Findings from the European Exchange of Experiences "Tomorrow's Distribution Networks" Symposium 12-13 April, 2011 in Darmstadt

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The overhaul of our energy system will have to take place much faster than has been expected even in the keenest forecasts. This paper summarises the findings from the European exchange of experiences obtained during the symposium "Distribution Networks of the Future", held 12-13 April, 2011 in Darmstadt, Germany. It also supplies suggestions to the government for the regulatory framework and additional fields of activity in research.

The technologies for the network penetration of information and communications technology (ICT) to fulfil innovative functions for the future energy market and grid operation have been prepared for launch with the 6 European Novel ICT and 6 German E-Energy projects. A wide-ranging network of Europe-wide projects is in future to also take advantage of the synergies and contribute to a Europe-driven global standardisation of new solutions. The focus now is on aligning definitions and developing common approaches. Standardisation in the field of SmartGrids can be driven forward at a much faster pace through similar feedback from different large research projects. In this way, not only can projects benefit significantly, but so can manufactures. We can ascertain that the technological components are steadily progressing.

However, profound paradigm changes in politics and society are urgently needed.

The symposium made clear, that SmartGrids represent the basis in order for the 20-20-20 goals of the EU for the year 2020 to become a reality and that the EU's "Strategic Energy Technology Plan" (SET Plan) has a chance of implementation.

Today, no one can calculate the rate of return for SmartGrids in Euros or Cents.

SmartGrids are a task for all of society today, in order for the supply challenges of the 21st century to be met and to ensure the rapid integration of "renewables" without any loss of supply quality.

"SmartGrids" are among the top 10 issues of the European Commission!

SmartDistribution as a part of SmartGrids is founded on three pillars:

- Improved network monitoring and automation all the way down to the low-voltage level,
- Aggregation of generators, storage and controllable loads to self-equilibrating active cells, so-called virtual power plants (VPP).
- Introduction of smart metering and participation of the electricity customers in the energy market.

It is high time that regulatory conditions are set forth along with the technological conditions so that the SmartGrid vision can become a reality – and only under these circumstances can the transition from nuclear power to "renewables" be completed without any danger to the "Generation – Grid – Loads" system!

The most important players in the realisation of SmartGrids are, by their nature, the grid operators - for transmission as well as distribution.

The primary task in distribution is ensuring the customary supply reliability and voltage quality despite the varied range of input and future connections for electric vehicles. The online monitoring, regulation and control must therefore be significantly expanded all the way to the low voltage level. Ongoing projects show how this works.

However, on which basis can distribution network operators (DNO) do this? They are subject to regulation and currently receive a fixed revenue ceiling, which they apportion between the distributed energy. A high percentage of distributed generation increases the internal consumption and the basis for the distributed energy supply erodes – this result in an increase of specific costs for the end customer. Hence, the grid operators have a high percentage of distributed generation and consequently they and their customers suffer serious disadvantages.

The current basis for grid charges is thus presently no longer sustainable. There are no incentives for the distribution network operators for load management either, and a higher internal consumption, because the lower supply from the upstream level is not remunerated in any way.

The current consideration, even on the part of the German Regulator (Bundesnetzagentur), of defining a new basis for grid charges for distribution networks based on the efficiency of the grids does not go far enough. The statement issued by the Power Engineering Society (ETG) on 27 March, 2010 concerning the Smart Grid position paper by the European regulators ERGEG of 9 December, 2009 goes into further detail:

The basis for the grid charges must in future include the necessary operating costs including depreciation for capital costs for fulfilling the supply tasks including the assumption of distributed generation. Benchmarks serve to define the foundation in this. In addition, selected key figures of the supply quality and equipping of SmartGrids offer the option of bonus-penalty incentives.

New services and market roles will be created within the SmartGrid context, either in the regulated sector of the distribution network operator or in the non-regulated sector as new companies. The distribution network operators are able to take on new services and develop into interactive partners of their customers, as well as for neighbouring distribution networks and transmission networks.

However, only under the conditions that

- distributed generators require equilibration starting with MW output,
- an amended Renewable Energy Law (EEG), on the one hand, retains the agreed promotion and on the other hand supports the participation in the markets for energy and balancing power,

- and that energy storage is also promoted

can the progressive concept of the virtual power plant become a reality supported by economic interests.

The discussion on a territorial or widely distributed coordinated aggregation of generators, controllable loads and storages to distinct advantages for the territorially positioned awarding of the "virtual power plant" service. The same also applies to additional new services related to SmartGrids, such as "metering point operators", "metering service providers", "communications suppliers" or "e-mobility control center".

The metering point operator, for example, is to be given the opportunity to service other sectors in his territory, such as gas, water, district heating, because this is the only way competition can result in lower costs.

For example, the following approach has been chosen to promote competition and lower costs in Great Britain: The bidding and awarding of metering point operations and metering services has been handled completely and territorially for all relevant sectors for years. In Germany as well, there are technological developments to organise the read-out of the different sector metering points digitally and uniformly by means of a superordinated Multiutility Controller (MUC) This would offer cost savings through uniform usage of the technical possibilities. Substitute competition could take place through bidding or benchmarking in a regulation. However, a political decision has not been reached!

A paradox seen in Germany, where the distribution network operator acts as the principle responsible party for metering point operations and the superordinated selection option of a metering point operator by each individual customer can only result in patchwork throughout Germany. This is something we had actually considered a thing of the past with the end of provincialism in the year 1870.

This does not make for cost savings!

The future belongs to the creation of regional optima on a distribution network level for ensuring stable network control, as shown in Figure 1.

In the territory of a distribution network operator, a number of smaller generators of different technologies, storage and consumers and who actively participate in the active load management are aggregated and coordinated as part of a virtual power plant, with the goal of economically optimised participation in the markets for energy, balancing power and emission certificates (maximisation of the use of renewable energies).

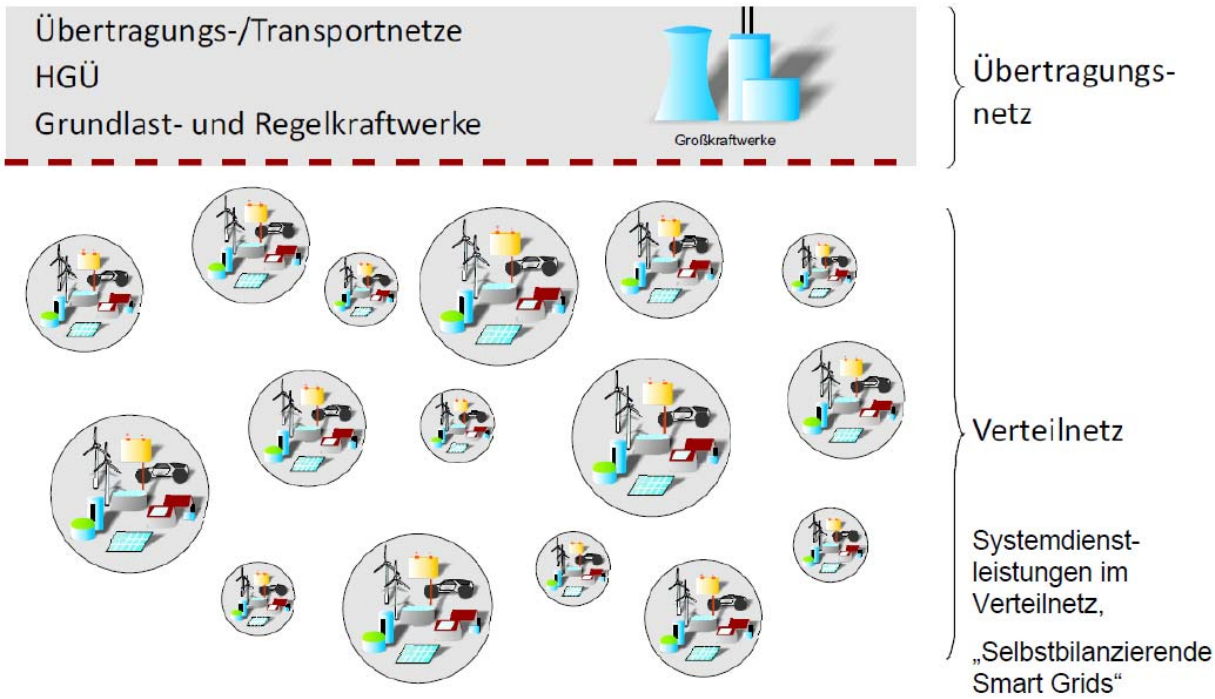

Figure 1: "100" self-equilibrating SmartGrids at the distribution level

Demands must be made for:

- These active virtual power plants are self-balancing and therefore release the transmission network operator from the EEG balance grid.
- All SmartGrid services are attributed to the non-regulated market and are to be opened for bidding and awarded for the distribution networks representative of the regions on a scale of approx. 1 % of the German electricity market.

The third pillar of SmartDsitribution is frequently referred to as Smart Metering today, which is often rejected because there supposedly is no apparent benefit to be expected. Argument:

"If I only run the washing machine at night during low tariff hours, I save less than € 20 across the entire year". And that is true - at least for now!

However, will the current tariffs with minimal spread between low and high tariffs still be valid in the future? Will not much stronger market fluctuations than we experience today also have an effect on tariffs, even hourly, e.g. in connection with wind fluctuations and the quick start-up of gas turbines, as shown in Figure 2. And what is a smart meter anyway? Is it sufficient that it can communicate, or are other characteristics required, such as the visualisation of variable tariffs and their forecasts, consumption and costs?

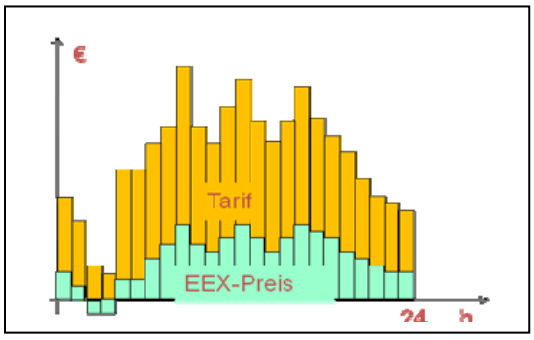

Figure 2: Perspective dependency of the tariffs on electricity prices on the stock market (the negative prices possible today as a result of high winds are shown here)
(Source: Life Needs Power 2010, Buchholz)

The spreadings of the tariffs should clearly rise, since on the one hand the costs of the renewable energies can be significantly reduced by quantity and technology effects, on the other hand the costs of fossil-fueled power stations drastically rise - because of the sinking annual use hours and the rising costs of primary energy?

All these questions must be clarified before starting to include electricity customers in the market with an area-wide roll-out of smart meters.

Here, too, a paradigm change is urgently required regarding:

- Weights and measures law with the demand for a register in each meter for each tariff. Do we not have a register in our mobile phones for each call? Can't the German boards of weights and measures learn from the Telekom or Vodaphone that it can be done differently? And are there not web services available today which reproduce registers transparently and in real-time?
- Procurement and accounting of energy on the basis of the network access ordinance according to analytical or standard load profiles. Therefore, there is no benefit to customers or suppliers when this load is shifted to off-peak periods.

All current efforts in the many smart meter pilot projects are for naught if there is no flexibility.

In summary:

If Germany takes its contribution to the European goals seriously, then new regulations are urgently needed:

1. A new basis for system usage charges for transmission network operators and distribution network operators (for increasingly distributed generation),
2. amended EEG and promotion of the introduction of future equilibration-required EEG plants and storage in steps,
3. expanded liberalisation in metering and the services sector for SmartGrid systems as well as regulatory standards for definition purposes and a large scale introduction of smart meters (also see 3rd EU package of measures).

However, the different laws, ordinances, codes and rules from different authorities must be uniformly amended in order to implement the new rules!

This requires superordinated coordination. The regulators should play a key role in this coordination.

A broad uniformity is also to be achieved Europe-wide for future regulation, so that a true European electricity market can be established at all.

European regulators and their associations re therefore also called upon to contribute their respective competencies.

The experiences and findings from the European and German E-Energy projects are essential in this "Apollo Program" and associations such as CIGRE or ETG within the VDE are ready to contribute their expertise.

During the symposium, experts discussed the essential topics in four workshops. At the close of the event, the results of these workshops were then summarised by the workshop hosts and discussed in a final podium discussion together with representatives of the European Commission, CIGRE, E-Energy, ETG, IEC and the expert audience.

The following topics were addressed in the workshops:

1. Workshop: Business model for new services in smart distribution networks
2. Workshop: Demand Side Management and Demand Side Response - initial experiences
3. Workshop: New data models for Smart Dsitribution and the way to update standards
4. Workshop: Obstacles on the path to SmartGrids - Which regulation is required?

The following recommendations were formulated during the podium discussion:

- Exploit additional synergy potential by compiling and publishing findings from the national programmes to a greater extent. For example, in Germany, the cooperation is to be intensified between the two European projects (Mirabel and Web2Energy) and the German E-Energy projects. The solutions developed in these projects are to be implemented on a broader practical basis as part of the ETG task force "Active Energy Grids".

- The results of all projects are to be summarised in a further symposium held in the second half of 2012 (e.g. in Spain) in order to have the goals uniformly represented around the world (among other things in standardisation).

- The obstacles mentioned above must be cleared away immediately to pave the way to SmartGrids. The necessary amendments must be formulated in current laws.

- The practical and future area-wide implementation in the networks is to be driven forward to a greater extent along with research and pilot projects, which continue to be necessary, and which must research additional components, such as storage.