which has many variants, the options are limited. In principal there are two ways to go forward if the aim is to create regulatory incentives for maintaining and investing in less-frequently used generation and in demand response.

• One path is to stick to the present design where the incentives to develop these goods come from the price volatility and price spikes in the short-term electricity markets, i.e., essentially keeping the energy only market design. To make sure this design does not jeopardize security of supply criteria's, a strategic capacity reserve can be added in addition to the "normal" operating reserves. This is a rather simple and straight forward way to make sure "the lights stay on", but it does not address some of other issues such as stabilizing the prices or reducing investment risk.

• The other path involves a more fundamental change in the market model and affects all actors. This would include a capacity mechanism with "full coverage". A capacity markets implemented in PJM system in the eastern part of USA is one example. A PJM style market modified to work in Europe's decentralized markets may solve most of the issues but due to the complexity, there is a risk of regulatory failure: if the design of the system is not internally consistent, it may not work as intended.

So the choice is (apart from the question whether to intervene at all) between a 'light' version that addresses only part of the problem or a 'heavy' solution that offers more features and security, but is more difficult to implement.

REVIVED INTEREST IN CAPACITY MECHANISMS THROUGHOUT EUROPE

- **France.** Concerns over the rise in peak demand, the need to replace coal-and oil-fired units that do not meet environmental standards, and an urgent need for a more appropriate mechanism for the valuation of demand reductions have lead French authorities to legislate on a capacity obligation for suppliers to be introduced by 2015-2016. Exactly how the mechanism will be implemented will be described in guidelines that will be published in 2012. Nevertheless the law anticipates that all capacities connected to the public electricity networks, either generation or demand resources, will have to be certified by the TSO and made available to suppliers, either directly or indirectly and that capacity guarantees will be tradable. Penalties will apply both for unavailable capacity and failure to procure enough capacity. .
- **Great Britain.** On July 12th 2011, Britain's Department of Energy and Climate Change (DECC) launched a public consultation seeking views on the most suitable design for a capacity mechanism for the British electricity market. The aim of the Government is to have a capacity mechanism in place by 2015. **Ireland** introduced capacity payments based on availability in 2005.
- **Italy**. Italy introduced capacity payments in 2004 and carried out a public consultation in 2010 on the introduction of a capacity market. The chosen design, based on reliability options, was published in July 2011.
- **Germany** writes in its Energy Concept 2050 that "there should be a review of the need to trade provision of capacity (so-called capacity markets) "
- **Spain** and **Portugal** have capacity payments since 2007 and 2010 respectively. Spain introduced daily capacity payments in 2007 to help flexible CCGT plants recover fixed costs, as due to the rapid expansion of wind power running hours and capacity factors were lower than expected when the investments were made. At 20 €/kW per year for existing plants that entered the market after 1998 and a maximum of 28 €/kW per year for new plant (2010). The Spanish capacity payments have received widespread criticism in Spain, as generators receive a payment for "almost nothing" as if a generator is not available on a certain day it only loses that day's capacity payment, but can be seen as a compensation for stranded costs for plant that was negatively affected by the massive introduction of wind power.
- **Sweden.** The Swedish TSO is mandated by Parliament to procure and maintain a strategic reserve. The reserve for 2012 will be a maximum of 1 759 MW, and will gradually be reduced to 750 MW in the years up to 2020. The Swedish strategic reserve is only for use in extraordinary circumstances during winter months.
- **Poland** and **Finland** have strategic reserves operated by the TSO.

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