Deliberation

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

Participants at the meeting: Philippe de LADOUCETTE, Chairman, Olivier CHALLAN BELVAL, Catherine EDWIGE, Hélène GASSIN, Jean-Pierre SOTURA and Michel THIOLLIÈRE, commission members.

The missions of the *Commission de régulation de l'énergie* (CRE) lead it to accompany the change from traditional electrical grids to smart electrical grids. In particular, the CRE ensures the proper functioning and development of electricity grids for the benefit of consumers and in compliance with the energy policy goals, especially those concerning greenhouse gas emission reduction, demand-side management and renewable energy generation.

From 4 November to 8 December 2013, the CRE launched a public consultation on smart grid development[1]. This consultation and the work carried out by the CRE on smart grids during four years show the need for legal, technical and economic evolutions to enable or speed up the large-scale deployment of smart grids, to the benefit of consumers.

The CRE publishes recommendations on evolutions of the legal, technical and economic frameworks for smart low voltage grid developments.

These first recommendations aim to:

- enable the development of new services for the users of public low voltage distribution grids;
- enhance the performance of public low voltage distribution grids;
- contribute to the overall performance of the power system.

The CRE expects an implementation roadmap of these recommendations from the transmission system operator (RTE) and the distribution system operators which provide electricity to more than 100,000 customers before 1 November 2014. This roadmap will include 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 the CRE.

This deliberation is based on feedback of existing demonstration projects and therefore is mainly related to power grids. However, other networks are concerned by the deployment of new information and communication technologies. In the context of its smart grids work, the CRE paid attention to the arrival of

[1] The documents on this public consultation are available at the following address: http://www.cre.fr/documents/consultations-publiques/developpement-des-reseaux-electriques-intelligents-en-basse-tension

these new technologies on gas, heating, cooling and water networks[2]. To date, synergies and interactions between these different networks are still to be identified more precisely. For this reason, several projects[3] have recently been launched

The CRE requests 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.

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

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[2] The CRE website on smart grids includes specific sections on smart gas grids and smart thermic networks. Documents on smart water networks are currently being prepared as follow-up to the forum organised on this subject by the CRE on 29 April 2014.

[3] Particularly the Sunrise project (*Smart Urban Networks for Resilient Infrastructures and Sustainable Ecosystems*) on the campus of university of Lille 1, the "*Brest rive droite*" local energy loop project and the GRHYD project at Dunkerque.

Contents

1. – Demonstration projects to prepare the smart grid technical, economic and legal frameworks

1.1. – The CRE supports demonstration projects to prepare the technical, economic and legal framework of smart grids

Due to renewable energy development, new power uses and devices and the need of demand side management, power grids have to be modernised. New smart grid technologies are being deployed.

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 France. They are supported by programmes designed to encourage innovation, such as the *Investissements d'avenir* programme entrusted to ADEME (French Environment and Energy Management Agency) since 2010, or the European Union Framework Programmes for research and technological development.

The CRE has decided to support the innovation projects of system operators.and the CRE has defined a regulatory framework to support investment and the development of research and development projects (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. A follow-up measure will also be implemented. This measure is designed to provide power system stakeholders with greater visibility over the system operator projects in the field of innovation. Besides their interests on the project results, some stakeholders have highlighted that system operators have to choose their partners in the demonstration projects on a non-discriminatory basis.

The CRE involves all smart grid project stakeholders in its work on smart grid development in order to prepare or adapt the regulation rules without waiting for demonstration project achievement. Regular discussions between the CRE and project developers have provided an opportunity for stakeholders to present their demonstrators. The CRE has therefore listed over than one hundred smart grid demonstration projects.

Over 100 smart grid projects throughout France… … that experiment new functionalities

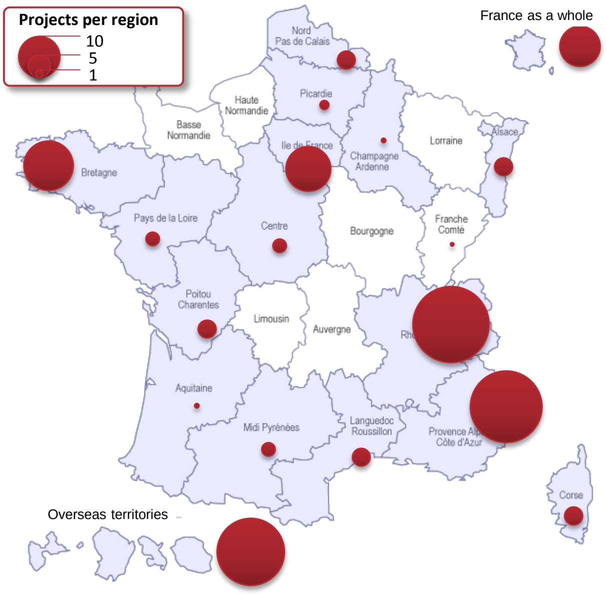

Figure 1 – *Smart grid* projects per region (*Source*: CRE)

N.B.: the map is not exhaustive and only shows the projects the CRE is aware of.

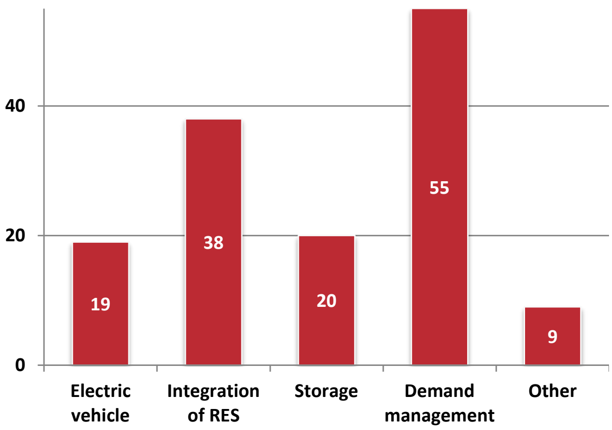

Figure 2 – number of projects per functionality (*Source*: CRE)

N.B.: some projects are testing several functionalities.

The CRE has continued communicating on and leading the French smart grid community. 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.

These demonstration projects aim to prepare for large-scale deployment of smart grid technology. In particular, economic and technical assessment of demonstration projects is key to evaluate their replicability and scalability.

1.2. – Stakeholders, especially local authorities, wish to carry out demonstration projects in the field of smart grids

Since early 2013, the CRE has interviewed representatives of many local authorities - municipalities, departments and regions - and EPCIs (public intercommunal cooperation establishments)[4] to understand the ongoing changes on energy at local level and these stakeholders' expectations of the regulating authority. Following on from these interviews, the CRE also got together representatives of local authorities, particularly elected representatives, at regional conferences on energy governance and regulation evolutions.

Most of the stakeholders wish the implementation a right to carry out demonstration projects in order to test new smart grids management procedures and business models. This request was also formulated by

[4] See the list of local authorities consulted in Appendix 1.

COMMISSION DE RÉGULATION DE L'ÉNERGIE

many stakeholders in their responses to the CRE public consultation on smart low voltage grids. In particular, they mentioned different themes which could benefit from this right to carry out demonstration projects:

- self-consumption at a local level (bigger than the scale of the individual system: e.g. the scale of a block or a district);
- closed distribution systems, as provided for in article 28 of directive 2009/72/EC of 13 July 2009[5];
- the services provided by storage, their complementarity and the associated business models;
- the optimised and coordinated management at a local scale of electricity, gas and thermic networks.

Legal tools already exist. Legislative and regulatory experiment is defined in articles 37-1 and 72 of the Constitution enforced by the constitutional law no. 2003-276 of 28 March 2003[6].

Article 37-1 of the Constitution allows demonstration projects in the following conditions:

- demonstration projects must focus on a limited purpose;
- demonstration projects must be of limited duration before being rolled-out, modified or abandoned.

Furthermore, article 72 of the Constitution opens up demonstration projects for local authorities for all areas within their competencies. Paragraph 4 of this article provides that "*in the manner provided for by an Institutional Act, except where the essential conditions for the exercise of public freedoms or of a right guaranteed by the Constitution are affected, territorial communities or associations thereof may, where provision is made by statute or regulation, as the case may be, derogate on an experimental basis for limited purposes and duration from provisions laid down by statute or regulation governing the exercise of their powers*".

In the framework defined by article 72 of the Constitution, organic law no. 2003-704 of 1 August 2003[7] defines the framework of demonstration projects opened to local authorities in of the legislative or regulatory field. On this basis, demonstration projects must be authorised by the law if they are subject to it and by a decree in *Conseil d'État* if they are subject to regulations. In particular, the law or the decree in *Conseil d'État* must specify:

- the purpose of the demonstration project;
- the duration (maximum five years);
- the specificities of the authorities likely to experiment;
- the provisions for which exemption may be granted.

According to the local authorities interviewed, the current framework is limited and relatively complex to deploy. In particular, they reported on the excessive level of paperwork inherent to this framework (deadlines, preparation of a report for the Parliament, *etc.*) and the key role played by the central authority. Indeed, a law is necessary for demonstration projects in the legislative field and a decree for demonstration projects in the regulatory field.

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[5] Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC.

[6] Constitutional law no. 2003-276 of 28 March 2003 on the decentralised organisation of the French Republic.

[7] Organic law no. 2003-704 of 1 August 2003 on trials by local authorities.

2. – Smart grid technology should enable the development of new services

The development of renewable energy and new power uses makes necessary to upgrade the power system. In the future, it will be possible to manage it in a more flexible manner in order to integrate the variability of renewable energy sources (RES) and the development of new uses such as electric vehicles. RES and new uses will also lead to an evolution of the system. While, until now, the balance of the system was mainly guaranteed by adapting generation to consumption, today balancing is also ensured by adapting demand to supply. The consumer is becoming a player of the power system in its own right. .

Consumers are now at the heart of smart grids. The evolution of their behaviour, whether in terms of demand (consumption) or supply (generation), will have an impact on the overall system management. Greater flexibility of supply and demand could also be possible thanks to the use of storage means by both consumers and producers. .

Consumers already contribute to the management of the power system through different mechanisms, such as pricing policies based on time periods (peak hours/off-peak hours, yield management, *etc*.) and demand response.

With the deployment of smart grid technology, a very large volume of data will be collected on the public distribution grids: particularly data on grid equipment, electricity quality, electricity consumption and generation. These data can be analysed and used to develop new services for users.

In this context, one of the main smart grid tasks is to ensure that all users, and especially consumers, are involved and have the necessary tools to manage their energy consumption or generation(or delegate this management to an authorised third party) according to the state of the power system.

2.1. – Consumers should be provided with relevant information and automation systems to play an active role in the power system

Power grids connect generation and consumption installations. Smart grids should allow all these systems to contribute to a more efficient grid and power system management, while preserving electricity quality and system safety and security. In this context, grid users (or authorised third parties) should have access to relevant information and the means of processing this information in order to be able to adapt the management of their installation to the needs of the power system.

2.1.1. – Smart solutions already exist

Data are essential to allow consumers to optimise, and even reduce, power consumption. Devices providing information on the operation of the system raise consumer awareness of energy issues. Customised information devices and automation system for energy management enable consumer better understanding by the consumer of energy issues and its involvement in the balance of the system and in improving the energy efficiency of its accommodation. Communication to end users can be realised through various solutions: smart solutions within the buildings or information from a third party (electricity supplier / aggregator‘s website, Short message service (SMS), *etc*.).

In this way, smart solutions can be deployed in homes and business premises even if smart meters are not yet deployed. In fact, consumers can install smart equipment directly beyond the meter. These solutions are usually composed of a local energy manager connected to measuring sensors (such as smart plugs) and the Internet. This equipment can enable various actions: measure of the overall electricity consumption (in kWh, euros, CO_2 emissions, *etc*.), heating control based on smart thermostat, remote control and analysis of the consumption of electric appliances, energy reports and comparisons with similar households, advice on how to reduce its consumption, the possibility to receive alerts (by email, text message, *etc*.) in the event of unusual electricity consumption and the automatic shutdown of appliances on standby mode, for example.

By raising consumers' awareness and enabling them to control their own installations according to their needs and/or the power system requirements, these tools are already a smart piece at consumer level in order to upgrade distribution grids to smart grids.

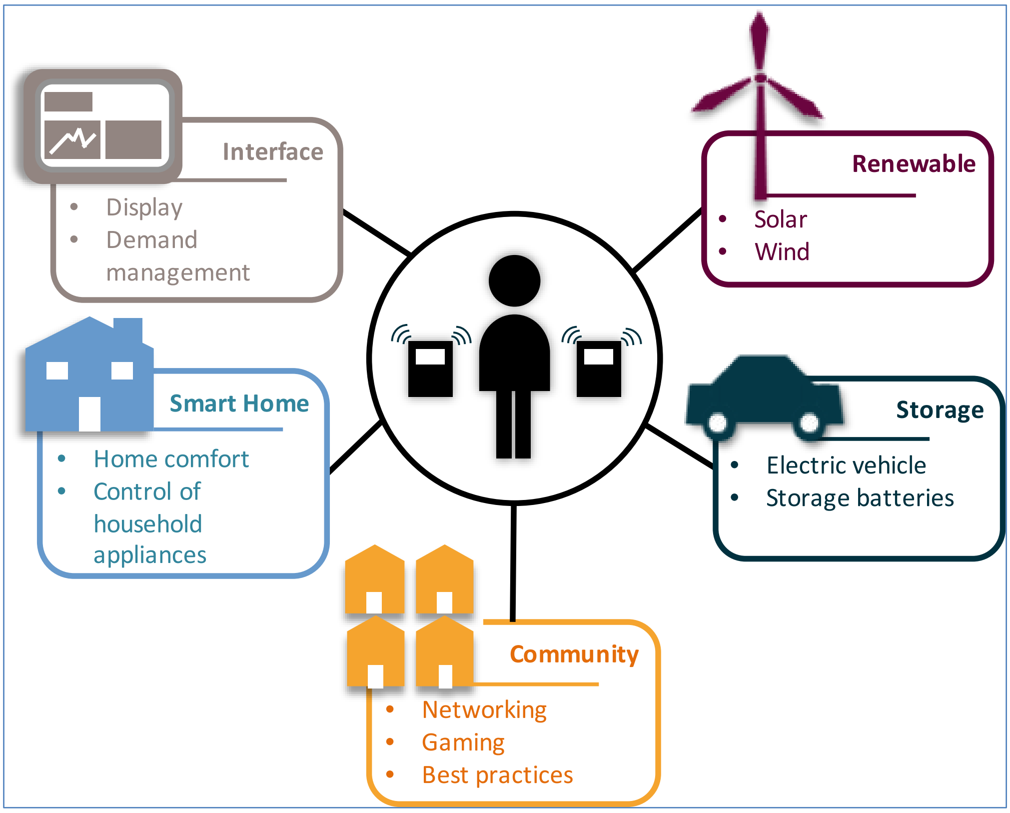

Figure 3 – The options offered to consumers by smart grids (*Source*: Colombus Consulting)

Recommendation no. 1

The development of information devices and home automation systems will enable consumer's awareness and his greater involvement as an active player of the power system.

In the case where these devices give information on the power consumption of the whole installation, the CRE recommends that these devices use the data from the electric meter. The CRE is in favour of the integration of this disposition in the works of standardisation bodies, and in particular AFNOR commission UC205 (electronic systems for homes and buildings).

2.1.2. – Optimising the use of smart metering systems involves standardising the customer digital output of smart meters

Upgraded control of beyond the meter appliances

From the current metering system…

For end-users with electronic meters, beyond-the-meter equipment can be managed with one single relay controlled by a pricing signals emitted (musical frequency remote control – TCFM at 175 Hz) by the distribution system operator (DSO). Based on the signal received, the relay controls the electricity supplied (on/off) to the equipment. It is mainly used to pilot accumulation heating devices (hot water for sanitary purposes). This functionality provides a first response to the need to modulate electricity demand.

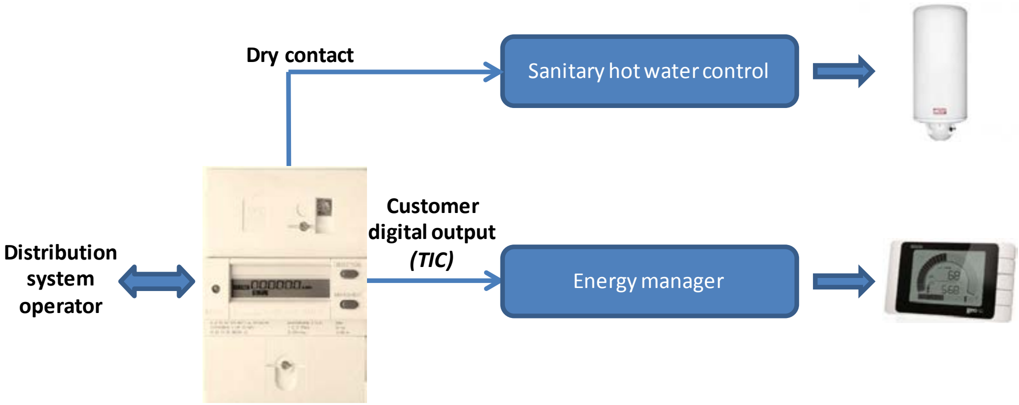

Figure 4 – Example of current operation: hot water supply control and customer digital output (*Source:* CRE)

In addition to their remote reading interface, electronic meters are equipped with a communication interface: the customer digital output. This interface enables the customer or a third party authorised by him to access metering data, via a direct connection to the meter.

Market operators can propose devices connected beyond the meter and offering more functionalities (several pricing relays in particular), by using the customer digital output.

… to the advanced metering system

Smart meters will integrate the same dry contact than the existing electronic meters. It can be controlled on the basis of the pricing schedule[8].

The customer digital output of the electronic meters is also used in the smart metering systems as it provides an effective solution to the needs of many applications using meter data and, in particular, some demand side management (DSM) applications. This output has been upgraded for this purpose[9]. Many items of data transit via this interface, particularly instantaneous power, information on the different pricing periods, consumption information (including an excess power alert), time-seasonality registers, load curve data, the maximum value of the power output (P_{max}), the most recent deviation for the quality of supply, the condition of the dry contact, *etc*.

This CRI interface includes seven *virtual* relays as well as the integrated dry contact, each of which can be used to activate or de-activate a usage (water heater, heating, charging of the electric vehicle, *etc*.).

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[8] Order of 4th January 2012, in application of article 4 of decree no. 2010-1022 of 31st August 2010, on meters for public power grids.

[9] The technical and functional characteristics of customer remote information output for *Linky* meters are described in the document ERDF-NOI-CPT_54E V1, which is available at the following address: http://www.erdf.fr/medias/DTR_Generalites/ERDF-NOI-CPT_54E.pdf

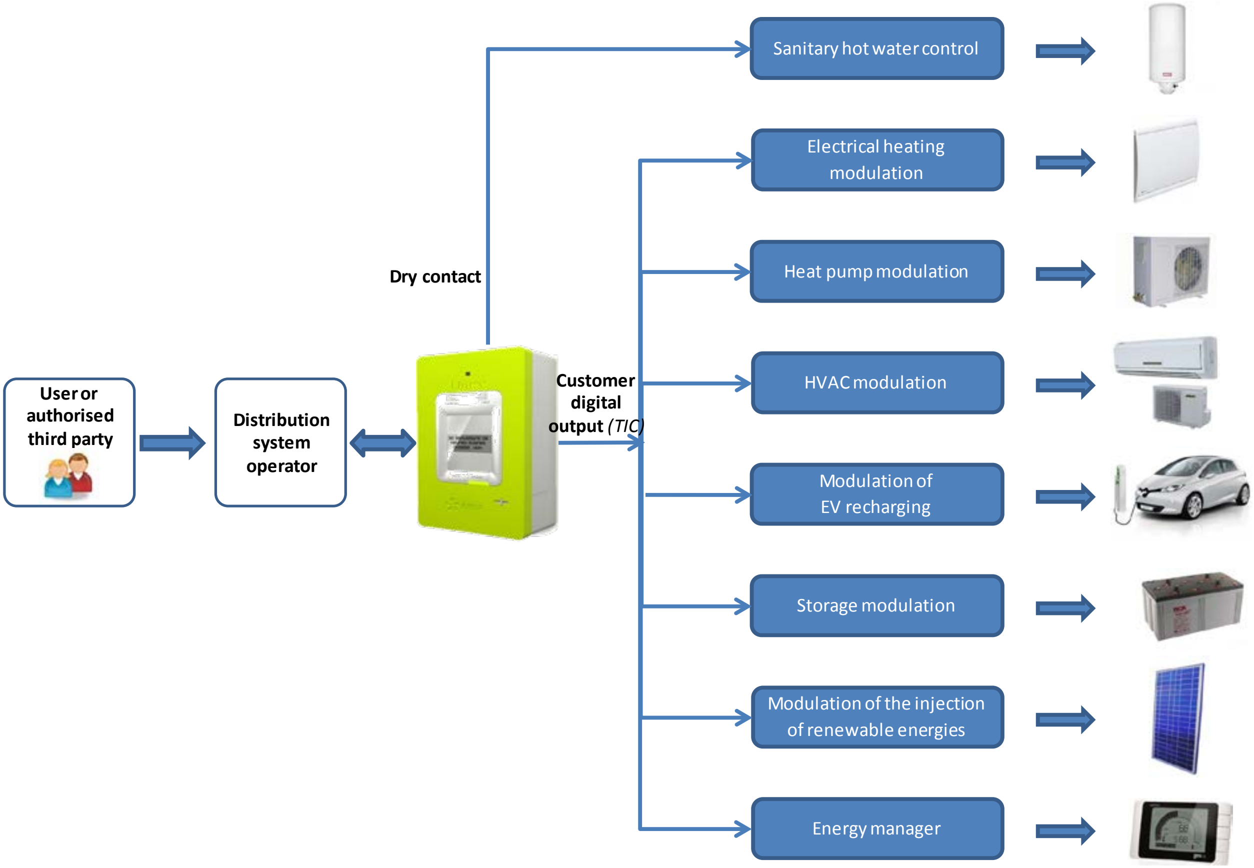

Figure 5 – Example of exchange of information and household appliances managed *via* the smart meter *Linky* (*Source*: CRE)

The customer digital output of smart meters can also be used to transmit short messages and ultra-short messages (32 and 16 characters respectively), which could be used by beyond the meter equipment. The fact that the content of the messages is not standardised in any way could hamper the rapid appearance of low-cost, effective, advanced services and equipment for grid users (e.g. energy boxes) and could also limit consumer choice.

The customer digital output can also be used to manage seven *virtual* relays in addition to the integrated dry contact. The activation of these relays will be defined by the pricing calendar of the electricity supplier. The harmonisation of the combination of *virtual* relays and standard usages (e.g. water heating, heating, *etc*.) will simplify the management of these usages by relays.

Recommendation no. 2

In order to take full advantage of the potential of smart metering systems, the CRE requests that the GTE (*Groupe de travail électricité* - Electricity Working Group EWG)[10] defines:

[10] The Electricity Working Group was created in 2005 by the CRE to define the practical procedures for the operation of gas and electricity retail markets. These markets concern all operators involved: consumer representatives, suppliers, grid operators and public authorities. The EWG site: http://www.gte2007.com/

- on the one hand, standardised content for short and ultrashort messages transmitted by the customer remote information (CRI) interface;
- and, on the other hand, the association of *virtual* relays with standard usages.

Recommendation no. 3

To ensure that the potential of smart metering systems is used as best possible, the CRE requests that distribution network operators publish, in their reference technical documentation, the standardisation adopted in the context of the works of the EWG for the content of messages and the association of *virtual* relays with standard usages.

2.1.3. – Controlling electric equipment *via* smart meters will be simplified by standardising the customer digital output of the meter

When responding to the CRE's public consultation on the development of smart low voltage grids, many operators highlighted the importance of constructing standardised open systems to ensure that the different components located on or connected to the electrical grids can interact.

With the deployment of advanced metering systems, the user, or an operator authorised by the former, will be able to control household electrical appliances located downstream from the meter (water heaters, household electric appliances, electrical vehicles, energy boxes, *etc*.).

In order to optimise the control of these appliances, the association between the *virtual* relays of the meter, which transmit these control orders, and standard usages, which correspond to the devices in the electrical system of the consumer, must be standardised.

The standard in question is NF C 15-100[11], which defines the connection principles for internal low voltage and low power systems.

In order to optimise the integration of data from the smart metering systems by the different items of equipment in the electrical system, the association of *virtual* relays with standard usages must be standardised and integrated in standard NF C 15-100 by standardisation bodies.

Recommendation no. 4

To simplify the connection of beyond the meter equipment, the CRE proposes that AFNOR standardise and integrate in standard NF C 15-100 the association of *virtual* relays with standard usages.

2.1.4. – The understanding and the use of the customer digital output of smart meters will be greater if end-users can customised it

The automatic management of beyond-the-meter equipment, which already exists, increases with the multiplication of *Smart grid* technologies. Automation systems are better understood by users if it can be adapted to their requirements.

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[11] Standard, NF C 15-100, on low voltage electrical systems, is compulsory, and can be accessed on the site of the French standardisation agency (AFNOR).

On the one hand, consumers with regulated time-of-use tariffs should be able to keep[12] their existing wiring configuration with the smart metering systems. This implies, at the very least, that the dry contact must be compatible with the regulated tariffs and offer the same possibilities to the users. At the current time, in the context of the historical blue tariff, with the *Tempo* option, users can select the condition of the dry contact (*EAU 1*, *EAU 2* or *EAU 3*) depending on the timeslot in question.

Time slot		Register description	Dry contact condition as preferred		
			EAU 1	***EAU 2***	***EAU 3***
Blue day	6:00 – 22:00	Blue day – Off-peak hours	C	C	C
	22:00 – 6:00	Blue day – Peak hours	O	C	C
White day	6:00 – 22:00	White day – Off-peak hours	C	C	C
	22:00 – 6:00	White day – Peak hours	O	O	C
Red day	6:00 – 22:00	Red day – Off-peak hours	C	C	C
	22:00 – 6:00	Red day – Peak hours	O	O	O
C: dry contact closed (usage ON) – O: dry contact open (usage OFF). In EAU 1 condition, the usage is off during peak hours every day. In EAU 2 condition, the usage is off during peak hours on red and white days. In EAU 3 condition, the usage is only off during peak hours on red days.					

Table 1 – Selecting the condition of the dry contact for the Tempo option (*Source:* ERDF)

Users must therefore keep the ability to select the condition of the dry contact, as was previously the case.

On the other hand, with smart metering systems, this automatic control can be managed by allocating *virtual* relays to standard usages. The operation of standard usages is defined per condition (operational or not operational) of the *virtual* relays. The condition of the relays is defined for each timeslot in the selected pricing package. It may appear simple to define the conditions of the relay for a tariff with only two timeslots and only one use case. However, it is more complex with additional time slots and many appliances connected. Users may wish to adapt the status of the *virtual* relays depending on their needs. Therefore, users (or an authorised third party) should be able to modify the predefined allocation of *virtual* relays according to their system and uses.

In the following example, the user has selected a relay condition different to that proposed by the electricity supplier.

Time slot		Register description	Relay condition							
			Rel 1	Rel 2	Rel 3	Rel 4	Rel 5	Rel 6	Rel 7	Rel 8
Weekend day	00:00 – 24:00	Weekend day	C	C	C	C	C	C	C	C
Week day	6:00 – 22:00	Week day – Off-peak hours	O	C	C	C	C	C	C	C
	22:00 – 6:00	Week day – Peak hours	O	O	C	C	C	C	C	C

[12] The CRE has requested that "*all advanced metering systems must be compatible with existing internal electrical systems* […] *particularly in terms of the pricing control relay*" in its deliberation of guidelines for advanced low voltage metering of 10 September 2007, which can be accessed at the following address: http://www.cre.fr/documents/deliberations/communication/evolution-du-comptage-electrique-basse-tension-de-faible-puissance-36-kva/consulter-les-orientations-des-services-de-la-cre

C: dry contact closed (usage ON) – O: dry contact open (usage OFF). All usages are operational on weekends. On weekday evenings, the usages connected to relay 1 are off. During the day, during the week, the usages connected to relays 1 and 2 are off.

Table 2 – Relay status proposed by the supplier in the context of an "*Evening and Weekend*" package[13] (*Source*: CRE)

Time slot		Register description	Relay condition							
			Rel 1	Rel 2	Rel 3	Rel 4	Rel 5	Rel 6	Rel 7	Rel 8
Weekend day	00:00 – 24:00	Weekend day	C	O	C	C	C	C	C	C
Week day	6:00 – 22:00	Week day – Off-peak hours	O	C	C	C	C	C	C	C
	22:00 – 6:00	Week day – Peak hours	O	O	C	C	C	C	C	C
C: dry contact closed (usage ON) – O: dry contact open (usage OFF). On weekends, the usages connected to relay 2 are off. On weekday evenings, the usages connected to relay 1 are off. During the day, during the week, the usages connected to relays 1 and 2 are off.										

Table 3– Selection of a relay status by a user in the context of an "*Evening and Weekend*"[14] tariff (*Source*: CRE)

Recommendation no. 5

To promote consumer knowledge of how the system is managed, the CRE supports allowing consumers (or a third party authorised by them) access to an interface which can provide information on the status of the relays allocated to each timeslot and the standard usages associated with each relay.

In order to take full advantage of the potential of smart metering systems, consumers (or a third party authorised by them) should be able to easily modify the allocation of relay statuses to registers, at least when subscribing a tariff, and at no extra cost.

To this end, the CRE requests that the GTE (*Groupe de travail électricité* - Electricity Working Group EWG) examine the procedure for modifying the status of *virtual* relays.

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

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).

[13] This deal was prepared for illustrative purposes, and will in no way influence the deal to be proposed by electricity suppliers with smart metering systems.
[14] This deal was prepared for illustrative purposes, and will in no way influence the deal to be proposed by electricity suppliers with smart metering systems.

When responding to the public consultation of the CRE of 4th November 2013, many operators called for the creation of a public data management service, as mentioned in the national debates on the energy transition[15], particularly in order to access consumption data and obtain load curves. This type of service would allow local authorities as well as many other operators, to be better informed, to propose new services to end-consumers and to develop new tools to optimise the management of the power system. In this respect, some operators would prefer *Smart grid* data management to be designed to integrate not only electricity, but also all other fluids (gas, heating, cooling, water, *etc*.).

Some operators have requested that anonymous data should be made accessible in the form of an open access database, particularly to simplify innovation and the development of new services.

Many of these operators did however reiterate that, under all circumstances, personal data must remain the property of the users.

However, according to other operators, the status of Commercially Sensitive Information (CSI)[16] must be revised to avoid hampering their demand side management activities at local level.

2.2.1. – Security and confidentiality are a prerequisite for the availability of personal energy data

Until now, data collected on electrical grids mainly consisted of a few readings taken twice a year at most in view of invoicing users. These personal data are protected. As smart grid systems can be used to collect a larger volume of personal data, it is necessary to ensure that this new data collected will also be appropriately protected.

2.2.1.a. – The CNIL ensures the protection of personal data

The French Commission on Information Technology and Liberties (CNIL) is the independent administrative authority in charge of ensuring that, in accordance with the provisions of article 1 of law no. 78-17 of 6th January 1978[17], information technology remains at the service of citizens, and does not jeopardize human identity or breach human rights, privacy or individual or public liberties.

The services of the CRE and the CNIL have frequently discussed topics relating to smart grids. According to these discussions, the two bodies jointly conclude that the declaration of files containing personal data by operators could be improved.

The CRE reiterates that, in application of law no. 78-17 of 6th January 1978, operators using or creating IT files containing personal data must ensure that these files are declared to, and if necessary, authorised by the CNIL.

2.2.1.b. – Personal data will be better protected by the application of the European Data Protection Impact Assessment Template

In order to satisfy priorities relating to the protection of personal data when rolling out smart grids, in 2012, the European Commission mandated a group of experts on the question of managing personal data collected via smart grids. The CRE, as representative of the Council of European Energy Regulators

[15] The site dedicated to the national debate on the energy transition can be accessed at the following address: http://www.transition-energetique.gouv.fr/

[16] See the list of Commercially Sensitive Information (CSI) in Appendix 2.

[17] Law no. 78-17 of 6 January 1978 amended on IT, files and freedoms.

(CEER) within the group of experts, actively participates in these works, and is convinced of the importance of ensuring the security and confidentiality of data.

The Data Protection Impact Assessment Template for Smart Grid and Smart Metering Systems (DPIA Template), prepared by this group of experts, received a positive opinion[18] on 4th December 2013 from the *Article 29 Working Party* composed of representatives from the data protection authority of each Member States, set up under the Directive 95/46/EC of the European Parliament and of the Council of 24th October 1995 on the protection of individuals[19]. The European commission should integrate this model in a directive.

Recommendation no. 6

In order to protect the data processed, the CRE recommends that smart grid projects carry out impact assessments, with the support of the CNIL, in accordance with the Data Protection Impact Assessment Template for smart grids and smart metering systems.

2.2.2. – Access to data must be simplified, particularly for local authorities and municipalities which delegate the development and the operation of the distribution grids to DSOs

New tools have also been defined by the Grenelle law on the environment ("*Grenelle I*" and "*Grenelle II*" laws, regulatory texts, contracts) to integrate energy planning at local level. In this context, the local authorities must draft or approve a certain number of documents (Regional master plan for climate, air and energy – SRCAE, Regional master plan for wind turbines – SRE, Regional master plan for connecting renewable energies to the power grid – S3REnR, Master plan for territorial consistency – SCoT, Territorial energy & climate plan – PCET, *etc*.) particularly in order to streamline the use of energy at local level and promote the integration of renewable energies.

In application of article L. 2224-31 of the general code of territorial authorities, each DSO for electricity and gas must grant access to economic, commercial, industrial, financial and technical information relevant to the exercise of its competencies to the concessionary authorities. The gross and net carrying values and the replacement value of the grids, among other information, must be disclosed on an annual basis. This information also includes data used to prepare and assess the regional master plan for climate, air and energy and the Territorial energy and climate plans, as well as a detailed report on the contribution of the concessionary authority to the local territorial climate and energy plans.

Furthermore, each gas and electricity DSO transmits a report on investment and development policy for grids to the awarding authorities, as defined in articles L. 322-8 and L. 432-8 of the French energy code.

In its opinion 20110951 of 3rd March 2011, the CADA (*Commission d'accès aux documents administratifs* - Commission for access to administrative documents) considered, having regard to the concession activity reports (CRAC) submitted by ERDF for electricity distribution grid operations, that the financial information disclosed in these documents is not covered by clauses on commercial and industrial secrecy

[18] Opinion 07/2013 on the data protection impact assessment model for smart grids and smart metering systems can be accessed on the site: http://ec.europa.eu/justice/data-protection/article-29/documentation/opinion-recommendation/files/2013/wp209_en.pdf

[19] Directive 95/46/EC of the European Parliament and of the Council of 24th October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data.

and is not considered as confidential information as listed in article 1 of the decree of 16th July 2001 on the confidentiality of information held by transmission and distribution systems operators. The CADA concluded that these administrative documents[20] can be forwarded in full to any party so requesting, in application of article 2 of law no. 78-753 of 17th July 1978.

Local authorities require energy data, such as grid equipment data, technical data, quality of supply data or consumption and generation data, as a basis for taking intelligent decisions in terms of energy planning and preparing or approving the aforementioned documents. However, this data is not always easy to access.

On 18th July 2013, the national council for the national debate on the energy transition proposed reinforcing local competencies in order to promote decentralisation in the implementation of the energy transition (priority no. 12)[21].

With this view in mind, the national council for the debate proposes implementing an "*obligation to manage and communicate consumption data for electricity, gas and heating, particularly to the benefit of the public authorities in question and the awarding authorities*"[22].

However, an obligation to manage and communicate consumption data alone could limit the possibility for, in particular, local authorities to achieve local energy targets for the development of sources of renewable energy, in an overall project to the benefit of smart districts, cities and territories[23] including, in addition to electricity, the other energy vectors, transportation and other public services as part of a wider framework of the competences of local authorities (public lighting, fight against fuel poverty, waste management, *etc*.). This service for the management and communication of data could also be expanded to grid equipment data, technical data, quality of supply data, *etc*.

The implementation of this data communication and management service can only be considered in compliance with regulations on data protection and security, particularly for personal data. Therefore, the access to consumption and generation data for local authorities could be achieved in a combined and anonymous manner, with various meshes (e.g., production, district, town and territorial meshes). With reference to personal data, the agreement of the user is still required in application of law no. 78-17 of 6th January 1978.

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[20] Law no. 78-753 of 17 July 1978 amended, on various means of improving relations between the authority and the public and including various administrative, social and fiscal provisions, defines administrative documents in article 1: "*Are considered as administrative documents, as defined in chapters I, III and IV of this volume, regardless of their date, place of storage, format and support medium, documents produced or received, in the context of their public services mission, by the State, territorial authorities and other bodies operating under public law and or under private law and responsible for such a mission. Files, reports, studies, statistics, directives, instructions, circulars, ministerial responses and memoranda, correspondence, opinions, forecasts and decisions, in particular, are all considered as administrative documents*".

[21] The summary of the national debate on the energy transition in France can be accessed at the following address: http://www.transition-energetique.gouv.fr/sites/default/files/dnte_synthese_web_bat_28-8.pdf

[22] See the actions for priority 12 of the summary of the national debate on the energy transition.

[23] Many terms can be used to designate a town with a smart grid: *Smart city*, *Green city*, *Connected city*, eco-district, eco-town, eco-city, sustainable town.

	Data collection	Data processing	Access to data	Use of data
Description of the activity	*This phase corresponds to the collection of data by operators of communicating equipment*	*This phase corresponds to the validation of data and any anonymous conversion or aggregation required for data*	*This phase corresponds to the provision of data. The access of some data may be open, while, for some specific data, it may be limited to those authorised*	*This phase corresponds to the use of data*
Parties involved	***Many parties are likely to collect data*** • Electricity and gas system operators • Electricity and gas concessionary authorities • Local authorities • Energy suppliers • Charging operators for electric vehicles • Cooling and heating grid operators • Water and purification services • *Etc.*	***Several data processing solutions can be considered*** • Directly by those collecting data • Centrally by one or more operators	***Several data provision solutions can be considered*** • Directly by those processing data • Centrally by one or more operators	***Many parties are likely to use this data*** • Electricity and gas system operators • Electricity and gas concessionary authorities • Local authorities • Electricity and gas suppliers • Charging operators for electrical vehicles • Cooling and heating grid operators • Water and purification services • New service providers • *Etc.*
Representation	*Raw data all over the country*	*Organised and validated data*	*Data accessible via data platforms*	*Data used to create new services and optimise operations*

Figure 6 – Diagram of the various phases from data collection to use (*Source*: CRE)

Data collection, management and use represent a new and important priority and, in this context, various points must be clarified:

- the governance of data management;
- the need or absence of need for trials at local mesh level, before expanding to the entire country;
- the costs (creation and operation of the IT infrastructure, and associated services) and benefits for the authority;
- the type of infrastructure (*Big data*, *Open data*, *etc.*);
- the standardisation of the exchange protocols used between operators;
- the type of data shared;
- data confidentiality (CSI and personal data);
- *etc.*

Recommendation no. 7

The CRE reiterates that distribution system operators must disclose a certain number of items of information to the electricity distribution organising authorities, particularly in application of article L. 2224-31 of the General code of territorial authorities.

The CRE requests that distribution system operators consider the implementation of interfaces in order to dynamically provide the electricity distribution organising authorities with the data collected and which must be disclosed according to the aforementioned text.

The CRE requests that distribution system operators consider the implementation of interfaces in order to dynamically provide data which may be freely disclosed to any party so requesting. The study must focus on the procedures for providing the public with data which may be freely disclosed, such as equipment data, in compliance with legal clauses on secrecy.

2.3. – The rollout of electric vehicle recharging station could be eased by modifying the current framework

Transport represents one third of energy consumption in France, therefore mobility is a major priority for the energy transition. The development of electric vehicles and plug-in hybrid vehicles could represent, alongside of natural gas vehicles, a means of reducing CO_2 emissions and atmospheric pollution in the transport sector. The general use of this new means of transport and its integration in the electrical system could be simplified by modifying the current legal framework.

2.3.1. – Electric vehicle recharging must be explicitly legally qualified

To date, electric vehicle recharging has not been specifically qualified in legal terms. According to current texts, this activity may be qualified either as "*electricity supply*", or, as "*a service contract*" depending on the planned services to be associated with the supply of electricity (booking service, parking, vehicle maintenance, *etc.*) and payment conditions (per kilometre, per period of time, per kilowatt-hour, *etc*.).

Current policies (approx. 14,000 recharging points accessible to the public in France at end-March 2014[24]) propose an overall service where the operator of recharging points purchases electricity from an electricity supplier. In most cases, the service proposed is effectively an overall service, including complementary services to electric vehicle recharging, such as parking or recharging point reservation. In other cases, the service proposed exclusively consists of the supply of the electricity needed to recharge the battery. When the service is not free of charge, the cost of the energy represents generally less than 50% of the cost of the overall service for slow (also known as normal recharges), fast and ultrafast recharges.

[24] The ChargeMap.com site has listed 13,774 plugs open to the public, including the plugs shared by individuals (approx. 11%). Source: Baromètre des bornes de recharge Janvier-Mars 2014 (Recharging station barometer, January-March 2014), AVERE France, Breezcar and ChargeMap.

Recharging method	Duration of a complete recharge (24 kWh battery)	Cost of electricity for a complete recharge (excluding connection costs) [25]	Examples of prices for recharging an electric vehicle (parking and other services included, March 2014)
Slow recharge (3 kW)	8 hours	€3.78	- Paris, Autolib'[26]: €8 during peak hours and €4 during off-peak hours, after an initial registration fee of €15 - Lyon, BlueLy[27]: €18 during peak hours and €36 during off-peak hours + a set monthly fee of €15 - Saint Germain en Laye, Château car park: €2.40 - Mayenne, SDEGM: €8 - Toulouse, Law faculty: €12 - Toulouse, Compans Cafarelli: €12
Fast recharge (22 kW)	1 hour	€4.05	- Mayenne, SDEGM: €8
Ultrafast recharge (44 kW)	30 minutes	€3.97	- Ultrafast recharging stations in public locations are generally free
The prices in this table do not reflect future changes to electricity prices. In particular, an important increase of electricity demand, for instance due to electric vehicle recharging, during peak periods could lead to a price increase.			

Table 4 – Cost of electricity (excluding connection costs) and prices to recharge an electric vehicle (March 2014) (*Source*: CRE)

The legal qualification essentially depends on the contractual structure and, in particular, on the characteristics of the service provided including the recharge. On this basis, depending on the contractual structure, recharging may be subject to regulations on the supply of electricity or to other regulations.

The question of the consumuser's right to freely choose an electricity supplier, via a recharging terminal (consumption site), must also be considered in the context of recharging electrical vehicles[28].

In the special case of electrical recharging invoiced per kilowatt-hour, the question of electrical buyback must be considered. This is not permitted without the agreement of the distribution system operator, according to dealer specifications for the public service for the development and operation of the distribution network and the supply of electricity at regulated rates.

When responding to the CRE's public consultation on the development of smart grids, many stakeholders referred to their need for visibility for the recharging legal framework in order to allow the electrical vehicle market to expand.

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[25] For recharging stations open to the public at the regulated sales price (RSP). The main assumptions used for:

- the 3 kW recharge: 0.33 recharge per day, blue RSP, 3 kVA base, home;
- the 22 kW recharge: 2 recharges per day, blue RSP, 22 kVA, non-home, recharges during peak hours;
- the 44 kW recharge: 5 recharges per day, yellow RSP, 44 kVA, non-home, recharges during peak hours.

[26] Autolib' offers a specific subscription for owners of electric vehicles who wish to recharge their vehicles at Autolib' stations. Recharges from 8:00 to 20:00 are invoiced at €1/hour, and from 20:00 to 8:00 at €1/hour, capped at €4.

[27] BlueLy offers a specific subscription for owners of electric vehicles who wish to recharge their vehicles at BlueLy stations. A set monthly rate of €15 for one year entitles owners to two initial free hours of charging, followed by recharging at €3 /30 min from 20:00 to 8:00 and €6 /30 min.

[28] The electrical consumption site consists of the establishment with an identity number listed on the National directory of companies and establishments, as defined in the decree of 14 March 1973 and, for sites without such an identity number, an electrical consumption site. Directive 2009/72/EC of 13 July 2009 defines two types of customers: "*wholesale customers*" and "*final customers*". A "*final customer*" is defined as "*a customer purchasing electricity for his own use*".

Qualification of recharging	Supply of electricity	Service contract
Selection of the supplier	By the user of the electrical vehicle	By the recharging operator
Contractual setup	- Supply of electricity Or - Combination of two separate services: supply of electricity + recharging infrastructure operator offering several services (parking, reservation, *etc*.)	- An overall "*itinerant recharging service*" allowing users to recharge their vehicle at any station open to the public with no option to select the supplier
The main arguments raised by operators	- Transparent prices for users - Allowing users to be responsible for their energy decisions regardless of the station selected (the energy prices used for vehicles can be compared, and users can decide to select whether or not to opt for a green electricity supply package) - Users can pick their preferred operator to optimise energy when recharging their vehicles	- Easy to implement - Lower operating costs incorporated in the traditional energy supply and distribution setup - Operators can optimise energy management at recharging stations and benefit from recharge packages

Table 5 – Summary of the responses of operators with regard to the legal qualification of recharging in the context of the CRE's public consultation of 4 November 2013 (*Source*: CRE)

On the one hand, in situations where recharging is considered as a service, and therefore excluded from the supply of electricity, this activity is not subject to most of the provisions of the energy code. The supplier is selected at the point of delivery of the energy in the recharging station (e.g. by the operator of the cluster of recharging points on public space or by the condominium of offices or flats). The advantage of this model is that it is easy to implement, particularly for users of electrical vehicles.

On the other hand, in situations where recharging is considered as electricity supply, authorisation is required (for the electricity supplier) and specific provisions of the consumer code apply. The question of the free selection of a supplier per consumption site must therefore be considered. Users of electric vehicles should be able to select a supplier. Furthermore, operators of recharging stations would be prohibited from purchasing electricity for resale and buyback. The policies currently applied by operators (current balance-responsible entity model, structure between the different recharging operators for electric vehicles and the information systems of these operators, *etc*.) are inappropriate for such a legal qualification. This model could therefore induce higher costs than the aforementioned model.

In both cases, competition between electricity suppliers will be based on the decisions of recharging operators, and on the decisions of the users of electrical vehicles.

Recommendation no. 8

The CRE supports the clarification of the legal qualification of the recharging of electric vehicles in order to provide the necessary visibility for the development of recharging services for electrical vehicles.

The energy code could specify that recharging is not considered as electricity supply. A minimum degree of obligations[29] specific to recharging would guarantee the healthy development of the market to the benefit of end-users. This qualification would remove the current legal uncertainty without subjecting recharging station operators to the full restrictions inherent to the supply of electricity.

This solution would also maintain the differentiation between electricity supply and service contracts.

2.3.2. – The management of recharging stations for electric vehicles in blocks of offices or flats could be simplified

According to initial feedback, users mainly recharge their vehicles in their workplaces or at their homes. On this basis, deploying recharging stations in the car parks of blocks of offices and flats is a key point for the development of electrical vehicles.

Decree no. 2011-873 of 25 July 2011[30], in application of article 57 of law no. 2010-788 of 12 July 2010[31] known as the "*Grenelle II*", provides for the implementation of recharging points for electrical vehicles, subject to certain conditions, in blocks of offices or flats containing more than two housing units and including a contained car park for which the building permit was submitted after 1 January 2012. In application of the construction and housing code, some categories of existing blocks of offices must be equipped with equipment to recharge electrical or hybrid vehicles as of 1st January 2015[32].

With reference to blocks of offices or flats, all tenants or owners living in the building are granted a "*plug right*" whereby they may install a recharging infrastructure for electric vehicles at their own cost. According to current regulations, a meter must be fitted "*downstream from the building breaker*"[33] and must integrate a measuring system for the "*individual invoicing of consumption*". In the context of power supply, metering enables consumption to be invoiced on an individual basis and is incorporated within the monopoly of the grid operator.

According to these provisions, consumers must order a metering service from the distribution system operator at their cost[34]. The development of other, potentially less costly, solutions for the end-user, is not

[29] Examples of obligations are given in appendix 4.

[30] Decree no. 2011-873 of 25 July 2011 amended, on facilities for the recharging of electric vehicles or rechargeable hybrid vehicles in buildings and infrastructures for secure bike parking.

[31] Law no. 2010-788 of 12 July 2010 amended, on the national commitment to the environment.

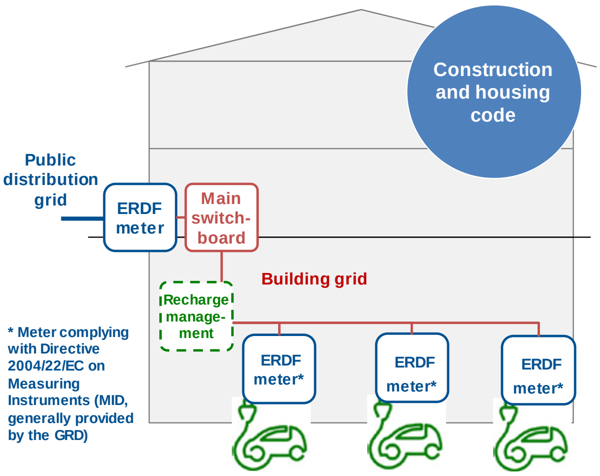
[32] Article R. 136-1 of the construction and housing code (application deferred to 1 January 2015).

[33] Article R. 111-14-2 of the construction and housing code.

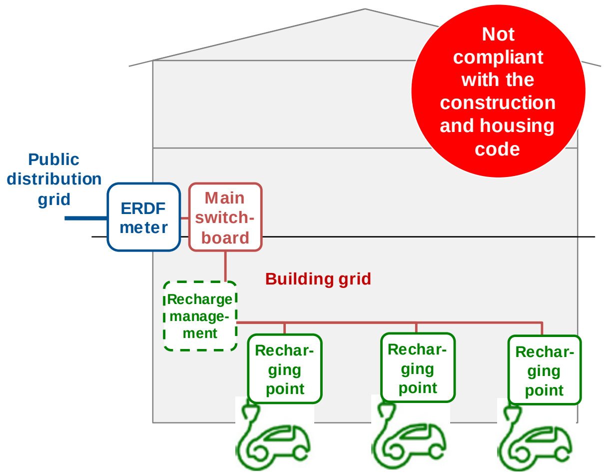
[34] The annual metering service, for users indirectly connected to the public distribution network via private electrical systems, consists of the public distribution network operator periodically reading and checking the metering of consumption, as well as carrying out metering calculations in view of allocating this consumption to the scope of a balance-responsible entity. This is a specific process attributable to specific power supply configurations, which cannot be adjusted simply, mainly for technical reasons. For customers connected to a public distribution network managed by ERDF, the price of the annual metering service for a customer with an indexed LV meter ≤ 36kVA is equal to €546.24 including tax. The catalogue of ERDF services can be consulted at the following address: http://www.erdfdistribution.fr/medias/Catalogue_prestation/ERDF-NOI-CF_32E.pdf

authorised in the current legal framework. Only the first of the four solutions described below complies with the construction and housing code:

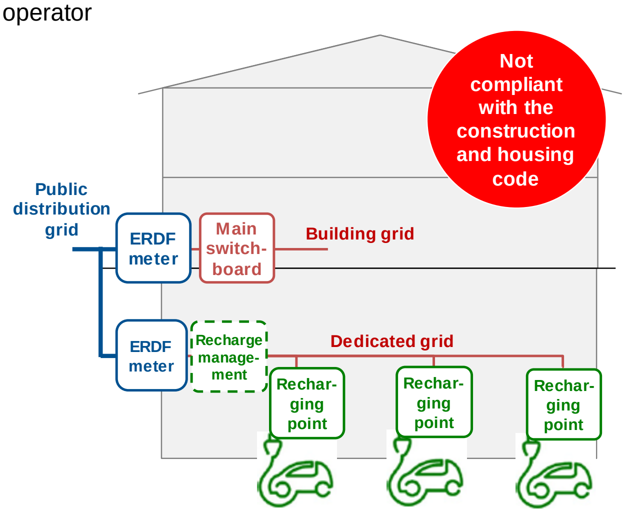
1. Connection of the recharging infrastructure to the building grid and installation of an electricity meter to carry out individual invoicing of consumption



2. Connection of the recharging infrastructure to the building grid and installation of a private measuring system (within the management system or the recharging points) operated by the condominium or a third party operator



3. Connection of the recharging infrastructure to the public distribution grid and installation of a private measuring system (within the management system or the recharging points) operated by the condominium or a third party operator



4. Connection of the recharging infrastructure directly to the public distribution grid

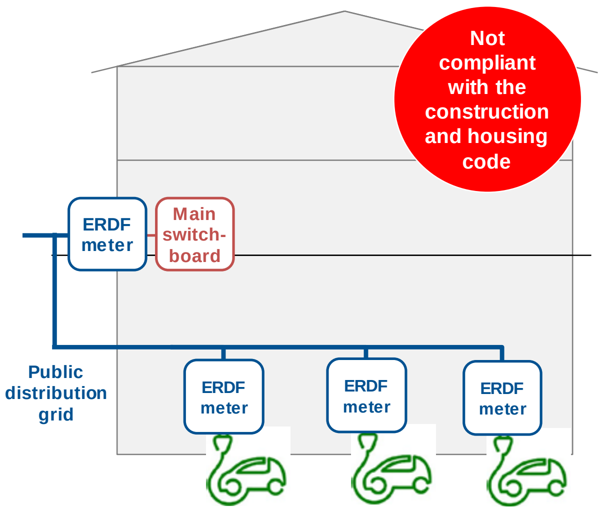


Figure 7 – Main connection options for recharging stations in blocks of offices or flats (*Source*: CRE)

Despite the current legal framework, solutions 2 and 3 have been implemented in some blocks of offices and flats and some private operators offer shared energy and station supervision management services to condominiums for these models.

Several market players, when responding to the CRE's public consultation on the development of smart low voltage grids, requested adaptations to the current legal framework to enable the development of these two solutions. These would indeed offer potential economic benefits[35] for users. Furthermore, thanks to solutions 2 and 3, users may benefit from a wider range of installation, operation and control services for recharging stations in blocks of offices and flats. These solutions would simplify optimising the management of electricity downstream from the point of delivery as well as the integration of the needs of the electrical system and those of the final consumer (as described in chapter 2.1).

However, these solutions also require the recharging of electric vehicles to not be considered as the supply of electricity, to ensure that the financial costs associated with recharging electric vehicles can be distributed between the various users. Should this not be the case, this distribution of financial costs would breach the prohibition of electricity buyback or buying for resale.

Finally, solution 4 could be worthwhile for new blocks of offices and flats, but does not appear to have been tested to date.

Recommendation no. 9

The CRE supports a modification of the current legal framework (article R111-14-2 of the construction and housing code and the implementation of recommendation no. 8) in order to distribute, on the basis of the information provided by recharging infrastructures, the financial costs associated with the operation of the internal system dedicated to recharging points, on the one hand, and electrical consumption inherent to the use of these systems, on the other hand.

Recommendation no. 10

The CRE supports the development of smart solutions for the recharging of electric vehicles.

In particular, the CRE supports the proposal that recharging devices (recharging points and management system) should be able to communicate with the different operators in the power system and should, in particular, integrate pricing signals (pricing signal from supplier, pricing signal from the distribution system operator, signals transmitted by new operators such as demand response operators, *etc.*).

2.3.3. – The deployment of recharging stations for electric vehicles in public areas could be simplified

According to initial feedback, most recharges are carried out in homes or at the workplace. However studies carried out have proven that the presence of recharging stations in public areas is an central issue when purchasing an electric vehicle. In particular, the presence of ultrafast recharging stations (44 kW) plays a "*reassuring"* role (back-up in case of unplanned needs or a breakdown), and is perceived as indispensable by potential buyers of these vehicles.

Although the number of recharging stations in public areas has increased substantially in the last two years, according to automobile manufacturers, numbers are still too low to boost the deployment of electric vehicles in France. Recharging stations are currently installed on public roads by private operators or municipalities should no prevent initiatives be launched[36]. The funding programme called

[35] See appendix 4, for the summary of the costs inherent to the different installation solutions for recharging stations for electric vehicles in blocks of offices and flats.
[36] Article 57 of the "*Grenelle II*" law.

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Investissements d'avenir[37] has enabled territorial authorities to take action. It targets authorities to manage projects involving the deployment of recharging infrastructures for electric vehicles and rechargeable hybrid vehicles. The creation of a national network of recharging stations throughout France[38] would guarantee a adequate density of recharging stations, particularly ultrafast recharging stations, throughout the country, and would simplify regional travel in electric vehicles. Complementary initiatives, as described in this chapter, could simplify the deployment of recharging stations.

As indicated in its CRE's public consultation of 4th November 2013, the development of electric vehicles impacts transmission and distribution grids. Indeed, studies carried out by system operators highlight the potential impact of the development of electric vehicles on consumption peaks, particularly for ultrafast recharges. According to these studies, the power output involved in recharging electric vehicles could lead to potentially significant economic (particularly the need to reinforce the grid) and environmental (recharges during peak periods, fossil energies are still the main source in the electrical mix for non-interconnected zones) consequences.

2.3.3.a. – Distribution system operators could act as market facilitators

Many market players consider that the role of each stakeholder could be specified to simplify the deployment of recharging stations open to the public. They also consider that main stakeholders should be involved in the deployment of recharging stations in order to integrate the different requirements in terms of location: handy locations for users, homogeneous distribution throughout the country, locations likely to limit civil engineering, connection and reinforcement costs for the distribution grid, *etc.*

The location of recharging stations is critical to determine the cost and lead time for connection. According to studies carried out by ERDF, the costs met by the recharging infrastructure operator (the cost of connections and extending connections) and the cost of reinforcing the grid met by distribution network operators, vary substantially depending on the location of the recharging stations. Over and beyond the financial impact, the delay required to connect the recharging stations depends on whether or not the grid must be reinforced or not.

Type of recharging system	**Connection cost range** (for the requesting party)	**Reinforcement cost range** (for the distribution network operator)
6 x 3 kW stations	€1,200 - €26,000	€3,400 - €21,000
6 x 22 kW stations	€2,300 - €40,000	€16,700 - €41,500

Tableau 6 – Connection and reinforcement costs by recharging stations for electric vehicles depending on the location of the recharging station (*Source*: ERDF)

[37] The call for proposals is available on the ADEME site: http://www2.ademe.fr/servlet/getDoc?id=86235&p1=1

[38] A bill simplifying the deployment of a network of recharging infrastructures for electric vehicles in public spaces was adopted by the Assemblée nationale on first reading on 6 May 2014 : http://www.assemblee-nationale.fr/14/ta/ta0335.asp

Recommendation no. 11

The CRE supports the proposal that distribution system operators should participate in the studies carried out by the parties leading recharging station projects, in coordination with territorial authorities and concessionary authorities, and will inform these operators of the capacities of public distribution grids and, in addition, grid development projects underway.

Recommendation no. 12

The CRE requests that distribution system operators study the feasibility of progressively implementing interfaces in order to dynamically share data on available capacity with parties leading recharging station projects, particularly with territorial authorities and concessionary authorities. These data should reflect existing and future grid constraints.

With regard to their connection charges reference, distribution system operators must attempt to "*improve transparency for financial conditions for connection, particularly in terms of changing demand*"[39]. A chapter specifically explaining the situation for connections to electric vehicles recharging stations would allow all market players requesting a connection of recharging stations, whether private operators or local authorities, to easily determine the applicable pricing scale for connections beforehand. This presentation would smooth out the connection process and simplify the deployment of recharging stations.

Recommendation no. 13

The CRE requests that distribution system operators add a chapter on recharging infrastructures for electric vehicles in public areas to their future connection charges reference, for the concessions granted, in order to improve the transparency of financial conditions for connection. For operators of distribution system serving over 100,000 customers, this new chapter will be submitted to the CRE for approval in the context of the revision of the future pricing sale for connections.

2.3.3.b. – Deployment options for electric vehicles recharging stations connected to public street lights must be considered

Some smart grid projects are currently studying slow recharging solutions (3 kVA) from light posts in order to simplify the deployment of recharging stations on public streets. The recharging points would then be directly connected to the light post. By using the public lighting system, this solution aims to reduce the civil engineering works required to install recharging points on public streets. According to the leaders of these projects, these solutions would not require the reinforcement of the public lighting system and

[39] As indicated by the CRE in its deliberation of 28 June 2011, approving the third pricing scale for Électricité Réseau Distribution France (ERDF) for the invoicing of user connections to public distribution networks for the concessions granted.

upstream public distribution networks, and the aim is to use existing structures with the capacity to absorb the recharging stations[40].

Some market players did raise their concern in terms of how this new usage would be invoiced if connected to the public lighting system and the impact on the associated consumer profile[41]. Public lighting facilities can currently be integrated in a specific electrical supply package reflecting their highly specific consumer profile.

Monitoring and controlling systems of the electrical consumption of the different items connected to the public lighting system (light post, urban fittings, recharging station, *etc.*) are proposed. These systems could be used to analyse the impact of this equipment on the consumer profile of public lighting and consider possible changes to contractual conditions for the users of public lighting systems. More specifically, the use of data from measuring systems (inside recharging points) in accordance with directive 2004/22/EC on measuring instruments (the MID directive) could be considered.

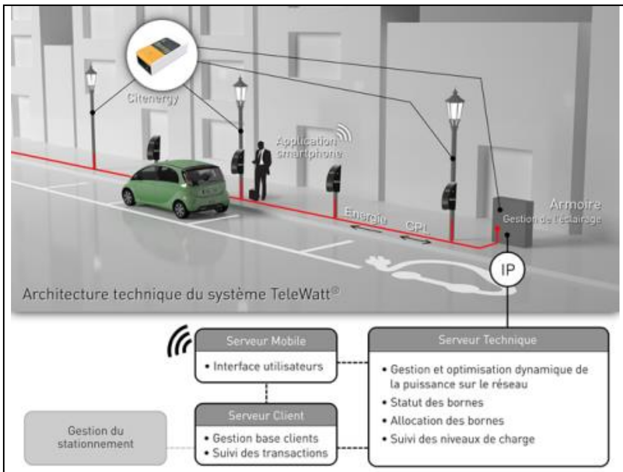

Figure 8 – Technical architecture of the *TeleWatt* project (*Source*: Citelum)

Figure 9 – Recharging stations on a light post (*Source*: Bouygues Énergie et Services)

[40] According to initial estimates by project leaders, approximately 5% of the 8 million light fittings in France, i.e. 400,000 light fittings, would be capable of absorbing a 3 kVA recharging station without the existing structures needing to be reinforced.

[41] The term "*consumer profile*" refers to the usage in the context of recreating flux. The list of profiles used and the method of allocating profiles to extraction sites are defined in chapter F of section 2 of the Rules on Programming, the Adjustment Mechanism and the Balance-Responsible policy.

Recommendation no. 14

The CRE supports demonstration projects which tests the connection of recharging stations for electric vehicles to public street lights in order to:

- confirm the technical feasibility and economic benefits of enabling the deployment of recharging stations on the public lighting system, particularly with the use of recharge management solutions. In addition, these studies should take into account the costs avoided in terms of civil engineering and the reinforcement of public distribution grids when compared with a situation where recharging stations are connected to public distribution grids;
- test the deployment of new services associated with recharging vehicles for the users of electric vehicles and local authorities;
- assess the conditions for the widespread deployment of recharging stations via the public lighting system, while attempting to identify any regulatory or contractual limitations and any possible changes required to ensure that each type of use (distribution of electricity, public lighting and recharging of electrical vehicles) absorbs the associated costs.

Recommendation no. 15

The CRE requests that distribution system operators participate in the studies aiming at assessing the conditions of deployment of recharging points to public street lights, in coordination with stakeholders involved in these projects.

2.4. – Targeting the emergence of a self-generating consumer: current policy must be adapted to enable self-consumption

Self-generation is defined as the consumption of electricity generated at the same connection point and at the same time and helps to improve the integration of distributed generation. The combination of identical location and timing for generation and consumption reduce transit via the public distribution grid and can therefore save system costs on both a short-term (for electrical losses) and a long-term (investment in grids and systems) basis.

In the context of feed-in tariffs, which currently represent the main means of supporting renewable energies, users are strongly encouraged to sell all of the energy generated to the obliged buyer and to purchase all of the energy consumed from the supplier rather than consuming at least part of the energy generated[42]. At the current time, when users consume part of the energy self-generated, they lose the benefits of the purchase obligation for the self-consumed volumes[43].

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[42] To illustrate, a user with a built-in photovoltaic system with a power less than 9 kW, benefiting from a purchasing price in the 1st quarter of 2014 and a consumption system with a subscribed regulated sales rate and a Basic subscribed power of 9 kVA, is paid €285 /MWh by the obliged buyer for the electricity generated and pays €165 /MWh to the supplier for the energy consumed.

[43] Article 4 of decree no. 2001-410 of 10 May 2001 amended, on the purchasing conditions for electricity generated by generators benefiting from a purchase obligation provides that: "*Excluding, if applicable, the electricity consumed internally, restitutions and reserves* […]*, an electricity generator benefiting from the purchase obligation provided for in*

From an electrical point of view, a given share of consumption concerns electricity generated at the same place and at the same time, and therefore without inducing transit via public grids. The following graphic shows 37% self-generation in one day in the month of March. However, in the context of the current provisions applicable to purchase obligation, self-generators are not currently encouraged to increase the synchronism between generation and consumption at the same connection point.

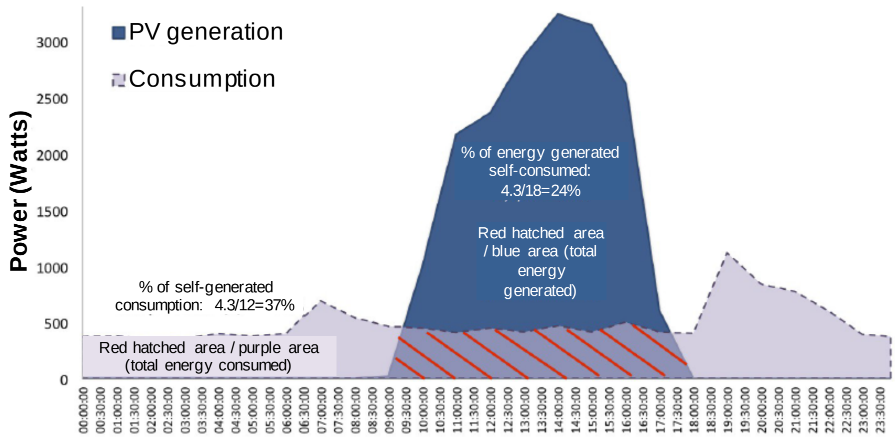

Figure 10 – Example of injection and extraction curves for a self-generating user over a typical day in the month of March (*Source*: Hespul)

A new economic framework must be defined to encourage generators to increase their level of self-generation. Prior to creating this framework, the connection arrangements for facilities integrating generation and consumption must be modified and regulations must be completed.

The implementation of a new grid connection arrangement for facilities combining generation and consumption is an indispensable prerequisite to the promotion of self-generated energy. The situation where the consumer/generator uses two grid connection points must be converted into a scenario where users only maintain one single grid connection point in order to allow self-generation to be measured. With this solution,net injection and consumption for the generation/consumption site can be measured. A sub-meter, measuring the energy generated or consumed with reference to the main meter, must be installed to complete the measuring system[44].

This modification to the connection arrangement can be used to measure self-generation for the generation/consumption facility. New information and communication technologies can enhance synchronism between generation and consumption. Indeed, they can be used to provide information to users on generation (forecast and real) and automatically control some items of system equipment, as well as the use of storage devices. Increased synchronism can also be easier for some categories of users than others. For example, home users can access consumption and generation profiles, which appear to lack synchronism "*in principle"*, while industrial and tertiary users benefit from greater synchronism between consumption and generation *in principle*, particularly due to significant loads during

article 10 of the aforementioned law of 10 February 2000, hereafter the generator, must sell all of the electricity generated by the facility in question to Électricité de France or to the non-national distributor […] *, operating the grid to which the generation system is connected, hereafter the buyer*".

[44] The cost of modifying connection arrangements for existing facilities is estimated at between €500 and €1,000 on average, and is zero for new facilities. With reference to invoicing based on metering, the service catalogue of ERDF currently provides for an annual metering service for C1 to C5 customers invoiced €21.07 inc. tax, for charge curve metering, and €556.84 exc. tax for indexed metering: http://www.erdf.fr/medias/Catalogue_prestation/ERDF-NOI-CF_32E.pdf. Important: while it is not indispensable to install charge curve meters in order to measure self-consumption, these meters can however be used for a more detailed appraisal of synchronism between generation and consumption.

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the day (HVAC, office equipment, chillers, *etc*.) and the storage capacity for site activities (cooling, heating, *etc.*). A "*basic"* level of synchronism between generation and consumption for one single connection point corresponding to the most frequently occurring situation can be defined for each given category of generation system[45] and user.

A dedicated economic framework should be set-up in order to encourage the synchronism between consumption and generation. It should integrate the savings on the variable part of the electricity invoice related to the reduction of consumption from public distribution grids.

In their responses to the CRE's public consultation of 4th November 2013, some market players raised the question of modifying the structure of the grid tariff (TURPE) with the development of self-generation. In this respect, it is important to remember that a self-generator may legitimately be considered as any other grid user. In particular, the amount invoiced for electricity distribution consists of several items, which vary, mainly depending on the power subscribed and the energy consumed. If the user benefits from the same subscribed power, the part of the TURPE, which is proportional to the power subscribed, will remain unchanged. If the user manages to reduce the amount of energy extracted from public distribution grids by consuming the energy directly generated, the part of the TURPE, which depends on the energy coming from public distribution grids, will be reduced. This reduction in the TURPE invoice will be identical to the reduction of a user reducing its consumption thanks to other means, e.g. demand side management, home renovation, *etc*.

In this way, in the current pricing context for grid access, treating differently self-generators and users which reduce their consumption by other means could be considered as discrimination. It is also important to note that this saving achieved on the variable part of the TURPE is not guaranteed on a long term basis, as the structure and level of the TURPE may change over the life cycle of the facility.

The CRE considers that, to enable the development of self-generation, a self-generation bonus should be defined and comply with the following principles:

- the self-generation bonus should be defined in line with the structure and level of feed-in tariffs. In particular, the self-generation bonus must not lead to an excessive level of payback for capital invested[46] and must not encourage users to artificially increase their consumption in order to benefit from the self-generation bonus;
- the policy adopted should encourage users to improve the synchronism between generation and consumption at the same grid connection point to reflect the savings in grid costs. In particular, a degree of synchronism between generation and consumption below the "*basic*" level of synchronism should not lead to benefits when compared with the current situation. A level of synchronism between generation and consumption which is better than this "*basic*" level of synchronism should, on the contrary, lead to benefits for the user by a reduction in the invoice when compared with the current situation;
- CSPE expenses: the policy adopted should reduce, or, at least not increase the extra cost of feed-in tariff, and the self-generation bonus must be less than or equal to the difference between the feed-in tariff and the cost avoided[47];

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[45] As defined by decree no. 2000-1196 of 6 December 2000 amended, defining the limit powers per system category for facilities compatible with a purchase obligation for electricity.

[46] Article L. 314-7 of the energy code on the purchase obligation particularly provides that the "*level of this bonus cannot lead to the payback for capital invested in facilities benefiting from these purchase conditions exceeding the normal payback for capital, in view of the risks inherent to these activities and the guarantee granted to these facilities, i.e. that all energy generated will be sold at a given rate.*"

[47] The cost avoided represents the savings achieved by the buyer due to avoiding the need to purchase the purchase obligation volume on the market. In application of article L. 121-7 of the energy code, the expenses attributable to public service missions include the extra costs inherent to the difference between purchase obligation rates and the cost avoided, as calculated on the basis of energy market prices. In application of article L. 121-9 of the energy code,

- the economic details of this policy must be adapted to areas which are not connected to the mainland France grid.

The effects of the new policy on taxation must be planned for and handled prior to definition. In particular, the impact of self-generation on taxes based on the variable part of the electricity invoice (the TCFE, CSPE and VAT in particular[48]) should be neutralised. In fact, self-generators do not reduce their consumption, but exclusively the amount of energy coming from public distribution grids.

The CRE considers that a self-generation bonus defined on the basis of the above principles could apply to all new generation systems wishing to benefit from support.

Furthermore, this new policy should be in line with the existing framework regarding state aid rules.

Recommendation no. 16

The CRE recommends that the conditions for energy production using renewable sources should be modified in order to recognise the economic value of the self-generated energy, defined as the share of consumption covered by the electricity generated at the same connection point and at the same time. The CRE recommends the adoption of modifications to the current legal framework according to the following principles:

- the self-generation bonus should be defined in line with the level of feed-in tariffs. In particular, the self-generation bonus must not lead to an excessive level of payback for the capital invested and must not encourage users to artificially increase their consumption in order to benefit from the self-generation bonus;
- users should be encouraged to increase the synchronism between generation and consumption beyond the "*basic*" level of synchronism between generation and consumption at one single connection point to reflect the savings in grid costs;
- the policy adopted should reduce, or, *at least*, not increase the extra cost of feed-in tariffs;
- the economic details of this policy must be adapted to areas which are not connected to the mainland France grid.

The effects of the new policy on taxation must be planned for and handled prior to definition. In particular, the impact of self-generation on taxes based on the variable part of the electricity invoice should be neutralised as self-generators do not reduce their consumption, but exclusively the consumption transiting via public grids.

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the Minister of Energy defines the amount of the charges of this public electricity service on an annual basis, at the proposal of the CRE.

[48] TCFE: Taxes sur la Consommation Finale d'Électricité (Tax on the final consumption of electricity). VAT: Value Added Tax. CSPE: Contribution au Service Public de l'Électricité (Contribution to the public power service).

Recommendation no. 17

The CRE requests that distribution system operators:

- estimate the cost of the different connection solutions, for an indirect connection to the public distribution network, from a generation system to a consumer facility;
- adapt processing procedures for connection requests and the means of collecting information (information sheets and electronic interfaces) in view of indirectly connecting generation systems;
- upgrade the pricing scale for the invoicing of connections in the event of new indirect connections to low voltage generating systems;
- consider changes to sub-metering procedures for the energy consumed and generated by the customer and allocation to the scope of a balance responsible entity, and any modifications required to the service catalogue, to ensure that the sub-metering service does not hamper the development of self-generation.

3. – *Smart grid* technologies should improve the performance of public distribution grids

3.1. – Developing smart grids to take advantage of power plants specific features

3.1.1. – New grid management principles are required in order to accommodate the rapid development of photovoltaic power plants on low voltage grids

For the last 10 years, the number of power plants connected to low voltage grid has risen significantly. 99% of power plants connected to the low voltage grids are photovoltaic power plants. The geographic footprint of photovoltaic generation in France is uneven: it is mainly located in the West and the South of France.

The massive arrival of variable energies has made it more complex to balance generation and consumption. At a local scale, the variability of generation and the synchronous nature of photovoltaic and wind generation make grid operation more complex, as it must integrate new phenomena, such as high or unbalanced voltage, harmonic injections by power electronics and rapid power variations.

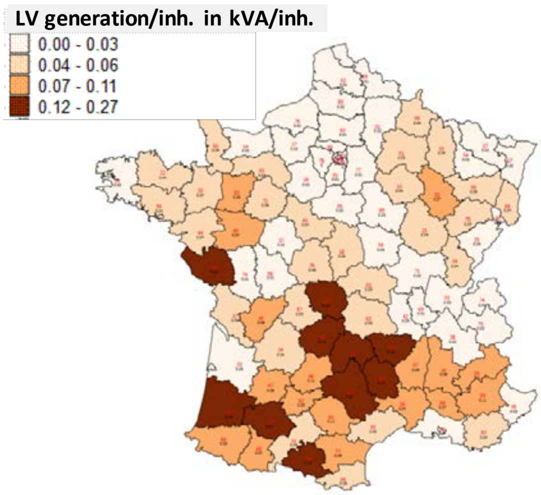

Figure 11 – Generation systems connected to LV grids per department and per inhabitant (*Source:* ERDF)

In some circumstances, the connection of this new type of power generation requires to reinforce the low and medium voltage grids, at some costs. *Smart grid* technologies open up new prospects to limit the need for reinforcement, helping to moderate costs for grid users. In 2011, the CRE selected the consultancy Adéquations to conduct a study on the costs and benefits inherent to increased photovoltaic generation penetration on public distribution grids. The results of this study were presented to stakeholders through the CRE's public consultation on the structure of tariffs for the use of public electricity transmission and distribution systems[49], on the 6th of March, 2012. This study showed that, with current technologies, the aggregate costs potentially borne by ERDF, which would therefore need to be covered by the grid tariffs, could range between €402 M and €1,284 M by 2020, depending on the scenario considered[50].

According to ERDF, the annual mean cost of reinforcement per kilowatt of new generation capacity varies by a factor ranging between 1 and 20 depending on local grid constraints. In some areas with low consumption density and a high density of photovoltaic generation, total low voltage generation is already likely to result in net power injection on the high voltage grids (HV) during low-consumption periods, leading to new operation strategies for these grids.

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[49] The documents on this public consultation for the CRE can be accessed at the following address: http://www.cre.fr/documents/consultations-publiques/structure-des-tarifs-d-utilisation-des-reseaux-publics-de-transport-et-de-distribution-d-electricite

[50] €402 M for the "*PPI*" scenario (500 MWc per year, i.e. a target installed power of 6 GWp by 2020) and €1,284 M for the "*fast-track*" scenario (2 GWc per year, i.e. a target installed power of 18 GWp by 2020).

The grid infrastructures required to connect[51] low voltage power plants are currently designed to allow them to function at maximum rated power at any time. To this end, prior to the connection of a power plant, grid operators carry out studies to anticipate the grid constraints[52] which could appear on the existing grid after connecting the power plant. It may then be necessary to reinforce the grid before connecting the power plant in order to avoid the actual occurrence of these constraints. In this case, the cost of reinforcement works at the same voltage level is attributable to the generator, while the cost of the reinforcement works is covered by network tariffs.

Distribution system operators specify the methodology and assumptions applied when carrying out connection studies in the technical documentation they publish in application of the decision of 7 April 2004[53]. According to these principles, grid infrastructures must be designed to allow power plants to function at maximum rated real power at any time, without absorbing reactive power, in accordance with the applicable regulations. The base-case – "*reference*" – connection solution proposed by DSOs is currently based on these principles. Changes to these principles could limit the need for reinforcement and, in particular, reinforcement costs attributable to generators in consideration of their commitment to participate to voltage regulation or to limit the real power they inject into the grid.

3.1.2. – The need for reinforcement can be reduced by the power plants reactive power absorption capability

Consumer facilities generally consume active power and absorb reactive power. These two factors tend to lower grid voltage. On the contrary, distributed generation inject real power into the grid and lead to local voltage increase. Grid operators must take these phenomena into account and use available resources (grid reinforcement, power transformers on-load or off-load tap changing, reactive power compensation means in MV, *etc.*) to ensure that voltage remains within regulatory limits for all users. However, the technical capability of some distributed power plants to absorb reactive power is not currently used.

Most photovoltaic systems are technically able to absorb reactive power, which would help reducing voltage locally. This solution, which avoids the occurrence of high voltage constraints, could be implemented in the form of local regulation (e.g. by controlling the reactive power absorbed by the power plant, depending on the active power injected or the voltage measured at the delivery point on the grid) or coordinated and centralised regulation (e.g., by the distribution system operator, according to the behaviour of all available systems).

ERDF has conducted initial trials on the absorption of reactive power by distributed generation. According to initial estimates by ERDF, savings in reinforcement costs could average to 20-40% for medium voltage grids (MV) and to 10-20% for low voltage grids (LV). On the other hand, absorbing reactive power leads to increased losses on distribution grids, which would be then covered by grid tariffs. This effect must be

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[51] The structures required for connection purposes are as follows: physical connection (low voltage only), the extension and reinforcement of public grids, or, in the context of a regional connection arrangement to the grid for renewable energies (S3REnR), the structures required to connect the generation system and the structures created or reinforced in the context of the arrangement.

[52] Voltage limitations (possible excursion outside of the regulatory interval of +/- 10% from nominal voltage) and/or, if applicable, current limitations (inducing thermal stresses on grid structures).

[53] CRE decision of 7 April 2004 on the implementation of technical references for public grid operators. The decision can be accessed at the following address: http://www.cre.fr/documents/deliberations/decision/mise-en-place-des-referentiels-techniques-des-gestionnaires-de-reseaux-publics-d-electricite

taken into account and compared with the reinforcement costs avoided, to determine the conditions in which the absorption of reactive power by decentralised power plants would be an overall beneficial solution.

Despite its potential global welfare benefits, particularly in areas with a high level of low voltage generation, the absorption of reactive power by power plants connected to the low voltage grid is not currently allowed by regulations[54].

The distribution system operator must currently propose one or several connection solutions, which must include the reference connection solution[55]. Should regulations change, grid operators could, if it increases global welfare, propose an alternative connection solution to generators, in addition to the reference connection solution, including a contractual obligation to absorb reactive power[56], as the reference connection solution does not provide for any absorption of reactive power. Generators could opt for the alternative solution, particularly if this solution allows connection costs and lead times to be reduced.

This modification would take advantage of the capability of decentralised power plants to regulate voltage if this solution is worthwhile both for the generator and in terms of global welfare. This solution could be rapidly implemented.

Subsequent studies could be conducted on cases where this solution is not beneficial to the generator in terms of reduced costs or shorter connection times, while it is beneficial in terms of global welfare. More specifically, in the future, public distribution system operators could use the ability of power plants connected to their grids to absorb reactive power in various ways and, in particular, they could use the capabilities of the power plant for which connection to the grid is requested.

Recommendation no. 18

The CRE supports the proposal that distributed generation should be enabled to participate to voltage regulation by absorbing reactive power.

The CRE therefore proposes the removal of article 9 of the order of 23 April 2008, in order to allow power plants connected to low voltage grids to absorb reactive power.

[54] Article 9 of the order of 23 April 2008 amended, on technical design and operational provisions for connecting a facility generating electricity to a public low voltage or medium voltage distribution network, provides that "*generation systems connected to a low voltage grid must not absorb reactive power*".

[55] This mechanism is part of the framework of the provisions of article 5 of the order of 28 August 2007, defining the principles for the calculation of the contribution mentioned in articles 4 and 18 of law no. 2000-108 of 10 February 2000, on the modernisation and development of the public power service.

[56] This connection solution would then specify how the generation system could help to modulate voltage, benefiting from the system's absorption capacities for reactive power, particularly for high-voltage.

Recommendation no. 19

In order to optimise the economic conditions of the connection of distributed generation to the low voltage distribution grids and reduce the costs attributable to generators and connecting lead times for these power plants, the CRE requests that distribution system operators:

- amend the principles used to carry on grid connection technical studies in order to provide for the study of connection solutions which differ from the reference connection solution, including, when it is beneficial in terms of global welfare, contractual obligations for the power plants connected to public distribution grids to participate to voltage regulation by absorbing reactive power, as soon as regulations allow this approach. These solutions would then be proposed as alternative solutions to the reference connection solution, and will be chosen by generators, if preferred;
- specify objective criteria to determine when such solutions would be studied and proposed, and publish these criteria in their reference technical documentation;
- amend their reference technical documentation (in particular models for contracts and conventions concluded with generators), to enable the implementation of connection solutions involving the absorption of reactive power by power plants connected to public distribution grids.

In order to consider solutions which are beneficial in terms of global welfare, the CRE requests that distribution system operators study, in coordination with the generators, the economic and contractual conditions under which connection solutions involving the participation of power plants to voltage regulation involving the absorption of reactive power could be implemented, provided that they are beneficial in terms of global welfare.

3.1.3. – In some cases, the reinforcement costs attributable to generators could be reduced in consideration of a commitment to limit the real power injected

The reference connection solutions proposed to the generator by the distribution system operator are designed to allow power plants to function at their maximum rated real power (requested at connection), at any time. This option may however, in practice, require reinforcement works, which, depending on the circumstances, may lead to significant costs for the generators, commissioning lead times, and even temporary limitations on the real power injected into the grid.

In some cases, generators may prefer to commit to limiting the maximum real power which they can inject into the grid, if this commitment enables them to benefit from an alternative connection solution with lower costs and shorter lead times. In particular, generators may be interested in this type of solutions, if these limitations do not significantly reduce the annual energy fed into the grid. The limit applicable to the real power injected and corresponding to the generator's commitment may, in some cases, be permanent and, in other cases, only apply in specific circumstances and to a specific number of hours per year.

This limit on the real power injected could avoid the occurrence of grid constraints. In some cases, this limit could be implemented locally, e.g. if the system reacts directly to the grid voltage measured. In other cases, the limit could be controlled in a coordinated manner, e.g. by the grid operator based on the different systems connected to the grid.

Power injection capacity is not limited on a long-term basis in the context of the reference connection solution, therefore grid operators could also, when it is beneficial in terms of global welfare[57], propose alternative connection solutions to generators with commitments to limit injected real power[58]. In order to be able to choose a connection solution, generators must have, to a certain extent, a precise idea of, firstly, the maximum extent and duration of the limits considered, and, secondly, the estimate of their probable effective implementation. Generators could opt for the alternative solution, particularly if this solution allowed connection costs and lead times to be reduced. In this case, the long-term commitments to limit the real power injected, in the context of this alternative connection solution, could be formally laid down in the different contractual documents established for the connection and for grid access.

Consequently, in order to implement this option, the standard practices of public distribution system operators should evolve and their reference technical documentation should be updated.

Recommendation no. 20

In order to optimise the economic conditions for the integration of distributed generation into low voltage grids and reduce the connection costs and lead times for generators, the CRE requests that distribution system operators study the feasibility of evolutions involving:

- modifying the principles behind connection studies in order to provide for the study of alternative connection solutions from the reference connection solution, when it is beneficial in terms of global welfare. Unlike the reference connection solution, these alternative solutions could imply limiting the real power injected by the decentralised power plants. These solutions would be proposed as alternative solutions to the reference connection solution, and would be selected by generators, if preferred;
- specify objective criteria to determine when such solutions are to be studied and proposed to generators, and publish these criteria in their reference technical documentation;
- adapt their reference technical documentation, and in particular models for contracts and conventions concluded with generators, to enable the implementation of connection solutions involving the possibility to limit the real power injected by the power plants connected to public distribution networks and define the corresponding grid access conditions.

3.2. – Connection solutions for consumers could take greater advantage of the flexibility they can provide

The boom in new usages and devices, such as heat pumps, electric vehicles, high tech equipment (flat screens, laptops, cell phones or smartphones, multimedia tablets, games consoles, *etc.*) has led to increased electrical consumption and potentially output power, putting electricity grids under stress.

[57] In particular, the assessment of global benefits must integrate the long and medium-term consequences of the alternative solution selected.

[58] This commitment would specify the extent and duration of the limit and, should the limit not be permanent, the circumstances and maximum number of hours in the year for which the limit applies.

With the arrival of new information and communications technologies, the electric power required for some usages can be modulated over time. Many trials are currently being carried out to test active demand management solutions able to temporarily modulate power demand when it allows to alleviate grid constraints. In particular, electrical vehicle recharging appears to be a relatively flexible usage where power demand can be modulated in many situations, while meeting user requirements.

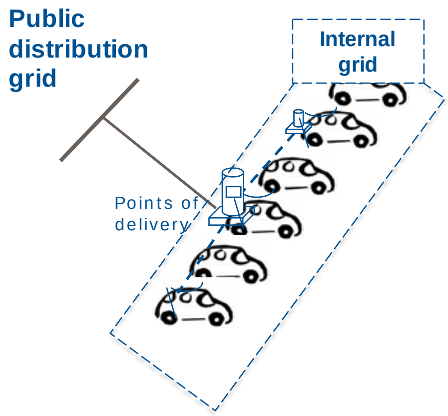

Figure 12 – Connecting recharging stations *(Source:* ERDF)

In order to reduce the need to reinforce the grid, it may be worthwhile modulating real power demand in situations which would lead to electrical constraints on the grid.

Based on initial feedback from experiments, several operators would be interested in connection solutions involving power demand modulation. The principles behind distribution system operators studies on new connections or grid development do not currently take into account these power modulation capabilities. Implementing these features will require evolutions of the standard practices of distribution system operators and updates of their reference technical documentation, particularly the models for contracts and conventions concluded with consumers.

The reference connection solution proposed to consumers by the distribution system operator is designed to allow them to function at the maximum real power requested at connection at any time. This option may however, in practice, require reinforcement works, which, depending on the circumstances, may lead to significant costs for the consumer, commissioning lead times, and even temporary power limits.

In some cases, consumers may however prefer to commit to limiting the maximum power which they can extract from the grid, if this commitment enables them to benefit from an alternative connection solution with lower costs and shorter lead times. In particular, consumers may be interested in this type of solutions, if these limits do not significantly alter their electricity usage. The power limit applicable and corresponding to the consumer's commitment may, in some cases, be permanent and, in other cases, only apply in specific circumstances and to a number of hours defined per year. This power limit could avoid some grid constraints. In some cases, this power limit could be controlled locally, e.g. in cases where the system reacts directly to the grid voltage measured. In other cases, the power limit could be controlled in a coordinated manner, e.g. by the grid operator based on the different systems connected to the grid.

Power limitations are not allowed on a long-term basis in the context of the reference connection solution, therefore grid operators could, when it is beneficial in terms of global welfare[59], also propose to consumers alternative connection solutions involving a commitment to limit the maximum power demand, in addition to the reference connection solution[60]. In order to be able to choose a connection solution, consumers should have, to a certain extent, a precise idea of, firstly, the maximum extent and duration of the limits considered, and, secondly, the estimate of their probable effective implementation. Consumers could opt for the alternative solution, if this solution allowed connection costs and lead times to be reduced. In this case, the limitations inherent to long-term commitments, in the context of this alternative

[59] In particular, the assessment of global benefits must integrate the long- and medium-term consequences of the alternative solution selected.

[60] This commitment would specify the extent and duration of the limit and, should the limit be permanent, the circumstances and maximum number of hours in the year for which the limit applies.

connection solution, could be formally laid down in the different contractual documents established for the connection and for grid access.

The implementation of this option requires appropriate changes to the standard practices of distribution system operators and their reference technical documentation.

Furthermore, in the future, distribution system operators could benefit from the various flexibility means (see chapter 3.4 of this deliberation), and, in particular, from the flexibility that the consumer which requests connection could offer.

The principles behind the connection studies of system operators could subsequently be modified to implement these options. In some cases, these changes would reduce the need for reinforcement, reinforcement costs attributable to the consumer, commissioning lead times or even the effective implementation of the power limits to which the consumer has committed.

Recommendation no. 21

In order to reduce costs and connection lead times for consumers, the CRE request that distribution system operators consider the feasibility and global economic benefits of the following evolutions:

- modifying the principles behind connection studies in order to provide for the study of alternative connection solutions from the reference connection solution, when it is globally beneficial. Unlike the reference connection solution, these alternative solutions could involve limiting the power demand of consumers. These solutions would be proposed as alternative solutions to the reference connection solution, and would be selected by consumers, if preferred;
- secondly, modifying the principles behind connection studies in order to integrate the option of benefiting from various flexibility means (see chapter 3.4 of this deliberation), and, in particular, from the flexibility that the consumer requesting connection could offer.
- specify objective criteria to determine when such solutions are to be studied and proposed, and publish these criteria in their reference technical documentation;
- amend their reference technical documentation, in particular the models for contracts and conventions concluded with consumers, to enable the implementation of these connection solutions and provide for the corresponding grid access conditions.

These studies should particularly examine the case of electrical vehicles recharging infrastructures.

3.3. – Technical requirements and contractual frameworks need to be adapted to take into account the specific characteristics of electricity storage facilities

3.3.1. – Grid users must benefit from objective, transparent and non-discriminatory access to the grids

Public distribution system operators must provide access to the grid in an objective, transparent and non-discriminatory manner.

On this basis, two grid users using the grid in the same way must be offered the same access conditions, regardless of their usage of the electricity. Thus, for example, the grid access conditions for a system injecting energy into the grid will not depend on the source of this energy and, in particular, the fact that the energy is generated from solar, wind turbine, nuclear or thermal energy or from a storage device. With storage facilities, the electricity stored can be produced from various sources.

In particular, article L. 341-2 of the energy code provides that "*grid tariffs for the use of the public transmission and distribution grids are calculated in a transparent and non-discriminatory manner* ". Two users in similar situations (particularly connected to the same voltage and using the grid in an equivalent manner) must pay equivalent amounts for supply.

Storage facilities can inject electricity into or extract electricity from the grid. In this respect, in order to inject energy, they must benefit from similar grid access conditions to those granted to any power plant. In the same way, in order to extract energy, they must benefit from similar grid access conditions to those granted to any consumer.

The same logic must apply in the context of pricing policy for grid access, with the application of charge when the storage facility extracts energy from the grid and an injection charge when the facility injects energy into the grid. It would not, *in principle*, appear justified to treat storage facilities any differently to consumer or power plants connected to public distribution grids. The potential benefits of storage facilities in terms of grid costs savings become evident when the load curve (charging or discharging) can be modulated, reducing constraints on the grid. These benefits are already taken into account in terms of connection charges and/or grid tariffs.

3.3.2. – The specific technical characteristics of electricity storage facilities must be taken into account

Electricity storage facilities, like power plants and consumers facilities, can lead to grid constraints on public distribution grids, requiring these grids to be reinforced, and leading to connection lead times and costs.

Despite this, some electricity storage facilities feature actual technical differences from other power plants or consumers facilities. For example, they combine several power electronic components (inverters, rectifiers, converters). These differences must therefore be taken into consideration when defining the technical requirements applicable to these systems, just like the differences in technical requirements which exist depending on the energy source used. The differences eventually put into place must result from objective criteria and relate directly to technical issues in terms of grid safety and security, and the quality of electricity.

Article L. 342-5 of the energy code provides that "*in order to ensure grid safety and security and the quality of operation, general technical design and operational provisions are defined in regulations and the following must satisfy the former:* […] *If connected to the public distribution network, power plants, consumers facilities, interconnection circuits and direct lines mentioned in article L. 343-1*".

The current wording of this article does not explicitly mention systems which could both inject energy into and extract energy from the grid, which is particularly the case for electricity storage facilities. Modifying this article would clarify the list of systems subject to the general technical design and operational requirements. This type of clarification should also be considered for other provisions of the energy code, which may be applicable to storage facilities.

Recommendation no. 22

The CRE supports the modification of the provisions of article L. 342-5 of the energy code to clarify the list of facilities subject to the general technical design and operational requirements. This type of clarification should also be considered for other provisions of the energy code, which may be applicable to storage facilities.

Two decrees have been adopted in application of the provisions of article L. 342-5 of the energy code. Decree no. 2003-229 of 13 March 2003[61] defines the general technical requirements for all systems currently mentioned in article L. 342-5 of the energy code, excluding power plants, which are subject to the provisions of decree no. 2008-386 of 23 April 2008[62].

The connection of electricity storage facilities currently raises technical issues, particularly in terms of the quality of supply (harmonic disturbance, resistance to voltage drops) and grid safety (no safety standard, grounding continuity, system conformity), as the aforementioned regulatory provisions do not integrate the specific technical characteristics of storage facilities. These issues have led to delays for the schedule for French experiments[63].

Regulatory provisions on general technical requirements could be modified or completed in view of the specific characteristics of electrical storage facilities.

Recommendation no. 23

The CRE suggests that the regulatory provisions on general technical design and operational requirements should be modified in view of the specific characteristics of some electrical storage facilities likely to raise issues in terms of the quality of supply and grid security. Any differences in treatment between two systems must be the outcome of objective criteria and relate directly to technical issues in terms of grid safety and security, and the quality of operation.

Pending the adoption of these modifications, electricity storage facilities are only subject to the applicable regulatory provisions. Distribution system operators could explicitly describe how these provisions are implemented for electricity storage facilities in their reference technical documentation. They could specify this aspect by putting into place rules on the technical design and operational requirements applicable to such facilities.

These rules, and, if applicable, modifications to reference technical documentation, will be subject to public consultation with all stakeholders, prior to publication. Prior to publication, and as specified by the CRE in its decision of 7 April 2004, distribution system operators should notify the CRE of the corresponding rules, and the results of the consultation, highlighting all opinions collected. The same consultation process with stakeholders and the notification of the CRE prior to publication should apply for any plans to modify these rules.

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[61] Decree no. 2003-229 of 13 March 2003, on the general technical design and operational provisions applicable to systems in view of connection to public distribution networks.

[62] Decree no. 2008-386 of 23 April 2008 amended, on general technical design and operational provisions for connecting generation systems to public power grids.

[63] A few examples of the connection of electricity storage facilities to the public distribution networks are given in appendix 6.

Recommendation no. 24

The CRE requests that distribution system operators explicitly describe how the applicable regulatory provisions are implemented for electricity storage facilities in their reference technical documentation.

In the absence of regulatory provisions enabling the integration of the specific characteristics of electrical storage facilities, the CRE also requests that distribution system operators define rules on the technical design and operational requirements applicable to an electricity storage facility. Any differences in treatment between two systems must be the outcome of objective criteria and relate directly to technical issues in terms of grid safety and security, and the quality of operation.

The connection procedures of grid operators ensure the transparent and non-discriminatory treatment of connection applications by users, particularly by explicitly laying down the classification criteria for connection requests and the management of connection "*queues*", in compliance with the principles laid down in the decision of the CRE of 25 April 2013[64]. It is important to check that procedures are not unsuitable for the processing of connection applications for electricity storage facilities and to make any necessary change.

Furthermore, in order to enable connection applications for electricity storage facilities to be processed and to enable access to public distribution grid in an objective, transparent and non-discriminatory manner, system operators must ensure that the contractual provisions proposed are not unsuitable for storage facilities and, if necessary, modify these provisions.

In particular, connection application forms do not provide for the collection of detailed characteristics on the electricity storage devices[65] associated with power plants. They are also unsuitable for the connection of standalone electricity storage facilities. Similar issues exist for the models for connection proposals, connection, operating and grid access contracts.

[64] Deliberation of the CRE of 25 April 2013 on the decision on the rules for the preparation of processing procedures for connection applications for public electricity distribution networks and the monitoring of implementation. The deliberation can be accessed at the following address: http://www.cre.fr/documents/deliberations/decision/demandes-de-raccordement

[65] Such as the characteristics of rectifiers (power, type of power electronics, rectifier impedance, output voltage rating, power factor, *etc*.) and the operating mechanisms with inverters or converters for the system (AC or DC bus, *etc*.) enabling grid operators to simulate the behaviour of these electricity storage facilities, particularly in the event of the fast variation of voltage or frequency (islanding).

Recommendation no. 25

The CRE requests that distribution system operators take electricity storage facilities into account in the grid connection procedures, in compliance with the principles inherent to the CRE's deliberation of 25 April 2013, in order to ensure the objective and transparent treatment of these applications with no form of discrimination.

The CRE requests that distribution system operators ensure that their procedures, contractual documents and reference technical documentation simplify the connection and access of electricity storage facilities on the grid:

- by adapting the forms used to collect information in view of connecting generation systems with associated storage devices. The characteristics of storage devices could be specified in these forms, for example;
- by adapting these forms to integrate the connection of standalone storage facilities;
- by specifying the applicable principles for studies when connecting storage facilities;
- by ensuring that the terminology used for models and templates for connection contracts, conventions and technical and financial proposals is not unsuitable for storage facilities and, if necessary, by making the necessary changes to integrate the specific characteristics of these facilities.

The CRE requests that distribution grids operators ensure that any differences in treatment between systems in view of these adaptations are attributable to objective criteria and relate directly to technical issues based on grid security and safety and operational quality.

3.4. – Grid operation integrating the flexibility offered by grid users thanks to smart grid technology

Constraints on public distribution grids are currently relatively limited in France as these grids have been reinforced as new users have arrived. As indicated in chapters 3.1 and 3.2, the development of public distribution grids may evolve to better integrate the commitment of those requesting connections to accept long-term limits in consideration for reduced connection lead times or costs, when connecting new systems.

With the development of new information and communication technologies, greater flexibility is gradually becoming available on public distribution networks. The operation of these grids could benefit from flexibility options, as inherent to all the systems connected to the public distribution grids. This new flexibility could help to ensure continuous supply and manage local constraints. It could, for example, reduce the duration of the effective application, by the distribution system operator, of the limits accepted by the generator at the time of connection, or, in some cases, avoid the need for costly reinforcement by the authority.

The benefits of this flexibility for the operation of the public distribution grids must however be assessed more precisely. Some demonstrations projects are currently carrying out tests aiming to confirm the technical and economic benefits of this flexibility provided by the different users in terms of public distribution grid operations. These projects foresee to identify and define potential mechanisms (management mechanisms for local limitations, procedures for concluding flexibility contracts, *etc.*) enabling a contribution of flexibility services to the operation of public distribution grids. Considerations also focus on the consistency of these new local management mechanisms with the current structure of the power system.

Distribution system operators do not, to date, have access to the flexibility offered by third party operators. On the other hand, thanks to the technical equipment deployed on the grid (means of MV offsetting, charge adapters in transformers, *etc*.), system operators can offset any unbalance detected.

Furthermore, direct communication systems between distribution system operators and some items of equipment located downstream from the meter already exist: centralised musical frequency remote control (TCFM), currently used to transmit signals for changing timeslots (e.g. to trigger hot water boilers) and to control public lighting, and power line carrier solutions ("*PLC*") from hubs located in MV/LS sub-stations. An extension of the technical use of these resources to other applications could be studied in the context of trials in progress.

Feedback from the demonstration projects which are currently testing the use of flexibility options, and particularly new demand flexibility options, should lead to a clarification of the economic benefits of these solutions for the whole value chain. If necessary, they should lead to the identification of any technical, economic and legal difficulties in developing these solutions. Changes could be suggested on the basis of this feedback, if necessary, to allow distribution system operators to improve the effectiveness of the operation of public distribution networks, in line with the different policies already implemented for the management of the electrical system.

These considerations must be based on the provisions of article 15 of the directive 2012/27/EU of 25 October 2012[66], which specifies that the Member States must ensure that regulators implement grid control and pricing encouraging grid users to improve energy efficiency. Means should therefore be studied in order to effectively use the potential for flexibility of facilities connected to grids, in an objective and transparent framework with no discrimination, when economically worthwhile for the management of public distribution grids, and when in line with pricing policies.

Recommendation no. 26

The CRE requests that distribution system operators consider means of effectively using the potential for flexibility of facilities connected to grids, in an objective and transparent framework with no discrimination, when economically worthwhile for the management of public distribution grids, and when in line with pricing policies.

3.5. – Interoperability and sustainability of the smart grid technology deployed in public distribution grids should be guaranteed

3.5.1. – Standardisation activities to be consolidated

3.5.1.a. – Standardisation must lead to simplification via harmonisation

Given the wide range of different components of the new electrical ecosystem formed by the deployment of *Smart grid* technologies, these components must be able to interact, to optimise the usage of the electrical infrastructure.

[66] Directive 2012/27/EU of the European Parliament and Council of 25 October 2012 on energy efficiency, amending directives 2009/125/EC and 2010/30/EU and repealing directives 2004/8/EC and 2006/32/EC.

The trial phase for smart grids has led to the development and the test of many innovative solutions and has therefore led to the creation of many technical standards[67] in order to ensure interoperability between the different components within one single demonstrator.

However, the existence of too many industrial standards could hamper the large-scale development of industrial solutions. This can lead to an increase in the unit cost of smart grid solutions, particularly for equipment, whose production phase involves significant fixed costs.

The harmonisation of standards by international standardisation bodies helps to reduce the number of standards and, therefore, homogenise the equipment to be deployed. Standardisation particularly enables one standard to be selected from the many existing standards, for common usage, or even for one standard to be created, integrating the different priorities. In this respect, many smart grid standardisation projects have been launched at international level[68]. These projects will reduce the unit cost of solutions on the one hand, and guarantee the interoperability of equipment on the other. These two conditions are essential for the development of *Smart grid* technologies.

Recommendation no. 27

The CRE supports the greater harmonisation of standards on metering and smart grids. In this respect, the CRE supports the work of international standardisation organisations, particularly those of European standardisation organisations via the European standardisation mandates, M/441[69] on metering, and M/490[70] on smart grids. These mandates indeed lead to the harmonisation of metering equipment and practices, and more generally, smart grids, via European standards.

3.5.1.b. – Communications procedures must be known for not hampering the development of **Smart grid** *applications*

Many smart grid applications require the systems of users to be able to communicate with public distribution grid equipment in order to optimise operations. To achieve this, the different items of equipment must use the same communications procedures (particularly communications protocols and interfaces based on standards).

Distribution system operators have not, to date, defined the minimum requirements, guaranteeing communication between grid equipment and equipment downstream from the meter, in their reference technical documentation. Defining and publishing communications procedures would ensure that these procedures are accessible, transparent and objective with no discrimination, particularly for designers of *Smart grid* applications. It would be more difficult for users to effectively contribute to implementing smart grids without defined communications procedures.

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[67] An industrial standard is a reference document published by a private entity other than a national or international standardisation body or not approved by one of these bodies for national or international usage.

[68] Standardisation works for smart grids at international level can be consulted on the CRE website at the following address: http://www.smartgrids-cre.fr/index.php?p=normalisation-monde

[69] Mandate M/441 can be accessed at the following address:
http://ec.europa.eu/energy/gas_electricity/smartgrids/doc/2009_03_12_mandate_m441_en.pdf
The CRE contributes to these works as a representative of the CEER.

[70] Mandate M/490 can be accessed at the following address:
http://ec.europa.eu/energy/gas_electricity/smartgrids/doc/2011_03_01_mandate_m490_en.pdf

Recommendation no. 28

The CRE requests that distribution system operators:

- define the minimum requirements to be met by user equipment to enable communication with distribution grid equipment;
- publish these requirements in their reference technical documentation.

Distribution system operators will attempt to define, as a priority, communications procedures with the existing *Smart grid* equipment or equipment currently being deployed on the grids operated, by describing the interfaces and protocols to be implemented.

3.5.2. – The risk of disturbing PLC signals must be taken into account by regulations

Power Line Carrier (PLC) is used in many smart grid projects and for the smart *Linky*[71] metering system: a higher frequency and lower energy signal is superposed on the alternating current at 50 Hz. This PLC signal can be used to transmit information, particularly pricing signals, to medium and low voltage grids. The signal is received and decoded by any equipment with a PLC receiver in the same category and on the same power grid. The TCFM works on this principle at a lower frequency (175 Hz in most cases).

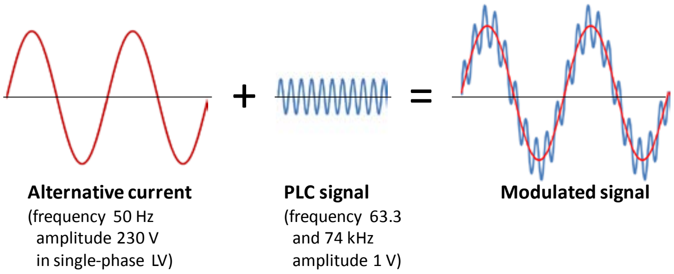

Figure 13 – The principle behind PLC communications (*Source*: CRE)

The PLC signals used for *Smart grid* projects for the advanced metering system, *Linky*, are located in the CENELEC-A frequency band between 9 and 95 kHz. This band is allocated to grid operator communications according to the standard, NF EN 50065[72].

The different items of electrical equipment installed near to or connected to public power distribution network can cause interference, attenuating or disturbing Power Line Carrier. This interference could endanger the sustainability of PLC technologies. Consequently, it is important to ensure that the level of interference caused by equipment connected to public power distribution grids or near to these grids is appropriately limited.

Interference caused by electrical equipment connected to the grid is subject to regulations on the connection of systems to the public power distribution grid. For new generation systems, these regulations

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[71] The advanced metering system, *Linky*, uses two communications tiers: one first tier of communication using PLC between the meter and the hub located in the MV/LV substation and a second tier of communication using the GPRS (*General Packet Radio Service*) between the hub and the ERDF supervisory centre.

[72] Standard on signal transmission for low voltage power grids in the frequency band from 3 kHz to 148.5 kHz.

provide that "*any limitations which the connection of the generation system is likely to induce, particularly on* […] *the operation of the transmission of tariff signals*"[73] must be identified and a connection solution removing these limitations must be proposed by the distribution network operator on the basis of this study. Similar initiatives[74] also exist for connecting consumption systems.

These orders do not explicitly mention PLC signals as one of the means of transmitting tariff signals. Furthermore, the reference technical documentation of distribution system operators only refers to the protection of TCFM signals. As these communications procedures are not mentioned, the PLC signal would not appear to benefit from adequate protection.

Recommendation no. 29

The CRE supports the improved protection of the PLC signal used by distribution system operators, particularly to transmit pricing signals. In this respect, the CRE recommends that the orders on the technical provisions to be satisfied by systems in view of connection to a public distribution network (of 23rd April 2008 and 17th March 2003), should be clarified, explicitly extending the concept of pricing signals to PLC signals and leading to a limitation of the level of emissions of systems connected to public distribution grids.

Recommendation no. 30

The CRE requests that distribution system operators describe, in their reference technical documentation, requirements in terms of protecting the PLC signal, as is the case for the current TCFM tariff signal (particularly the 175 Hz signal) in application of article 9 of the order of 17th March 2003 and article 3 of the order of 23rd April 2008.

Furthermore, the interference caused by electrical equipment installed near to public power distribution networks is subject to regulations and standards on electromagnetic compatibility. As the use of this signal is relatively recent, current standards and regulations do not protect this signal appropriately. These texts must be upgraded to integrate this development appropriately.

For example, regarding a similar subject, the electromagnetic compatibility of radio frequencies is governed by decree no. 2006-1278 of 18th October 2006[75].

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[73] Article 3 of the order of 23 April 2008 amended, on technical design and operational provisions for connecting a facility generating electricity to a public low voltage or medium voltage power distribution network.
[74] Article 9 of the order of 17 March 2003 amended, on technical design and operational provisions for connecting a facility consuming electricity to the public power distribution network.
[75] Decree no. 2006-1278 of 18 October 2006, on the electromagnetic compatibility of electrical and electronic equipment, transposing directive 2004/108/EC, on electromagnetic compatibility.

Recommendation no. 31

The CRE supports the improved protection of the PLC signal from electromagnetic disturbance and recommends:

- the introduction of regulations in order to protect PLC frequency bands such as radio frequencies in the decree of 18 October 2006;
- the preparation of an international standard on compatibility levels, defining maximum emission levels to avoid interference and degrees of immunity to guarantee robustness, in accordance with the works in progress within the IEC.

4. – *Smart grid* technologies can help to improve the overall performance of the power system

This chapter presents the CRE's recommendations on the contribution of *Smart grid* technologies to the overall performance of the electricity system. It particularly relates to the following subjects:

- the contribution of the facilities connected to public distribution networks to the management of the power system;
- the participation of flexible demand on the energy markets;
- the potential services provided by storage systems;
- the new priorities inherent to the safety of the electrical system due to changes to generation equipment;
- the specific problems inherent to the supply-demand balance in non-interconnected zones.

It takes into consideration the progress provided for in European directive 2012/27/EU of 25 October 2012[76], particularly the fact that demand can contribute, alongside generation, to all of the services required for the proper operation of the electrical system and energy markets.

4.1. – Facilities connected to public distribution networks could further contribute to the operation of the electrical system

The development of smart grid technology on distribution networks facilitate the contribution of all sites connected to public distribution networks, to the services required to ensure the proper operation of the power system.

In the past, nearly all of these services were provided by generating systems connected to the public transmission network. In recent years, these services have been progressively opened to facilities connected to public distribution networks. It seems preferable to continue opening up in this way to ensure further contribution of systems connected to public distribution networks, providing that these systems have the technical capacity to meet the expected level of performance. Indeed, some of these facilities are likely to be able to provide some of the services for a reduced cost.

4.1.1. – The contribution to the services that ensure supply-demand balance has been initiated for facilities connected to public distribution networks

To ensure supply–demand balance, the French transmission system operator, RTE, currently uses various mechanisms, as listed below, which have been progressing opened up to an increasing number of systems.

[76] Directive 2012/27/EU of 25 October 2012 particularly provides that "*Member States shall ensure the removal of those incentives* [...] *that might hamper participation of demand response, in balancing markets and ancillary services procurement*" and that "*Member States shall ensure that national energy regulatory authorities encourage demand side resources, such as demand response, to participate alongside supply in wholesale and retail markets*".

Mechanisms	Characteristics of the mechanism	Participation options at end-March 2014
Interruptibility contracts (article L. 321-19 of the French energy code)	- Input power for the mechanism: 400 MW - Response time: 5 seconds	- Consumption systems > 60 MW (possible combination for sites > 40 MW[77])
Primary reserve (article L. 321-11 of the French energy code)	- Input power for the mechanism: ≈ 600 MW[78] - Response time: < 30 seconds	- Any generation facility can participate[79]
Secondary reserve (article L. 321-11 of the French energy code)	- Input power for the mechanism: 500 - 1,000 MW[80] - Response time: < 15 minutes	- Any generation facility can participate[79]
Fast reserve (article L. 321-11 of the French energy code)	- Input power for the mechanism: 1,000 MW - Response time: 13 minutes	- Any facility > 10 MW (possible combinations[81])
Complementary reserve (article L. 321-11 of the French energy code)	- Input power for the mechanism: 500 MW - Response time: 30 minutes	- Any facility > 10 MW (possible combinations[81])
Additional consumer reserve (call for tenders for demand response) (article L. 321-12 of the French energy code)	- Input power for the mechanism: 760 MW - Response time: < 2 hours	- Consumption facilities > 10 MW (possible combinations[81])
Other resources activated for the balancing mechanism (article L. 321-10 of the French energy code)	- No prior conclusion of contracts required - No power limit for this mechanism - Lead time: depending on the proposal submitted	- Any facility > 10 MW (possible combinations[81])

Table 7 – Main national mechanisms accessible to RTE to balance electricity supply and demand

Since 1st January 2014, the Rules on Ancillary Services[82], drafted by RTE and approved by the CRE in its deliberation of 28 November 2013[83], have enabled power plants connected to the public distribution network to contribute to frequency control on a voluntary basis.

The aforementioned CRE's deliberation also specifies expected developments over the coming years. In particular, this deliberation provides for allowing consumer connected to public transmission and distribution networks to contribute to frequency control. In this respect, contribution procedures will progressively be modified, particularly to integrate the conclusions of feedback for consumer systems

[77] Consumption sites between 40 MW and 60 MW can participate, providing that they are part of a combined site with a total capacity in excess of 60 MW.
[78] This value is defined annually by the ENTSO-E on the basis of the ratio between total annual production for *n-2* for each country and total production for continental Europe.
[79] Trials for consumption facilities connected to the public transmission network will start on 1 July 2014.
[80] The value is calculated by RTE for each half-hourly slot, according to several criteria, including level of demand (consumption in France + border exchanges).
[81] Consumption sites below 10 MW can participate, providing that they are part of a combined site with a total capacity in excess of 10 MW.
[82] Ancillary services include the automatic control of frequency and voltage. Such control is intended to limit frequency and voltage variations and, more generally, ensure the stability of the electrical grid.
[83] The CRE's deliberation of 28 November 2013 on the approval of System Service Rules can be accessed at the following address: http://www.cre.fr/documents/deliberations/approbation/regles-services-systeme/consulter-la-deliberation

connected to the public transmission grid. In order to allow as many users as possible to contribute, it is also foreseen to allow asymmetric capacities[84] to provide frequency control.

In this context, and particularly in view of the expected developments, the CRE has considered that the contribution procedures and the rules for determining remuneration for the provision of automatic frequency reserves are based on objective and non-discriminatory criteria.. The CRE will ensure that the the Rules on Ancillary Services will remain objective and non-discriminatory.

Recommendation no. 32

The CRE requests that the transmission system operator continues, as provided for in the CRE's deliberation of 28 November 2013, to work to enable all systems to contribute to primary and secondary frequency control, as long as they are able to meet the expected technical requirements.

Tertiary frequency control can also contribute to the balance between supply and demand. To allow a greater number of power plants and consumers to be used by market players in the context of tertiary frequency control, some operators have requested changes to the rules for contributing to the mechanisms applied by RTE. In particular, they would prefer to see the threshold for contribution to the adjustment mechanism to be reduced from its current 10 MW for an adjustment entity. In the same way, they referred to specific limitations in terms of aggregation, restricting the ability to combine sites together, particularly based on the network connected or the allocated balance-responsible entity.

In the context of trials in the region of Brittany, the threshold for contributing to the adjustment mechanism has been reduced to 1 MW for adjustment entities contributing to improving local grid congestion. These trials have allowed the use of additional capacities, leading to overall cost reductions.

In its deliberation of 16 October 2013[85], the CRE requested that RTE "*prepares a status report of the activities carried out to improve flexibility in the management of capacity or the control of actual generation, and a roadmap on the deadlines for the implementation of the planned developments: reduction in the contribution threshold, removal of any restrictions for creating adjustment entities, and the introduction of new methods of generation control*".

Recommendation no. 33

The CRE requests that the transmission network operator continue, as particularly provided for in the CRE's deliberation of 16 October 2013, works enabling, on a long-term basis, a greater number of installations to contribute to the tertiary frequency control mechanisms, subject to their technical capability to meet requirements in terms of expected performance.

[84] Asymmetric modulation capacities allow operators to propose different sizes of reserves to increase or decrease voltage, or even to establish a unique modulation consisting exclusively of increases or decreases.

[85] Deliberation of the Commission de Régulation de l'Energie of 16 October 2013 on the approval of the trial rules for participation in the Adjustment Mechanism in the context of trials in the region of Brittany. Deliberation available on the website of the CRE:
http://www.cre.fr/documents/deliberations/approbation/experimentation-bretagne

4.1.2. – Generation connected to public distribution grids could contribute to controlling reactive power flows at the interface between the transmission and distribution grids

Most generation systems connected to public distribution grids can absorb or generate reactive power. Using this capacity could allow a more efficient operation of public grids.

Chapter 3.1.2 describes how the absorption of reactive power by generation systems can limit the need to reinforce the public distribution grids by mitigating excessive local voltage variations.

Power plants connected to public distribution networks can also use this technical capacity to contribute to the control of the exchange of reactive power at the interface between the public transmission grids and public distribution grids. The general application of this type of contribution could, in some circumstances, prove economically worthwhile for managing public power grids. For instance, the improved control of the exchange of reactive power could reduce losses on the public transmission system, limit the need for reinforcement and reduce expenses related to voltage control on transmission grids[86]. More in-depth analysis will be required to further analyse the economic benefits of such a contribution and the conditions for implementation.

The ability of decentralised generation systems to absorb reactive power, as described in chapter 3.1.2, would have specific benefits during off-peak times. On the other hand, *in principle*, the main benefits of the contribution to controlling the exchange of reactive power at the interface between the public transmission network and the public distribution networks arise during peak consumption periods. Therefore, the two potential uses of this technical capacity have complementary targets.

Recommendation no. 34

The CRE requests that transmission and distribution system operators study, in coordination with all stakeholders, the conditions in which the power plants connected to the public distribution grids could contribute to the control of the exchange of reactive power at the interface between the public transmission network and the public distribution networks. These studies should also lead to the definition of contribution procedures, improving the overall effectiveness of the electrical system.

These studies will be undertaken in addition to:

- the considerations already underway on the possible developments for existing rules on the exchange of reactive power at the interface between the public transmission network and the public distribution networks;
- and incentives applicable to the transit of reactive power at the interface between the public transmission network and the public distribution networks. The CRE requests that transmission and distribution system operators work together in order to complete these works, in coordination with stakeholders.

[86] For example, the installation of capacitors or Flexible Alternating Current Transmission Systems (*FACTS*).

4.2. – A greater contribution of demand side flexibility should be possible on energy markets

Demand side flexibility can be defined as the ability for final consumers (homes, offices, industry, *etc.*) to modulate their consumption.

With the development of new information and communications technologies, demand side flexibility is easier to exploit and more applications exist for the entire electrical system.

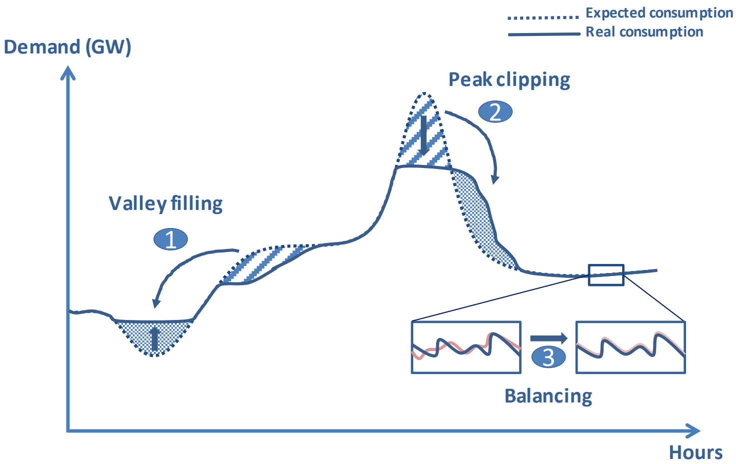

Figure 14 – Examples of applications of demand side flexibility (*Sources*: CEER and CRE)

Demand side flexibility appears in the form of two main actions by consumers:

- downwards modulation, involves temporarily reducing the level of consumption when compared with the expected level on a punctual basis. This approach can particularly be achieved by temporarily curtailing some electrical appliances for consumers, by deferring consumption, or even by abandoning some types of usages (e.g. adapting the use of electrical heating or hot water boilers for individuals, or industrial machines for companies);
- upwards modulation, involves temporarily raising the level of consumption when compared with the expected level on a punctual basis. This approach can be achieved by planning ahead for some types of usages. The aim is not to increase the overall level of consumption, and therefore this approach remains compatible with overall energy efficiency and consumption reduction targets.

In the same way as downwards demand response can benefit the electrical system, the temporary increase in consumption can contribute to improving the integration of renewable energies.

RTE is particularly responsible for ensuring the balance between supply and demand for the entire French electrical system. The balancing mechanism is compatible with the use of flexibility reserves, as required to avoid any unbalance between the energy generated and the energy consumed.

To avoid an energy deficit, RTE can benefit from flexibility to both increase the output of generation systems or reduce the level of consumption. On the other hand, to avoid energy surplus, RTE can use the opposite service, which is currently provided exclusively by foreign operators or generation systems. At this stage RTE does not use any increase of the consumption level. However, if consumption is sufficiently flexible (in terms of increases), this service could be achieved in those cases.

Furthermore, if the level of electricity generated by inflexible generation units (must-run generation such as hydraulic systems, nuclear power plants, wind turbine and photovoltaic systems, *etc.*) is significant and if the level of electrical consumption is low, extremely low prices, or even negative pricing, could appear on the market: generators would then have to pay to keep running their units and avoid stopping them.

According to current rules, most consumers cannot, in these conditions, benefit from this abundant and cheap energy, which they could, for example, wish to consume by planning ahead for other usages.

Temporarily increasing the level of consumption would bring additional flexibility to the electrical system, particularly during periods where most advanced generation units, which are highly flexible, have not been started. The corresponding increase in consumption would therefore be covered by a low-carbon power generation energy generated with little, and possibly no, carbon-based input. When this consumption has been transferred from a less positive period, it can also contribute to reducing greenhouse gas emissions.

Furthermore, over and beyond the benefits in terms of balancing costs, a temporary increase in consumption can represent an effective means of managing local overdemand on the grid, a source of congestion.

Finally, developing demand response options can lead consumers to offer symmetrical flexibility capacities (upwards and downwards). Benefiting from flexibility in terms of increases could therefore encourage consumers to develop such capacity and simplify the development of demand side flexibility.

The current legislative and regulatory framework does not, however, allow consumers to benefit from the full flexibility they could provide to the electrical system. Demand side flexibility procedures are only currently defined for downwards modulation. Imbalance settlement rules are not compatible with a sufficiently detailed accounting system to fully benefit from the flexibility offered by consumers.

Current supply offers, particularly double index options for peak/off-peak periods (HP/HC), authorise an active contribution to peak clipping and are a key means of modulating consumption. Yet, these offers cannot be used to modulate electrical consumption to a sufficiently detailed level, or to ensure real-time flexibility: the timeslots for these offers are indeed too extensive to manage punctual requirements. For example, suppliers cannot precisely differentiate supply prices based on procurement costs, particularly when the market price of electricity varies substantially from hour to hour.

No procedures have been defined for upwards consumption modulation, particularly means of organising energy transfers and financial flows between the operators involved. Only some remote reading sites are able to benefit from this flexibility, e.g. on the *spot* market, by notifying the exchange of blocks or the adjustment mechanism with suitable financial flows, which can be implemented if the sites are invoiced on the basis of the charge curve.

Inventory	Ancillary services	Balancing mechanism		Wholesale Market
		Contracted Reserves	Other reserves	
Downwards consumption modulation	Sites connected to the public transmission network[1] (opened on 1 July 2014)	All[3]	All[3]	All[3]
	Sites connected to the public distribution network[2]			
Upwards consumption modulation	Sites connected to the public transmission network[1] (opened on 1 July 2014)	No requirement[7]	Sites with remote reading[5]	Sites with remote reading[5]
	Sites connected to the public distribution network[2]		Site with profiles[4]	Sites with profiles[6]

Participation possible for all sites | Partial participation | No possible participation

[1] The Ancillary services rules provide for a trial participation phase for extraction sites connected to the public transmission network from 1 July 2014.

[2] The Ancillary services rules provide that RTE must study, in coordination with the operators of the distribution networks, the conditions for the contribution to the balance between instantaneous generation/consumption for extraction sites connected to the

public distribution networks, 6 months after initial participation at an extraction site at the latest.
[3] Subject to compliance with the contribution conditions provided for in rules, and particularly the minimum aggregation threshold of 10 MW for the balancing mechanism and 100 kW for the wholesale market.
[4] The current framework is not compatible with the implementation of energy transfers and financial flows between the operators involved.
[5] Under certain conditions, a consumer with remote reading can propose means of reduction for the balancing mechanism or exchange blocks of energy when required.
[6] Current market operation rules do not allow for the explicit use of such flexibility.
[7] RTE does not conclude contracts for procuring downwards reserves (reduced generation or increased consumption), as, at the current time, no obligation applies and no requirement exists.

Table 8 – Simplified vision of the options for extraction sites contributing to the different mechanisms based on demand side flexibility (*Source*: CRE)

The legislative framework must be modified in order to benefit from upwards consumption modulation, particularly to organise the financial flows between the operators in question.

Recommendation no. 35

The CRE supports changes to legislation, as applied for downward consumption modulation, to define the economic terms and conditions enabling the system to benefit from the flexibility inherent to temporary increases in consumption. This modification will complete the legislative framework for flexible consumption.

Recommendation no. 36

The CRE requests that the transmission system operator study, for situations where there is no need to reinforce the legislative and regulatory framework, any solutions required to ensure that the flexibility provided by modulating consumption can be provided for the electrical system via the different mechanisms (e.g. specific remote reading sites within the balancing mechanism).

4.3. – Feedback is expected from demonstration projects to specify which services could be provided by energy storage facilities

Energy storage technology can contribute to flexibility options. While demonstration projects have already provided with technical feedback, particularly in relation to the difficulties faced at connection (see previous chapter), the CRE has not, to date, received any economic feedback[87] on the services which the energy storage facilities could provide to the electricity sector as a whole.

By way of illustration, the Energy Storage Technology Development Roadmap towards 2030 drafted jointly by the *European Association for Storage of Energy* (EASE) and the *European Energy Research Alliance* (EERA) identifies 26 services which the storage facilities could provide to the electrical sector, some of which are already exploitable:

[87] A study has, however, been carried out on the potential of energy storage between now and 2030, jointly by ADEME, ATEE and DGCIS. This study was published on 5 November 2013. It can be accessed at the following address: http://ademe.typepad.fr/presse/2013/11/etude-stockage-energies.html

Conventional Generation	Transmission	Distribution	Customers Services
Black start	Participation of the primary frequency control	Capacity support	End-user peak shaving
Arbitrage	Participation to the secondary frequency control	Dynamic, local voltage control	Time-of-use energy cost management
Suport to conventional generation	Participation to the tertiary frequency control	Contingency Grid Support	Particular requirements in power quality
Renewable Generation[8]	Improvement of the frequency stability of weak grids	Intentional islanding	Continuity of energy supply
DG Flexibilty	Investment deferral	Reactive power compensation	Limitation of upstream disturbances
Capacity firming	Participation to angular stability	Distribution power quality	Compensation of the reactive power
Limitation of upstream perturbations		Limitation of upstream perturbations	
Curtailment minimisation			

Table 9 – Services provided by storage according to the EASE-EERA Roadmap
(*Source:* EDF, EASE-EERA Roadmap)

Recommendation no. 37

The CRE supports the proposal that feedback from demonstration projects should be used to specify the initial results of studies carried out in recent years on services provided by energy storage facilities, via the analysis of costs and benefits throughout the value chain. The CRE also recommends that these studies should cope with the allocation of benefits between the different market players and consider means of using these services when they maximise global welfare.

4.4. – Changes in electricity generation leads to new priorities in terms of the safety of electrical system

4.4.1. – Solutions to be considered to offset the reduced inertia of the electrical system

Any variation in the consumption or generation of electricity will lead to a temporary variation in electrical frequency. If all other inputs remain constant, this frequency variation will depend on the type of generation plant in operation. Synchronous systems, i.e. those with a rotation frequency which is synchronised with the electrical frequency, help to slow down frequency variations and therefore contribute to ensuring the safety of electrical systems. These systems are said to provide inertia to the power system.

Most hydraulic and thermal generation systems provide inertia to the power system. On the other hand, some RES, including photovoltaic plants and most wind turbines, do not provide inertia to the system.

As electricity generation mix is changing in Europe, the inertia of European power systems is generally decreasing, which could increase the risk of a major incident. Consequently, transmission system operators could launch support initiatives, as indicated, for example, in some ENTSO-E publications[88]. Initial proposals have been raised:

- require power plants which do not provide inertia to the electrical system to provide "*synthetic*" inertia[89];
- limit the penetration of power plants which do not provide inertia[90].

For the synchronous area of Continental Europe (*CE area*)[91], the reduced inertia of the system could be a source of concern in the future. It would appear preferable to henceforth continue with the analyses started at a greater depth. Considering the alternatives to the aforementioned proposals, the rapidity of all or part of primary reserves could be increased, for example, to reduce the need for inertia, or inertia supply obligations could be exchanged.

Recommendation no. 38

The CRE requests that the transmission system operator, with the other European transmission system operators, carry out a preliminary assessment of the risks inherent to the progressive reduction of inertia in the Continental European (CE) zone and identify means of managing this issue at national level or for the entire CE synchronous zone.

4.4.2. – The contribution of the generation systems connected to public distribution grids to the safety of the system could increase

Should an incident occur on grids, generation systems must comply with specific provisions, which are defined in France by grid operators, in order to avoid endangering the safety of the electrical system, equipment or people.

In most countries, and particularly in France, the requirements applicable to generation plants connected to public distribution networks are subject to demands which are not really compatible, depending on whether they come from distribution system operators or transmission system operators. On the one hand, transmission system operators want to to ensure that power plants remain connected to the grid for as long as possible when large disturbances occur, in order to limit the probability of massive cascade disconnections likely to lead to major incidents, or even *black-outs*. On the other hand, for small power plants and particularly those connected to the low voltage grid, distribution system operators prefer that these plants are disconnected from the grid as quickly as possible when local incidents occur. Distribution system operators fear unwanted islanding situations, which could prove dangerous for both their personnel and equipment.

[88] See the following document in particular (p.40): http://www.acer.europa.eu/Media/News/Documents/120626%20-%20NC%20RfG%20-%20Frequently%20Asked%20Questions%20(2).pdf
[89] The supply of *synthetic inertia* could be considered as automatic frequency modulation, with a particularly short activation time (a few hundred milliseconds), *source:* ENTSO-E.
[90] The maximum instantaneous penetration of systems which cannot provide inertia would be fixed, according to initial analyses, at approximately 60%, according to the indications of EirGrid and ENTSO-E.
[91] A synchronous area is an area in which one single frequency is used. France is included in the Continental Europe (*CE*) synchronous area, which covers most of Continental Europe, from Portugal to Greece.

The provisions applicable to power plants connected to public distribution networks are changing in Europe, mainly at the initiative of ENTSO-E, moving towards the greater integration of the requests of transmission network operators. The European network code on the connection of generators (*RfG network code*), due to be shortly adopted by the European Commission, also provides for changes to these provisions. In particular, this code could require dynamic behaviour (LFSM-O : Limited Frequency Sensitive Mode - Overfrequency) for power plants connected to public distribution networks: these power plants would then have to progressively reduce their power in the event of an excessive rise in frequency, and no longer suddenly disconnect.

In France, ERDF updated its technical rules in 2013. The high-frequency threshold of loss of mains protections for photovoltaic power plants has been increased from 50.2 Hz to 50.4 Hz for new systems, whose connection application was received by ERDF after 1 September 2013. This threshold will be raised to 50.6 Hz for power plants whose connection application is submitted after 1 July 2014. According to European transmission network operators, these modifications could still prove insufficient to guarantee the long-term safety of the electrical system.

Recommendation no. 39

Following the definitive adoption of the European network code on the connection of generators, the CRE requests that distribution system operators start discussions in order to determine whether the parameters of loss of mains protection need modifications. The involvement of the transmission network operator must be ensured at all stages. A detailed analysis on whether dynamic behaviour is appropriate for all small power plants is required in particular.

4.5. – A more complex balance of the electrical system in zones which are not connected to the mainland continental grid

Variable renewable energy sources, when they represent a significant percentage of the instantaneous generation in an power system, can lead to faster variations in the total power injected into the power grid. This is particularly true if the geographic scope of the synchronous zone including these generation systems is small, limiting the consolidation of the different users. When these power variations are fast and of high amplitude, the stability of the power system could endanger. The power system may not have adequate fast reserves to offset these variations at that specific point in time.

In order to integrate this difficulty, which mainly arises with small electrical systems, current regulations[92] provide that generation systems with a power P_{max} more than or equal to 3 kVA and using variable energies in zones which are not connected to the mainland continental grid can be disconnected from the grid if the power produced by the systems exceeds 30% of the total power transiting through the same grid. Also according to regulations, generation systems with a power of more than 100 kVA equipped with electricity storage devices, particularly enabling them to modulate the real power, are not subject to these provisions. The reference technical documentation of the grid operators in question must therefore specify the minimum characteristics, particularly capacity, of these electricity storage devices.

[92] Articles 22 and 22 *bis* of the order of 23 April 2008 amended, on technical design and operational provisions for connecting a facility generating electricity to a public low voltage or medium voltage power distribution network.

	Corsica	**Guadeloupe**, St Martin and St Barthélemy	Martinique	Reunion island	French Guiana
Minimum power input for the grid at noon (Sundays and public holidays)	165 MW	160 MW	150 MW	263 MW	82 MW
Installed power Wind turbines Photovoltaic systems	 18 MW 93 MW	 26 MW 67 MW	 1.09 MW 62 MW	 15 MW 156 MW	 - 34 MW
Power in a queue Wind turbines Photovoltaic systems	 6 MW 32 MW	 9 MW 20 MW	 12 MW 24 MW	 - 26 MW	 - 15 MW

Table 10 – Minimum power extracted from the grid and capacity of wind turbine and photovoltaic systems installed in non-interconnected zones (*Source*: CRE)

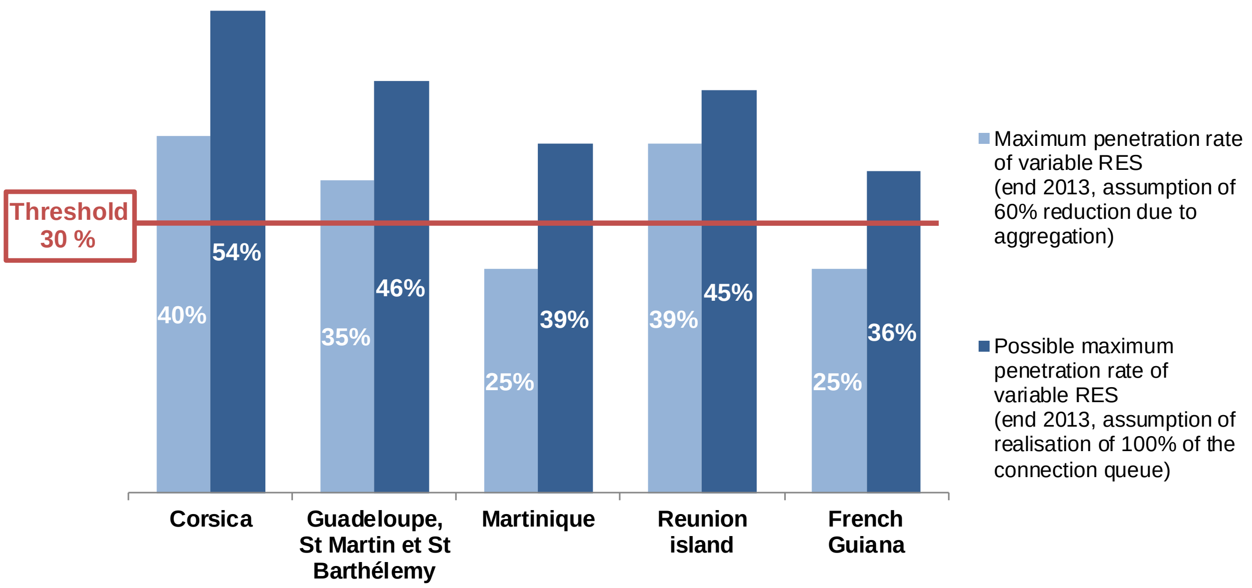

Figure 15 – The disconnection threshold of 30% is likely to be exceeded in non-interconnected zones (*Source*: CRE)

In its deliberation of 23 January 2013[93] on its opinion on the order of 8 March 2013[94], the CRE recommended greater flexibility when defining the 30% threshold, in order to make it possible to integrate

[93] Deliberation of the CRE of 23 January 2013 on an opinion on the draft order defining the purchasing conditions for the electricity generated by the facilities using the mechanical energy of wind in areas not connected to the mainland France grid and applying a forecasting and smoothing policy for the energy generated. This deliberation can be accessed at the following address: http://www.cre.fr/documents/deliberations/avis/eolien

[94] Order of 8 March 2013 defining the purchasing conditions for electricity generated by facilities using the mechanical energy of wind located in areas which are particularly vulnerable to cyclone risks and applying a forecasting and smoothing policy for the energy generated.

a higher number of RES[95] without endangering the safety of insular power systems. The CRE therefore recommended "*enabling the adoption of various thresholds, depending on the characteristics of the storage device used*" in order to spread requirements out progressively.

Électricité de France – Systèmes Énergétiques Insulaires (EDF SEI) and Électricité de Mayotte (EDM), insular system operators, are mandated to ensure the safety of electrical systems which are not connected to the mainland continental grid (Corsica, Guadeloupe, French Guiana, Martinique, Reunion island, Saint-Martin, Saint-Barthelemy, Saint-Pierre-et-Miquelon, some islands in Brittany for EDF SEI and Mayotte for EDM)[96]. The safety of these electrical systems in the context of integrating variable RES substantially depends on the particular characteristics of each area: presence of highly reactive generation systems in the mix, electricity storage devices, the meshing of the power grid, communicating actuators and sensors deployed on the grid, consumption trends and characteristics, *etc*.

The specific characteristics of each territory are not currently taken into consideration when defining the maximum instantaneous penetration threshold for variable RES and the characteristics of the different devices (electricity storage, forecasting systems, *etc*.) leading to exemptions. In fact, these criteria are defined in regulations[97] or in specifications[98] for call for tenders related to generation systems. Operators do not therefore have direct access to the capacity and flexibility required to modify the requirements inherent to the safety of electrical systems not connected to the mainland continental grid while matching local needs. Defining these parameters in the reference technical documentation of grid operators, after consulting grid users[99], would simplify the integration of these local characteristics and changes to these characteristics over time.

This development would clarify the status of variable renewable energy projects with storage, adopted following the request for proposals. Initial commissioning was expected for 2013. To date, the absence of the applicable technical provisions to be exempt from the 30% threshold in reference technical documentation means that no guarantee exists that these generation systems will not be disconnected by the grid operator.

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[95] Planning Law (Loi de programmation) no. 2009-967 of 3 August 2009 amended, on the implementation on the Grenelle law on the environment particularly provides for a "*target 30% renewable energies in final consumption at Mayotte and at least 50% for other authorities*".

[96] Article L. 322-9 of the French energy code: "*Each public electricity distribution network operator must monitor the balance of electricity flows, effectiveness, safety and security for the grid operated at all times, in view of the technical restrictions applicable to the network*".

[97] The penetration threshold for RENs is defined in the aforementioned order of 23 April 2008 and the technical provisions for generation systems benefiting from purchase obligations are defined in the orders defining the conditions for the purchase of the electricity generated.

[98] By way of example, appendix 3 of specifications no. 332689-2010-FR on land-based wind turbine farms generating electricity in Corsica, Guadeloupe, French Guiana, Martinique, Reunion island, Saint-Barthelemy and Saint-Martin defines the requirements of the injection guarantee for the electricity generated.

[99] Reference technical documentation is prepared and published based on the procedure described in the aforementioned CRE decision of 7 April 2004.

Projects adopted after the requests for proposals with storage solution	Corsica	Guadeloupe	Martinique	Reunion island	French Guiana
Request for proposals for wind turbines with storage	6 MW	14 MW	13 MW	24 MW	9 MW
Request for proposals for solar systems with storage	17 MW	3 MW	6 MW	19 MW	12 MW
Potential penetration for variable RENs with storage	8%	6%	8%	10%	16%

Table 11 – Number of projects integrating storage solutions in non-interconnected zones (*Source:* CRE)

Recommendation no. 40

The CRE supports the adoption of various penetration thresholds for variable RES[100], depending on the characteristics of the power system in the area in question and the power plant as a whole (including any electricity storage devices and forecasting systems associated with the generation system or used by the grid operator), in line with any regulatory provisions which may define strategic objectives in terms of energy per pertinent geographic segment, instead of the single penetration threshold for RES of 30% provided for in the order of 23rd April 2008 in areas which are not connected to the mainland France grid.

The CRE supports the proposal that penetration thresholds for variable RES, and the characteristics of devices (electricity storage, forecasting systems, *etc*.) bypassing these thresholds, must be defined, not in regulations, but in the reference technical documentation of the system operator, after consulting with grid users and according to the procedure defined by the CRE in its deliberation of 7th April 2004. On this basis, articles 22 and 22 *bis* of the order of 23rd April 2008 must be modified.

These developments should enable RES to be greater integrated in each insular territory in compliance with safety rules for insular electrical systems.

Recommendation no. 41

The CRE requests that Électricité de France – Systèmes Énergétiques Insulaires (EDF SEI) and Électricité de Mayotte (EDM), insular system operators, define safety criteria and update their reference technical documentation. Following the adoption of the above recommendation requiring the order of 23rd April 2008 to be modified, these grid operators will also be able to define RES penetration thresholds.

[100] As previously indicated by the CRE in its opinion dated 23 January 2013 on the aforementioned order of 8 March 2013.

5. – Summary of the CRE's requests and recommendations

5.1. – Summary of recommendations

Recommendation no. 1

The development of information devices and home automation systems will enable consumer's awareness and his greater involvement as an active player of the power system.

In the case where these devices give information on the power consumption of the whole installation, the CRE recommends that these devices use the data from the electric meter. The CRE is in favour of the integration of this disposition in the works of standardisation bodies, and in particular AFNOR commission UC205 (electronic systems for homes and buildings).

Recommendation no. 2

In order to take full advantage of the potential of smart metering systems, the CRE requests that the GTE (*Groupe de travail électricité* - Electricity Working Group EWG)[101] defines:

- on the one hand, standardised content for short and ultrashort messages transmitted by the customer remote information (CRI) interface;
- and, on the other hand, the association of *virtual* relays with standard usages.

Recommendation no. 3

To ensure that the potential of smart metering systems is used as best possible, the CRE requests that distribution network operators publish, in their reference technical documentation, the standardisation adopted in the context of the works of the EWG for the content of messages and the association of *virtual* relays with standard usages.

Recommendation no. 4

To simplify the connection of beyond the meter equipment, the CRE proposes that AFNOR standardise and integrate in standard NF C 15-100 the association of *virtual* relays with standard usages.

Recommendation no. 5

To promote consumer knowledge of how the system is managed, the CRE supports allowing consumers (or a third party authorised by them) access to an interface which can provide information on the status of the relays allocated to each timeslot and the standard usages associated with each relay.

In order to take full advantage of the potential of smart metering systems, consumers (or a third party authorised by them) should be able to easily modify the allocation of relay statuses to registers, at least when subscribing a tariff, and at no extra cost.

To this end, the CRE requests that the GTE (*Groupe de travail électricité* - Electricity Working Group EWG) examine the procedure for modifying the status of *virtual* relays.

Recommendation no. 6

In order to protect the data processed, the CRE recommends that smart grid projects carry out impact assessments, with the support of the CNIL, in accordance with the Data Protection Impact Assessment Template for smart grids and smart metering systems.

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[101] The Electricity Working Group was created in 2005 by the CRE to define the practical procedures for the operation of gas and electricity retail markets. These markets concern all operators involved: consumer representatives, suppliers, grid operators and public authorities. The EWG site: http://www.gte2007.com/

Recommendation no. 7

The CRE reiterates that distribution system operators must disclose a certain number of items of information to the electricity distribution organising authorities, particularly in application of article L. 2224-31 of the General code of territorial authorities.

The CRE requests that distribution system operators consider the implementation of interfaces in order to dynamically provide the electricity distribution organising authorities with the data collected and which must be disclosed according to the aforementioned text.

The CRE requests that distribution system operators consider the implementation of interfaces in order to dynamically provide data which may be freely disclosed to any party so requesting. The study must focus on the procedures for providing the public with data which may be freely disclosed, such as equipment data, in compliance with legal clauses on secrecy.

Recommendation no. 8

The CRE supports the clarification of the legal qualification of the recharging of electric vehicles in order to provide the necessary visibility for the development of recharging services for electrical vehicles.

The energy code could specify that recharging is not considered as electricity supply. A minimum degree of obligations[102] specific to recharging would guarantee the healthy development of the market to the benefit of end-users. This qualification would remove the current legal uncertainty without subjecting recharging station operators to the full restrictions inherent to the supply of electricity.

This solution would also maintain the differentiation between electricity supply and service contracts.

Recommendation no. 9

The CRE supports a modification of the current legal framework (article R111-14-2 of the construction and housing code and the implementation of recommendation no. 8) in order to distribute, on the basis of the information provided by recharging infrastructures, the financial costs associated with the operation of the internal system dedicated to recharging points, on the one hand, and electrical consumption inherent to the use of these systems, on the other hand.

Recommendation no. 10

The CRE supports the development of smart solutions for the recharging of electric vehicles.

In particular, the CRE supports the proposal that recharging devices (recharging points and management system) should be able to communicate with the different operators in the power system and should, in particular, integrate pricing signals (pricing signal from supplier, pricing signal from the distribution system operator, signals transmitted by new operators such as demand response operators, *etc.*).

Recommendation no. 11

The CRE supports the proposal that distribution system operators should participate in the studies carried out by the parties leading recharging station projects, in coordination with territorial authorities and concessionary authorities, and will inform these operators of the capacities of public distribution grids and, in addition, grid development projects underway.

Recommendation no. 12

The CRE requests that distribution system operators study the feasibility of progressively implementing interfaces in order to dynamically share data on available capacity with parties leading recharging station

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[102] Examples of obligations are given in appendix 4.

projects, particularly with territorial authorities and concessionary authorities. These data should reflect existing and future grid constraints.

Recommendation no. 13

The CRE requests that distribution system operators add a chapter on recharging infrastructures for electric vehicles in public areas to their future connection charges reference, for the concessions granted, in order to improve the transparency of financial conditions for connection. For operators of distribution system serving over 100,000 customers, this new chapter will be submitted to the CRE for approval in the context of the revision of the future pricing sale for connections.

Recommendation no. 14

The CRE supports demonstration projects which tests the connection of recharging stations for electric vehicles to public street lights in order to:

- confirm the technical feasibility and economic benefits of enabling the deployment of recharging stations on the public lighting system, particularly with the use of recharge management solutions. In addition, these studies should take into account the costs avoided in terms of civil engineering and the reinforcement of public distribution grids when compared with a situation where recharging stations are connected to public distribution grids;
- test the deployment of new services associated with recharging vehicles for the users of electric vehicles and local authorities;
- assess the conditions for the widespread deployment of recharging stations via the public lighting system, while attempting to identify any regulatory or contractual limitations and any possible changes required to ensure that each type of use (distribution of electricity, public lighting and recharging of electrical vehicles) absorbs the associated costs.

Recommendation no. 15

The CRE requests that distribution system operators participate in the studies aiming at assessing the conditions of deployment of recharging points to public street lights, in coordination with stakeholders involved in these projects.

Recommendation no. 16

The CRE recommends that the conditions for energy production using renewable sources should be modified in order to recognise the economic value of the self-generated energy, defined as the share of consumption covered by the electricity generated at the same connection point and at the same time. The CRE recommends the adoption of modifications to the current legal framework according to the following principles:

- the self-generation bonus should be defined in line with the level of feed-in tariffs. In particular, the self-generation bonus must not lead to an excessive level of payback for the capital invested and must not encourage users to artificially increase their consumption in order to benefit from the self-generation bonus;
- users should be encouraged to increase the synchronism between generation and consumption beyond the "*basic*" level of synchronism between generation and consumption at one single connection point to reflect the savings in grid costs;
- the policy adopted should reduce, or, *at least*, not increase the extra cost of feed-in tariffs;
- the economic details of this policy must be adapted to areas which are not connected to the mainland France grid.

The effects of the new policy on taxation must be planned for and handled prior to definition. In particular, the impact of self-generation on taxes based on the variable part of the electricity invoice should be neutralised as self-generators do not reduce their consumption, but exclusively the consumption transiting via public grids.

Recommendation no. 17

The CRE requests that distribution system operators:

- estimate the cost of the different connection solutions, for an indirect connection to the public distribution network, from a generation system to a consumer facility;
- adapt processing procedures for connection requests and the means of collecting information (information sheets and electronic interfaces) in view of indirectly connecting generation systems;
- upgrade the pricing scale for the invoicing of connections in the event of new indirect connections to low voltage generating systems;
- consider changes to sub-metering procedures for the energy consumed and generated by the customer and allocation to the scope of a balance responsible entity, and any modifications required to the service catalogue, to ensure that the sub-metering service does not hamper the development of self-generation.

Recommendation no. 18

The CRE supports the proposal that distributed generation should be enabled to participate to voltage regulation by absorbing reactive power.

The CRE therefore proposes the removal of article 9 of the order of 23 April 2008, in order to allow power plants connected to low voltage grids to absorb reactive power.

Recommendation no. 19

In order to optimise the economic conditions of the connection of distributed generation to the low voltage distribution grids and reduce the costs attributable to generators and connecting lead times for these power plants, the CRE requests that distribution system operators:

- amend the principles used to carry on grid connection technical studies in order to provide for the study of connection solutions which differ from the reference connection solution, including, when it is beneficial in terms of global welfare, contractual obligations for the power plants connected to public distribution grids to participate to voltage regulation by absorbing reactive power, as soon as regulations allow this approach. These solutions would then be proposed as alternative solutions to the reference connection solution, and will be chosen by generators, if preferred;
- specify objective criteria to determine when such solutions would be studied and proposed, and publish these criteria in their reference technical documentation;
- amend their reference technical documentation (in particular models for contracts and conventions concluded with generators), to enable the implementation of connection solutions involving the absorption of reactive power by power plants connected to public distribution grids.

In order to consider solutions which are beneficial in terms of global welfare, the CRE requests that distribution system operators study, in coordination with the generators, the economic and contractual conditions under which connection solutions involving the participation of power plants to voltage regulation involving the absorption of reactive power could be implemented, provided that they are beneficial in terms of global welfare.

Recommendation no. 20

In order to optimise the economic conditions for the integration of distributed generation into low voltage grids and reduce the connection costs and lead times for generators, the CRE requests that distribution system operators study the feasibility of evolutions involving:

- modifying the principles behind connection studies in order to provide for the study of alternative connection solutions from the reference connection solution, when it is beneficial in terms of global welfare. Unlike the reference connection solution, these alternative solutions could imply limiting the real power injected by the decentralised power plants. These solutions would be proposed as alternative solutions to the reference connection solution, and would be selected by generators, if preferred;

- specify objective criteria to determine when such solutions are to be studied and proposed to generators, and publish these criteria in their reference technical documentation;
- adapt their reference technical documentation, and in particular models for contracts and conventions concluded with generators, to enable the implementation of connection solutions involving the possibility to limit the real power injected by the power plants connected to public distribution networks and define the corresponding grid access conditions.

Recommendation no. 21

In order to reduce costs and connection lead times for consumers, the CRE request that distribution system operators consider the feasibility and global economic benefits of the following evolutions:

- modifying the principles behind connection studies in order to provide for the study of alternative connection solutions from the reference connection solution, when it is globally beneficial. Unlike the reference connection solution, these alternative solutions could involve limiting the power demand of consumers. These solutions would be proposed as alternative solutions to the reference connection solution, and would be selected by consumers, if preferred;
- secondly, modifying the principles behind connection studies in order to integrate the option of benefiting from various flexibility means (see chapter 3.4 of this deliberation), and, in particular, from the flexibility that the consumer requesting connection could offer.
- specify objective criteria to determine when such solutions are to be studied and proposed, and publish these criteria in their reference technical documentation;
- amend their reference technical documentation, in particular the models for contracts and conventions concluded with consumers, to enable the implementation of these connection solutions and provide for the corresponding grid access conditions.

These studies should particularly examine the case of electrical vehicles recharging infrastructures.

Recommendation no. 22

The CRE supports the modification of the provisions of article L. 342-5 of the energy code to clarify the list of facilities subject to the general technical design and operational requirements. This type of clarification should also be considered for other provisions of the energy code, which may be applicable to storage facilities.

Recommendation no. 23

The CRE suggests that the regulatory provisions on general technical design and operational requirements should be modified in view of the specific characteristics of some electrical storage facilities likely to raise issues in terms of the quality of supply and grid security. Any differences in treatment between two systems must be the outcome of objective criteria and relate directly to technical issues in terms of grid safety and security, and the quality of operation.

Recommendation no. 24

The CRE requests that distribution system operators explicitly describe how the applicable regulatory provisions are implemented for electricity storage facilities in their reference technical documentation.

In the absence of regulatory provisions enabling the integration of the specific characteristics of electrical storage facilities, the CRE also requests that distribution system operators define rules on the technical design and operational requirements applicable to an electricity storage facility. Any differences in treatment between two systems must be the outcome of objective criteria and relate directly to technical issues in terms of grid safety and security, and the quality of operation.

Recommendation no. 25

The CRE requests that distribution system operators take electricity storage facilities into account in the grid connection procedures, in compliance with the principles inherent to the CRE's deliberation of 25 April 2013, in order to ensure the objective and transparent treatment of these applications with no form of discrimination.

The CRE requests that distribution system operators ensure that their procedures, contractual documents and reference technical documentation simplify the connection and access of electricity storage facilities on the grid:

- by adapting the forms used to collect information in view of connecting generation systems with associated storage devices. The characteristics of storage devices could be specified in these forms, for example;
- by adapting these forms to integrate the connection of standalone storage facilities;
- by specifying the applicable principles for studies when connecting storage facilities;
- by ensuring that the terminology used for models and templates for connection contracts, conventions and technical and financial proposals is not unsuitable for storage facilities and, if necessary, by making the necessary changes to integrate the specific characteristics of these facilities.

The CRE requests that distribution grids operators ensure that any differences in treatment between systems in view of these adaptations are attributable to objective criteria and relate directly to technical issues based on grid security and safety and operational quality.

Recommendation no. 26

The CRE requests that distribution system operators consider means of effectively using the potential for flexibility of facilities connected to grids, in an objective and transparent framework with no discrimination, when economically worthwhile for the management of public distribution grids, and when in line with pricing policies.

Recommendation no. 27

The CRE supports the greater harmonisation of standards on metering and smart grids. In this respect, the CRE supports the work of international standardisation organisations, particularly those of European standardisation organisations via the European standardisation mandates, M/441 on metering, and M/490 on smart grids. These mandates indeed lead to the harmonisation of metering equipment and practices, and more generally, smart grids, via European standards.

Recommendation no. 28

The CRE requests that distribution system operators:

- define the minimum requirements to be met by user equipment to enable communication with distribution grid equipment;
- publish these requirements in their reference technical documentation.

Distribution system operators will attempt to define, as a priority, communications procedures with the existing *Smart grid* equipment or equipment currently being deployed on the grids operated, by describing the interfaces and protocols to be implemented.

Recommendation no. 29

The CRE supports the improved protection of the PLC signal used by distribution system operators, particularly to transmit pricing signals. In this respect, the CRE recommends that the orders on the technical provisions to be satisfied by systems in view of connection to a public distribution network (of 23rd April 2008 and 17th March 2003), should be clarified, explicitly extending the concept of pricing signals to PLC signals and leading to a limitation of the level of emissions of systems connected to public distribution grids.

Recommendation no. 30

The CRE requests that distribution system operators describe, in their reference technical documentation, requirements in terms of protecting the PLC signal, as is the case for the current TCFM tariff signal (particularly the 175 Hz signal) in application of article 9 of the order of 17th March 2003 and article 3 of the order of 23rd April 2008.

Recommendation no. 31

The CRE supports the improved protection of the PLC signal from electromagnetic disturbance and recommends:

- the introduction of regulations in order to protect PLC frequency bands such as radio frequencies in the decree of 18 October 2006;
- the preparation of an international standard on compatibility levels, defining maximum emission levels to avoid interference and degrees of immunity to guarantee robustness, in accordance with the works in progress within the IEC.

Recommendation no. 32

The CRE requests that the transmission system operator continues, as provided for in the CRE's deliberation of 28 November 2013, to work to enable all systems to contribute to primary and secondary frequency control, as long as they are able to meet the expected technical requirements.

Recommendation no. 33

The CRE requests that the transmission network operator continue, as particularly provided for in the CRE's deliberation of 16 October 2013, works enabling, on a long-term basis, a greater number of installations to contribute to the tertiary frequency control mechanisms, subject to their technical capability to meet requirements in terms of expected performance.

Recommendation no. 34

The CRE requests that transmission and distribution system operators study, in coordination with all stakeholders, the conditions in which the power plants connected to the public distribution grids could contribute to the control of the exchange of reactive power at the interface between the public transmission network and the public distribution networks. These studies should also lead to the definition of contribution procedures, improving the overall effectiveness of the electrical system.

These studies will be undertaken in addition to:

- the considerations already underway on the possible developments for existing rules on the exchange of reactive power at the interface between the public transmission network and the public distribution networks;
- and incentives applicable to the transit of reactive power at the interface between the public transmission network and the public distribution networks. The CRE requests that transmission and distribution system operators work together in order to complete these works, in coordination with stakeholders.

Recommendation no. 35

The CRE supports changes to legislation, as applied for downward consumption modulation, to define the economic terms and conditions enabling the system to benefit from the flexibility inherent to temporary increases in consumption. This modification will complete the legislative framework for flexible consumption.

Recommendation no. 36

The CRE requests that the transmission system operator study, for situations where there is no need to reinforce the legislative and regulatory framework, any solutions required to ensure that the flexibility provided by modulating consumption can be provided for the electrical system via the different mechanisms (e.g. specific remote reading sites within the balancing mechanism).

Recommendation no. 37

The CRE supports the proposal that feedback from demonstration projects should be used to specify the initial results of studies carried out in recent years on services provided by energy storage facilities, via the analysis of costs and benefits throughout the value chain. The CRE also recommends that these studies should cope with the allocation of benefits between the different market players and consider means of using these services when they maximise global welfare.

Recommendation no. 38

The CRE requests that the transmission system operator, with the other European transmission system operators, carry out a preliminary assessment of the risks inherent to the progressive reduction of inertia in the Continental European (CE) zone and identify means of managing this issue at national level or for the entire CE synchronous zone.

Recommendation no. 39

Following the definitive adoption of the European network code on the connection of generators, the CRE requests that distribution system operators start discussions in order to determine whether the parameters of loss of mains protection need modifications. The involvement of the transmission network operator must be ensured at all stages. A detailed analysis on whether dynamic behaviour is appropriate for all small power plants is required in particular.

Recommendation no. 40

The CRE supports the adoption of various penetration thresholds for variable RES, depending on the characteristics of the power system in the area in question and the power plant as a whole (including any electricity storage devices and forecasting systems associated with the generation system or used by the grid operator), in line with any regulatory provisions which may define strategic objectives in terms of energy per pertinent geographic segment, instead of the single penetration threshold for RES of 30% provided for in the order of 23rd April 2008 in areas which are not connected to the mainland France grid.

The CRE supports the proposal that penetration thresholds for variable RES, and the characteristics of devices (electricity storage, forecasting systems, *etc*.) bypassing these thresholds, must be defined, not in regulations, but in the reference technical documentation of the system operator, after consulting with grid users and according to the procedure defined by the CRE in its deliberation of 7th April 2004. On this basis, articles 22 and 22 *bis* of the order of 23rd April 2008 must be modified.

These developments should enable RES to be greater integrated in each insular territory in compliance with safety rules for insular electrical systems.

Recommendation no. 41

The CRE requests that Électricité de France – Systèmes Énergétiques Insulaires (EDF SEI) and Électricité de Mayotte (EDM), insular system operators, define safety criteria and update their reference technical documentation. Following the adoption of the above recommendation requiring the order of 23rd April 2008 to be modified, these grid operators will also be able to define RES penetration thresholds.

5.2. – CRE requests

The CRE requests the following for 1 November 2014:

- that the transmission network operator (RTE) present a roadmap for the implementation of recommendations no. 32, 33, 34, 36 and 38;
- that electricity distribution network operators serving more than 100,000 customers submit a roadmap for the implementation of recommendations no. 3, 7, 12, 13, 15, 17, 19, 20, 21, 24, 25, 26, 28, 30, 34 and 39;
- that Électricité de France – Systèmes Énergétiques Insulaires (EDF SEI), an insular system operator, present a roadmap for the implementation of recommendations no. 3, 7, 12, 13, 17, 19, 20, 21, 24, 25, 26, 28, 30 and 41.

These roadmaps must include a schedule including the technical and economic studies to be carried out to assess the costs and benefits of these changes for the authority, implementation milestones and the planned progress reports with the CRE.

At Paris, 12th June 2014

On behalf of the Commission de Régulation de l'Energie,

The President,

Philippe de LADOUCETTE

6. Appendices

Appendix 1 – Lists of stakeholders interviewed

The CRE interviewed the representatives of many territorial authorities and local operators involved in *Smart grid* initiatives in the context of its energy and territories policy:

- AMORCE
- Local energy and climate agency of Rennes
- Brest Métropole Océane
- Chamber of Commerce and Industry - Nice Côte d'Azur
- CLER – Network for the energy transition
- Urban community - Pôle Azur Provence (06)
- Grouping of municipalities - Val d'Ille (35)
- Urban community - Dunkirk (59)
- Urban community - Lyons – Grand Lyon (69)
- Departmental council - Seine-Saint-Denis (93)
- Departmental council - Alpes-Maritimes (06)
- Departmental council - Yvelines (78)
- Regional council - Brittany
- Regional council - Rhônes-Alpes
- Regional council - Provence-Alpes-Côte d'azur
- Regional directorate of the environment, urban planning and housing (DREAL) - Brittany
- Regional directorate of the environment, urban planning and housing (DREAL) - Provence-Alpes-Côte d'azur
- Public urban planning unit (EPA) - Plaine du Var
- Public urban planning unit (EPA) - Bordeaux Euratlantique
- Public urban planning unit (EPA) - Marne-la-Vallée
- Public urban planning unit (EPA) - Paris-Saclay
- Île d'Houat (56)
- La Calade, Consultants for territorial authorities
- Townhall - Paris (75)
- Townhall - Cannet (06)
- Metropolis - Nice Côte d'Azur (06)
- Urban community - Nantes Metropolis (44)
- Metropolis - Rennes (35)
- Syndicat départemental d'énergies (Departmental energy union) - Morbihan (56)
- Syndicat intercommunal d'énergies du département (Intermunicipal department energy union) - Loire (42)
- Town - Issy-les-Moulineaux (92)
- Town - Courbevoie (92)
- Town - Grasse (06)
- Town - Grenoble (38)
- Town - Croix-Valmer (83)
- Town - Lambesc (13)
- Town - Lille (59)
- Town - Loos-en-Gohelle (62)
- Town - Rennes (35)

The CRE organised workshops on the functionalities of low voltage smart power grids during the year 2013. These workshops also provided the opportunity to share information on progress with consideration of the insertion of electric vehicles in the grid, the integration of renewable energies into the low voltage grid, the potential services that could be provided by storage devices, active demand management, the particularities of insular zones, and *Smart grid* business models. The following parties participated in the workshops:

- Accenture
- Actility
- Agence de l'Environnement et de la Maîtrise de l'Énergie (ADEME)
- AGNES
- Alstom Grid
- Areva
- Atos
- Bouygues Energy et Services
- BPL Global

- Capénergies
- Clean Horizon Consulting
- Commissariat à l'énergie atomique et aux énergies alternatives (CEA)
- Delta Dore
- Direct Energie
- E-CUBE Strategy Consultants
- Électricité de France Direction Recherche et Développement (EDF R&D)
- Électricité de France Direction Commerce (EDF Commerce)
- Électricité de France Direction des Systèmes Energétiques Insulaires (EDF SEI)
- Électricité de Mayotte (EDM)
- EMBIX
- Électricité Réseau Distribution France (ERDF)
- Fédération Nationale des Collectivités Concédantes et Régies (FNCCR)
- GDF Suez
- GDF Suez Cofely
- Groupement des industries de l'équipement électrique, du contrôle-commande et des services associés (Gimélec)
- IBM
- Ijenko
- Institut National Polytechnique de Grenoble (INP G2Elab)
- Itron
- Legrand
- French Ministry of the Economy and Finances
- French Ministry of Energy
- Nexans
- Orange
- Renault
- Réseau de Transport d'Électricité (RTE)
- Saft
- Schneider Electric
- Société d'Électricité Régionales des Cantons de Lassigny et limitrophes (SER Lassigny)
- Société française du radiotéléphone (SFR)
- Sorégies Réseaux de Distribution (SRD),
- Tenerrdis
- Total
- Union Française de l'Électricité (UFE)
- Veolia
- Conseil général of Yvelines

The CRE also met with the following operators, involved in the development of smart grids in France:

- Capgemini
- Chamber of Commerce and Industry (CCI) Nice Côte d'Azur
- Citelum
- Compagnie Nationale du Rhône (CNR)
- Edelcom
- ENERPLAN
- ITEMS International
- Niji
- Siemens
- Sun'R Smart Energy

83 responses were received for the public consultation organised from 4 November 2013 to 8 December by the CRE on the development of smart low voltage grids. The CRE received a written contribution from the following operators:

- Agence de l'Environnement et de la Maîtrise de l'Énergie (ADEME)
- Alren
- Alstom Grid
- Altie
- Amorce
- Apis Mellifera
- Association Nationale Robin des Toits
- Bouygues Énergies et Services (BES)
- Bouygues Immobilier
- Bouygues SA
- Brest Métropole Océane
- Comité de Liaison Énergies Renouvelables (CLER)
- Compagnie Nationale du Rhône (CNR)
- Confédération Française de l'Encadrement CGC (CFE – CGC Énergies)
- E.ON
- Électricité de France (EDF)
- Local distribution network operators:
    - Association Nationale Régie Services Publics Organismes Constitués (ANROC)

- Syndicat Professionnel des Entreprises Locales d'Énergie (ELE)
  - Fédération Nationale des Sociétés d'Intérêt Collectif Agricole d'Électricité (FNSICAÉ)
  - Union Nationale des Entreprises Locales d'Électricité et de Gaz (UNELEG)
- Embix
- Enerplan
- Ericsson France
- Ethic Wear
- Fédération Départementale d'Électricité de l'Yonne (FDEY)
- Fédération Nationale des Mines et de l'Énergie CGT (FNME – CGT)
- Gaz Réseau Distribution France (GrDF)
- GDF Suez
- GDF Suez Énergie Services (Cofely)
- Gimélec
- Greenovia
- Cahors group
- La Poste group
- Quadran group
- Hespul
- ID4CAR
- Itron
- Mr Jean CUEUGNIET – CGEIET
- Mr Jean LUCAS
- Legrand
- M&R Énergies
- Meteolien Scoparl
- Mouvement National de Lutte pour l'Environnement
- Niji
- Okwind
- Orange
- Pôle Énergie Bretagne (PEBreizh) :
  - Syndicat Départemental d'Énergies du Morbihan (SDEM)
  - Syndicat Départemental d'Énergies du Finistère (SDEF)
  - Syndicat Départemental d'Énergies d'Ille-et-Vilaine (SDE35)
  - Syndicat Départemental d'Énergies des Côtes d'Armor (SDE22)
- Réseau Pure Avenir
- Renault
- Reuniwatt
- Réseau de Transport d'Électricité (RTE)
- Schneider Electric
- Syndicat des Énergies Renouvelables (SER)
- Syndicat des Entreprises de génie électrique et Climatique (SERCE)
- Syndicat Intercommunal de Gestion des Énergies de la Région Lyonnaise (SIGERLy)
- Syndicat Intercommunal de la Périphérie de Paris pour l'Électricité et les Réseaux de Communication (SIPPEREC)
- Socomec
- Solucom
- Steria
- Storengy
- Sun'R Smart Energy
- Syndicat Départemental d'Énergie de Saône-et-Loire (SyDESL)
- Syndicat Intercommunal d'Électricité de Côte d'Or (SICECO)
- Syndicat Intercommunal d'Énergies, d'Équipement et d'Environnement de la Nièvre (SIEEEN)
- Total Énergies Nouvelles
- Union des Syndicats d'énergies de Rhône-Alpes (USéRA):
  - Syndicat Intercommunal d'énergie et de e-communication de l'Ain (SIEA)
  - Syndicat Départemental d'Énergies de l'Ardèche (SDE07)
  - Syndicat Départemental d'Énergies de la Drôme (SDED)
  - Syndicat des Énergies du Département de l'Isère (SEDI)
  - Syndicat Intercommunal d'Énergies du département de la Loire (SIEL)
  - Syndicat Départemental d'Énergies du Rhône (SYDER)
  - Syndicat Intercommunal de Gestion des Énergies de la Région Lyonnaise (SIGERLy)
  - Syndicat Départemental d'Énergie de Savoie (SDES)
  - Syndicat des Énergies et de l'Aménagement numérique de la Haute-Savoie (SYANE)
- Veolia Environnement
- Town of Lyon

At their request, the Fédération nationale des collectivités concédantes et régies (FNCCR) and the Électricité Réseau Distribution France (ERDF) were interviewed by the CRE group.

The companies, Voltalis and Colombus Consulting, and the Confédération Française de l'Encadrement CGC (CFE – CGC Énergies) were heard by CRE services, at their request.

Appendix 2 – List of Commercially Sensitive Information (CSI)

The French energy code includes a specific section on the confidentiality of sensitive information held by transmission and distribution system operators. Articles L. 111-72 and L. 111-73 of the French energy code therefore provide that system operators must maintain the "*confidentiality of economic, commercial, industrial, financial or technical information whose disclosure would breach rules on free and fair competition and non-discrimination*". The list of these types of information is defined in two decrees:

- decree no. 2001-630 of 16 July 2001 amended, on the confidential nature of the information held by the operators of public transmission or distribution grids;
- decree no. 2004-183 of 18 February 2004, on the confidentiality of the information held by operators of transmission and distribution or natural gas storage structures or liquefied natural gas systems.

In electricity (decree no. 2001-630 of 16 July 2001 amended), the following information is protected by law:

- the provisions of contracts and protocols for access to public transmission and distribution grids, and the information exchanged in view of the preparation and application of the former, on:
  . the identity of the parties to a supply contract;
  . the prices applied for electricity transactions;
  . financial data on the balance behind transactions;
  . the characteristics of the energy generated, supplied or consumed;
  . the duration of supply or access protocols and contracts;
  . the technical and financial conditions of connection;
  . contractual sanctions and penalties.
- extraction, procurement and consumption programmes as mentioned in article L. 321-9 of the French energy code;
- adjustment proposals for extraction programmes as mentioned in article L. 321-10 of the French energy code;
- the modifications applied by the public transmission grid operator to the extraction programmes in application of articles L. 321-10 and L. 321-11 of the French energy code;
- any information exchanged between the system operators and users of these grids in view of establishing and implementing these programmes;
- the provisions of the contracts and protocols for the purchase of electricity concluded by the public transmission network operator and mentioned in article L. 321-12 of the energy code, and the information exchanged in view of preparing and applying the former, on:
  . the prices applied for electricity transactions;
  . financial data on the balance behind transactions;
  . the characteristics of the energy generated or supplied;
  . the duration of purchase protocols and contracts;
  . contractual sanctions and penalties.
- information on the power registered, the volumes of energy consumed or generated and the quality of the electricity, based on the metering mentioned in articles L. 321-14 and L. 322-8, 7° of

the energy code or on any other physical measurement taken by the system operators in relation to the connection structures or the systems of a grid user;

- the degree of deviation detected from extraction, procurement and consumption programmes, and the amounts of financial compensation requested or allocated by the public transmission network operator to the users in question (article L. 321-14 of the energy code).

In gas (decree no. 2004-183 of 18 February 2004), the following information is protected by law:

- the provisions of contracts and protocols for:
  . access to structures and systems (including those providing auxiliary services);
  . the use of storage;
  . transit;
  . purchases concluded in view of rebalancing grids.
- the information exchanged in order to prepare and apply these contracts and protocols on:
  . the identity of the parties;
  . the price of the services;
  . the characteristics of the supply;
  . the duration of protocols and contracts;
  . the conditions for modifying or renewing contracts and protocols;
  . contractual sanctions and penalties.
- information on the quantities delivered based on metering, pressure measurements upstream from the point of delivery, flow measurements, or any other physical measurement by the gas operator on the connection structures or systems of a user of these structures or systems.

Furthermore, to enable territorial authorities to assess the regional master plans for climate, air and energy and the territorial climate and energy plans, article 1 of decree no. 2011-1554 of 16 November 2011[103] defines an exhaustive list of the data which can be used to prepare and assess the regional master plans for climate, air and energy and the territorial climate and energy plans:

[103] Decree no. 2011-1554 of 16 November 2011, on the data used to prepare and assess the regional master plans for climate, air and energy and the territorial climate and energy plans.

Information forwarded to the awarding authority for the public distribution of electricity and gas and forwarded to the statistics service of the Ministry of Energy	Information provided for territorial authorities and forwarded to the awarding authority for the public distribution of electricity and gas	Information disclosed to the statistics service of the Ministry of Energy and provided for territorial authorities
For electricity distribution system operators		
Total consumption, per municipality and voltage range	Presentation of the area served	Consumption of the most significant point of delivery per municipality and per voltage range
Number of points of delivery	Management system used for the service and concession contract(s)	
Total power connected for generation units, per sector and municipality	Priorities for the distribution of gas and electricity	
For gas distribution system operators		
Total quantity of gas consumed per municipality and per pricing option	Presentation of the area served	Consumption of the most significant point of delivery per municipality and per pricing option
Number of points of delivery	Management system used for the service and concession contract(s)	Highest quantity of gas injected, per municipality
Total quantity of gas injected, per municipality	Priorities for the distribution of gas and electricity	

Appendix 3 – Access to energy data

Extract from the summary of the works of the national debate on energy transition in France by the National Council of the debate, 18 July 2013

Issue no. 12: Reinforce the competencies of the territories to promote the decentralisation of the implementation of the energy transition

- Guarantee a service obligation to manage and communicate consumption data related to electricity, gas and heat, especially to the benefit of the public authorities in question and the awarding authorities.
- Allow local reporting on energy consumption to local authorities, particularly the authorities organising distribution, in the context of a public service mission for distribution network operators, integrating the consideration of costs in prices, technical development times, and information collection and conservation rights.
    - Access to data on energy consumption must be possible, at least at the IRIS mesh[104] within a period compatible with the revision of the Territorial energy and climate plan (PCET).
    - With reference to information on the financial aspects and assets per concession, other operators reiterate that the centralised national structure of operators is not based on the concession mesh and distributes a large number of loads with distribution keys which make it very difficult to identify precise financial data per concession.
- Establish a shared national database on data distribution.

[104] Breakdown of the territory into equal sized meshes or "*Islands combined for statistical data purposes*".

Appendix 4 – Potential provisions for the recharging of electrical vehicles

With reference to article L. 121-87 of the consumer code, the recharging proposal for electric vehicles specifies the following information in clear and understandable terms:

1° The identity of the service provider, the address of its head office and number on the trade and companies register, or any equivalent document for companies established outside of France and for operators not listed on the trading and companies register;

2° The telephone number and, if applicable, the electronic address of the service provider;

3° The description of the products and services proposed;

4° The prices of these products and services on the date of the proposal, as well as, if applicable, any conditions for price revisions;

5° The duration of the contract and renewal conditions;

6° The period of validity for the proposal;

7° The forecast period of supply for the energy;

8° The invoicing procedures and means of payment proposed, particularly via the Internet;

9° The existence of a right to retract, as per articles L. 121-21 and L. 121-21-1 of this code;

10° The conditions and procedures for the determination of the contract;

11° Out-of-court and court-based means of settling litigation.

The recharging of electric vehicles could also be subject to the following provisions (adaptation of decree no. 2004-388 of 30 April 2004[105])

I. – The distribution system operators mentioned in article L. 121-5 of the energy code, generators selling electricity to eligible consumers, traders as defined in this decree and recharging station operators, must inform the final consumers, whether eligible or not, of the source of the electricity supply, according to the following conditions.

To this end, they must indicate the following on electricity invoices or in an enclosed document and in all promotional documents on electricity sent to final consumers:

1° The different sources of primary energy used to generate the electricity sold during the preceding year;

2° The contribution of each source of primary energy to their overall electricity supply during the preceding year;

3° The reference of the publications where consumers can find information on the quantity of carbon dioxide or radioactive waste generated per kilowatt hour based on all sources of primary energy used by the operator. This provision does not mean that operators must provide this information in response to individual requests.

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[105] Decree no. 2004-388 of 30 April 2004 amended, on the purchase of electricity for resale to eligible customers and supplier obligations in terms of informing electricity consumers.

Appendix 5 – Management, metering and extraction costs for the different installation solutions for recharging stations of electric vehicles in blocks of offices and flats

The following assumptions have been used to simulate the different solutions for connecting recharging stations for electric vehicles in blocks of offices and flats:

Number of recharging stations connected	5
Recharging capacity of each station	3 kVA
Mean electrical consumption of each recharging station	6 kWh/day
Monthly co-ownership management service charge if a recharge management service is used	€30 exc. V.A.T.[106]
Aggregate power extracted if a recharge management service is used	50%: maximum power output is equal to 7.5 kVA for 5 x 3 kVA stations

Table 12 – General assumptions for systems and the use of recharging stations

Annual management component		
a_1 (€/year)	CARD	Unique contract
LV > 36 kVA	348.84	55.92
LV ≤ 36 kVA	34.80	9.00

Table 13 – Annual management component in euros excluding tax (rates on 01/01/2014)

Annual metering component (€/year)	
18 kVA < P ≤ 36 kVA	22.92
P ≤ 18 kVA	19.08

Table 14 – Annual metering component in euros excluding tax (rates on 01/01/2014)

Annual extraction component LV ≤ 36 kVA MU TD (Mean Use with Time Differentiation)		
Power subscribed P	a_2 (€/kVA/year)	d_2 Off-peak hours (€op/kWh)
P ≤ 9 kVA	4.32	2.44
9 kVA < P ≤ 18 kVA	7.32	2.19
18 kVA < P	14.04	1.84

Annual extraction component LV > 36 kVA MU (Mean Use)		
a2 (€/kVA/year)	Off-peak hours, winter (€op/kWh)	Off-peak hours, summer (€op/kWh)
12.00	3.11	1.64

Table 15 – Annual extraction component excluding tax (rates on 01/01/2014)

The following tables provide an overview of management, metering and extraction costs for the different installation solutions for recharging stations for electric vehicles in blocks of offices and flats:

- Solution 1: Connection of the recharging infrastructure to the building system and fitting of a measuring system to allow for the individual invoicing of consumption
- Solution 2: Connection of the recharging infrastructure to the building system and fitting of a private measuring system (within the control system or the recharging stations) operated by the co-ownership grouping or a third party operator
- Solution 3: Connection of the recharging infrastructure to the public distribution network and fitting of a private measuring system (within the control system or the recharging stations) operated by the co-ownership grouping or a third party operator

[106] I.e. €72 per year and per recharging station (= €30 x 12 months / 5 stations).

- Solution 4: Connection of the recharging infrastructure directly to the public distribution network

In this simulation, the user selects a pricing option for moderate use with time-based differentiation (recharging takes place overnight during off-peak periods) and recharging is only managed for solutions 2 and 3.

Different costs in € exc. tax per year	Solution 1		Solution 2		Solution 3 LV ≤ 36 kVA	Solution 4 LV ≤ 36 kVA
	LV ≤ 36 kVA	LV > 36 kVA	LV ≤ 36 kVA	LV > 36 kVA		
Management component	5.16	58.58	-	-	9.00	9.00
Metering component	19.08	19.08	-	-	19.08	19.08
Extraction - Fixed part	42.12	36.00	21.06	18.00	6.48	12.96
Extraction - Variable part	40.30	49.33	40.30	49.33	53.44	53.44
Control service management	-	-	72.00	72.00	72.00	-
Sub-total	**106.66**	**162.99**	**133.36**	**139.33**	**160.00**	**94.48**
Itemisation (host with an indexed metering service)	464.03	575.34	-	-	-	-
Itemisation (host with a metering service with a charge curve)	128.26	227.26	-	-	-	-

Table 16 – Summary of annual management, metering and extraction costs for the different installation solutions for recharging stations for electric vehicles in blocks of offices and flats in euros before tax

Appendix 6 – Examples of the connection of storage facilities

Appendix 6.1 – Storage device connected directly to the grid

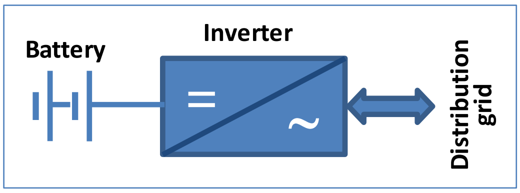

Figure 16 – Storage device connected directly to the grid

Appendix 6.2 – Generation system equipped with a storage device

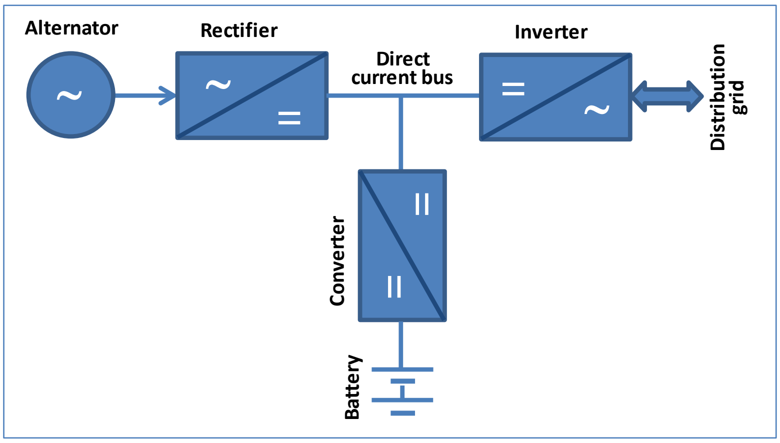

Figure 17 – Generation system equipped with a storage device

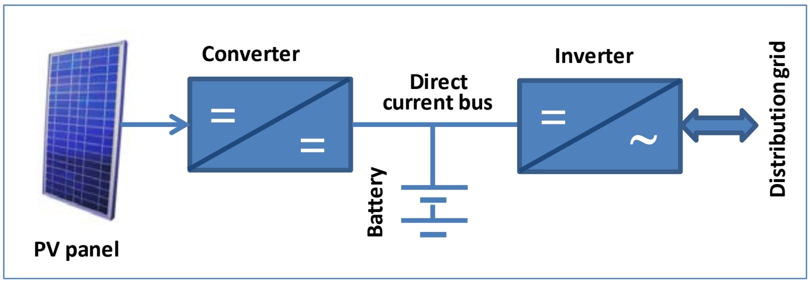

Figure 18 – Photovoltaic generation system equipped with a storage device

Appendix 6.3 – Consumer system equipped with a storage device

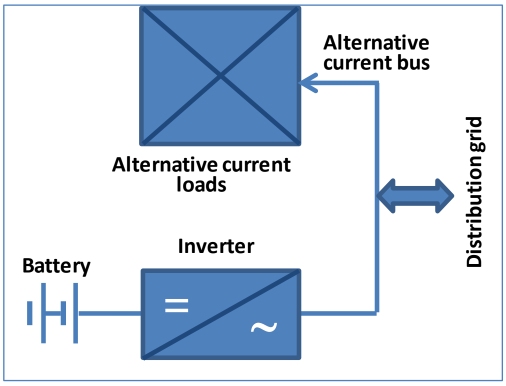

Figure 19 – Consumer system equipped with a storage device

Appendix 6.4 – Hybrid system

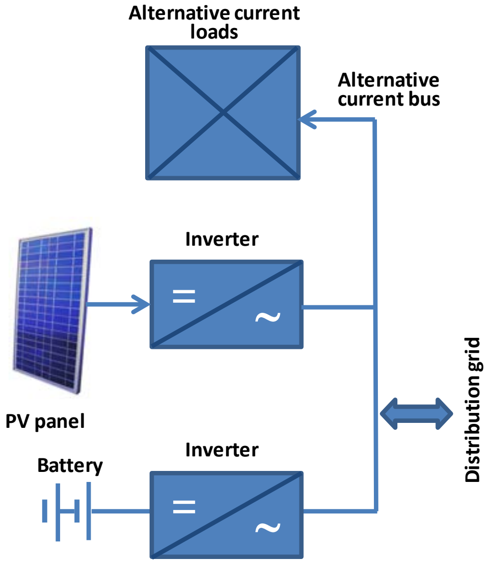

Figure 20 – Load with generation and storage

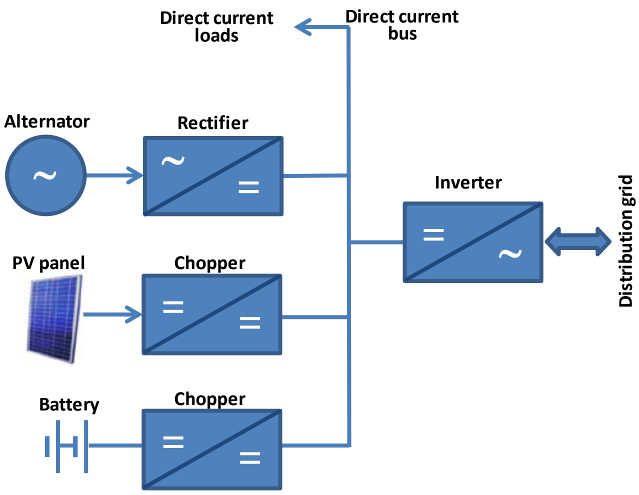

Figure 21 – Hybrid generation systems equipped with a storage device with a direct current bus

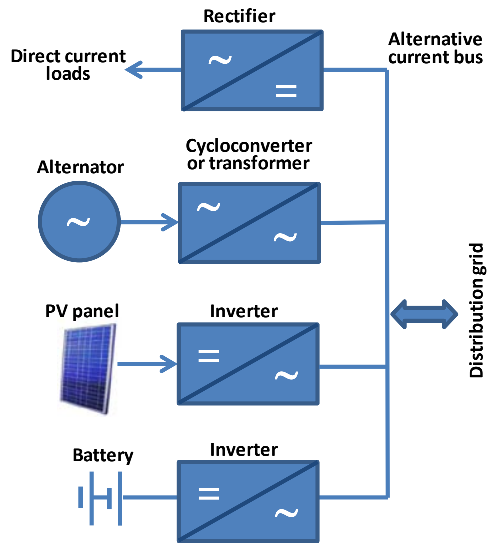

Figure 22 – Hybrid generation systems equipped with a storage device with an alternating current bus