SMART REGULATION FOR SMART GRIDS

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ABSTRACT

The deployment of smart grid technology opens new regulation challenges. Many issues have to be considered. For example, should the network operators be incentivized to foster innovation? and develop cost effective investments? How to ensure that the pace of investments is industrially and financially sustainable for all players? and that the investments benefit to the final consumers? Given these questions, regulatory authorities have a major role to play in the development of smart grids. Some incentives have been reviewed or created and additional ones may have to be designed in order to enable the creation of market conditions as soon as the technology is mature.

This article tackles the main issues addressed by regulators and CRE's first propositions in order to enable the deployment of smart grids.

SMART GRIDS OPEN NEW REGULATION CHALLENGES

Smart grids: a means to achieve energy policy objectives

The electricity sector is facing new challenges. In accordance with the ambitious 20/20/20 targets set by the European Commission, renewable energy is rapidly increasing. Distributed and less predictable generation such as wind and solar power implies a change in distribution systems.

In parallel with the transition towards the low-carbon economy, the new uses of electricity such as air conditioning, heat pump and electric vehicle have appeared and the electricity peak demand is growing in France. Thus the need for smart grid technology is greatly increasing in order to manage these new constraints and ensure a more efficient, economically viable and safer delivery of electricity.

Demonstration projects are testing new functionalities all over Europe

Smart grid development is mainly based on an experimental approach. Demonstration projects are currently being carried out to assess the technical, economic and legal hurdles arising in the context of this evolution. Many innovative projects, gathering stakeholders with complementary expertise (system operators, equipment manufacturers, telecommunications and IT companies, research centres, local authorities, *etc.*), have been launched throughout Europe.

The JRC [1] has identified 459 smart grid projects in Europe for a total budget of 3,15 billion euros and with 578 implementation sites.

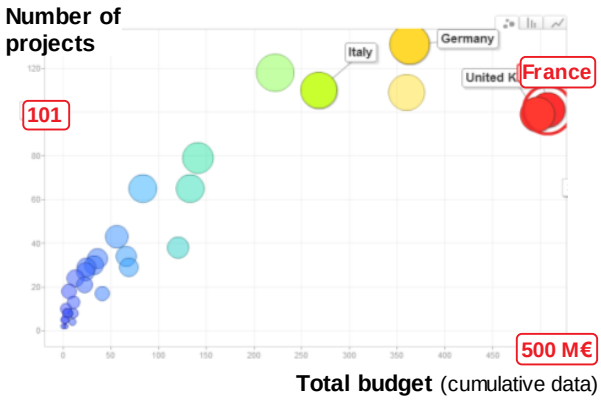


Figure 1 - Smart grid demonstration projects in Europe (Credit: JRC, 2014)

These projects are testing tomorrow's functionalities: active demand management, integration of distributed energy resources, smart network management, electric vehicle charging, *etc.* at different levels: smart building, smart district and smart city. The next step of smart grid development is, while taking into account feedback from these pilot projects, to replicate them at a larger scale.

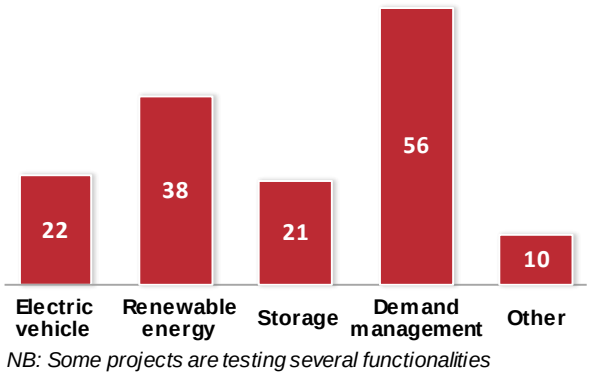


Figure 2 – Number of projects per functionalities in France

Business cases of smart grid projects are difficult to elaborate and investment decisions difficult to make

At first sight, the deployment of smart grid technology could increase costs. These new technologies imply additional research, development and demonstration costs and then their deployment all over the grid has to be financed. Nevertheless, smart grids can also be seen as a way to minimize costs increase. Indeed, the electrical system has to be modernised in order to cope with the changes in the energy landscape while maintaining high levels of quality and security. Such a modernisation means considerable investments. French and European contexts, in which grids are already well developed, lead to favour the deployment of smart grid technology rather than the massive replacement and reinforcement of grids.

The benefits from smart grid projects are often split among the different players of the value chain. Hence the profitability of a project for a specific player can be very different from overall benefits. The investment decision is then more difficult to make for a Distribution system operator (DSO) when benefits are not concentrated at the distribution system operator level. Consortiums regrouping the main stakeholders are usually needed and the optimal solutions for the community should then be looked for. For example, benefits from smart metering systems are usually mainly split between consumers and DSOs.

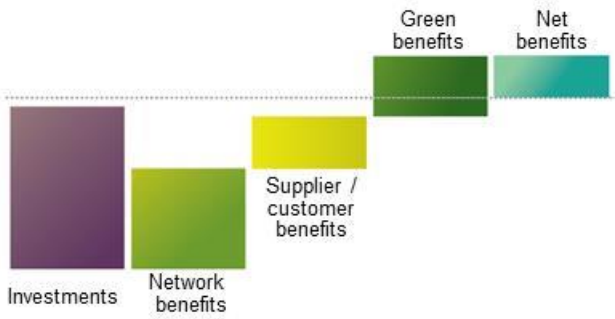


Figure 3 - Investments for smart grids bring benefits to all actors along the electricity value chain (Credit: Eurelectric)

The business case of smart grid projects should also take into account the features of the territory. For instance, in windy and sunny areas, it is easier to make technologies aiming at improving predictability of distributed renewable generation profitable while technologies such as storage and demand side management can be gainful in a region where the electrical system is fragile. The profitability of smart grids is getting even more complex if externalities are difficult to evaluate. Some positive impacts of smart grid projects such as black-out risk or air pollution reduction can be difficult to monetize and include in the cost-benefit analysis.

THE EXISTING REGULATION IS EVOLVING IN ORDER TO SUPPORT THE DEPLOYMENT OF SMART GRIDS

The future role of the DSOs is being considered by the Council of European energy regulators (CEER)

In its public consultation on the future role of the DSOs [2] launched in December 2014, the CEER considers different regulatory tools to help specifying and setting up the needed changes. In particular, it examines the existing and future activities of the DSO, its core role, the facilitation of new markets and services, and areas where there is a need for further regulatory control.

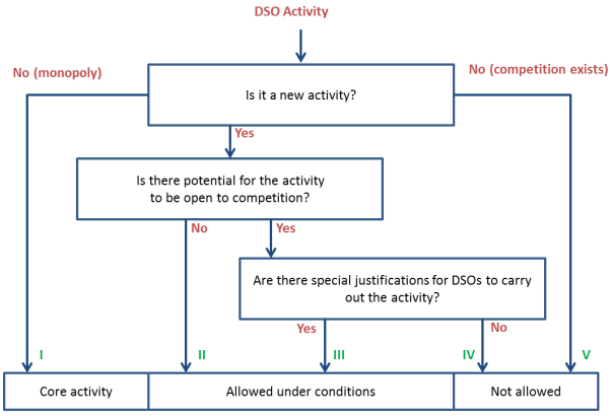


Figure 4 - Logical framework for DSO activities (Credit: CEER)

The regulators also focus on relationship between the DSO and the transmission system operator (TSO). A greater cooperation between DSOs and TSOs is needed as DSOs are becoming active grid managers and collect a huge amount of data.

Finally, the CEER proposes several regulatory changes and addresses the various economic signals "*to encourage and incentivise, on one hand, DSOs to better discharge their evolving role of neutral market facilitators and, on the other, consumers to modify their behaviour taking account of economic signals for improved energy efficient consumption patterns*".

Informing and strengthening dialogue with all stakeholders

The regulator plays a major role in informing and strengthening dialogue with all stakeholders concerned with the subject. The French energy regulator (Commission de régulation de l'énergie – CRE) has put in an action plan since 2010: organisation of two institutional symposiums on smart grids, publication of a book which shares the points of view of power system

stakeholders, creation of a website *www.smartgrids-cre.fr* dedicated to smart grids to share knowledge and experience and organisation of bi-monthly meetings gathering all market players on a specific smart grid theme (renewable energies, storage, smart city, electrical vehicle, *etc.*).

By presenting the smart grid projects and their progress, the CRE smart grid website is a new means to share expertise and set off stakeholders' thoughts. Feedback from the different demonstration projects has also enabled stakeholders to identify different questions to which they would like the public authorities to respond. With more than 120 stakeholders who actively participate in the website and almost 20 000 visitors per month, CRE smart grid website is huge success.

CRE seeks to give the necessary financial means to grid operators to carry out R&D

Grid access tariffs cover most of the investments of TSO and DSOs in smart grid projects. CRE has decided to support the innovation projects of system operators and has defined a regulatory framework to encourage investments in research and development activities (R&D). The 4th tariffs for the use of electricity transmission and distribution networks (TURPE 4) introduced a measure to give RTE and ERDF the resources to implement the R&D and innovation projects necessary to build smart grids. This decision guarantees that there is no tariff obstacle to realise R&D projects or invest in innovation. R&D expenses of TSOs and DSOs are fully covered by the tariffs and there is no productivity factor on R&D operating expense (OPEX). In case the money initially allocated to R&D is not spent, it will be returned to grid users.

A follow-up measure will also be implemented. This measure consists, for system operators, in providing annual reports on R&D activities and using key performance indicators to evaluate the performance of R&D programs. This measure aims at providing all interested stakeholders with greater visibility over the system operator projects in the field of innovation.

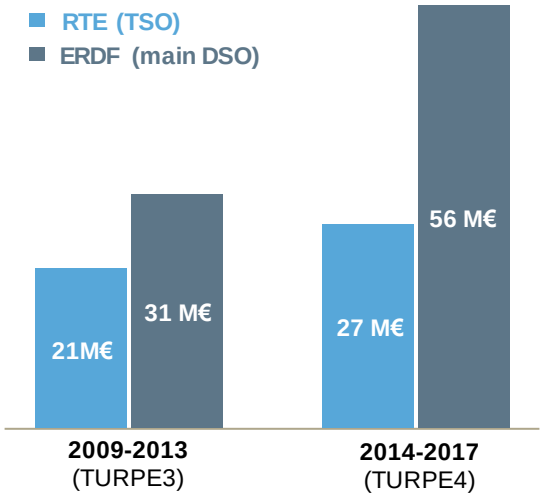


Figure 5 - Average R&D expenses per year

Dedicated financing schemes have to be foreseen

In France, the regulator defines the tariffs related to the use of public electricity grids. The regulator has to ensure that grid operators are able to carry out their public service tasks, to guarantee non-discriminatory access to the networks for all and to provide a high level of quality of supply to all users of their network. The regulator does not directly make the decisions to invest in the grids, though CRE can create a regulatory framework favourable to efficient decisions from system operators and give appropriate directions in order to enable the deployment of smart grid technology.

In this respect, after conducting the economic assessments of smart metering projects, CRE decided to define a specific financing scheme for the deployment of electric and gas smart meters. Given the specific features of these projects (in particular their sizes and their risks), an incentive bonus is given to assets used in the smart metering deployments. This bonus is awarded throughout the asset life time. The whole bonus will be given to DSOs if all deadline, cost and performance targets are reached. But each drift implies a penalty which reduces the incentive bonus. During the roll-out period, project monitoring is implemented, including:

- every two years, a roll-out compliance with schedule monitoring with a penalty if schedule is not met;
- every year, a smart meter unit cost monitoring with a penalty or a bonus if they are over or lower a reference cost;
- every year, a performance monitoring with a penalty if predefined targets are missed.

Project operating expenses will be specifically monitored during the development of the future tariffs. At each tariffs period, for gas or electricity, CRE will ensure that operating expenses submitted by operators are consistent

with forecast.

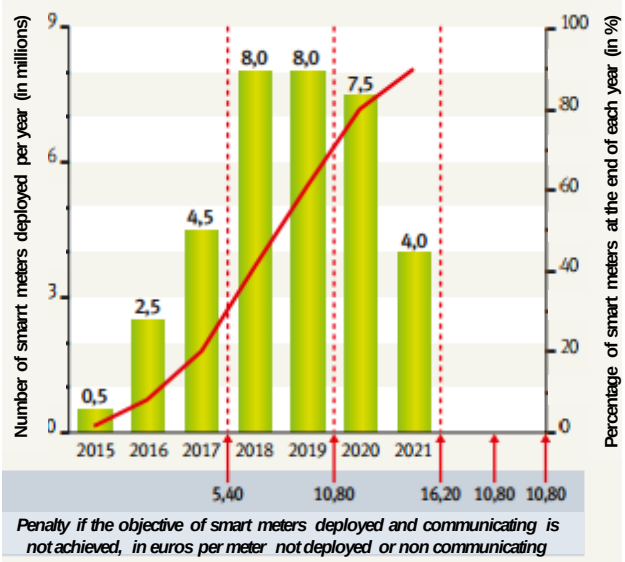


Figure 6 - A penalty reduces the incentive bonus if targets are not achieved for the smart metering *Linky* project

41 recommendations in order to facilitate the deployment of smart grid technology in France

Changes in the legal, technical and economic frameworks are proposed

The existing regulation is evolving in order to support the deployment of smart grids: some of the incentives currently provided to grid companies and grid users must be amended and additional mechanisms considered. In particular, the regulator's activities aim at enabling the creation of market conditions in order to value the services provided by the technology as soon as it is mature. The regulation should define a framework which recognises the services provided to the system and allows grid users to offer new services.

Hence, CRE recently published 41 recommendations [3] aiming at:

- enabling the development of new services for the users of public low voltage distribution grids;
- enhancing the performance of public low voltage distribution grids;
- contributing to the overall performance of the power system.

These recommendations propose some changes in the legal, technical and economic frameworks for smart low voltage grid developments. They are directed to different market players depending on their type.

Number of recommend-dations	Recipients	Type of recommendations
9	Legislator / Ministries	Proposal of changes in French laws or decrees
6	Standardisation bodies	Proposal of changes or creations of new standards
21	TSO and DSOs	Demand to change system operators' practices
7	All stakeholders involved in smart grid projects	Proposal of studies or feedback to realise

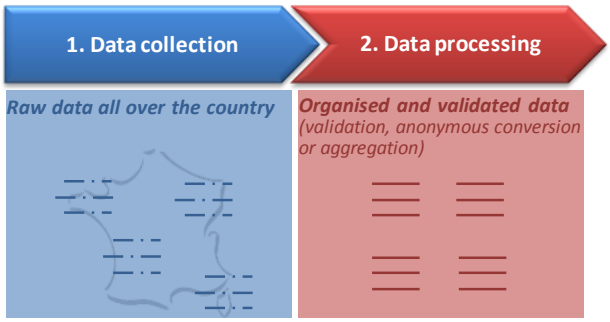
Table 1 - CRE type of recommendations per recipient

Implementation roadmaps of these recommendations have been provided by the transmission system operator (RTE) and the distribution system operators which provide electricity to more than 100,000 customers. These roadmaps includes an agenda with the necessary technical and economic studies to assess the costs and benefits of these evolutions for the whole value chain, implementation milestones and planned progress reports with CRE.

Two major recommendations of this decision concern data provision and limitation of the active power injected

Data must be made available to allow the development of new services for users

Among the various recommendations of CRE, an important one is related to the provision of data by DSOs. With the deployment of smart grid technology, extensive data will be collected from low and medium voltage grids (data on grid equipment, technical data, measuring data on the quality of supply and consumption and generation data). CRE requested that distribution system operators consider the implementation of interfaces in order to dynamically provide data which may be freely disclosed to any party requesting it, in compliance with legal clauses on privacy.



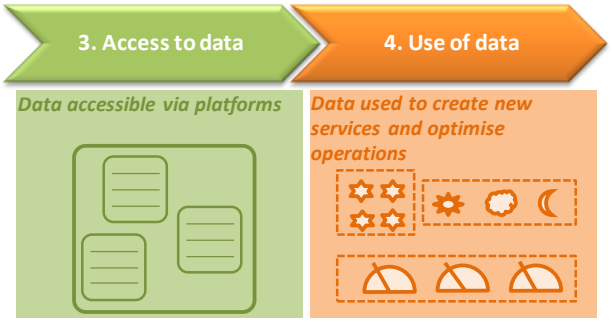


Figure 7 – From data collection to creation of new services

Reinforcement costs related to the connection of renewable generation could be reduced thanks to a commitment to limit the active power injected

Another recommendation of CRE concerns the connection of distributed generation to distribution grids. The current reference connection solutions proposed to generators by the distribution system operator are designed to allow power plants to operate at their maximum rated real power (requested at connection), at any time. In practice, this option may require reinforcement works, which, depending on the circumstances, may lead to significant costs for the producers, commissioning lead times, and even temporary limitations on the real power injected into the grid. In order to optimise the economic conditions for the integration of distributed generation, CRE requests that distribution system operators consider the feasibility of modifying the principles of grid connection studies in order to take into account the ability of generators to limit the power injected when it is advantageous in terms of global welfare.

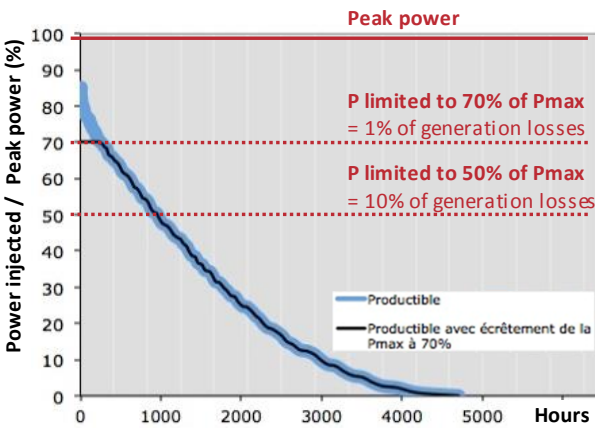


Figure 8 – Power injected vs. peak power from a PV installation in France (Credit: Hespul)

CONCLUSION

Thanks to the involvement of all stakeholders, the economic and regulatory framework is changing in order to enable or speed up large-scale deployments of smart grids, to the benefit of consumers.

To date, regulatory changes are based on feedback of existing demonstration projects and therefore mainly related to power grids. However, other networks are concerned by the deployment of new information and communication technologies. CRE paid attention to the arrival of these new technologies on gas, heating, cooling and water networks. Synergies and interactions between these different networks are still to be identified more precisely. For this reason, several projects have recently been launched. CRE invites all operators affected by smart grid development to continue and amplify the sharing of technical, economic and legal feedback of the demonstration projects they are involved in.

If necessary, CRE will publish new recommendations based on experiment feedback from demonstration projects.

REFERENCES

[1] JRC, 2014, *Smart grid project outlook*

[2] CEER, 16/12/2014, *CEER Public consultation on the future role of the DSO*

[3] CRE, 12/06/2014, *Deliberation of the Commission de régulation de l'énergie (French Regulatory Commission of Energy) of 12 June 2014 on recommendations on smart low voltage grid development*