

Title of the measure:	FRA70 Smart meters
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General description

Following the requirements of Directive 2009/72/CE regarding the rollout of smart meters in case of favorable cost/benefits analysis, Directive 2006/32/EC on energy end-use efficiency and energy services¹, after a successful experimental phase² led in both urban and country based regions, and on recommendation of the French Commission for Energy Regulation (*Commission de Régulation de l'Énergie*), the French Prime Minister has **announced in September 2011 the generalization of smarters for gas & electricity for both households and companies.**

Aiming at **reducing billing errors, easing remote operations and improving the electricity consumption monitoring** (in particular by increasing the number of time slots), and therefore **easing the development of new market opportunities for energy demand & supply management**, the smart meters are expected to **speed up diagnosis in case of dysfunction of electrical infrastructure**, and more generally to **contribute to grids optimization**. Article L. 341-4 of the French Energy Code obliges in particular electricity DSO to deploy **advanced meters allowing the suppliers to offer their customers different prices** based on different periods (year or day), and encouraging consumers to **limit their consumption during peak periods.**

According to article R. 341-6 of the Energy Code, specifications and cost elements of metering devices belonging to public electricity **DSO supplying more than 100,000 customers are subject to the opinion of the Commission for Energy Regulation**, which may make recommendations, in particular to ensure the establishment of interoperable metering systems at the national level.

Article 7 of the Energy Transition for Green Growth act **obliges DSO to give access to aggregated energy metering data** (electricity and gas) **to owners or lessors of collective buildings³ on demand**, and on the conditions to plan supply demand management actions. In addition, DSO have to guarantee the possibility for suppliers to access to consumption data upstream the meter and in real time.

Regarding the deployment calendar, the article R. 341-8 of the French Energy Code requires that **by December 31 2020, at least 80% of the meters of users connected to the low voltage grid for powers less than or equal to 36 kVA are deployed with an objective of 100% by 2024.** Thus, the main French electricity DSO, ENEDIS, has announced the equipment of 35 millions of households with electricity smart meters (named “Linky”) within 2021, and the main gas French DSO, GRDF, is expected to equip 11 millions of gas customers with gas smart meter (named “Gazpar”) within 2022.

¹ This directive requires Member States to make available to final consumers, in particular in the framework for replacing an existing meter or a new connection, individual meters accurately measuring their actual consumption and allowing bills based on actual energy consumption. It has been repealed by Directive 2012/27/UE on energy efficiency that incorporates these provisions.

² Covering 270,000 smart meters

³ At least 10 energy subscribers are requested



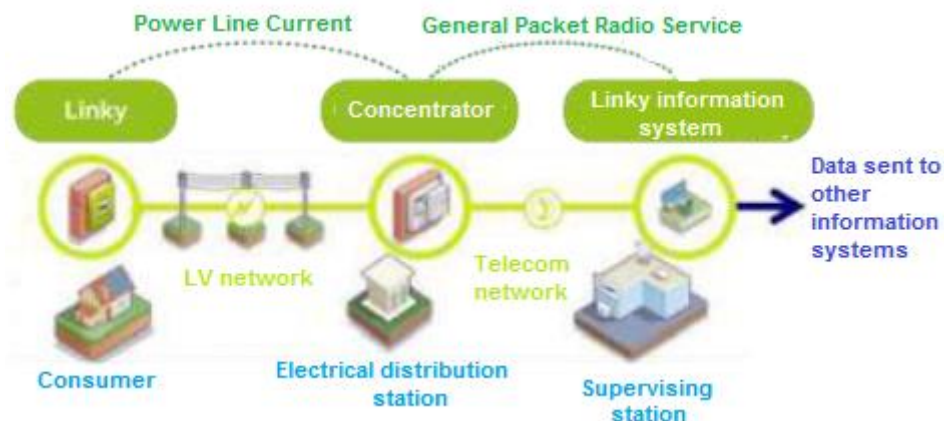
Focus on non-interconnected zones

The DSO of the non-interconnected areas of the continental metropolitan French network, EDF SEI, is in charge of deploying the smart meters in these zones. It planned to deploy around 1.25 million smart meters between 2018 and 2024, ie around 270,000 meters in Corsica, 200,000 in Martinique and 245,000 in Guadeloupe, 85,000 in French Guiana and 450,000 in Réunion

Article 165 of the Energy Transition for Green Growth act (so-called "LTECV") has introduced in the Energy Code the possibility for DSO in non-interconnected zones to choose an equalization mechanism based on the analysis of their accounts, as part of the Equalization Fund for Electricity (*Fonds de péréquation de l'électricité*).

The Commission for Energy Regulation's deliberation of November 17, 2016 allows expenses coverage by the tariff, at their effective level, of the expenses of Enedis corresponding to the allocations paid to EDF SEI, the amount of which is determined by the CRE.

In order to help stakeholders adopting the smart meter, the electricity DSO ENEDIS (which represent 95% of the French electricity DSOs) gave a **specific name (Linky) and colour to its smart meter (anise)**. These meters are **connected to concentrators thanks to the power line current technology (PLC)** which consists of overlaying to the 50Hz AC a higher frequency and low energy signal to **propagate signals in the existing electrical cables**. Each meter and concentrator has a CPL modem that encodes and decodes the signal (see Figure below).



The Linky infrastructure (source ENEDIS)

The electricity smart meter **transmits data about the daily consumption to the DSO once per day** and stores the consumer's load profile. This load profile, built from various measurements (up to every 10 minutes), may be transmitted to DSO or third parties on the condition to get the consumer's approval.

The Energy Transition for Green Growth act voted in 2015 has forced DSO (gas and electricity) to provide to consumers their energy consumption (through a free secured website), a **mean to activate alarms related to their level of consumption, comparative elements** (derived from statistical averages based on local and national consumption data at least).

Specific measures for dwellings in fuel poverty situation

The Energy Transition for Green Growth act has introduced the obligation for energy retailers to provide remote displays of energy consumption (gas and electricity) to low income households (article 28^a). These displays are expected to give them easy access and directly understandable information about the quantity (kWh, and m³ for gas) and cost (in euro) of their energy consumption in real time, in order to help them assessing the economic return of energy efficiency works.

Freely available for households in energy poverty situation from January 2019^b such a display could progressively be offered for free to all domestic consumers, after a technical and economic evaluation conducted by the French Energy Regulatory Commission in 2021.

^a Provisions are specified in Decree N°2016-1618 of November 29, 2016
(<https://www.legifrance.gouv.fr/eli/decret/2016/11/29/DEVR1612950D/jo/texte>)

^b Originally scheduled to come into effect on January 1st, 2018, the measure was postponed one year because of delays in orders preparation (see Decision 2017-252 CRE
<http://www.cre.fr/documents/deliberations/avis/comptage2>)

Impact evaluation & main results

Feedback from demonstrators & studies supported by the ADEME

The impact of smart meters on energy savings is mainly based on human behaviour changes through energy information management, and on electrical losses reduction. Different demonstrators supported by the French government and ADEME have experienced different means to achieve it. The first results underlined the **necessity to provide different means to access to energy information** (web interface accessible from PC or smart phone, traditional paper bill...) and **need for specific indicators enabling the easy monitoring of behaviours' changes effects** on energy savings by consumers (ADEME, 2016). They also stress the importance for consumers to **see instantaneously the effects of their actions**.

The project SMART ELECTRIC LYON⁴ supported by ADEME showed in particular, that consumption analysis based on a detailed bill sent every 2 months by mail or email to consumers, added to consumption comparison with neighbours' (like Opower does in US) allowed **1% of reduction in electricity consumption (in average) and up to 1.8% for 25% of the biggest electricity consumers (>11,000 kWh/y)**. The SOLENN project⁵ experienced in the French Brittany region (which is an "electric peninsula") also showed that consumption comparison with peer pool (without any relation with billing) have positive impact on the energy consumption reduction.

In addition, the literature review led by ALPHEEIS in 2015 for the ADEME highlighted the **importance to provide consumers with tools to monitor energy consumption over time and to compare situation to similar household**.

⁴ www.smart-electric-lyon.fr

⁵ www.smartgrid-solenn.fr



ADEME's general opinion on benefits for the environment

According to ADEME's white paper on the French smart meter Linky, the more precise the consumption information are, the more chance there is to offer options **allowing CO₂ emissions reduction by easing the insertion of a renewable electricity into the grid**, and to **improve the peak consumption management**. Indeed, thanks to tariff incentives, suppliers may control certain uses, and encourage the shift and/or erasure of consumption during peak hours to avoid the use of highly CO₂-emitting electricity generation system (thermal power stations and in particular those feed with fuel oil) or highly concentrated carbon-intensive energy imports. In addition, the new meter enables the monitoring of both energy consumption & generation (and therefore avoid the installation of a meter dedicated to energy generation production), and allows the monitoring of the voltage in the network by the DSO. Furthermore, the smart meters allow DSO & TSO to better identify technical and non-technical losses, and take action to reduce them. According to the DSO ENEDIS, these losses represent around 20 TWh per year (whose 40% of non-technical losses)⁶. However, according to a study supervised by ADEME (Cap Gemini 2015) on the impact of ICT, the replacement of traditional meters by smart meters would generate additional energy consumption of 0.5 TWh per year.

The analysis of the first rollout feedbacks by the Court of Auditor

The "control" carried out in 2017 by the French Court of Auditors has consisted of examining the objectives of the new system, analysing the procedures for electricity meters replacement, controlling the cost and the financing of operations and evaluating the risk that the objectives are not achieved.

This control shows that the **reality slightly differs from the theoretical conditions** planned initially in particular in terms of consumers information, and energy saving. Indeed the meters installer has little time to explain the meter functioning in 30 minutes and present actions for energy savings even if they are not expected to be specialists of energy saving actions promotion to households.

Economical gains

The technical-economic study conducted in 2011 evaluated the gains possible at the production, marketing and consumption levels for the period 2011-2038, according to two electricity price scenarios.

If we look at the most carious one, the gain at the production level would amount to €1.3 billion in 2010 thanks to savings on investments mainly achieved through peak demand management from "consumption erasing" (€₂₀₁₀ 1.1 billion).

For suppliers, the gain would be €₂₀₁₀ 0.8 billion, and would mainly result from peak demand removal.

At the consumer level, the gain is assessed at €₂₀₁₀ 9.2 billion and come essentially from competition strengthen (€₂₀₁₀ 5.2 billion), the remote reading and tele-operations that required the presence of the user (€₂₀₁₀ 2.3 billion), and the consumption reduction resulting from demand management (€₂₀₁₀ 1.6 billion 2010), minus the deduction of the additional equipment paid directly by consumers⁷.

⁶ For comparison, the volume of electricity distributed by the DSO is around 345 TWh/y

⁷ 19.7 million of users were assumed to be equipped with additional equipment such as remote screens, plugs, boxes for a total expense of €₂₀₁₀ 3,5 billion.



NB: this technical-economic study had also shown that the gains for the users varied very strongly according to the hypotheses used (the benefits from demand and supply management in certain situations could turn to losses with other hypotheses⁸).

Costs

According to the Court of Auditors, the cost of the new smarter deployment must be split into 2 categories:

- the cost of the Linky programme implemented by the DSO ENEDIS ;
- and those supported by the local distribution enterprises (*entreprises locales de distribution* – ELD) at of the programs of the others

According to ENEDIS the overall cost of the Linky programme is estimated to € 5.39 billion. This amount includes the experimental phase (€ 0.15 billion), the "deployment" phase for the period 2014-2021 (€ 4.70 billion) to achieve a equipment rate of 90%, and the final phase enabling to achieve an installation rate of 100% (€ 0.54 billion) within 2024.

The average cost the meter is 130 €: 1/3 accounts for the equipment, 1/3 accounts for the installation, and 1/3 accounts for the other equipment⁹.

According to the Court of Auditors, the costs seem to be optimized but this optimization has been done to the detriment of communication with users (the installer has little time to explain the operation of the meter since the total time of installation is on average 30 minutes).

Even if the assessment of such costs is not yet available, it can be approached by assuming that they represent 5/95ths of the Linky device cost (ie € 0.28bn). This cost is probably undervalued, since local distribution companies cannot benefit from the same economies of scale than ENEDIS.

Therefore, the **total cost of the smart meters deployment can be assessed to €5.7 billion.**

Impact level assessment

By assuming that the smart meters could save some TWh by reducing electrical losses¹⁰ (over total volume of electricity distributed of 345 TWh), this measure could be have a **medium impact on the overall final energy consumption of France.**

Regarding energy savings for households, the ADEME's expert on smart meters issues has suggested to also consider the **impact on the households sector as medium** even if there are a lot of uncertainty due to the huge influence of social aspects (behavior changes, capacity and willingness to invest in additional equipment to implement supply & demand management actions...)

Measure Impact Level		
<input type="checkbox"/> low	<input checked="" type="checkbox"/> medium	<input type="checkbox"/> high

Definition of impact:

Low: energy savings < 0.1% of overall final energy consumption of France

Medium: between 0.1 and 0.5%

High: > 0.5%

⁸ The cost of sending the user a monthly mail informing of its consumption may exceed the amount of the savings achieved by this information transmission.

⁹ Information systems necessary for the operation of the whole infrastructure and the 700,000 concentrators installed to receive the information coming from the meter (including the indexes read-up) and retransmit them to the central station.

¹⁰ Around 12 TWh/y of technical electrical losses, and 8 TWh/y of non-technical electrical losses (according to ENEDIS the French DSO)



Interaction of measures

Measures related to information of consumers on their energy consumption such as FRAHOU16 (one-stop-shops) and FRAHOU56 (individual heating consumption measurement in multi-rentals building equipped with common heating system)

References

General information

The French NEEAP 2014 and 2017

The official website of the public service <https://www.service-public.fr/particuliers/actualites/A12209> (in French)

The webpage of ADEME dealing with smart meters updated in March 2018 <https://www.ademe.fr/particuliers-eco-citoyens/habitation/bien-gerer-habitat/compteurs-communicants-linky-gazpar> (in French)

The ADEME's white paper on the French smart meter Linky published on July 2015 <http://www.ademe.fr/avis-lademe-compteur-linky-analyse-benefices-lenvironnement-consommateurs-collectivites>

The webpage of the electricity DSO ENEDIS dedicated to the meter Linky <https://espace-client-particuliers.enedis.fr/web/espace-particuliers/accueil>

The webpage of the gas DSO GRDF dedicated to the meter Gazpar <https://www.grdf.fr/particuliers/services-gaz-en-ligne/gazpar-le-compteur-communicant-gaz>

Regulatory

The [French Energy Code](#)

[The Energy Transition for Green Growth act entered in force in August 2015](#)

[The law N°2010-1488 of 7 December 2010 reorganising the French electricity market](#) (so called "loi Nome")

[The decree N°2010-1022 of 31 August 2010 on metering mechanisms for public electricity grids](#)

The deliberation of the French Commission for Energy Regulation on means to implement and evaluate the experimentation led by the French electricity DSO ENEDIS (ex-ERDF) on low voltage and power <https://www.cre.fr/Documents/Deliberations/Orientation/experimentation-d-erdf-en-vue-de-l-evolution-du-comptage-electrique-basse-tension-de-faible-puissance>

The [law n°2009-967 from August 3, 2009 for the implementation of the Grenelle for environment](#) (*loi Grenelle*) that set objectives and the main features of smart meters, and introduces the definition of smart meter.



The [Act of 13 July 2005 laying down the guidelines for the French energy policy](#) (loi POPE) that obliges electricity DSO and TSO to implement mechanisms enabling electricity suppliers to offer their customers different prices depending on the time of year or day and encouraging consumers to limit their consumption during peak period

Evaluation

The Court of auditors – The Linky smart meters: let's consumers benefit from all costly investment ([les compteurs communicants linky: tirer pour les consommateurs tous les bénéfices d'un investissement coûteux](#)) – February 2018 (in French)

Schwartz and Co for the Commission for Energy Regulation – Technico-economical study on the smart metering project led by EDF SEI ([Étude technico-économique du projet de comptage évolué d'EDF SEI](#)) – November 30, 2017 (in French)

The study supervised by the Commission for Energy Regulation to assess costs and benefits of the smart meters rollout project in non-interconnected zones led EDF SEI

ALPHEEIS for ADEME – [Gas smart meters, household practices and energy savings](#) (Compteurs communicants gaz, pratiques des ménages et économies d'énergie) – June 2015

This literature review was conducted to help defining the optimal conditions for the Gazpar gas communicating meter deployment in the residential sector in particular in terms of energy supply & demand management. It gathers recommendations on what kind of information device should be tested, or which method should be used to support households in managing their gas consumption in a sustainable manner.

Cap Gemini for ADEME - [Assessment of electricity consumption in the ICT layer in Smart grids](#) – December 2015 (in French + [synthesis available in English](#))

ADEME – [The Linky smart meter: analysis of benefits for the environment, consumers and local authorities](#) (« Le compteur Linky », Analyse des bénéfices pour l'environnement, les consommateurs et les collectivités) – July 2015 (in French)

Poignant and Sido - working group report on the electrical peak management ([Rapport Poignant-Sido](#)) – April 2010

The report written by members of the French National Assembly, and the French Senate to identify solutions to reduce the French electricity peak demand (in French)

ADEME, 2016. [Smart Grids: First results from French demonstrators](#) (in French and English)

This report gives an overview of the first results reached by the projects supported by the PIA and facing with smart grid issues.

The ADEME's webpage presenting the innovative demonstrators supported by the ADEME in the framework of the Investment for the Future programme <https://www.ademe.fr/recherche-innovation/programme-dinvestissements-davenir/projets-laureats> (in French)

Commission for Energy Regulation (CRE) – [Experimentation evaluation report](#) – June 2011 (in French)

The webpage of the energy regulation commission on the Linky smart meter experimentation <http://www.smartgrids-cre.fr/index.php?p=compteurs-linky> (in French)



Rollout

The interactive map of the French DSO ENEDIS showing the progression of the Linky meters deployment <https://commune.app-linky.fr/index.html>

Web pages of the Commission for Energy Regulation dedicated to the rollout of the meters:

- for electricity: <http://www.smartgrids-cre.fr/index.php?p=compteurs-generalisation-linky>
- for gas: <http://www.smartgrids-cre.fr/index.php?p=compteurs-projet-deploiement>