Germany:

Grid Agency Opens Debate on Smart Grids

Integrating large amounts of wind power is a challenge. “Smart Grid” is one of the standard answers to this challenge. But is the smart grid a well defined concept or just a buzzword? The German Network Agency (Bundesnetzagentur) has presented its own understanding in a 50 page paper[1] and invites to a public debate.

Opinions on many important smart grids issues are included in the paper. At the beginning of each chapter it presents one or more theses of which some appear to be unconventional. They may reflect special German conditions or traditions. Due to its interesting views and its high quality the paper is a welcome opportunity to discuss smart grid visions.

This note is my contribution to the debate. I have concentrated my attention on some main aspects. My comment is not intended to be a complete discussion of the paper.

Some main views of the Bundesnetzagentur

- The Bundesnetzagentur wants grid functions to be separated from market functions. Therefore the “Smart Market” is introduced as a necessary complement to the smart grid.
- Grid reinforcements should be economically (volkswirtschaftlich) justified. Bottlenecks in the grids cannot be avoided. A main purpose of smart grid functions is a reduction of the need for grid investments.
- Germany has about 850 grid operators. The transition into smart grids will be an evolutionary process over some decades.
- The wind power integration will require infrastructure changes including new market, communication and data arrangements. The Bundesnetzagentur does not support the assignment of the responsibility for the new infrastructure exclusively to the grid operators.
- The Bundesnetzagentur is against the use of variable grid tariffs in the congestion management. This position seems to exclude the use of nodal pricing and price areas in Germany.
- The Bundesnetzagentur does not find an all-embracing installation of smart meters necessary. Smart meters may be needed for market functions. Therefore they should not be financed exclusively by the grid operators.

Why separate Grid and Market operations?

Wind power integration will require a different infrastructure for electricity trade and transport. The assignment of responsibilities must be an important element of the transition process. The paper has an open view on the assignment of the new responsibilities and presents some alternative models.

Grid operators do exist. The 4 transmission system operators and the about 850 local grid operators are supposed to cover the increasing need for electricity transport and some related activities. But it is not clear who should organize and operate the market place.

From a foreign perspective the separation of infrastructures for trade and transport seems to blur the infrastructure responsibility.

[1] ”Smart Grid” und ”Smart Market” – Eckpunktepapier der Bundesnetzagentur zu den Aspekten des sich verändernden Energieversorgungssystem, Bonn, im Dezember 2011.

The paper supposes grids to be smart if advanced functions allow operation close to the technical limits. The paper admits that according to this definition transmission grids cannot be much smarter than today. A smart market is defined as “the area beyond the grid where amounts of energy or derived services can be traded between different market participants within available grid capacities” (chapter 3.3). This definition could be used on the present markets, so what makes it smart?

In most literature “smart grid” is an intelligent infrastructure integrating the actions of all types of electricity users efficiently. The uncontrollable production from wind power will add new challenges. New intelligent functions in networks, protection, communication, data management and trading arrangements will be needed for the integration. All these functions are necessary elements of a coherent infrastructure which must be continuously developed and updated.

The paper is right in emphasizing smart market features but the separation of grid and market operations might prevent the necessary coherency.

A clear assignment of responsibilities is desirable

Germany has 4 transmission system operators and about 850 grid operators corresponding to 4 transmission grids and 850 local grids.

The transmission system operators are providing long distance transports of electricity and the ancillary services which are required for maintaining a stable operation. However, the local grids hold an increasing share of uncontrollable production. Therefore it is natural to expect local grid companies to provide a corresponding share of the ancillary services.

The paper indicates that some local grid operators might be reluctant in the reorganization of their grids. The Bundesnetzagentur says that they would welcome more cooperation and more consolidation among the local grid companies.

The market is more anonymous in the paper. It explains that balancing demand and supply within available grid capacities could be either negotiated by market participants or optimized by grid operators. The paper rightly asks the question: who should be responsible for organizing market places, tariffs and congestion management?

The Bundesnetzagentur rejects to assign this responsibility completely to grid operators (chapter 3.3), but indicates that grid operators should be reluctant with service curtailments while market participants are negotiating possible solutions.

This is not a solution. The same question has been discussed elsewhere since the nineties. Several possible solutions exist. None of them is perfect, but according to local conditions it is possible to find a usable model. The best solutions will have the common feature that one body is responsible for organizing the necessary infrastructure for an efficient service for all users of the electricity system. Operating the infrastructure can be distributed among several bodies.

Instead of the separation of market and grid operations a distinction between infrastructure operators and commercial market participants could be considered. The duties of the infra-

structure operators should be defined in a legal framework which must be centrally planned and continuously updated.

A dilemma: Balancing grid investments and congestion problems
The increasing share of fluctuating production will create local peak loads in the grid and reduce the average utilisation of the grid components. Many grid reinforcements will have a low utilization and therefore a low profitability. The paper says that the investments should be economical from a social and from a business point of view, but that unavoidable interruption of grid services should be kept at an acceptable level.

There is no doubt that balancing investments and service quality will be a growing dilemma in the wake of the growth of fluctuating power. On the other hand flexible electricity production and demand might create a more varied need for service quality. A diversified service quality could give some relief.

The paper acknowledges the dilemma and says that a reasonable balance should be found (chapter 5.2). It recommends a discussion on the dilemma. Who could disagree?

The market can be a main tool in the allocation of grid capacity
Chapter 5 of the paper is called “Grid Capacity Management” (“Netzkapazitätsmanagement”). The introduction mentions three possible control methods: variable grid tariffs, negotiated curtailments and curtailments ordered by the grid operators.

These measures are supposed to reduce the need for grid reinforcements. The paper expects that the acceptability of new transmission lines will be better when it becomes obvious to everybody that grid reinforcement cannot be avoided.

The Bundesnetzagentur cannot support variable grid tariffs, mainly because of the assumed administrative complexity (chapter 5.1). Market models have been developed for an optimal allocation of supply and demand within given grid constraints. One example is Nordpool Spot serving four Nordic countries since the 1990s. The Nordpool system implies a division into bidding areas and in cases of congestion also price areas. The approach of the Bundesnetzagentur has excluded such models from the discussion.

What could be wrong in splitting Germany temporarily into price areas (chapter 10.1)?

A cell structure can define local responsibilities
Chapter 9 of the paper discusses organizing the grid as cells. The head line says “Cells in stead of long distance transmission” (“Zellen statt Verbund”). A thesis in this chapter states that the trend towards decentralism will reduce the use of the transmission system.

The assumptions are wrong and may deflect the discussion. The growing fluctuating production from wind and PV will have the opposite effect. The transmission system will have a very important role under all circumstances.

The cell can be a common concept for organizing local grids. The local grid operator will be responsible for activating local resources, including reactive power. The purpose is better utilization of resources and maximum robustness to critical conditions. During emergencies the local grid operators should try to maintain local services and contribute to the restoration process.

By defining a common grid concept it will be possible to press local grid operators to implement smart grid functions locally.

Infrastructure for communication and information

The paper discusses collection of data, transmission of data and processing of data as open questions. This is understandable due to the complexity of the smart grid functions and the number of actors.

Commercial data must be kept confidential. This is one reason why the distinction between market participants and infrastructure operators is important. The paper presents the idea of having a data "turntable" for the electricity market corresponding to the PANDA system used in Denmark. The paper outlines more or less central ways of organizing the data turntable.

The Bundesnetzagentur realizes that an electricity market is a condition of the transition from demand controlled production into production controlled demand. Market-based activation of end-user flexibility would require two way communications with each customer. It is correct that this function does not require broadband communication (chapter 7.1), but local automation will currently need some market information and metering must be made continuously, for instance per hour.

The Bundesnetzagentur has a reluctant attitude to smart meters. The reluctance seems to be based on the opinion that market participants should pay for smart metering to the extent it is serving market purposes (chapter 12.1). This is a fair position, but the metering process should be operated by an infrastructure operator who can observe the necessary confidentiality.

There are different understandings of the smart meter concept. Therefore it is strange that the paper defines smart grids and smart markets but not smart meters.

Electricity storage

Chapter 8 discusses the possibilities of storing electricity. The Bundesnetzagentur distinguishes between grid storage and market storage. This chapter shows the difficulties of this distinction. A storage can be operated according to price signals and contribute to a more efficient use of the grid. The market and the grid are two complementary elements of a system aiming at the best possible service to the users of the electricity system.

The paper also discusses more exotic solutions such as hydrogen production (chapter 8.2) and electric vehicles (chapter 13).

On this background it is strange that the paper does not mention combined heat and power (CHP). There is a considerable CHP production in Germany. Depending on the capacity of the hot water storages CHP systems can convert large amounts of surplus electricity to heat by heat pumps or electric heaters and they can increase the electricity production when needed. The CHP operation can be perfectly optimized by the use of price signals from the electricity market. These functions could easily be activated and make the CHP systems smart grid forerunners.