German TSOs to Present Joint Grid Plan in 2012

Comprehensive analyses on wind power integration in Germany have been published by dena (Deutsche Energie-Agentur GmbH) in 2005 and 2010. After the nuclear moratorium in 2011 these analyses must be updated.

Infrastructure for electricity, gas, communications, mail services and railways in Germany is under surveillance by Bundesnetzagentur (The Federal Network Agency).

In its immediate response to the nuclear moratorium on 11th April 2011 [1] the Bundesnetzagentur emphasized that the moratorium was an unprecedented reversal of policy and that it might increase the risk of power failures in Germany and in its neighbouring countries.

A new public grid planning procedure

The future grid planning work must comply with new procedures which have emerged from a law[1] which was passed by the German Bundestag on 26th July 2011 in order to meet EU Directive 2009/72. The new law is an addendum to the German energy law from 2005.

An instruction for the four German transmission system operators (TSOs) is included in §12:

- §12a: Annual preparation of a framework of at least 3 scenarios for the next 10 years and one scenario for the next 20 years.
- §12b: Annual preparation of a grid development plan. The first plan must be ready by 3rd June 2012. The following years the plan must appear on 3rd March.

Scenario frameworks and grid development plans must be presented to the supervising authorities (Bundesnetzagentur) for approval. The approval procedure includes a publication of the documents and a public consultation. A simplified procedure applies after approval of the first plan, however, every three years a complete procedure must be carried through.

An accelerated expansion of primary grids

There has been a strong resistance against new high voltage overhead lines in Germany and in many other countries. It has been argued that reinforcement of primary grids could be avoided by the use of renewable energy sources connected to local grids. Now it seems to be a more common view that stronger primary grids will be crucial for solving the variability problems of renewable energy sources.

In a press release on 7th December 2011 the Bundesnetzagentur approved the first scenario framework prepared by the four German TSOs[2]. *Mathias Kurth*, president of the Bundesnetzagentur, says that a first important step towards an accelerated expansion of the electricity grids has been taken.

It remains to be seen if the new electricity supply problems will soften the popular resistance against new overhead lines.

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[1] Gesetz zur Neuregelung energiewirtschaftrechtlicher Vorschriften , Bundesgesetzblatt 2011 Teil I Nr. 41 (http://www.bgbl.de/Xaver/start.xav?startbk=Bundesanzeiger_BGBl)

[2] Scenariorahmen für den Netzentwicklungsplan 2012 – Eingangsdaten der Konsultation – Stand: 18. Juli 2011 (http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/BNetzA/Sachgebiete/Energie/Energienetzausbau/SzenariorahmenNEP_2012pdf.pdf?__blob=publicationFile)

The three scenarios for 2022

The planning will be rather a parameter analysis than a scenario study. The differences are quantifiable and not fundamental. Scenario B is presented as the central case.

The demand side main characteristics are given in the following table:

Demand		2010	2022	2022	2022
Scenario		Reference	A	B	C
Energy	TWh	548	500	550	550
Maximum load	GW	83	75	83	83

10% reduction of the electricity demand has been assumed in scenario A. There is no discussion of this choice in the scenario framework paper. The reduction would probably require an energy saving program with firm measures. In the slide show from the press meeting the reduction is shown as a possible sensitivity range for all three scenarios.

The supply side main characteristics are given in the following table:

Capacity		2010	2022	2022	2022
Scenario		Reference	A	B	C
Nuclear power	GW	20.3	0.0	0.0	0.0
Thermal power	GW	76.1	79.2	85.7	69.3
Others	GW	9.7	13.1	13.1	13.1
Total controllable	GW	106.1	92.3	98.8	82.4
Run of river hydro	GW	4.5	5.6	4.7	4.6
Onshore wind	GW	27.0	33.4	44.0	69.9
Offshore wind	GW	0.2	11.3	13.0	18.0
Photovoltaic	GW	16.9	34.1	54.0	46.8
Other	GW	6.4	9.1	10.9	10.7
Total renewable	GW	55.0	93.5	126.6	150.0
Total installed	GW	161.1	185.8	225.4	232.4
Share of max load		194%	248%	272%	280%

The table shows that the capacity of the controllable production units exceeds the maximum load in scenario A and B, but not in scenario C. It is clearly stated in the text that Germany will need foreign help for supplying the maximum load in scenario C.

Since the first dena study the major wind power development seems to have been moved from offshore to onshore wind.

It is striking that controllable production capacity is assumed to be maintained at the same level as the maximum demand.

The installed capacity in the three scenarios is between 2½ and 3 times the maximum load, but the capacities cannot be compared and adding them together does not make sense. The production system should be seen as a whole aiming at providing both an acceptable security of supply and less polluting electricity production.

Fuel prices

The future fuel prices are assumed to be the same for all scenarios (table 1 of the scenario framework paper):

Fuel prices (2009) in Europe	
Nuclear energy	0.35 €/GJ
Lignite	0.15 €/GJ
Coal	2.78 €/GJ
Natural gas	8.79 €/GJ
Oil	11.61 €/GJ
CO2 price (2009)	25 €/t

European background

Germany's primary grid is the backbone of electricity supply in Europe. A collapse of the German grid might cause severe disturbances in several European countries. As a result of its central location Germany is exchanging power with a large number of neighbouring countries.

Therefore German market simulations and grid analyses must include several other European countries. ENTSO-E has developed European scenarios in its SO&AF 2011-2025[3].

Scenarios for Germany in Grid Development Plan 2022	Selected scenarios for the rest of Europe from "SO&AF 2011-2025"	Properties of the European scenarios
Scenario A 2022	SO&AF scenario B	Moderate growth in RES. Demand increased by 14%. Max load covered. higher capacity of coal and gas fired units than now.
Scenario B 2022	SO&AF scenario B	
Scenario C 2022	EU 202020	Higher growth in RES. Demand increased by 6%. Max load covered. Reduced capacity of coal and gas fired units.

The German scenarios A and B will be combined with scenario B from SO&AF 2011-2025 and the German scenario C will be combined with EU 202020.

One scenario for 2032

The 20 year forecast will be an extrapolation of scenario B combined with the European scenario EU 202020. The demand in Germany is assumed to be 600 TWh, but the max load will still be 83 GW. Coal and lignite fired capacity has been reduced from 2022 by 10 GW while wind and PV has been increased by 43 GW.

A wide range of analyses

The scenario framework paper explains that for each scenario a *market simulation* will be made for each hour of the year. For each of the 8760 hours the electricity production will be specified for each market area and for each type of power plant.

[3] ENTSO-E: Scenario Outlook and System Adequacy Forecast 2011-2025 (https://www.entsoe.eu/system-development/system-adequacy-and-market-modeling/soaf-2011-2025/)

It will be very interesting to study operational patterns, production shares of thermal power plants and overflow of uncontrollable power.

The market simulation will offer a unique opportunity. By varying the share of renewables in scenario B from the reference level to the scenario B level it will be possible to optimize the production system and to quantify the value the additional renewable power in terms of saved fossil fuel and reduced emissions of CO_2, SO_2 and NOx.

However, the main objective is a national grid development plan. *Load flow calculations* and *stability analyses* will be made for each hour. As a result of these analyses the grid can be optimized and measures for grid reinforcements and grid extensions can be prepared.

A grid development plan for the German primary grid will be specified for each scenario and presented for public discussion.

Desirable transparency in the planning

The stability of the German grid is vital to several countries and many German citizens will be interested in the location of new German transmission lines. Therefore the publication of the results of the planning and the premises of the planning will be anticipated by a lot of people.

The premises of planning include data, calculations and criteria for the evaluation of results and for proposals on grid reinforcement.

The scenario framework paper does not present any details on rules or criteria for the grid planning. Hopefully sufficient details for a well informed public participation in the hearing phases will be published.

The confidentiality required by the energy law could be taken as a convenient excuse for a tight information policy. However, it must be possible to publish information at a suitable level on data, calculations and criteria without compromising confidentiality.