Enedis
Our commitment: Innovating for customers, territories and their energy challenges
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FOREWORD
As a response to the energy transition, Enedis is shifting the electricity distribution network into a more dynamic system where the exchanges between production and consumption will be done at national, regional and local scales. The move towards a smart grid will provide more information to customers, market actors and local authorities, enabling them to make the most of the network that supplies them. This booklet highlights how Enedis is developing a more reliable and flexible network, along with all its partners.

Smart grids key principles
1. Data collection by numerous sensors on the distribution network.
2. Analyses of the distribution network condition with all power flows transiting on it.
3. Precise location of incidents and remote action.
4. Forecasting of local renewable energy generation.
5. Creation of services that allow an optimal and controlled integration of new means of production and new uses of electricity.

THE SMART GRID USES TECHNOLOGIES OF POWER ELECTRICITY, INFORMATION AND TELECOMMUNICATION TO OPTIMISE GENERATION, DISTRIBUTION AND CONSUMPTION. Its objective is to optimise all the connections of the electricity network, from the producers to the consumers, in order to improve the energy efficiency of the system.
**Enedis, European leader of Distribution Systems Operator**

Enedis, as the new name of ERDF since June 2016, manages 95% of distribution network in continental France.

Enedis was created on January 1st 2008, in the wake of the liberalisation of the energy sector. Enedis is a state company with around 1,000 sites located across France. As part of its remit, the company frequently performs work on the grid, including the set-up of connections, commissioning, repairs and supplier switching, 24 hours a day. Enedis is independent from the electricity suppliers which are in charge of selling and managing the power supply contract.

Its 39,000 employees control, maintain and develop some 1.3 million kilometers of power lines, serving 35 million customers.

This makes Enedis the European leading electricity distributor. The grid is owned by the local authorities (municipalities or joint municipalities), which award concessions to the company and entrust it with the grid’s management through delegation of public service.

11 million interventions are made every year.

More than €3 billion are invested each year by Enedis throughout France.

As the organisation in charge of managing the public distribution network, Enedis is responsible for ensuring that access to the power grid meets the expectations of stakeholders. Now that the market is open to competition the service continuity of the country’s electricity distribution network lies at the heart of a system that requires Enedis to liaise with the government, the Energy Regulation Commission, local councils, the authorities that grant concessions and the grid users (customers, suppliers and producers).

**The medium-voltage grid already «smart»**

Each day, Enedis develops, maintains and controls more than 1.3 million kilometers of power lines, including 702 000 km of LV (low-voltage) and 622 000 km of MV (medium-voltage) lines, serving 35 million customers.

Sensors and remotely controlled devices have already improved the reliability of power grids over the last twenty years. At the end of the 1980s, French customers suffered an average of 400 minutes of power cuts per year. In 2015, this figure dropped to 61 minutes (average power outage per year per customer, irrespective of the cause).

This highlights Enedis successful investments to equip medium-voltage grid with sensors and numeric devices in order to strengthen its inner connections.

Today, when an incident occurs on the medium-voltage grid, automated software (DEMS/OMS) are able to restore power in few minutes to 70% of the customers affected, without human intervention. These advanced management processes, known as self-healing functions, allow electricity to be restored automatically and remotely. These terms vividly describe the new qualities of power grids that are able to reconfigure themselves in record time, sometimes without customers even noticing it, with the aim of maintaining the quality of electricity distribution.

**The low-voltage (LV) grid**

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The energy transition: an industrial and societal challenge

Integrate renewable energy and new uses of electricity in the most efficient way, are Enedis everyday challenges

Enedis deals with technical issues of:

- Intermittent and unpredictable production
- Variable power demand, geographically spread linked to the recharging of electric vehicle

Injecting electricity directly into the distribution grid at multiple points tends to disrupt voltage levels, which in turn can place the electrical equipment of customers at risk. Facing these new constraints, Enedis is experimenting solutions that contribute permanently to the local balance between supply and demand of electricity, with the will to maintain the best quality of supply.

95% of renewable energy sources are connected to the distribution grid managed by Enedis

Today there are a vast number of producers of renewable energy, solar in particular: while there were practically none in 2005, more than 340,000 solar power producers are now connected to the local low-voltage grid.

Objectives of the European Union:

- 20% of renewable energy in the EU’s energy consumption by 2020 (meaning 23% for France: 20% of renewable energy in the EU’s energy mix by 2020 and 32% by 2030)
- Reducing by 50% the consumption of fossil fuel from 2012 until 2050
- Reducing by 30% the consumption of fossil fuel from 2012 until 2030
- Reaching 23% of renewable energy in the energy consumption by 2020 and 32% by 2030
- Reducing by 40% the greenhouse gas emission from 1990 until 2030.

Objectives of the French energy transition law for the green growth:

- Reducing by 50% the energy consumption from 2012 until 2050
- Reducing by 50% the nuclear share in the energy mix by 2025
- Reducing by 30% the consumption of fossil fuel from 2012 until 2030
- Reaching 23% of renewable energy in the energy consumption by 2020 and 32% by 2030
- Reducing by 40% the greenhouse gas emission from 1990 until 2030.

In the wake of the energy transition, the volume of power and number of generation sites of intermittent renewable energy will keep up growing intensely. Furthermore, new uses of electricity such as the electric vehicle will involve an upgrade of the distribution network to incorporate recharging stations.

Enedis continues to modernise the grid

Enedis has opted for new technologies and investments optimisation to meet the energy challenges.

To prepare and support this major technical shift, Enedis is investing in numerous demonstrators in France and Europe. Their aim is to design tomorrow’s « smart grids », solutions combining electricity and NICT. The Linky smart metering system is a core element of this new system.

The integration of new technologies will allow these grids to feedback information. It will make it possible to analyse the actions of the electrical system’s various stakeholders so as to guarantee the efficiency, reliability and security of electricity distribution.

With all these technologies that come with Smart Grids, it is possible to manage the network balance in real time, by adapting consumption to production. The adjustment in the future will shift towards the demand side, making the consumer an active player. Enedis is contributing to the development and the smooth running of the whole system.

Smart Grids development relies on real condition experiments (equipment, software tools, telecommunications…)

Smart Grids are the combination of advanced power network solutions and information and telecommunication technologies. The following solutions are currently tested by Enedis on its pilot projects (see next page demonstrators map):

- Implementation of smart meters sensors that give precise information about the network state and consumption profiles.
- Development of advanced software (incidents location, self-healing, voltage control…).
- Implementation of data exchange system with decentralised generation sites.
- Solutions for active downstream meter management (demand and storage management).
- Development of tools to forecast local consumption and production, and tools to simulate possible constraints on the local scale (8 days to one hour ahead power-flow forecasts).
- Implementation of advanced digitised equipment in primary substation (transformation system from TSO to DSO, MV to LV) and secondary substation (transformation system from LV to LV): digitised controls, voltage regulation...
Enedis at the heart of demonstrators

Enedis is involved in all major smart grids projects in France and Europe in order to carry out a full-scale test of much awaited functionalities and services: contribution to the local adjustment of production* intermittency, to the demand side management and the possible related constraints on the network, to provide support for better energy conservation.

* Production: development of Renewable Energies (RES).

- **Production and consumption match:** contribution to the local adjustment of production* intermittency, to the demand side management and the possible related constraints on the network, to provide support for better energy conservation.
- **Raising awareness among consumers and local authorities about the energy demand management:**
  - Free, secure and instructive checking of consumption data.
  - Providing informations for local authorities to develop local energy plan (PCET – Plan Climat Energie Territorial) and efficient energy policies.
- **Securing the power supply:**
  - Optimisation of the MV and LV networks control allowed by an observable and remotely managed network.
  - Provisional management of maintenance work from forecasts, simulations and priority investments thanks to data collection on the grid.
- **Making the incorporation of renewable energy sources easier:**
  - Creation of new connections offers to welcome more RES productions on the MV network enabling to maximise the network potential of integration.
  - Coordination with the decentralized producers to regulate the voltage level on the grid.
  - Production (wind and solar) and consumption forecasts to foresee the local supply-demand balance.
  - Possibility for the electricity supplier to propose pricings and/or services to manage household equipment and to consume when there is local generation.
- **Participating in the electric and plug in hybrid vehicles development:**
  - Coordination between consumers and charging stations operators to contribute to the smart monitoring of charging.
  - Optimisation of charging stations installations considering the potential of integration of the grid.

Enedis participated in the European projects ADVANCED (Active Demand Value And Consumers Experience Discovery) and TRANSFORM (TRANSformation Agenda for Low Carbon Cities) and was also leader of Grid4EU project, made up of 27 partners in 10 countries. Enedis is involved in EnEvO3D, GreenGrid and SmarterTogether. Following Grid4EU project, Enedis coordinates a new European project, InterFlex, with a consortium of 15 partners in 5 countries. InterFlex project brings together 5 European distribution system operators to improve the performance and the reliability of a local electric system by testing new uses of local flexibilities and new solutions of system automation.
Linky, not only a smart meter but also a communication infrastructure

Carry on with distribution network modernisation on the low-voltage grid

Thanks to the Linky smart meter roll-out, Enedis is modernising the low-voltage electricity network making grid monitoring and data processing easier and more efficient. Linky is the first step on the path to smart electricity grids. It is replacing the former meter in residential and professional blocks (with a contract power <36kVA). Its installation contributes to making the network smart by creating a constant interaction between monitoring centres and the grid.

Linky makes it possible to:
- Know better the network condition;
- Detect incidents and reduce in this way the intervention delays (power supply quality);
- Make the incorporation of renewable energy sources and electric vehicle easier on the network;
- Provide precise consumption data to the consumers.

And offers new services to consumers:
- Remote intervention and reduced delays (24 hours instead of 5 days);
- Easier access to consumption data to control it better;
- Bills based on actual consumption and not on estimates;
- Diversified range of pricing offers.

Enedis has prepared a roll-out plan to allow all the consumers on the territory to have the new Linky smart meter. Linky’s industrialization started on December, 1st 2015.

A roll-out plan based on three criteria:
- Provide Linky’s feature as soon as possible to the greatest number of consumers.
- Support the territories’ development projects in a collaborative way.
- Observe an economic and technical optimum.

How is the roll-out plan developed?
- In order to guarantee the economic and operational performances of the project, but also to provide visibility to the corporate partners of Enedis.
- In a progressive and fair manner, in all the regions.
- With the assurance to start the roll-out in all the departments within 3 years, to secure the deadlines and to handle the costs.
- By working with the local employment market.

A roll-out on the whole territory:
- For Enedis, national public service operator, the challenge of the deployment is to progress as quickly as possible on the whole territory.
- Enedis will rely on its territorial grid to offer a strong support to local stakeholders.

Since the end of 2015, a support process will be established for the customers:
- Personal letters for customers, posters in Town Hall, phone support, web site.
- Stakeholders (elected members, associations, lessor, …) will be associated to this process creation and will sustain it.

35 million smart meters will be deployed during 6 years and will replace French people meters

As its mission of DSO, Enedis manages a fleet of 35 million meters (power < 36 kVA). These meters are part of the concession’s contract and belong to the local authorities. Every year, Enedis installs 600 000 new meters and replaces 600 000 old meters, which means 1 million new meters a year.

Examples of mature solutions for the distribution network for 2018:
- Smart Primary substation: transformation system from HV to MV, equipped with numerous advanced sensors (digitised remote control) and communication tools interacting with other parts of the network (regional control centres, smart MV/LV substation, sensors, etc).
- Smart MV/LV substation: transformation system from MV to LV equipped with sensors (electronic and environmental measures) and communication tools towards control centres.
- Medium-voltage (MV) producer equipped with smart objects: located in the connection to the grid, solutions delivering grid state information and level of production information towards control centres and that allow remote intervention.
- Communicating tools that measure in real-time the state of the network (voltage, current, etc).

Towards the digitissed electricity network

The experiments of new technologies led by Enedis should be used to identify the best solutions in terms of choice and roll-out for the local authority.

Even if most experiments will draw their conclusion in 2016 or 2017 only, Enedis is already on its way to prepare actively the roll-out of industrialised solutions.

From the maturity and value analysis, for the grid and the community, of the different « smart » solutions currently tested, Enedis has written its technical roadmap to implement smart solution by 2018.

The industrialisation of smart solutions by 2018 will be decided on a technical platform tested and validated by Enedis teams. This base will be used to develop new customers or local authority offers.

The Enedis roadmap is structured around the three main field of technical activities:
- the remote monitoring of the grid;
- the management and the maintenance of the grid;
- the development, connection, database and mapping.

Observe an economic and technical optimum.
Enedis is a public company that manages the electricity distribution network. It develops, operates and modernises the electricity network and handles the related data. It provides client connections, a 24/7 breakdown service, and carries out meter readings and all other technical operations. It is unconnected with the energy suppliers who sell power and manage electricity supply contracts.