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## Smart Grids: a vision and recommendations from technology providers

### INTRODUCTION

The present paper has been drafted by Orgalime representing the engineering industry as a whole and a number of European Sector Associations including T & D Europe, ESMIG, CECED, EUROPACABLE, CAPIEL LV and CECAPI as well as member companies.

Orgalime supports the idea that an integrated strategy towards smart grids must become a priority area for the future energy strategy for Europe [1] and welcomes the work of the European Task Force on Smart Grids Implementation [2] which is actively supported by Orgalime members' experts in order to issue practical recommendations to European policymakers which can be built upon in the context of the development of the EU2020 strategy. Orgalime believes that the modernisation of energy networks and smart grids should also be given a priority in negotiations on the future multiannual Financial Framework of the EU (2014-2020) which will decide on budgets for the funding of infrastructure programmes and R&D programmes as well as large scale demonstration projects.

There is a significant potential for smart grid solutions that optimise the energy system as a whole – from production to distribution and consumption of energy – in the field of electricity, heat and transport. However, in our view, the roadmap for the development of a smart grid is still not clear today and the current regulatory framework, in particular, in many member states, does not create consistent conditions to reach the objective of developing a sustainable smart grid system in Europe. Indeed the current regulatory framework will not be sufficiently flexible to deal with immediate requirements due to the change in energy mix arising from the current 20-20-20 objectives and will not offer sufficient possibilities for innovative applications in the future, in particular arising from the demands of consumers.

If the EU is to pursue its environmental and climate change objectives it needs to optimise the potential of electrical energy and implement a number of technologies, products, systems and competences which will push the development of an optimised green energy system in Europe. Orgalime believes that European legislation could also help to support the development towards a future European energy system that must be able to handle a number of new requirements and challenges highlighted in this paper. In this first policy paper, then, we outline our core vision and initial recommendations for the development of a European smart grid and look forward to the support of the European Commission and a continued collaboration with the EU institutions for the development of smart grid policies which at the same time should enable EU's manufacturing industry to retain leadership in technologies which will answer our societies' requirements tomorrow.

## WHY DO WE NEED A SMART GRID?

The EU and its 27 Member States have adopted a set of policies, measures and targets to mitigate climate change, reduce environmental pollution and to increase the security of energy supply to consumers and a highly energy-dependent economy in Europe. Europe has committed to deliver the 20-20-20 targets on greenhouse gas emissions, renewable energy and energy savings. As a result, 20% of the EU's energy supply should come from renewable energies by 2020 – a substantial share of total energy production which has to be integrated smoothly in order to ensure that the energy system continues to function adequately.

It has been widely accepted in Europe that it is more cost-effective for society in the longer run to tackle environmental problems early instead of allowing them to build up. To meet the societal challenges ahead, increase the share of renewable energies and enhance the energy efficiency from production to end-consumers, the electrical energy system needs to be transformed from a largely centralised production and managed system to a much more decentralised and consumer-interactive, flexible and intelligent system. And the electrical system needs to be highly integrated with other energy systems, such as district heating and gas distribution systems, in order to fully harvest efficiency benefits across energy systems. (e.g. Utilising district heating systems to absorb surplus production of wind power or using small distributed combined heat and power plants to supplement electricity production with low production of renewable energy.) Orgalime believes that the investment into smart grids today will save society costs for investment into generation and network infrastructure and reduce the energy cost for end users in the future. Furthermore it will also allow the integration of sustainable technologies (for example wind) and sustainable transport (for example e-vehicles).

In order to meet the agreed environmental and geopolitical goals the energy system in Europe must evolve in the years ahead. The overall energy-mix of the future in Europe needs a change in paradigm to successfully develop a pathway to achieve the overall targets for CO2 emissions reduction. Renewable energy sources from, for example large scale off-shore wind power plants down to small scale photo-voltaic installations on roof tops are delivering electricity. This “green electricity” is the only form of energy that can be used directly for lighting, heat, mechanical drives, communication, and all kinds of other applications such as electrical vehicles, heat-pumps, green buildings etc. which seek to achieve the right balance between our society, nature and the environment. Therefore, one of the most important paradigm shifts must be that such electricity is a green and reasonable complement to an energy policy focusing on energy efficiency.

It is for this reason that an optimised electrical network from generation to end use is a core element of our future energy system and needs to be strengthened and developed as the decisive factor for fighting climate change.

The electrical grid of the past was designed to simply carry the power flow in one direction from the bulk power plants to the industrial or private end consumers.

A future dynamic green energy system and especially electrical grid must handle a number of new requirements, including:

- The optimisation of investment in the transmission and distribution grids taking into account the availability of energy generation from renewable sources (e.g. wind farms, solar farms)
- Reducing losses in long distance transmission and balancing a large share of variable, electricity in-feed from large bulk renewables (wind, solar...)
- Managing consumer side in-feed from thousands of small decentralised and dispersed renewable sources (photovoltaic, biomass ...) which can moreover form micro-grids that need to be interfaced with the main grid

- Controlling the increasing bi-directional power flow from and to the grid, mainly in the distribution, and providing sufficient grid capacity for peak-power management while interfacing with more intelligent loads (e.g. smart buildings, electrical vehicles, micro combined heat and power plants based on gas or fuel cells)
- The future need for connection of energy storage capacity, either by electric vehicles or by battery systems.

Some important questions must be tackled and resolved in order to preserve the overall security of electrical supply even more in future than today, while the efficiency of the electricity supply itself must also be improved:

- How to secure the system against blackouts?
- How to integrate electric vehicles without a huge expansion of the electricity distribution networks? How to ensure the utilisation of e-car batteries as a mean of electricity storage and how to develop associated services to the network (resale of energy, demand response, peak management...)?
- How to ensure a dynamic and efficient communication and interaction between electricity supply and energy efficient sectors ( industrial processes, data centres, electric heating, heat pumps, micro CHP, water heating, heating ventilation and air conditioning systems etc.)?
- How to activate means of system regulation when international grid interconnections are already operating at full load and cannot meet demand?
- How to use automation and communication systems with secured information to increase energy efficiency and thereby reduce waste of energy? How to increase and improve the energy efficiency in the industry, buildings and residential sectors?

## HOW DO WE GET THERE?

No one can achieve these objectives alone. It needs political will, cooperation of all participants in the energy chain and an adequate legal framework. In particular more emphasis needs to be given towards encouraging all stakeholders (utilities, consumers, industries, buildings) and public administrations to invest into smart grid technologies and applications. The implementation of smart grid technologies requires significant investment by stakeholders which is unlikely to happen in the short and medium term without national governments' and European funding, tax incentives or regulation to facilitate the emergence of these new markets.

When talking about the cost of the necessary investment for grids to become smart, it is essential to keep in mind that smart grids will increase the efficient utilisation of infrastructures in general from generation to end use. The transformation towards smart grids is a necessity given the 20-20-20 objectives and will reduce the total cost of energy for end users in an energy systems with large amounts of variable renewable energy production.

Considering the three necessary layers for Smart Grids (Power, Automation/Communications and Information/Applications), there are an important number of complementary technologies, products, systems and competencies which will push their development:

- Integration of Renewable Energy Sources, Distributed Generation (power quality, voltage control etc.) and Virtual Power Plants (VPP) management
- Grid Optimisation/Distribution Automation for power system security of supply and reliability, operational & energy efficiency, asset protection, Grid Power Quality management, advanced grid sensing and monitoring, optimised FACTS devices (Flexible Alternative Current Transmission Systems)
- Energy Storage (large scale or small scale, centralised or decentralised)
- Flexible generation schemes for smart power solutions

- Advanced High Voltage and Medium Voltage components (products)
- Micro - grids in factories, buildings or utilities markets
- Home, Building and Factory Automation and Control to manage consumption in accordance with customers' acceptance
- Advanced Utility Control and Energy Management Systems
- Advanced Metering Infrastructure (AMI) and Smart Metering solutions
- Demand Response and Demand Management to optimise from the consumption from energy using devices in the production and in the network and thereby reduce costs for all stakeholders
- Dashboard and displays for end-users to manage their consumption and their impact on CO2 emissions
- Electro-mobility (smart charging, vehicle to grid...)
- Communication infrastructure and protocols
- Data security and data handling (data management, end-users authentication)

## KEY RECOMMENDATIONS

As technology and solution provider Orgalime industries are interested in all aspects of smart grids as our industries manufacture and supply technological solutions to all stakeholders in the energy supply value chain: equipment for conventional and renewable production of energy, transmission and distribution equipment (Electric Power Grid Equipment), smart meters, electronic components for energy and communication, infrastructure solutions for e-mobility, heating & ventilation, home & building energy management, household appliances etc.

Our industries have the ambition to remain a global leader in sustainable technologies and to play a leading role in the emerging "green economy". We see smart grids as a promising area of technological development which could help the European economy to grow and create new job opportunities. The economic benefits of the implementation of new technologies in Europe were already outlined in 2008 in the ELECTRA report "Twenty solutions for growth and investment to 2020 and beyond", a joint report drafted by the European Commission and our industry.

In Orgalime's view the European vision should be to create a flexible and intelligent energy system that:

- Can deliver a high level of security of supply,
- Is able to efficiently integrate a high share of sustainable technologies especially on consumption side , e.g. wind power, solar panels, biomass, electric-vehicles, heat pumps etc. by exploiting demand management,
- Allows the end user to efficiently manage his/her energy consumption in terms of CO2 emissions and cost.

The intelligent system should be dynamic in all its elements and robust with respect to incorporating potential new resources, technologies and solutions that the future might bring. This specifically applies to:

- Smart Transmission with enhanced power transmission solutions through e.g. improving of energy flow management and supporting free electricity trading,
- Smart Distribution with for example extended automation and surveillance especially in the Low Voltage grid,
- Smart Grid Applications providing new services at the consumption side around Smart Metering and their integration into the grid while providing flexible tariffs and helping demand response development.
- Home and Building demand management that enables the consumer to also become an electricity provider ("prosumer").

With a view to develop a flexible and intelligent energy system as previously outlined, Orgalime therefore makes the following recommendations:

- The variability of renewable electricity production through wind and solar should be addressed by promoting technologies and economic policies which pair renewable energy sources with either energy storage or demand management on an automated basis.
- The design of future smart grids must reflect the need for data while at the same time ensuring system security and protection of private data of businesses and households. Consumers should remain able to decide who will have access to which kind of information in their “energy profile”.
- European Regulators need to recognise the economic value of smart grids applications for the energy consumer and society as a whole. For example the deployment of smart metering solutions and factory, building & home automation and control equipment could be supported through legislation for new buildings and renovation of existing ones. The regulatory framework should be adapted accordingly. A step in the right direction has been taken with the adoption of recent legislation such as the recast Energy Performance of Buildings Directive of 19 May 2010.
- European policymakers should take into account the benefits of the modernisation of energy networks and the implementation of smart grids when negotiating on the future multiannual Financial Framework of the EU (2014-2020) which will decide on budgets for the funding of infrastructure programmes and R&D programmes as well as large scale demonstration projects. The upcoming Commission proposal for an energy infrastructure package should integrate a strategy towards smart grids together with proposals on innovative financing instruments to boost investments in smart networks.
- Research & development and demonstration policies: Smart Grids technologies must be affordable and competitive. A clear European R&D and Demonstration Policy is necessary to boost innovation and accelerate the deployment of these technologies. One example is the EU’s approach through the European Industrial Initiatives (EII), under the scope of the SET-Plan. The investments of the different initiatives (Electricity Grid, Solar, Wind, Energy Efficiency-Smart Cities...) over 10 years should be kept and continued despite the current difficult financial situation in the European Union. Large scale demonstration projects should play an important role in R&D policies as they will help to convince society of the benefits of smart grids. Europe needs a coherent, long term policy vision for demonstration projects on smart grids which should involve technology and equipment suppliers. Demonstration projects for smart grids also need to integrate energy storage which is key for the future implementation of smart grids.
- Orgalime would welcome the promotion of modernised and adaptable education/training systems including enhanced cooperation between national authorities, education institutions, social partners and business to ensure that skills and qualifications are up to date with technology developments.
- The European Commission should assess different incentives to invest into smart grid technologies and applications with a profitable return and benefits for stakeholders (companies & consumers who invest in smart household appliances, smart e-vehicles, smart automation, etc.) and propose European guidelines and, if required, supporting regulation.
- The European Commission should create framework conditions to increase all stakeholders' awareness, acceptance and behavioural changes notably for consumer

integration into the energy markets especially for electricity. The implementation of real commercial projects is central to the elaboration of new power supply systems with special focus on municipalities and industrial co-generation plant integration. To gain public acceptance and support, the benefits of smart grids implementation need to be carefully explained.

- The incentive for customers to shift their demand in time depends on the price differential over a suitable time interval. Applications such as electric vehicle charging, heat pumps as well as hot water tanks, electrical heating and cooling units can act as an electrical power drain or storage for surplus energy generated from renewable sources, while other household appliances could be operated off peak hours. However new incentives or a reward system must be in place in order to change users' behaviour. Direct control of loads must not be imposed remotely if the user does not agree with it. Users who voluntarily decide to participate to a demand response program deserve an appropriate and clear reward for it. For users who participate in demand response a framework is needed in order to ensure that the economic benefits of such a consumption choice are fairly shared.
- Moreover, users should be aware of the amount of green energy available over the grid at regular time intervals so that they can choose to adopt more environmental friendly consumption behaviour.
- It must be recognised that smart metering systems can function as an enabler for the development of smart devices, which can participate to demand response while minimizing the impact on the user.
- Orgalime welcomes the recent CEN/CENELEC initiatives for Smart Grid standardisation with a clear goal to keep interoperability and open standards to allow for economies of scale. Orgalime would welcome that technologies covering every aspect of smart grids and for communication in particular should be based on open international standards so as to ensure competitive, cost effective solutions which will enhance the interoperability of the systems and therefore their deployment.
- Real time grid sensing/monitoring and power flow recording especially in the distribution grid should become a regulatory issue for more transparency and better optimization of grid loading and grid efficiency to be reported by grid operators.
- The development of grid codes should be accelerated by establishing a neutral body related organization under the umbrella of the new regulatory agency (ACER) in order to develop pan European grid operation standards especially in regard of renewable energy integration into the grid. It is highly recommended to involve also all grid participants and the relevant equipment manufacturers in this activity (such as small renewable installation industries).
- Enhanced grid efficiency reporting and improved incentive regulation should be developed under the guidance and control of ACER to extend the existing incentives methodology for grid operation and investment in order to reduce losses and waste of energy in the grid

In conclusion we believe that it will be essential to maximise the potential that a properly designed and implemented smart grid can offer to consumers and society as a whole and to underpin the competitiveness of the European manufacturing and technology industries which will provide the modern and innovative solutions for its implementation and development. Orgalime believes that European regulation could also help to support the implementation of smart grids technologies by setting European targets in a similar legislative approach as that for the energy performance of buildings.

This position paper has been drafted by Orgalime in collaboration with the following European Sectors Associations:

**ORGALIME**, the European Engineering Industries Association, speaks for 33 trade federations representing some 130,000 companies in the mechanical, electrical, electronic, metalworking & metal articles industries of 22 European countries. The industry employs some 10 million people in the EU and in 2009 accounted for some €1,427 billion of annual output. The industry not only represents more than one quarter of the output of manufactured products but also a third of the manufactured exports of the European Union.

**CAPIEL LV** is the Coordinating Committee for the Associations of Manufacturers of Industrial Electrical Switchgear and Controlgear in the European Union (AFBEL, AFME, AGORIA, ANIE, BEAMA, FEEL, GAMBICA, GIMELEC, ZVEI).

**CECAPI** is the European co-ordinating Committee representing the Associations of Manufacturers of Electrical Installation Equipment within member states of the European Union.

**CECED** represents the household appliance industry in Europe. Direct Members are Arçelik, Ariston Thermo Group, BSH (Bosch und Siemens Hausgeräte), Candy Group, De'Longhi, Electrolux AB, Fagor Group, Gorenje, Liebherr, Indesit Company, Miele, Philips, Groupe SEB and Whirlpool Europe. CECED's member associations are present the following countries: Austria, Belgium, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

**ESMIG** The European Smart Metering Industry Group is the European industry association that provides knowledge and expertise on Smart Metering and related communications at a European level. ESMIG's members are the leading companies in the European Smart Metering Market: meter manufacturers, IT companies and system integrators. ESMIG covers all aspects of Smart Metering, including electricity, gas, water and heat measurement.

**EUROPACABLE** The European Confederation of National Associations of Manufacturers of Insulated Wire and Cable was founded in 1991 as the European platform for cable manufacturers. Europacable represents approximately 90 % of the European industry and, through National Associations, more than 200 individual cable manufacturers.

**T&D Europe** ([www.tdeurope.eu](http://www.tdeurope.eu)) is the European association of the electricity transmission and distribution equipment and services industry, which members are the European national associations representing the interests of the electricity transmission and distribution equipments manufacturing and derived solutions. The companies represented by T&D Europe account for a production worth over € 25 billion EUR, and employ over 200,000 people in Europe.

[1] Towards a New Energy Strategy for Europe 2011-2020, EC-consultation on:  
[http://ec.europa.eu/energy/consultations/index\\_en.htm](http://ec.europa.eu/energy/consultations/index_en.htm)

[2] DG Energy webpage for Smart Grids TF:  
[http://ec.europa.eu/energy/gas\\_electricity/smartgrids/taskforce\\_en.htm](http://ec.europa.eu/energy/gas_electricity/smartgrids/taskforce_en.htm)