

## SMART GRIDS AND NETWORKS OF THE FUTURE - EURELECTRIC VIEWS

Mihai PAUN, Gunnar LORENZ, Pierre SCHLOSSER  
EURELECTRIC  
[glorenz@eurelectric.org](mailto:glorenz@eurelectric.org)

**Preliminary definition:** A Smart Grid is an electricity network that can intelligently integrate the behaviour and actions of all users connected to it - generators, consumers and those that do both - in order to efficiently ensure sustainable, economic and secure electricity supply.

### ABSTRACT

This paper is a summary of information on the existing level of the Smart Grids environment and of the related challenges in terms of networks development. It focuses on regulatory recommendations for an optimal smart grids implementation.

### INTRODUCTION

Smart Grids is a new concept for electricity networks across Europe. Its initial objectives are to increase the efficiency, safety and reliability of the European electricity and gas system and networks, e.g. by transforming the current electricity grids into an interactive (customers/operators) service network, and to remove the technical obstacles to the large-scale deployment and effective integration of distributed and renewable energy sources as required by the recently adopted Renewables Directive.

Efficient electricity transmission and distribution systems are a fundamental requirement for providing European citizens and companies with an essential energy source and meeting the demands of the 21st century. The need to strengthen Europe's electricity networks, meet growing electricity demand, support rational use of energy, develop a trans-European electricity market and integrate more distributed sustainable generation resources, including renewable sources, presents major challenges. The role that future electricity network design and investment will play in achieving wider EU energy policy objectives is decisive. To that end, the networks technologies will be the key enabler for the wider and deeper penetration of distributed low-carbon generation.

### SELECTED RESULTS OF EURELECTRIC SURVEY ON SMART GRIDS

In the framework of the EURELECTRIC survey on smart grids [1], data on the Smart Grids concept and practical implementation in distribution companies have been

collected and summarized. This data collection gives a first idea of what Smart Grids really means in many European countries.

### Network Development

Major changes in MV network architecture are not expected by all DSOs, but more prominent changes seem to be expected in LV network architecture. Bidirectional flows of electricity at distribution level are expected to still be an exception. The power will flow mainly in the usual top-down direction (from T to D). The power flow from distribution level to the overlying level will only occur on specific spots and for limited durations (ex. rural networks with on-shore wind farms).

Future distribution network operation is still an issue and the distribution network will not be operated like a transmission network. Distributed Generation developments will influence future networks investments and the expected installed capacity for DG will be a criterion in network dimensioning (Fig. 1).

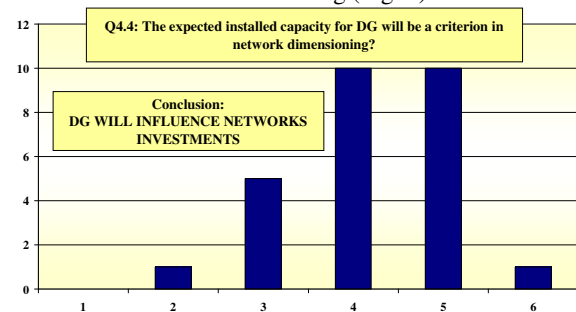


Figure 1: Network development and DG influence.

The expected mass introduction of electric plug-in (hybrid) vehicles gives rise to the question what challenges DSOs expect in facilitating the network integration. Integrating the charging of electric vehicles (EVs) in electricity networks does not require any new technology to be developed. The existing European electricity infrastructure can be used in most of the countries for charging vehicles. If cars are charged at night even a standard household socket would be sufficient. The grid is robust enough to allow a significant number of electric plug-in (hybrid) vehicles to charge simultaneously without any severe impact on the network in off-peak time.

The EURELECTRIC survey shows that electricity distribution network development for plug-in vehicles is not an immediate issue to be addressed. However, more

discussion is needed. Advanced storage devices (batteries, compressed air systems, etc.) are used in some cases in DSOs operation, however, no breakthrough of advanced storage devices in DSOs operation is to be expected. Advanced technologies enabling the island operation of parts of the electricity distribution network are occasionally implemented, but island operation of parts of the distribution network is not yet expected by all DSOs.

**Active Management of the Grid**

Most DSOs see active management of the grids an alternative to network reinforcement. The actual degree of networks automation will increase in order to ensure better quality of service to customers. The impact of Virtual Power Plants on the power flow is not clear, and nor is the role of DSOs in their "operation". DSOs have a key role in system security and a role in enabling DG to contribute to the system security. The question is how this should take place in practice.

**Regulation – key success factor**

Legislators and regulators need to take into account the new tasks of DSOs in contributing to the environmental goals of the European Union ("20-20-20 goals"). They should incentivise DSOs to invest in the most efficient way for the benefit of market participants and the society as a whole. Support for technical research and development could be considered as well. However, the risks associated with new technology are covered only to a limited extent by the existing regulatory framework and more work should be done in order to cover this technological risk (Fig. 2).

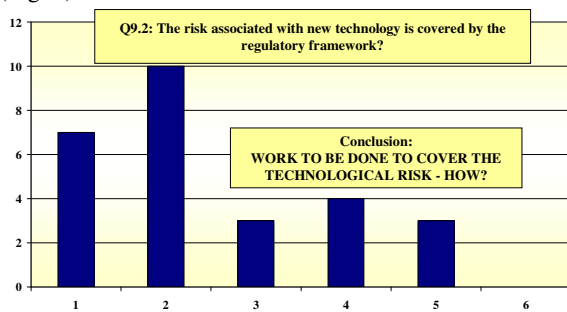


Figure 2. Future Challenges for Distribution Business

Incentives given by Regulators to DSOs for their involvement in R&D work and for the development and deployment of new technologies supporting Smart Grids should be improved.

**EURELECTRIC VIEWS ON SMART GRIDS**

EURELECTRIC believes that Smart Grid will contribute to a paradigm shift in the way electricity networks will be planned, operated and maintained in the future [2]. This paradigm shift will be achieved by incremental

deployment of innovative new technologies and solutions as networks are renewed and expanded. With this evolution, the power grid will become a platform for advanced business and new energy services and products are to be provided by the suppliers and other market operators, for instance ESCOs. This is expected to offer added value for the customers, market players and the society. This will most probably require more changes in market structure, commercial arrangements and certainly regulation. Defining the interfaces between regulated and non regulated activities is highly needed.

**Towards a new tariff structure?**

Within this framework and in order to optimize the possible benefits of smart grids, EURELECTRIC would like to underline that there is a need to develop new grid tariff and commodity price structures (dynamic pricing) ; in this context the introduction of a fixed net tariff structure based on, for example, agreed power could also be assessed.

Currently, network owners receive revenue from connection charges that have nothing to do with energy flow and use of system charge that is related to energy flows. Attempts to increase efficiency and peak load reductions do not necessarily decrease energy volume and instead we see energy volume shifting that makes the overall energy usage more efficient. In any case use of system charge is to be reviewed on a regular basis and the regulators could provide the right incentives to operators and network owners to pursue the efficient use of energy.

The added value can be enhanced by introducing flexible grid fee and power price structures which offer customers an incentive for better grid loading and a reduction of peak loads.

**Clear role and responsibilities needed**

A vital precondition for a successful Smart Grid implementation is the neutral role of the Smart Grid and the DSO role / service provider responsible for access to the grid, metering, and depending on the market model also metering data management. Together this should create a neutral market platform where DSOs act as market facilitators. This optimally responds to the needs of the market parties.

EURELECTRIC deems it essential that the roles and responsibilities of the different actors are clearly defined, where a distinction is made between competitive activities of suppliers and ESCOs on the one hand, and regulated activities of DSOs on the other hand. Competition will encourage innovative approaches aimed at better meeting customers' requirements.

**Regulatory incentives to invest**

EURELECTRIC thinks that the economic regulations for the DSO's should give suitable incentives for making the necessary investments according to regulations and market demands. Using a market based strategy and a technology neutral approach will contribute to an efficient and dynamic development to the best for the customers. EURELECTRIC considers that regulators should provide appropriate incentives for the grid operator to sufficiently invest in a smart infrastructure, but he should also ensure a suitable return on investment, especially if this investment provides no other advantages for the grid operator within the remaining regulations. This does not exclude but rather requires that the needs of the grid users and the power and services' suppliers should be clearly determined and also taken into account when initially defining the investment requirements.

Benefits should be carefully identified and allocated to stakeholders. Noting that mainly DSOs are investing in smart grids, but are not necessarily the only beneficiaries, some incentives should be given to them in order to invest, and this can be done through incentive regulation for smart grids. Investments for smart grids might benefits several parties but are often only done by DSOs (See Figure 3).

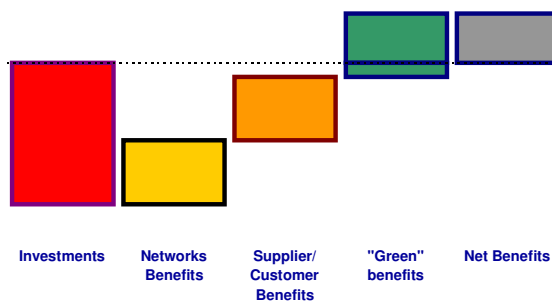


Fig. 3: Investments for Smart Grids and benefits.

### AN OPTIMIZED SMART METER ROLL OUT AS A STEPPING STONE FOR SMART GRIDS

On behalf of the European Distribution System Operators (DSOs), EURELECTRIC expresses its strong support towards the roll-out of Smart Meters in the European Union. EURELECTRIC sees this positive move as a first step towards the development of Smart Grids [3].

EURELECTRIC sees Smart Metering as a very promising technology that can substantially empower electricity customers to become active managers of their consumption. In this promising context, EURELECTRIC would like however to point towards the remaining barriers to a smooth roll-out of smart meters in Europe and outline key considerations that could help improving the

design of the future smart metering frameworks. Accordingly, EURELECTRIC issued six recommendations to optimize smart meter roll out in Europe:

- (1) The EU Smart Meter roll-out should be optimized. It should occur on a geographical basis so as to maximize economies of scale and reduce costs. Likewise, only essential functionalities should be put in the meter installed by DSOs. Customised services could be added by interested consumers (directly or indirectly through retailers or energy service providers).
- (2) National Regulatory Agencies should clearly indicate that Smart Meter roll-out will be tariff-financed. Smart Meters will not only bring benefits to the whole length of the electricity value chain, they will also carry externalities to society as a whole.
- (3) Smart Meters should provide frequent and precise information to maximize benefits in terms of billing, demand-side-management, grid load planning and interruption management.
- (4) Considering the constant improvements in smart metering technologies, rolled-out smart meters should be able to be remotely upgraded to keep costs down
- (5) Electricity retailers and energy service companies should be put in a position to enable customers in making use of smart meter information to reduce peak consumption and CO2 emissions
- (6) Following the 441 Mandate issued by the European Commission, EURELECTRIC welcomes the on-going standardisation efforts at the European Union level to set up open communication interfaces. However, in order to reach full inter-operability of smart meters, EURELECTRIC calls on the European Commission to issue another mandate to the European standardisation bodies: its objective would be to reach standardised data exchange protocols so that Distribution System Operators (DSOs) can improve verified customer data transfer to the service providers of the customer's choice.

### REFERENCES

- [1] *EURELECTRIC Views on Smart Grids*, 2009
- [2] *EURELECTRIC Response to ERGEG Consultation on Smart Grids*, 2010
- [3] *EURELECTRIC Policy Statement on Smart Meters*, 2010