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Press conference of 27 May 2011

Update of Bundesnetzagentur report on the impact of nuclear power moratorium on the transmission networks and security of supply

Summary

The update of Bundesnetzagentur's earlier (11 April 2011) report on the impact of nuclear power moratorium on the transmission networks and security of supply fundamentally confirms the initial findings and recommendations.

The historically singular simultaneous shutdown of power plants amounting to 5,000 MW capacity and the long-term lack of some 8,500 MW capacity bring the transmission grids to the edge of their resilience.

As a consequence of lack of these capacities, the market (via trade transactions and renewable energy feed-in forecasts) in many hours gives rise to a situation, i.e. a generation dispatch pattern, which does not allow for a (n-1) secure network operation. (A (n-1) secure operation implies that the network can still be operated in a stable manner in the event of failure of an essential operating facility. Such precaution is necessary as these failures are not uncommon.)

The TSOs must therefore correct the market result through increase use of their instruments such as network switchings, counteracting transactions (countertrading, SiV¹, redispatch) and other interventions in power plant operation (instruction to provide reactive power, postpone maintenance, re-activate cold reserves, feed-in management of renewable energy generators).

Load management measures (i.e. controlled disconnection of load) could be avoided so far.

As a consequence, the original objective of competition-driven market results is replaced by a more or less centrally controlled planning approach.

This is dubious in terms of energy economics, economically inefficient and ecologically harmful, but must be accepted for a transitional period and is unavoidable at the moment.

¹ "Sicherheitsbedingte regelzoneninterne Verkäufe", security-related intra-day power sales within a control area, whereby the TSO purchases electricity intra-day on the exchange and sells it to generators within its control zone, leading to reduced injection by these generators.

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The serious technical network problem resulting from this market correction stems from the fact that such measures were initially devised for exceptional situations such as power plant or line outages, but nowadays are almost completely exhausted in the context of normal operation of a faultless network and are therefore no longer available in case of additional unexpected emergencies.

For this reason the risk of non-controllable network disturbances is increasing distinctly.

The forecast given in Bundesnetzagentur's initial report of 11 April 2011 that network risk can still be controlled for the summer semester can be maintained for now – subject to a special investigation announced by TSOs into the low load situation over the Pentecost weekend. This forecast is also in line with experiences and assessments by the TSOs so far.

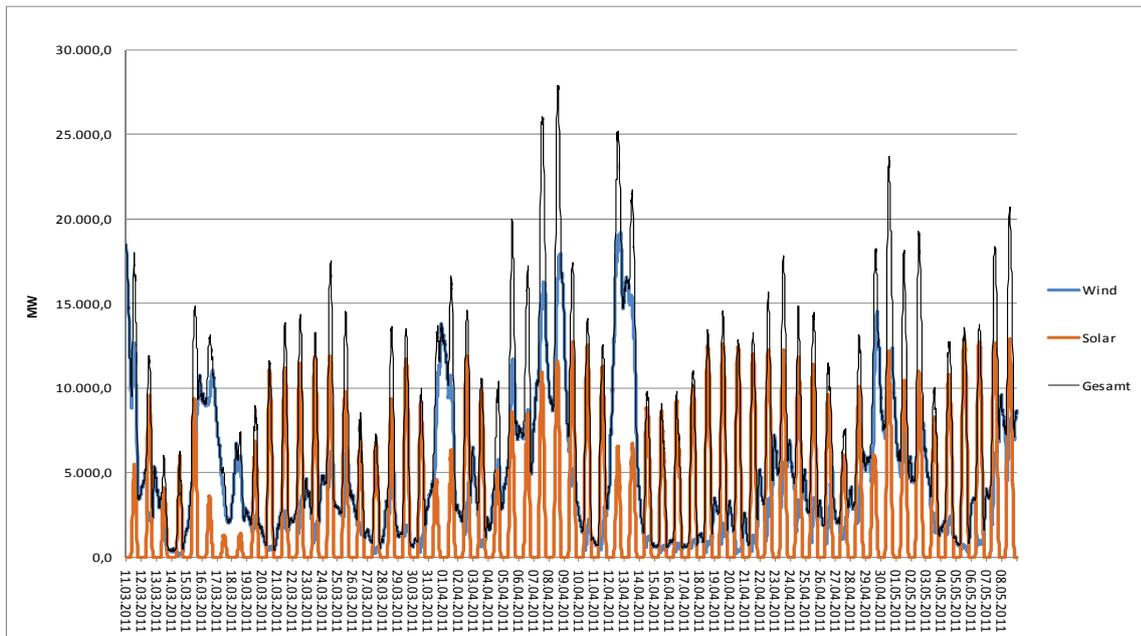
The same however applies for Bundesnetzagentur's assessment that risk will increase markedly during the winter semester due to higher load on the network linked to higher domestic and foreign power demand and significantly lower PV generation. Whether or not additional measures for the provision of capacity, over and above those mentioned earlier and those already foreseen under the ongoing revision of the Energy Industry Act (EnWG), are appropriate in order to protect against this increased risk, requires a deliberate decision which should only be taken following a thorough examination of the facts for which there is still time.

Bundesnetzagentur has invited both ENTSO-E and the other national regulatory authorities to analyse and assess effects and consequences of the moratorium on the neighbouring countries. The relevant investigations are ongoing.

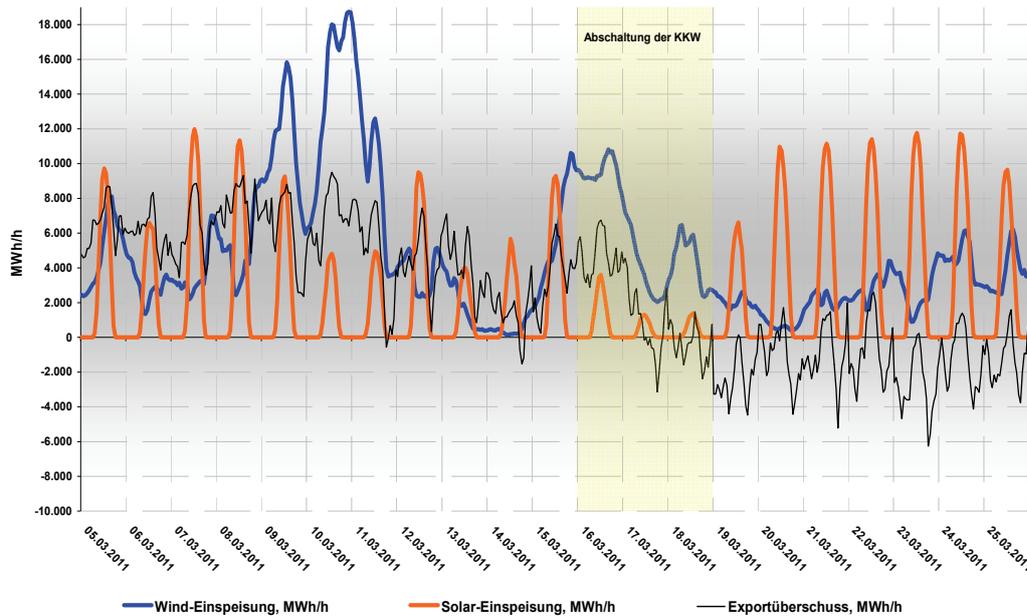
Nevertheless, there is no reason to depart from Bundesnetzagentur's call to seek coordination with European neighbours prior to taking further measures or decisions. There is just as little reason to refrain from urging against shutting down any further power plants based on political considerations. Such steps should in any event only be taken after thorough coordination with Bundesnetzagentur and the TSOs.

More specifically, the following findings have been established:

1. Due to favourable weather conditions since the beginning of the moratorium (moderate load, little wind, often plenty of sun), no significant adverse effects through changed load flows have been found so far. The following charts show PV and wind injection from 11 March to 8 May. They illustrate that renewable energy sources (RES) already have an enormous potential to cover load. At maximum, PV and wind injection reach up to 28 GW, corresponding to approximately 28 nuclear power plants and leading to a manageable network situation as outline above. The charts, however, also clarify that this capacity is not available in a reliable manner, but regularly disappears completely.



Wind, PV and cumulative feed-in during spring 2011
Source: German TSOs



Wind and PV feed-in; export/import balance during spring 2011
Data: ENTSO-E, EEX; Chart: Bundesnetzagentur

The intermittent RES feed-in is at present and in the medium term not compensated for adequately by storage capacities. Pump storage capacity in Germany currently amounts to ca. 7 GW. These plants are discharged within a few hours and operate mostly in daily cycles for frequency maintenance and trading purposes. Total available energy storage capacity adds up to ca. 40 GWh. In comparison, daily electricity consumption stood at ca. 1440 GWh in May 2011.

2. The increased stress in the north-south and east-west transmission paths in the form of increased load flows, expected by Bundesnetzagentur following the shutdown of 7+1 nuclear power plants, has been confirmed. In particular during periods of strong wind, security-related interventions by TSOs in accordance with § 13 (1) EnWG (inter alia network switchings, redispatch and countertrading) are becoming necessary more frequently. In times of strong wind injection and impending overload, feed-in management measures for RES plants are expected to be carried out more often.

3. The changed network load pattern due to the shutdown of the 7+1 nuclear power plants has already led to postponements of scheduled service and maintenance works in the transmission grid, because many such works can only be undertaken when there is little or no load.

Maintenance work at transformer station Großkrotzenburg, a major north-south network node close to Frankfurt, for instance, had to be postponed because the relevant circuits are indispensable. Further delays must be expected. To a certain degree, delay of service and maintenance works can be managed. Additional detailed analyses by TSOs are required to establish which works will be affected and whether this will lead to appreciable restrictions or problems.

4. Due to higher network load as a consequence of the moratorium, delays can also be expected for network expansion. A paradox arises in that an increase in transport capacities is required as a result of the moratorium, while at the same time network conversion and reinforcement measures cannot be carried out as planned due to the increased network load.

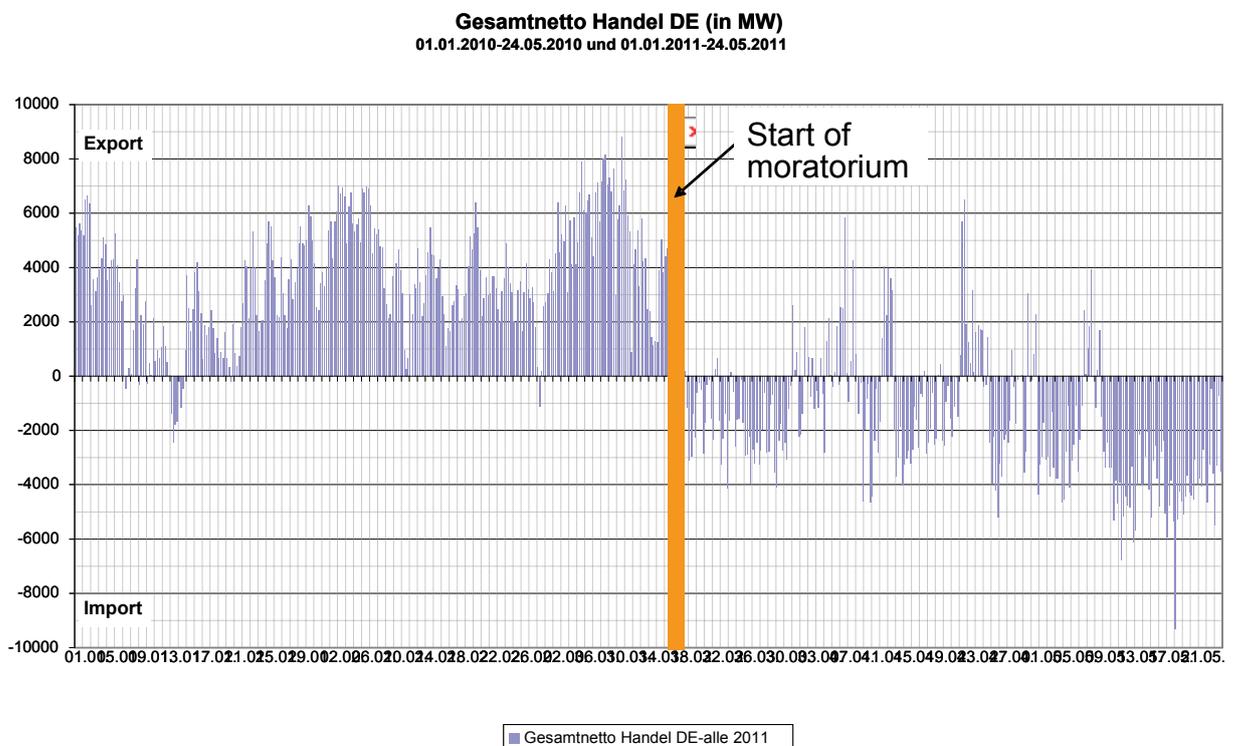
The shutdown of the 7+1 nuclear power plants in the context of the moratorium increases the need to rapidly implement the additional planned new line paths in the Germany transmission network (in particular the EnLAG² projects and within these, the projects Görries-Krümmel, Osterath-Weißenthurm and the so-called “Thüringer Strombrücke“) and to expedite these.

5. The moratorium causes major voltage maintenance issues in the Rhine-Main, Rhine-Neckar regions as well as the Hamburg region, because major providers of reactive power have disappeared in the wake of the moratorium. The TSOs, on the one hand, assist each other by providing relevant equipment (reactive power compensators). On the other hand, they intervene in power plant dispatch and maintenance schedules of conventional generators in order to provide a sufficient amount of reactive power.

The TSOs consider using offline power plants in ‘phase shifter operation’ mode. This mode, in principle, is appropriate for providing required reactive power; it however requires conversion work taking between three and six months and raises, depending on the type of generator, complex issues including legal questions that need to be investigated further.

² Energieleitungsausbaugesetz (EnLAG), Energy Line Extension Act

6. In case of a permanent shutdown of the eight nuclear power plants affected by the moratorium, Germany as of today can no longer support security of supply in the European interconnected grid to the extent it has done so far. This is illustrated by the following chart. This development is not without problems as neighbouring countries have so far counted and relied on German exports.



Data: ENTSO-E, Chart: Bundesnetzagentur

7. Even after repeated analyses, Bundesnetzagentur maintains that in critical load/generation situations in both summer 2011 and winter 2011/12 the level of security of supply in terms of generation is only just adequate. Security of supply in terms of generation can be maintained in Germany independently, i.e. without additional imports.
- This does not mean, however, that Germany will not become a net electricity importer on certain days or during certain weeks. Such imports are however market-driven on the basis of lower generation cost in neighbouring countries.

There is no possible buffer left for any additional power plant shutdowns. By contrast, it seems essential to ensure completion of those power plants already under construction that use non-volatile sources of energy, and to accelerate realisation of planned projects. It needs to be assessed carefully whether all projects under construction actually go on stream as planned.

To Bundesnetzagentur's current knowledge, new build and decommissioning of conventional generation capacities is developing as can be seen in the following table. Uncertainties such as boiler issues or other technical problems cannot be anticipated of course.

Capacity in MW	New build	Decomm.	Balance	New build	Decomm.	Balance	New build	Decomm.	Balance
Energieträger	2011			2012			2013		
Waste	0	0		7	-33		26	0	
Lignite	1050	-980		1690	-980		0	-60	
Natural gas	1038	0		251	0		445	0	
diverse	36	-89		0	-110		70	0	
Pump storage	0	0		195	0		0	0	
Coal	725	0		1481	-861		5824	-214	
Total	2849	-1069		3625	-1984		6365	-274	
Balance			1780			1640			6092

Source: Bundesnetzagentur

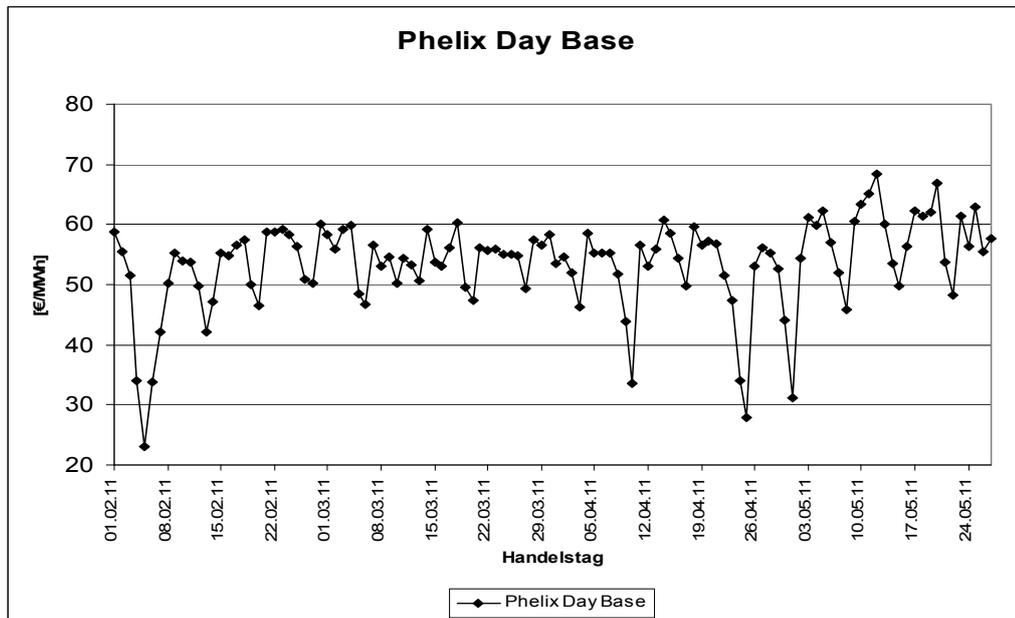
The balance of decommissioning and new build until 2013 is estimated at 9512 MW. Of these, however, only ca. 2700 MW will be located in southern Germany.

In 2011, to Bundesnetzagentur's knowledge only the CCGT plant Irsching 4 with a capacity of 530 MW will go on stream in southern Germany. E.ON has announced to decommission the fuel oil power plants Pleinting 1 und 2 with a combined capacity of 740 MW. It needs to be investigated whether this should be postponed.

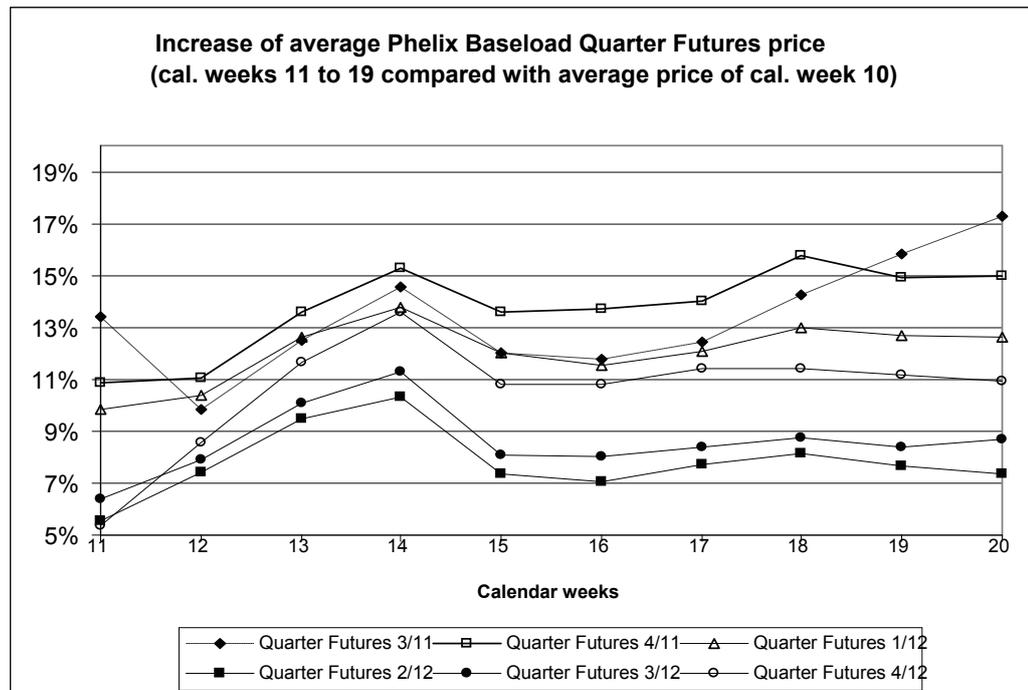
All other gas and coal power plants that are expected to go on stream in 2011 still are located in North Rhine-Westphalia and Lower Saxony and therefore cannot alleviate the critical network situation outlined above.

- The level of power prices on the spot and derivatives markets has risen as a consequence of the moratorium. This however mainly concerns a singular price increase which has not been followed by any major increases since.

The price increase is significantly higher for the winter quarter than for the entire year 2012 and for the summer quarters (winter quarters appreciate by ca. 11-15%, summer quarters by ca. 7-8%). A comparably strong price increase can be noted for power deliveries in the third quarter of 2011. The markets do not appear particularly nervous so far.



Source: Bundesnetzagentur



Source: EEX, Bundesnetzagentur

9. It appears reasonable to reactivate power plants which are in 'cold reserve' and to put them into an operational state again. Bundesnetzagentur explicitly welcomes that the new EnWG will contain relevant powers for the TSOs in this regard. An early adoption of the Act is advisable. This measure serves to relieve networks especially south of the river Main. At the moment Bundesnetzagentur cannot determine the cold reserve potential in southern Germany exactly. Bundesnetzagentur is currently aware of some 280 MW which can be reactivated in the short term. For this reason cold reserves alone cannot remedy the network problems in southern Germany.
10. Bundesnetzagentur has initiated proceedings for a determination to implement a short-term obligation for all generators connected to the transmission network or with a significant influence thereupon to offer redispatch based on current sample contracts. The issue of appropriate cost assessment and reimbursement will also be clarified by Bundesnetzagentur.
11. The power plant maintenance schedule for 2011 requires a continuous review. The TSOs must ensure (and, in the case of the power plant Staudinger 5, have ensured) postponement or modification of such maintenance measures. Bundesnetzagentur has corresponding legislative measures to clarify the TSOs' powers in this regard and welcomes the fact that it will be taken up in the

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revised EnWG.

12. From a TSO perspective, long distance transport corridors running in the same direction as a result of load-remote generation create a challenge: There is an increased risk of cascading and thus large-scale supra-regional effects in the event of exceptional faults, if the load flow from other lines bearing an equally heavy burden needs to be picked up when a central system fails.

It can be expected that such errors in Germany would also have an effect on the neighbouring European control areas. The far-reaching implications of such errors, however, are not a specific consequence of the moratorium. Nevertheless, the German transport network will tend to become more susceptible to so-called multiple faults due to the absence of feed-in from the 7+1 nuclear power plants.

13. The TSOs have analysed, partly on their own accord, partly at Bundesnetzagentur's request, certain especially risky scenarios with regard to both permissible line load and voltage support.

These scenarios include:

- a. the case of a heavy load day in summer on which, in addition to the moratorium, a large number of generators are offline due to maintenance;
- b. the case of a heavy load / heavy wind day in winter;
- c. the case of a heavy load day in winter with very little renewable energy feed-in;
- d. the case of a heavy load day in winter with very little renewable energy feed-in, coupled with failure of a North-South transmission line experiencing heavy load.

These scenarios are deemed highly critical for the network. With current knowledge, scenarios a) and d) appear just about manageable, if major interventions in generation as outlined above. Scenarios c) und d) are most critical and require further in-depth examination and possibly additional further-reaching measures which would need to be discussed.

14. Assuming case c) of a December or January weekday at 5 PM with no wind, no relevant renewable energy feed-in is available. At the same time, given temperatures below zero degrees Celsius, daily peak load is close to annual peak load. This situation is not uncommon and has been experienced in the past years.

15. If, in the case of a heavy load day in winter with very little renewable energy feed-in, a heavy load North-South transmission line fails (e.g. the so-called Paffendorf line), line loads of 120-125% occur already in the (n-1) case and a critical voltage level occurs in the Frankfurt region, even if the TSO takes all available measures to relieve the situation (except disconnection of load).

Further analysis is required to clarify whether the situation could remain just about manageable provided that temperature monitoring is applied under the assumed freeze scenario.

16. In any case, the situation under case d) remains risky, because in a combination of circumstances (failure of a power plant or of another network facility), a line load in excess of 140% would occur which would be uncontrollable due to cascading automatic tripping of protective devices.

It needs to be assessed whether or not precautions should be taken for this case, over and above the (n-1) case which is assumed usually. This is not Bundesnetzagentur's task alone. Instead, the issue as to which level of security of supply is to be guaranteed should be decided as part of the discussion on phasing out nuclear and on extending the moratorium.

17. If the intention is to guarantee a controllable network situation even in a (n-2) case (i.e. parallel failure of two essential network facilities), additional capacity would have to be provided, especially in southern Germany. In the alternative, load would have to be disconnected in a targeted way as a preventive measure.

Bundesnetzagentur's investigation into the potential of additional capacity from pump storage plants and/or generators connected to the distribution grid could not be completed yet, despite intense efforts; and will be continued in depth.

18. The TSOs are currently not aware of any such additional capacities on the German market. They report, depending on the specific case, an additional capacity need of 1400 to 2000 MW in southern Germany due to nuclear power plants that were shut down in the wake of the moratorium.

Bundesnetzagentur is not able to confirm this magnitude at the moment with the certainty required. Bundesnetzagentur however concurs that in a (n-2) case [see above], capacities in the order of 1000 MW would have to be provided.

Given the time available, it is not yet known with clarity and certainty what the additional generation requirements will be and how they could be covered by alternative means, where possible. A thorough investigation will therefore have to be carried out and completed by mid-August.

As there is, according to the TSOs, no threat of a critical situation until winter, the option of covering missing capacity from power plants affected by the moratorium, especially in southern Germany, should be maintained.

19. The extremely critical situation described above again reveals how important a rapid and efficient network expansion is. Reflections on a NABEG³ are therefore indispensable. Following a rapid extension of the relevant North-South paths, in particular the EnLAG project No. 15 (Osterath-Weißenthurm line), such a sufficiently dimensioned network could reliably ensure that the aforementioned case d) is manageable without additional generation capacity.
20. The same holds true for similar problems in northern and southern Germany. In particular the realisation of the line Görries-Krümmel, relevant for Hamburg, and of the „Thüringer Strombrücke“ would significantly improve the controllability of moratorium-induced stress situations in the network.

The full report is available (in German) on Bundesnetzagentur's website at www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Bundesnetzagentur/Presse/Berichte/2011/FortschreibungMoratoriumsBericht26Mai2011.pdf?__blob=publicationFile.

³ Netzausbaubeschleunigungsgesetz, Act on the Acceleration of Grid Expansion