Enedis R&D and Innovation Programme

CONTENTS

REGULATORY PROVISIONS

The French Energy Regulatory Commission (CRE) has implemented an initiative aimed at providing Enedis with the means to conduct the R&D and Innovation projects necessary to design the electricity networks of tomorrow, while guaranteeing that there are no tariff-related obstacles. Enedis operating expenses for R&D, included in the tariff for use of the network, over the 2017/2020 period were €56 million per year on average and are forecast at €57 million per year for the 2021/2024 period. Moreover, every two years, the CRE publishes a report which aims to give electricity sector stakeholders greater visibility of the projects led by Enedis.

Enedis,
a leading distribution system operator
in terms of innovation

Enedis manages 95% of mainland France public electricity distribution network.

This network belongs to local authorities (municipalities or groupings of municipalities) which entrust its management through a public service delegation. Enedis is therefore responsible for two major public service missions:

- non-discriminatory access to the distribution network,
- network modernisation, development, and operation.

Since it was created in 2008, Enedis has been one of the four main European Distribution System Operators (DSOs), with 37 million customers and the management of a large asset base: 2,300 primary substations, 1.4 million kilometres of power lines, and 790,000 secondary substations.

Everywhere in the world, public electricity distribution networks are at the crossroads of environmental, technological, digital, economic, and societal transitions. All of these transitions impact our business activities and the way we work.

In just a few decades, there will be a shift from centralised electricity systems with controllable production that adapts to consumption to a partially decentralised electricity system with intermittent, non-controllable production means, often located near consumers. Local logics will develop to adapt consumption to production as much as possible, with the emergence of flexibility, self-consumption, and storage. Certain autonomy logics will emerge, but this decentralisation will very largely rely on the electricity distribution network which will become the backbone of the ecological transition underway.

At the same time, the deployment of smart meters and the digital transformation have created the new role of neutral data manager for Enedis and have opened up new prospects for major improvements in our industrial performance and the development of new services.

Finally, social expectations are guiding us towards a public service that is closer to regions and more ecological, local, and inclusive.

In this context, innovation is clearly essential.

To meet these challenges, Enedis has built an ambitious research programme which benefits from the expertise of company employees acquired over time and across all regions. It includes a panel of projects addressing major electricity distribution challenges carried out within the company with its own resources by promoting participatory innovation as well as with the support of acknowledged research laboratories, innovative companies, start-ups, or in cooperation with European partners.

Enedis relies on its R&D and its capacity to innovate to carry out its work in an increasingly efficient manner by inventing the network of tomorrow, which will be smarter, more digital, more interactive, and more inclusive to serve customers, electricity market players, and regions.

Enedis
R&D and Innovation programme

Enedis R&D and innovation programme integrates the expectations of all the company stakeholders: customers, market players, local-authorities. It allows, on the one hand, a long-term vision to be developed, technological or societal breakthroughs to be anticipated, new expected services to be identified and, on the other hand, concrete industrial solutions to be designed in compliance with deadlines.

Two main focus are value creation and ability to make operational use of the products and services developed.

Mainly composed of applied research activities and experimental development, supplemented by an open innovation approach to forge cooperation with promising start-ups, the R&D programme is enriched by experiments carried out in demonstrators.

R&D AND INNOVATION PROGRAMME IS MANAGED IN COOPERATION WITH VARIOUS PARTNERS:

- **10 universities and research laboratories**, including EDF R&D, Grenoble INP, L2EP Laboratory of Lille, Mines ParisTech, Ecole Polytechnique, CentraleSupélec, CEA, Datastorm-GENES, Paris Dauphine, Efficacity, etc.
- **50 innovative start-ups and SMEs**
- **100 industrial and academic stakeholders** participating in forty joint smart grid projects (demonstrators, European projects)

The objective of Enedis R&D programme is to address our main challenges. The French Energy Regulatory Commission validated provisional funding of ***57 million euros per year*** *for the 2021/2024 period.*

Seven themes structure Enedis R&D programme:

THEME **1** Transform the operation of distribution systems to facilitate the energy transition

THEME **2** Prepare the Public Service of the 21st century in response to territories expectations

THEME **3** Better meet customer needs and offer new services

THEME **4** Create conditions for electric mobility rapid development

THEME **5** Support the evolution of our business activities and transform our managerial practices

THEME **6** Improve our industrial performance

THEME **7** Make digital transformation a real asset serving Enedis ambitions

THEME 1 Transform the operation of distribution systems to facilitate the energy transition

The energy transition is accelerating: by 2030, 50 GW of additional renewable energies are expected to be connected to our networks, 7 million charging points supplying 5 million electric vehicles, 6 GW of flexibility, 8 GW of self-consumption, etc. The coupling between energy vectors is increasing and the hydrogen sector is the subject of massive state support. Energy communities are developing.

These transformations will very largely rely on the electricity distribution network which will become the backbone of the ecological transition underway. In this breakthrough environment, we must design and deploy new solutions to continue to guarantee the quality of the power supply at the lowest cost. In particular, we need to adapt network development approaches, develop new management tools to identify and control local constraints, prepare for the use of new flexibilities, allow the DSO to play its new role in the management of local systems, and adapt the interface between the Distribution System Operator and the Transmission System Operator.

Flexibility implementation, now a reality

Flexibility is a new lever available to the DSO to resolve network constraints resulting, in particular, from the development of renewable energies. To prepare for their implementation, Enedis has designed methods to identify, develop, activate, and then control flexibility opportunities. Thus, faced with a network constraint, the first step consists in identifying the relevance of resorting to flexibility to overcome it: the technical and economic assessments of two solutions, network reinforcement and ideal flexibility (ideal location with no power or duration limitation) are compared. When the performance of this flexibility is greater than reinforcement, the market needs to be called on to quantify the real source of flexibility, in efficiency and in price, and to enter into contracts with flexibility providers when flexibility "beats" reinforcement - namely, if its collective value integrating the residual non-quality and the service cost is higher. In mid-2020, Enedis launched the first flexibility invitations to tender which led to the first two flexibility contracts.

System safety: a new approach to frequency load shedding

Frequency load shedding is an emergency response, automatically initiated to quickly reduce the power consumed by "shutting down" consuming parts of the distribution network as soon as the frequency drops below a certain threshold. This makes it possible to restore the balance between generation and load, of which the frequency is an indicator on the interconnected electricity system. These actions are carried out in stages, for example, by offloading 20% of national consumption from 49 Hz, then an additional 20% from 48.5 Hz, etc.

Enedis research work with Grenoble INP for a thesis defended in 2020, made it possible, on the one hand, to propose innovative methods to increase the number of stages without modifying the existing load shedding equipment, and, on the other hand, to rely on stochastic approaches to better choose the parts of the network to shut down, which is a growing challenge as power flows are increasingly variable.

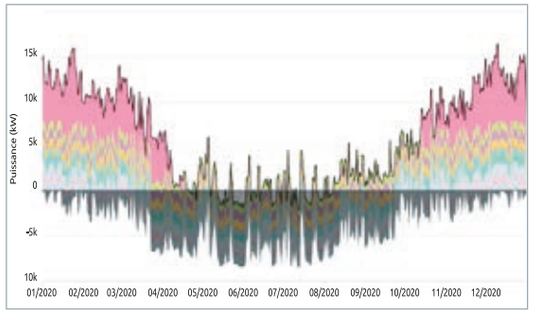
Better forecast the development of power flows to anticipate the adaptation of networks

In the context of the energy transition, the profound and rapid development of the use of the network with the increase of renewable energy production, self-consumption, and the electrification of new uses requires electricity flow anticipation methods to change.

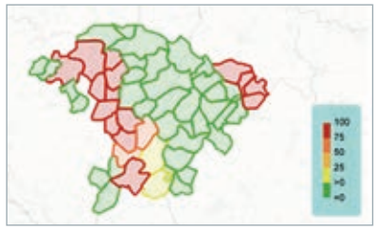
Thus, to shed light on the future and consider the next challenges of the temporality of the use of networks in consumption and production, R&D developed a scenario generator with correlated variables (temperature, cloudiness, and wind) at the scale of a delivery point substation.

This platform was used, in particular, to assess the challenges of optimising distribution network sizing in areas to accommodate new renewable energy production sites.

Load curve **scenarios**



Identified **local network** constraints



Hydrogen: first studies on the impact of the hydrogen sector on the distribution network

The possible significant role of the electrolytic hydrogen sector in reducing the carbon intensity of part of our economy, through its linking with the electricity sector, has led Enedis to study the impact of developing and integrating H2 technologies and systems (electrolysers, storage, and fuel cells, in particular) in the electrical system.

In cooperation with CEA-Liten, Enedis, through simulations and experiments in various configurations, assesses the consequences of the future deployment of H2 systems, serving energy transition and electric mobility, on the distribution network's development and operation.

In addition, Enedis plans to assess various mobile hydrogen generator technologies as an alternative to diesel generators in order to reduce CO_2 emissions and noise pollution.

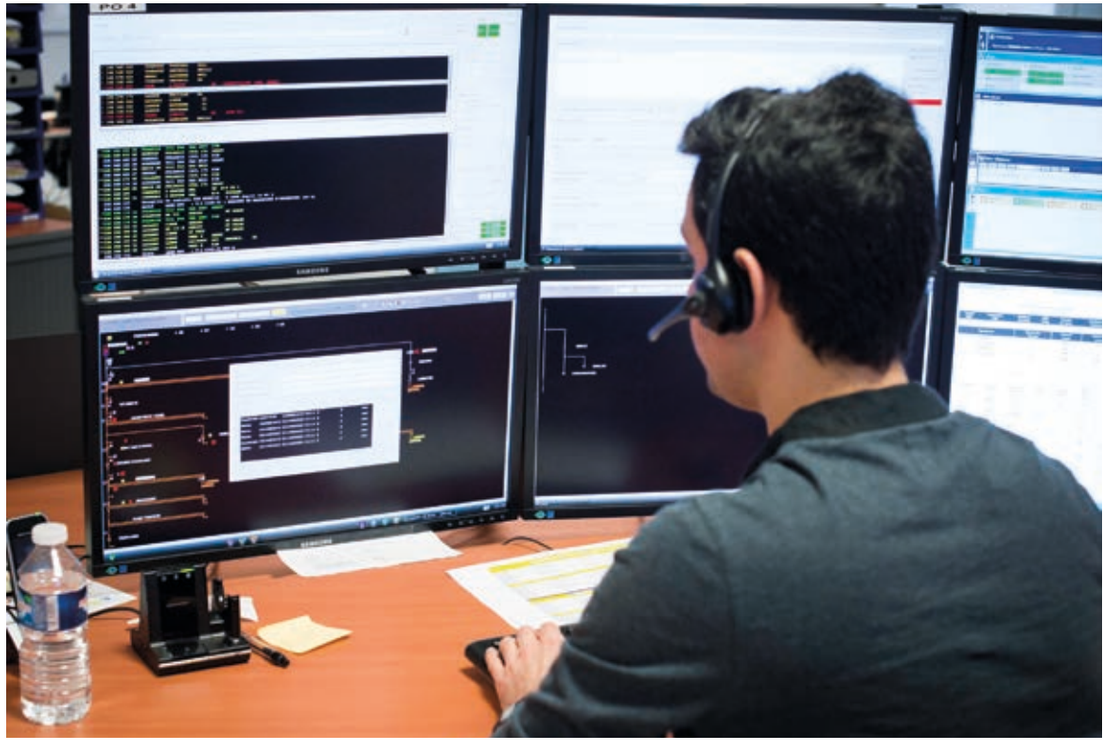
Adapt protection plans to renewable energy development

The increasingly massive connections of renewable energy sources reveal new challenges, in the event of a fault on the network, for the protection of goods and people.

The traditional approach was to detect and eliminate separate networks, which can appear in the case of local balance between consumption and generation but are unstable and less efficient in terms of electrical safety.

R&D work on storage and smart grid infrastructure is opening up a new path, consisting in controlling these "electrical islands".

However, there is still some way to go before being able to offer this type of operation on the distribution network at an acceptable cost for the community.



THEME 2 Prepare the public service of the 21st century in response to territories expectations

The 21st century will be the century of ecological transition. We have no alternative, we must control our CO_2 emissions and, more broadly, protect our planet. We need to turn good intentions into actions. Shifting from the energy transition to the ecological transition means adopting a new economic and social model that renews how we consume, work, and live together.

We will make the ecological transition our priority. In particular, we are committed to reducing our carbon footprint by 20% by 2025 and achieving carbon neutrality by 2050. Our R&D actions will help meeting this objective, reducing the impact of our activities on the environment, preserving biodiversity, and developing the circular economy.

Focused on the regions, we will design and offer solutions adapted to the expectations and issues of each. We will develop the public service of the 21st century, an augmented public service that meets CSR expectations.

Energy dashboards

Energy dashboards now meet the needs expressed by local authorities to analyse and measure the effects of their energy policy at the level of different geographic areas: city, district, or even portfolio of sites. The development of these dashboards involves defining energy indicators to monitor and guide decisions for communities and to measure collective ecological transition actions for residents.

Enedis is currently working on the deployment of a dynamic space for the provision of data allowing communities to monitor their consumption.

Validation of vacuum circuit breakers

Sulphur hexafluoride (SF6) has long been used for electrical insulation and current interruption in medium and high voltage switchgear. While its electrical qualities are undeniable, SF6 has a global warming potential 22,800 times higher than CO_2.

Therefore, Enedis has initiated a technological transition to vacuum circuit breakers for medium voltage circuit breakers in primary substations. In this technology, the current is interrupted by opening a contact in a high vacuum, and it has the advantage of not presenting any toxicity and ecotoxicity risks. In order to achieve an industrial solution, Enedis carried out investigations, supplemented the requirements of IEC standards with specifications necessary for the integration on our network and initiated the necessary developments. These solutions are deployed on the networks since 2021 and constitute the new technological standard for HV/MV substations in the years to come.

Testing of low-carbon mobile power solutions

In various regions, Enedis has begun testing low-carbon mobile power solutions, in the form of batteries or hydrogen fuel cells, to replace or supplement conventional diesel generators used to temporarily supply electricity to customers during network maintenance work.

Ultimately, Enedis aim is to deploy these solutions countrywide, thus helping to reduce the carbon footprint and local nuisances (such as pollution and noise) linked to its activities. These innovative solutions also aim to allow renewable energy facilities to continue producing during maintenance work.

THEME 3 Better meet customer needs and offer new services

Our customers expect a high-performance service and efficient communication from Enedis, especially during connection and maintenance work, as well as in the event of incidents. Our customers also expect new services, particularly regarding the digital revolution and the ecological transition.

To become France preferred Public Service, we must improve our relationship with our customers. We will design new solutions to improve their satisfaction with our core business activities and to anticipate their expectations. We will also aim to develop new services and respond to the emergence of new uses.

In particular, our work will contribute to our commitment to halve connection time for customers by 2022 and to allow all our customers, thanks to smart meters, to monitor their consumption and benefit from an innovative offer from their supplier.

AI solutions to better meet customer expectations (e-coute, voicebot, etc.)

Enedis is developing solutions based on AI technologies to improve customer reception and complaints handling. Thus, a tool called “e-coute” has been tested. It allows, thanks to the detailed analysis of customer verbatim, to better classify complaints and direct them to the right advisers and support the latter in responding.

In addition, the “Customer Relationship AI” project offers a series of tools designed to improve responses to customers, regardless of the channel through which they made their request. A chatbot, a chatlive, and a cognitive search engine have already been deployed; a voicebot will soon be tested. They all facilitate the work of advisers, improve the quality of their responses, and facilitate the customer experience.

All of these solutions are being integrated into the Enedis complaints management tool.

Anticipate the impact of new uses on supply quality through AI: a harmonic risk estimation model for LV networks

To assess the risk of medium and long-term harmonic disturbances associated with the development of new uses (in particular electric vehicles, photovoltaic panels, and heat pumps), a model based on machine learning algorithms has been developed.

This model makes it possible to estimate the harmonic levels that these new uses could generate at community level.

This model is expected to be continuously enriched by integrating penetration scenarios for new uses and by refining the modelling of their harmonic disturbances, in particular through campaigns to measure harmonic emissions and their propagation on distribution networks.

THEME 4 Create conditions for electric mobility rapid development

Reducing air pollution, reducing the carbon intensity of transport, ecological transition, etc. are social issues that the public authorities have largely taken up, in particular by promoting alternative mobility. Under this impetus, the development of electric mobility, according to all forecasts, will be particularly sustained, by 2035, all over France.

This increase in the number of electric vehicles in the fleet will mechanically increase power demand due to new charging needs. However, electric vehicle batteries are also a useful source of flexibility for the electricity distribution system. The electricity system management must therefore adapt and, in particular, allow complex interactions between many stakeholders.

As such, the development of solutions facilitating electric mobility is an R&D priority for the coming years.

Assess the impact of charging on 50 Hz wave quality

Guaranteeing its customers electricity that meets quality requirements is one of Enedis missions. New use involving power electronics, electric vehicles are likely to deteriorate wave quality. Conversely, certain harmonic or high frequency disturbances can affect charging service quality. Measurements are thus carried out to characterise the behaviour of many electric vehicle models, including those in the Enedis fleet, and, in particular, to ensure that the massive deployment of electric mobility will not deteriorate the quality of the voltage wave supplied to customers.

Tests include emission measurements in the harmonic and supra-harmonic bands and immunity tests under different power supply conditions (normal or degraded, smartcharging, etc.).

Anticipate charging needs and impacts on the distribution network

To support the development of long-distance electric mobility and meet the electricity demand associated with electric vehicle rapid charging infrastructure on motorways, Enedis and RTE (the French Transmission System Operator) conducted a joint study to anticipate the adaptation of networks. The study shows that motorway charging will have a limited impact on annual national peak consumption but, demand in certain motorway service stations could locally reach 5 MW in 2028 and then 16 MW in 2035, leading to network reinforcements which Enedis is preparing for.

The power requirements for charging electric vehicles in residential or commercial car parks are also important. R&D work should make it possible to consolidate the load factor to be applied to optimise facilities. The models are compared to field experiments, in particular through the aVEnir demonstrator.

A third research line concerns heavy mobility charging needs: Enedis is anticipating the impact on the network of the electrification of bus depots, dynamic charging on the E-highway, etc.

Prepare charging management

As of now managing electric vehicle charging can generate value for the end user as well as for the electricity ecosystem and its stakeholders. It should help reduce the impact on the electricity system and avoid over-investment in electricity networks.

Through the aVEnir demonstrator, Enedis is testing smart charging solutions with ecosystem players and experimenting with the flexibility provided by electric vehicles.

Enedis is therefore studying how network infrastructure can transmit messages to charging sites to modulate charging in order to respond to specific and local network constraints or to facilitate synchronisation between photovoltaic production and electric vehicle charging on behalf of stakeholders.

THEME 5 Support the evolution of our business activities and transform our managerial practices

Mobilizing everyone is at the heart of Enedis Industrial and Human Project. In a context where the ecological transition and the digital revolution are changing our business activities and where social transformations have an impact on expectations both within the company and externally, we have set ourselves the objective of reinforcing confidence and refocusing our organisational methods on initiative and employee accountability.

We must innovate to permanently eradicate serious and fatal accidents within our teams and those of our service providers, give more leeway to local managers, and guarantee our current and future skills. We will combine the contributions of social sciences and digital technology to prepare for changes, improve performance, and support transformations.

Exoskeletons to support technicians in the field

The work carried out by Live Work team technicians is physically demanding and, in some cases, can cause musculoskeletal disorders due to repetitive movements and the carrying of loads with raised arms. In 2018, Enedis and the Tarbes-based start-up Human Mechanical Technologies (HMT) partnered to develop an exoskeleton for technicians. The Plum' exoskeleton reduces fatigue by relieving shoulder, neck, and back muscles with support ranging from 3 to 5 kg per arm. Thanks to user feedback, the exoskeleton has constantly evolved. Plum' is the world's most compact and lightweight exoskeleton for overhead work, weighing 1.6 kg.

Training in the age of multi-modal courses

Far from classroom training as a quasi-exclusive training method, today, multi-modal courses comprise units that can integrate all educational methods: individual or group, synchronous or asynchronous, assisted by digital technology or not, remote, classroom, and on the job. Such pathways should promote the acquisition of knowledge and skills that will be useful and relevant for the future work situations of employees. Enedis has started work to better understand the overall functioning of trainees following these courses to determine the configurations, combining dispositions, contexts, and practices that facilitate individual learning processes.

Augmented reality supporting technicians in the field

Enedis invested in artificial intelligence as a lever for the performance and safety of operations in the field very early on. In addition, agile development methods make it possible to define, explain, and share needs directly expressed in the field and to have ergonomic solutions adapted to needs more quickly. The "Dataposte" application strengthens the experience of collecting information in the field and allows technicians and service providers to quickly characterise equipment in MV/LV substations through image recognition. Another example is the "RDD Client" solution which allows the technician to view the underground network in augmented reality, day and night, allowing them to be more responsive during troubleshooting.

OTELO: Robotics serving live work

The key robotics technologies are experiencing spectacular advances: development of artificial intelligence, sophistication of sensors, improvement in battery efficiency, IoT, 5G, etc. This statement has led Enedis to study how robotics can contribute to its activities, particularly in terms of performance and safety. Live work on 20 kV overhead networks which maintains optimum quality of service during maintenance operations is a promising area for the use of robotics. Controlled directly by an agent on the ground, the prototype robot OTELO developed by Enedis should therefore be able to perform 60% of live work in the long term and make traction work during live work possible, which was not the case previously.

THEME

6 Improve our industrial performance

Enedis is committed to having one of the best value for money services in Europe by 2025 and to restoring electricity to 90% of customers within 48 hours in the event of a major climatic event on the network.

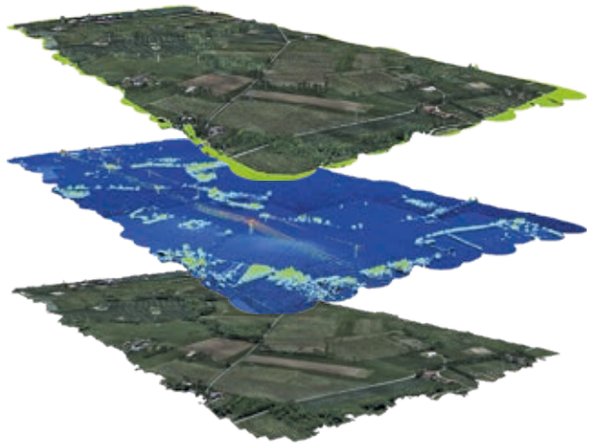
To meet these commitments, we will design and develop innovative solutions to have high-performance components; to manage our assets as effectively as possible; to observe, control, and operate our MV and LV networks; to forecast the electricity balance; and assess losses. We will ensure network resilience in a context of climate change and the interdependence between the electricity system and the IT system.

Image recognition serving scheduled refurbishment

Enedis started R&D on image recognition very early on to automatically identify equipment and anomalies on overhead networks.

As a result of this work, it was possible to initiate the industrial application of these artificial intelligence methods to support the scheduled refurbishment of these networks. In addition to defining the portions of networks to be inspected, the platform implemented allows all photographic data to be collected and centralised and the diagnosis, based on the AI analysis of the images (nearly half a million photographs integrated), to be automated.

Thus, the establishment of investment programmes and their prioritisation have been accelerated to improve the quality of supply for customers.



Big data to optimise MV underground lines renewal

After the success of Big Data methods applied to targeting LV underground cables replacement, Enedis extended its work to MV networks which are more complex.

Even if Enedis has been replacing the oldest and most incident-causing technologies for years, it is important to be able to identify as precisely as possible what needs to be replaced in priority. So far, conventional methods based on key features of these structure have been used to develop replacement strategies.

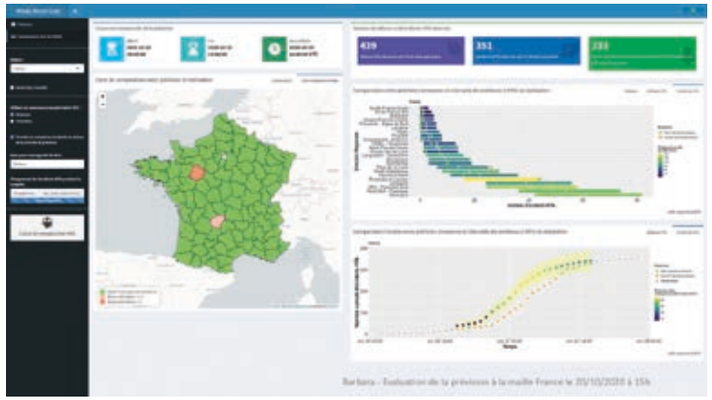
Today, as for LV networks, an approach based on massive data processing has been developed and successfully applied: this allows all the data available to be used to feed self-learning algorithms for more precise targeting of the structures to be replaced.

CartoLine, the new “Predictive Maintenance” tool for Enedis LV networks

The Cartoline tool, developed by Enedis R&D, uses the mass of data relating to the voltages observed by Linky meters to significantly improve the management of predictive maintenance on the low voltage network.

For experts, it offers a Dataviz interface facilitating data analysis. Above all, artificial intelligence runs these analyses in “supervised learning” first and then is able to conduct them autonomously.

These analyses aim to identify situations reflecting a voltage anomaly or a future incident that could lead to a power outage on the LV network. The question answered by CartoLine can be summed up simply as this: does the voltage data observed require the intervention of a field technician to be scheduled to avoid a breakdown?



Predict the impact of storms with Windy

Predicting electricity network incidents caused by a windstorm with 90% accuracy was a challenge not so long ago.

Today, it is a reality with the Windy tool, which converts weather forecasts into future impacts on the MV network.

Windy is a real breakthrough in climatic hazard preparation: it makes it possible to optimise and anticipate the crisis management resources. This increased anticipation is part of Enedis commitment to restore supply to 90% of customers within 48 hours in the event of a major climate incident.

Thus, the tool proved its worth during storm Barbara in 2020: the forecasts turned out to be almost perfect 12 hours before the start of the storm and enabled Enedis Regional Departments concerned to adapt their crisis management and anticipate the resources needed to cope with the climatic episode.

IoT serving network performance

The development of connected objects has opened up new perspectives for electricity network performance.

With new sensors, associated with low-cost telecommunications means, new information enriches the business processes related to electricity distribution network operation, management, maintenance, and development.

Solutions have been imagined, developed, and deployed in several areas: status diagnosis of primary substation transformers, network operation - including communicating fault indicators, flood detectors, and surge arrester status indicators – and mobile generator operation.

The data collected in real time improves the responsiveness of repairs during incidents on the electricity network and the data collected in deferred time feeds algorithms to target maintenance.

THEME

7 Make digital transformation a real asset serving Enedis ambitions

With 35 million Linky meters, 770,000 concentrators, soon 30,000 communicating objects connected to the network, 110,000 remotely controlled devices, 63 Open Datasets, 22 million text messages sent to its customers in 2020, Artificial Intelligence-based solutions already in use in numerous industrial processes daily, and a third of the 2020 R&D projects using AI, Enedis has initiated the digital transformation of its business activities.

However, this transformation has only just begun. Data collection, transmission, storage, and processing as well as data security have become central missions and skills for the company and we must anticipate future breakthroughs, increase the resilience of Information System at the heart of a now cyber-physical system, and facilitate exchanges with external stakeholders. We must make full use of the solutions offered by advances in artificial intelligence. We must also design solutions to preserve the place of humans in a digital world.

Dynamic profiling serving the market: a successful implementation

Since 4 July 2020, the dynamic profiling model used to balance the electrical system and determine the half-hourly flow of electricity by Balance Responsible Entity (BRE) has been implemented on almost all 37 million sites (LV customers ≤ 36 kVA) and in all flow reconstitution processes. Dynamic profiling reduces half-hourly energy allocation uncertainties between BREs by a factor of 2, which can represent several GW.

The service provided "to the market" was also significantly improved by a D+1 Open Data publication of the dynamic coefficients of day D, in anticipation of the regulatory values calculated and published in W+1, which was set up in March 2020. In particular, during the Covid 19 crisis, these values made it possible to conduct responsive analyses to measure its effects on electricity consumption by major categories of customers.

Geodescriber: tell me a story based on my "data"

A method and a prototype for automatically generating a short text describing the characteristics of a geographical area from a pool of available information have been developed. More precisely, the GeoDescriber tool generates a short text summarising the main characteristics of residential consumption, annual production, and habitat of a geographical area, taking into account its surroundings and history. The texts generated are being integrated to enrich the data services offered by Enedis to local authorities and, in particular, the "Regional Energy Balance" service.

5G: use cases and work in progress

5G technology is presented as one of the pillars of the factory of the future. Enedis therefore undertook to study and assess its impact on its business activities. To do this, Enedis entered into a partnership with Orange, Nokia, and Schneider Electric and, within this framework, initiated a process to explore and define the relevant 5G use cases for Distribution System Operators. This first step will be followed by an experiment in Marseille, a 5G pilot city for Orange and Nokia. In particular, Enedis and its partners will assess 5G solutions to maintain and operate networks and adapt them to the energy transition.

Power Line Carriers G3: contribution to performance development (dense environment, hybrid profile, standardisation progress, etc.)

With 35 million meters communicating through Power Line Carriers (PLC) expected at the end of 2021, Enedis will develop and maintain in operational condition this telecom network covering 100% of its territory for the next 20 years. In anticipation of the future uses of the Linky system, driven by the energy transition, Enedis has worked on optimising PLC performance in dense configurations to guarantee a high and consistent level of reliability across all electrical configurations in the country. Research work carried out with the G3-PLC Alliance and Grenoble Alpes University has made it possible to define new mechanisms reducing, by up to 90%, the number of messages required for the proper functioning of the PLC network in dense urban configurations. To secure the use of powerline frequency bands in the long term, standardisation work has been extended, and an international compromise was finalised in October 2020 to limit electromagnetic disturbances produced by devices in residential installations.

Experiment with **smart grid demonstrators**

To go beyond studies and research projects, it is necessary to experiment different smart grid solutions, in actual conditions, in a system approach.

The objective of the Enedis smart grid demonstrator programme is to integrate these results into a global vision of the network of the future.

FRENCH DEMONSTRATORS

The demonstrators are located all over France in order to test the various possible local contexts; a number of them are supported by ADEME (French Environment Agency). Over a hundred partners, representative of the diversity of stakeholders concerned by the development of smart grids, work on these various projects together.

The table below shows some examples among the thirty or so demonstrators in progress.

PROJECT	DURATION	DESCRIPTION
Autogreen	2020 – 2028	DC network test in a real estate project with high environmental quality.
aVEnir	2019 – 2022	Experiments with “smart charging” business models.
SO MEL	2017 – 2022	Local electricity system optimisation through the management and use of flexibility.
SMAC	2018 – 2022	Synchronism between renewable energy generation and electric mobility in Champagne-Ardennes.
St Nicolas des Glénan	2018 – 2020	Support for the creation of the first area 100% powered by renewable energy by 2021.
Smart Occitania	2017 – 2020	Experimentation of new technical and educational solutions to support the energy transition in rural areas of the Occitanie region.

aVEnir

The aVEnir project, supported by ADEME and coordinated by Enedis, aims to support the large-scale development of electric mobility by experimenting with the interactions between the public electricity distribution network, charging stations, and electric vehicles. It covers the technological, economic, sociological, organisational, and legal aspects related to EV integration.

As part of this project, Enedis signed a consortium agreement with nine industrial partners and two academic partners, representing the major trades and experts in the French electric mobility sector.

EUROPEAN DEMONSTRATORS

Enedis is involved in several European projects co-financed by the European Union and in cooperation with international partners, electricity market, communication, and information technologies stakeholders, innovative start-ups, research organisations, universities, etc.

PROJECT	DURATION	DESCRIPTION
INCIT-EV	2020 – 2023	Development of the technologies necessary to meet the expectations of users and communities for the deployment of electric mobility. Enedis is particularly involved in experiments on dynamic inductive charging.
IElectrix	2019 – 2022	Connection of renewable energy generation facilities to the network, as part of energy communities, in Europe and India.
ONENET	2021 – 2023	Design of an IS architecture that allows the European electricity system to function as a single system in which several markets operate.
interconnect	2020 – 2023	Implementation of interoperable digital solutions to adjust the electricity consumption of buildings according to the electricity network's needs.
RESPONSE	2020 – 2025	Development and testing of innovative and integrated solutions to contribute to the deployment of "positive energy districts" in Europe by 2050.
SBI Smart Border Initiative	2017 – 2020	Optimisation of the distribution system by setting up a cross-border Smart Grid (France/Germany) mobilising the flexibility provided by multi-energy coupling and electric vehicle charging.

ONENET

The OneNet project is part of the European H2020 call for projects on the "TSO-DSO-Consumer" theme. Its purpose is to conduct large-scale demonstrations of innovative network services using energy, storage, and distributed generation, to design an IS architecture that allows the European electricity system to function as a single system in which a variety of markets operate. It brings together a consortium of 72 partners, including Enedis, which is a member of the Project Management Team. The OneNet project's French demonstrator aims to coordinate the use of flexibility between Enedis and RTE (the French TSO) and sets up a framework of trust between the different stakeholders via a blockchain solution.

Academic partners
to deepen leading-edge topics with the best experts

A dozen universities and research laboratories have been chosen for the excellence of their teams under a structured partnership policy.

Examples

Grenoble INP

Privileged partnership - SmartGrid Chair
- Integration of renewable energies and network operation
- Big Data for electricity networks
- Training in SmartGrid skills

MIAI Grenoble Alpes

MIAI, Interdisciplinary Institute of Artificial Intelligence of Grenoble - AI and energy Chair
- Robotisation of complex tasks,
- Advanced processing of DSO's data

efficacity
- Smart territories
- Labelling of eco-districts

MINES ParisTech / ARMINES
- Consumption forecasting models and application to regional energy policies

CentraleSupélec
- Insertion of electric vehicles

ÉCOLE POLYTECHNIQUE
- Climate change

DAUPHINE UNIVERSITÉ PARIS
- Regulatory and economic issues

cea
- Prospects for hydrogen-power network interactions
- Microgrid simulations

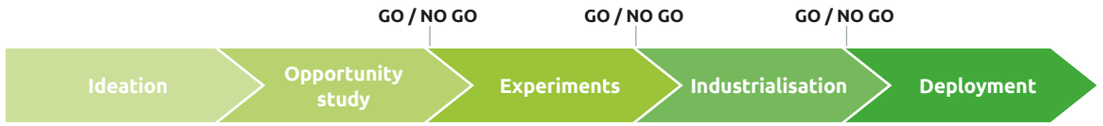
Open Innovation
at Enedis

Enedis wishes to accelerate the new solutions development process.

This is why, in addition to its R&D and demonstrations, Enedis has relied on start-ups and innovative SMEs, for several years, to identify and experiment with new solutions in view of improving the performance of the various distribution business lines, training or on-the-job support tools, works safety, customer relationships, etc.

The agility of the partners, the complementarity of their skills with those of Enedis teams and the stimulation of collective intelligence are the strong points of this initiative.

AN END-TO-END PROCESS



Sterblue ***...to diagnose the overhead MV network***

Each year, Enedis inspects over 110,000 km of lines, almost three times around the earth. Automated analysis techniques therefore represent an interesting opportunity to improve performance. This is why Enedis has assessed the maturity of solutions for detecting anomalies on the overhead MV network lines with the support of companies at the forefront of these technologies, which are at the crossroads of data sciences, computer science, and robotics. At the end of the experiments, the performances were deemed suitable for operational use to support the diagnosis for the planned renovation of the network.

DATAKEEN

...to improve customer relationships

Thanks to the use of the start-up Datakeen's platform, Enedis can automatically sort tens of thousands of customer verbatims in a few clicks.

Thus, the Customer Relations Department is able to better understand and know customer issues and can define concrete action plans and prioritise them in order to better meet customer expectations to better serve them.

INTERVIEW

Kévin REGI, CEO of HMT

A Tarbes company and winner of the Enedis start-up competition in 2018, HMT (Human Mechanical Technologies) developed its Plum' exoskeleton, suitable for MV works technicians during live work, in partnership with Enedis. This "made in France" project was achieved thanks to the quality of the region's industry and the specific expertise at HMT. There are currently 25 exoskeletons in use at Enedis.

How has the project evolved since winning the Start-up competition in 2018?

Thanks to various user feedback since 2018, we have been able to adjust the exoskeleton. Adapted to each body type while allowing each employee to carry out their technical gestures, Plum' now helps limiting physical exertion. The different opinions pushed us to improve our product. As such, its weight has been reduced by a third since the first prototype, officially making Plum' the world's most compact and lightweight exoskeleton for overhead work with a weight of 1.6 kg.

What, in your opinion, makes Enedis support unique?

Enedis support stands out by the availability of our various contacts, whether they are innovation managers in the regions or technicians within Live Work teams. Regular discussions with Enedis have enabled us to quickly adapt the solution to the needs of technicians.

The key to the success of Personal Protective Equipment (PPE) projects is acceptance by field teams. Enedis greatly facilitates this phase of acculturation and agent training in the use of our exoskeleton, which explains, in particular, the success of its deployment.

Our partnership with Enedis has enabled us not only to improve Plum' for all our customers, but also to gain visibility. These various opportunities and exchanges between Enedis and our teams enabled us to optimise the exoskeleton and assert our position on the market.

Enedis is a public-service company managing the electricity-distribution grid.
It develops, operates and modernises the electricity grid and manages the associated data.
It performs customer connections, 24/7 emergency interventions, meter reading and all technical interventions. Enedis is independent from the energy providers, which are responsible for the sale of electricity and the management of the supply contract.

Find us on the Internet

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