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Consultation Paper on generation adequacy

About the authors and their institutions

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Both institutes are involved in many research projects concerning grid stability and security of electricity supply, ranging from batteries and fuel cells to pumped hydro and control systems for inverters to stabilise the grid. EFZN is also member of ENSEA region of knowledge together with partners from the Netherlands, Norway and Scotland.

General remarks

The consultation paper addresses a problem which concerns many stakeholders. It is feared that lack of generation capacity will threaten the security of supply and cause severe economic and social problems. Whether this concern is justified or not is a matter of judgement and of choice of reference point. The situation is drastically different for Germany compared to Austria with its high proportion of hydropower.
The consultation paper does not try to quantify adequate capacity in terms of GW as the future electricity demand, the level of residual generation by non dispatchable renewable and/or small scale decentralised power generation, and the impact of demand side and supply response management cannot be estimated with any reasonable degree of accuracy for the next 10 - 20 years.
The electricity supply system must be capable of providing sufficient electricity even under the most unfavourable climatic conditions. For all practical purposes this means that the annual peak electricity demand will have to be covered by dispatchable electricity generation units. For the discussion here, it is not important to know to what extent residual, non dispatchable power generation will be available in 10 or 20 years, and any estimate now will have a wide margin of error.

Unfortunately the paper does not make clear what all projections show. A considerable proportion of the required capacity will only be used for a few hours per year and the fixed costs of investment and maintaining the electricity generation unit operational for immediate dispatch will have to be recovered within such a short time frame.

In addition, the consultation paper does not address the impact of insufficient generation capacity (black outs) and locational constraints. The result of lack of capacity to meet power demand is not unstable voltage and an increase in voltage sags lasting for a few seconds, but black outs.

1. Rolling black outs
   A rolling blackout is defined here as planned disconnection of small areas, e.g. affecting 50000 – 10000 people at a time for e.g. one hour each. These

blackouts would occur in addition to the occasional black out caused by power line failure
In order to implement such a strategy it would be necessary to discuss this fully in advance and estimate the frequency of occurrence and its impact so that a sound public decision could be made.
It is my firm belief that the additional cost for preventing such blackouts, even assuming a poor market design or incentives, will be considered negligible in comparison to the effect of rolling black outs and will lead to a rejection of such a strategy by the general public.

2. Large scale black out
This is defined as affecting millions of people over very large areas for many hours and possible days (Italy 2003, East coast of the USA in 2012).
A large scale blackout requiring a rebuilding of the grid is economically unacceptable, in particular because rebuilding of the grid can only start once sufficient capacity is available.
3. Location of generation capacity
The location of generation capacity to be effective is a function of grid capacity and security of supply. Generation capacity in Scandinavia cannot be used for power supply purposes in the Mediterranean countries if the transmission lines from North to South cannot transmit the power in addition to carrying their own loads. The capacity market therefore is not an unrestricted market. Capacity must be physically available where it can be used under the existing and future grid constraints. Building additional North-South transmission lines is likely to be both more expensive and less acceptable to the public than potentially higher cost of establishing capacity where there are no grid constraints.
In addition, long distance transmission is likely to increase the risk of power supply problems as a result of grid failures. For this reason, generation capacity should be located close to demand centres.

These points should make clear that adequate generation capacity which must be available at all times is a necessity and not an option. In addition, due to the necessity of suitable locations for the generation capacity, the solution must follow local respectively regional conditions which the transmission systems operators are best qualified to decide upon.

The consultation paper also makes assumptions about the method and speed to respond to a lack of generation capacity, and the impact that these might have.

1. Smart grid and information technology
Demand side management is falsely linked to smart metering and information technology. It should be noted that demand side management technology to shift demand by an hour or so is state of the art. Industrial users were and sometimes still are offered financial incentives if they switch off major loads, peak load control to reduce grid connection charges are frequently used and switching off large domestic consumers such as heat pumps, washing machines and driers during peak time is in some cases a mandatory requirement by the utility in some countries.
Demand side management therefore is an immediate option. The fact that this is not widely used is low or even negative financial impact for the utilities. With more and more renewable energy on the market at zero variable costs, the incentive decreases for most of the time and exists only very seldom and only

for a very short time. The financial impact of demand side management might be very high during such times.
However, as with investing into reserve capacity, the investment risk is high and the return difficult to evaluate.
Detailed information on power consumption and flow in the grid is important, but will only address the problem if switching operations are carried out as a result. It seems very likely, that peak demand of households and companies can be reduced with smart metering even further than with conventional demand side management. However, implementing and exploiting them fully will take a long time and will require higher incentives and/or mandatory requirements. It should be pointed out that the quality and availability of communication needs to be very high, if the security of supply depends on it. The financial risks for implementing such a system are high considering the few hours that it will provide financial benefits.

2. Use of industrial and domestic power generation
   Large industrial power generation can even now be used and is used in many cases to optimise energy costs by trading on the electricity exchange. Small power generators cannot take part unless being pooled. Technically this can be done using state of the art technology.
   However, the incentives and investment risks are the same as above. Occasionally very high prices will be paid, but it is unclear whether the investment into a dispatch system can be justified on such uncertain grounds. In addition, the grid operator as the entity which knows when power generation is required is often not allowed to operate such a system.
3. Building new generation capacity
   Planning, receiving permits, building and commissioning new generation capacity takes a very long time, unless smaller and thus often less efficient units are being built. Price indicators must exist many years before the need for the capacity to be available and must be available at least for the payback time, i.e. today for the year 2030 - 2040.

It is symptomatic that the annex of the consultation paper gives a number of barriers for the market delivering generation adequacy and policy responses, but does not address the underlying problem that decisions to invest into new capacity simply cannot be taken by private, unregulated companies with the current uncertainties, particularly with a very long time frame of at least 20 years, but more often 30 - 40 years.
Also, the consultation paper with its focus on market design and its disregard for the long term investment decisions assumes that a solution based on financial hedges against high prices as opposed to payments for physical availability is possible (page 8). Non delivery because the financial institution cannot pay very high prices or because generation capacity is simply not there will lead to a black out. It would be important to know which financial institutions would be able to pay the resulting damage caused by a long term black out and what the impact on the real economy would be in case of default.

To reach the economic optimum for the electricity supply system and ensure that adequate capacity is always available at the right place is a public task either by setting appropriate market incentives or by public investment. The State of Lower

Saxony in its energy paper (Das Energiekonzept des Landes Niedersachsens) calls for market incentives to be established for providing adequate capacity in the future and cooperates with the Federal State of Germany in achieving this.

Answers to specific questions

(1) Do you consider that the current market prices prevent investments in needed generation capacity?

Not current prices alone, because investment decisions are made on price expectations which cannot be realistically made. There are no long term capacity markets which cover the lifetime of the investment. Where is the exchange where an investor can sell his capacity availability for 2020 to 2050?

(2) Do you consider that support (e.g. direct financial support, priority dispatch or special network fees) for specific energy sources (renewables, coal, nuclear) undermines investments needed to ensure generation adequacy? If yes, how and to what extent?

Priority dispatch and financial support for renewables leads to reduction in run time of existing power stations and lower prices on the wholesale market. As a result, new investments are less profitable. In addition, even without such support, renewables have zero variable cost. It can be expected that wind power will soon reach such low costs, that no other electricity generation unit can compete. When this point is reached, conventional power stations will only be able to operate for relatively few hours per year, the lowest cost units perhaps for 3000 hours with frequent ramping up and down, the least efficient for a few hours per year or per decade. The current support is therefore only a short term distortion and will disappear before the first new power generation planned in 2013 becomes operational.

(3) Do you consider that work on the establishment of cross-border day ahead, intraday and balancing markets will contribute to ensuring security of supply? Within what timeframe do you see this happening?

No. Investment decisions for new power plants will not depend on optimised pricing for the present. Cross border, 20 years ahead pricing is required.

(4) What additional steps, if any, should be taken at European level to ensure that internal market rules fully contribute to ensuring generation adequacy and security of supply?

The systems operator must be given full responsibility to ensure generation adequacy and security of supply in its area of responsibility, taking all constraints and customer expectations into account:
- Power exchange with neighbouring TSOs

- Mandatory requirements which are acceptable to its customers
- Freedom to contract out all system components which are necessary for system stability, e.g. voltage and frequency stabilising systems, peak power generators, transmission stations etc. and influence operation as closely as desirable.
- Supervising the projected demand and intervene when market abuse is determined and/or increase the price for providing reserve power always beyond the market price.
- In addition all other grid operators and suppliers should be allowed to act in a similar fashion.
- Removal of technical barriers e.g. for the operation of emergency power supply systems to provide additional capacity.

(5) What additional steps could Member States take to support the effectiveness of the internal market in delivering generation adequacy?

It must be necessary to provide guidelines which penalise the building of power stations at, from a grid point of view, unsuitable locations. Generators, including renewables, should pay grid connection fees proportional to their distance from centres of high demand.

(6) How should public authorities reflect the preferences of consumers in relation to security of supply? How can they reflect preferences for lower standards on the part of some consumers?

Europe is not a poor developing country. Lower standards which mean risk of rolling or complete black outs are unacceptable.
If lower standard of supply means automatic load shifting for a short time, then this should be widely used and incentives for doing so should be given, including the right of grid operators to operate such a system.

(7) Do you consider that there is a need for review of how generation adequacy assessments are carried out in the internal market? In particular, is there a need for more in depth generation adequacy reviews at:
a. National level
b. Regional Level
c. European Level

Generation adequacy is an issue on the level of the responsibility of a TSO and thus needs to be addressed on this level which is regional. In addition, demand and generation patterns differ severely between regions.

(8) Looking forward, is the generation adequacy outlook produced by ENTSO-E sufficiently detailed? In particular,
a. Is there a need for a regional or European assessment of the availability of flexible capacity?
b. Are there other areas where this generation adequacy assessment should be made more detailed?

Depending on the amount of renewable energy and particularly the amount of wind and PV power in a region, the question of generation adequacy is completely different. Austria and Norway may have no problem at all due to their high level of hydro power, Germany has a very big problem. However, it seems futile to study this in detail, as investment decisions will not be taken on the basis of studies but only on expected prices. Where is the futures market for 2050?

(9) Do you consider the Electricity Security of Supply Directive to be adequate? If it should be revised, on which points?

(10) Would you support the introduction of mandatory risk assessments or generation adequacy plans at national and regional level similar to those required under the Gas Security of Supply Regulation?

Only if prior to this a consensus has been reached on who will have authority to ensure investments.

(11) Should generation adequacy standards be harmonised across the EU? What should be that standard or how could it be developed taking into account potentially diverging preference regarding security of supply?

Each TSO must be made responsible for his area of supply. If this is made a binding requirement, then no harmonised standards are required.

(12) Do you consider that capacity mechanisms should be introduced only if and when steps to improve market functioning are clearly insufficient?

Capacity mechanisms must be introduced now. Is there any doubt that investments are being delayed and cancelled and is there any certainty that this situation will definitely be reversed within a few years time?

(13) Under what circumstances would you consider market functioning to be insufficient:
a. to ensure that new *flexible* resources are delivered?
b. to ensure *sufficient* capacity is available to meet demand on the system at times of highest system stress?

There is no difference. Any new electricity generation units will have to be able to ramp up and down frequently with an operation time between a few hours and few weeks. There will not be a market for base load and inflexible power stations.

(14) In relation to strategic reserves:

a. Do you consider that the introduction of a strategic reserve can support the transition from a fossil fuel based electricity system or during a nuclear phase out?
b. What risks, if any, to effective competition and the functioning of the internal market do you consider being associated with the introduction of strategic reserves?

(15) In relation to capacity markets and/or payments:
a. Which models of capacity market and /or payments do you consider to be most and least distortionary and most compatible with the effective competition and the functioning of the internal market, and why?
b. Which models of capacity market and /or payments do you consider to be most compatible with ensuring flexibility in a low carbon electricity system?
c. Are there any models of capacity mechanism the introduction of which would be irreversible, or reversible only with great difficulty?

(16) Which models of capacity mechanisms do you consider to have the least impact on costs for final consumers?

(17) To what extent do you consider capacity mechanisms could build on balancing market regimes to encourage flexibility in all its forms?

(18) Should the Commission set out to provide the blueprint for an EU-wide capacity mechanism?

(19) Do you consider that the European Commission should develop detailed criteria to assess the compatibility of capacity mechanisms with the internal energy market?

(20) Do you consider the detailed criteria set out above to be appropriate?
a. Should any criteria be added to this list?
b. Which, if any, criteria should be given most weight?