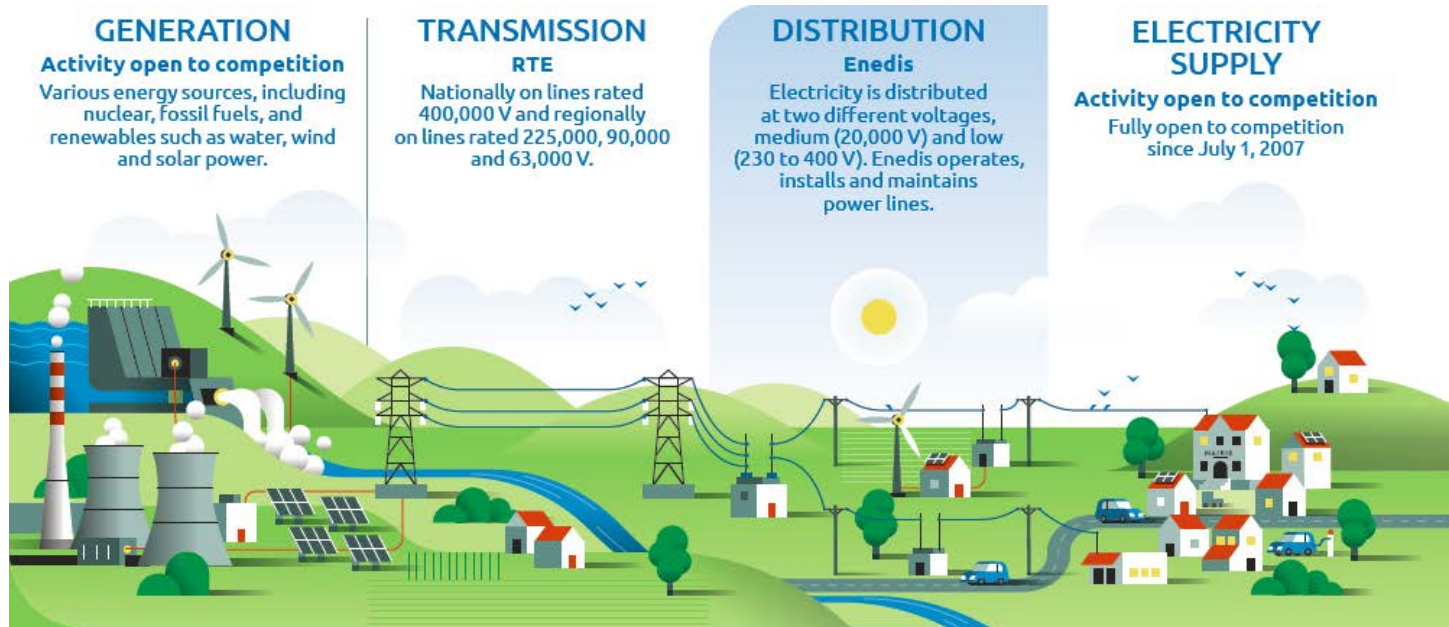


A new business model for the French DSO Enedis enabled by Smart Grid

November 6th, 2019

Enedis, the essential grid of the French electricity system



Enedis in a nutshell – Key figures



€ 14,413 bn revenue in 2018

36 million customers

Interventions 24 hours a day

38,691 employees

410,710 generation facilities connected to the distribution grid in France

- ✓ **More than 21 million Linky *smart meters*** deployed as of September 2019
- ✓ **21 GW DRES*** connected to MV and LV networks by the end of 2018 (13 GW wind farms and 8 GW PV plants)
- ✓ **1.35 million km MV and LV networks** operated by Enedis (40% of underground cables)
- ✓ **€ 4 billion investments** in 2018
- ✓ **SAIDI** (exceptional events and transportation failure excepted): ≈ **64 min** in 2018

Major societal, digital and environmental challenges for the Distribution System

More frequent and severe climatic events

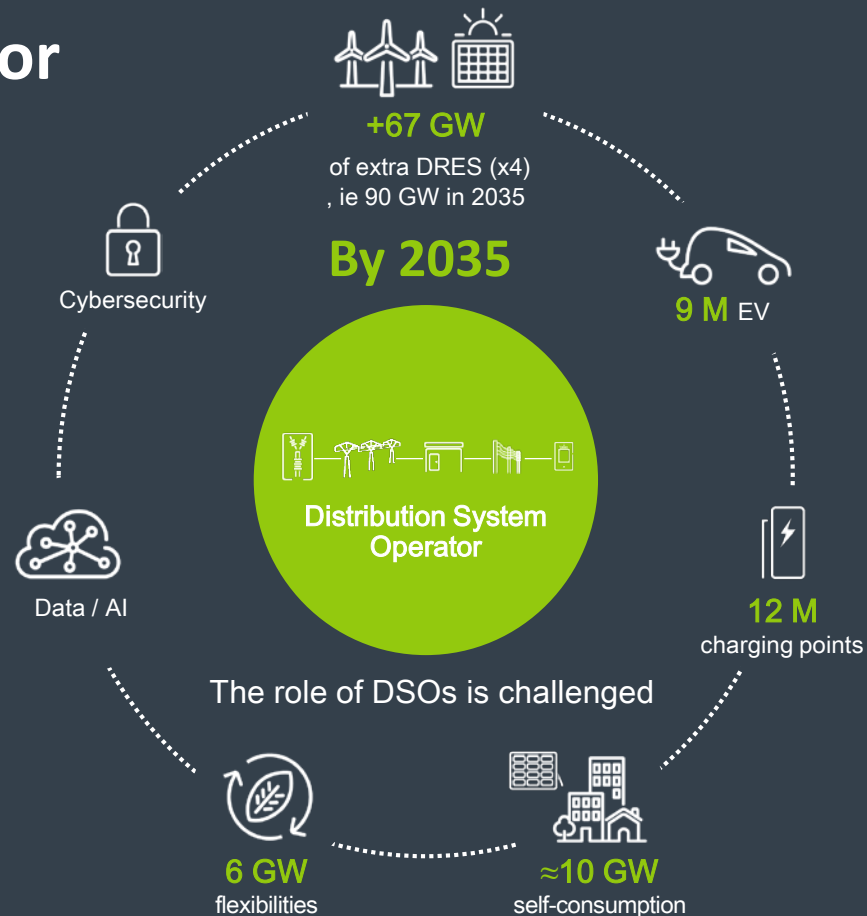
Faster development of renewable energies

Development of new uses: electric vehicle, storage,...

Emerging trend towards consumption of local generation: self-consumption, local energy systems and communities,...

Growing expectations from local authorities and territories in the field of energy with digital solutions everywhere

And 35 million Linky Smart Meters deployed by 2021



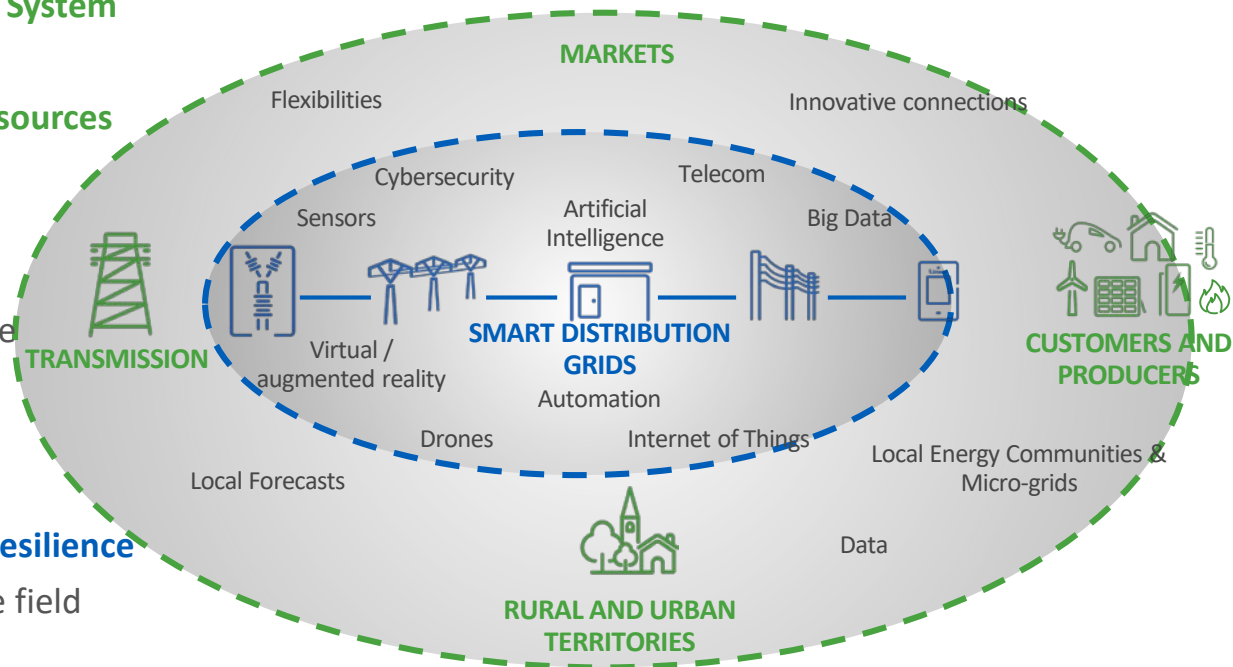
Transformation towards a new D.S.O. business model for Enedis enabled by smart grid

New roles driven by **Energy Transition and Digital revolution**

- Contribute to the Safety of the **Power System**
- Providing power **data to stakeholders**
- Facilitate **integration of renewable resources** and optimise local energy potential
- Enable the **development of EV** and decarbonated mobility

Modernise infrastructure and strengthen the **network's operating performance**

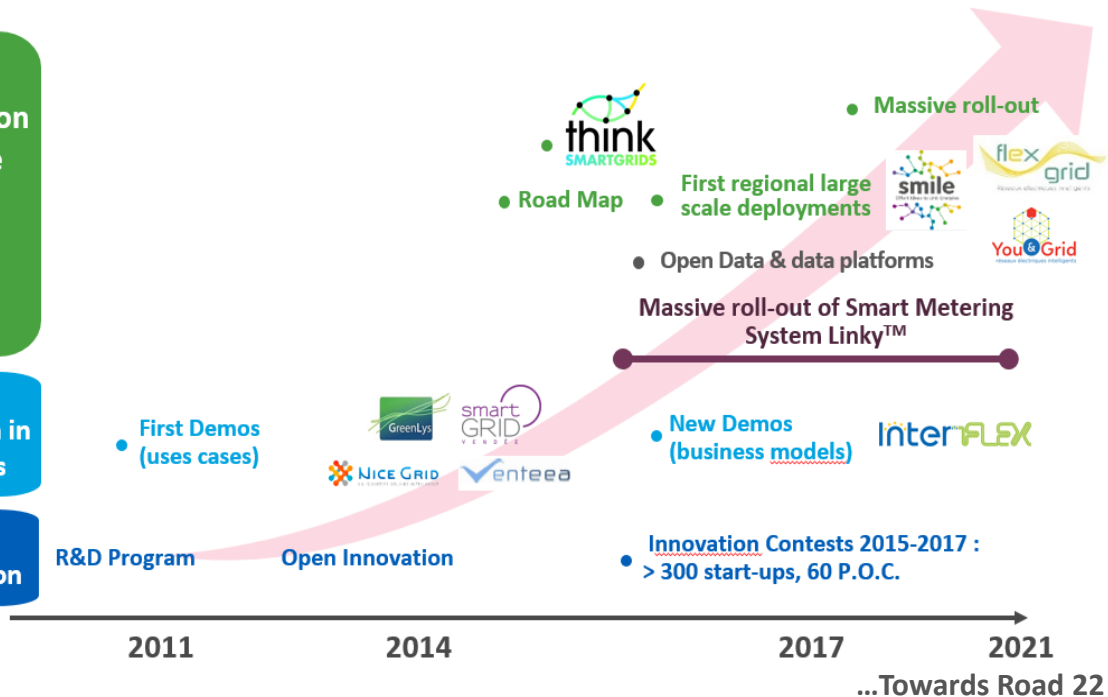
- Optimise **industrial assets**
- Develop the system **observability**
- Improve power quality and **network resilience**
- Secure **safety and performance** of the field interventions



Enedis and French Smart Grid Sector : from demonstrators to massive roll-out of smart grids solutions

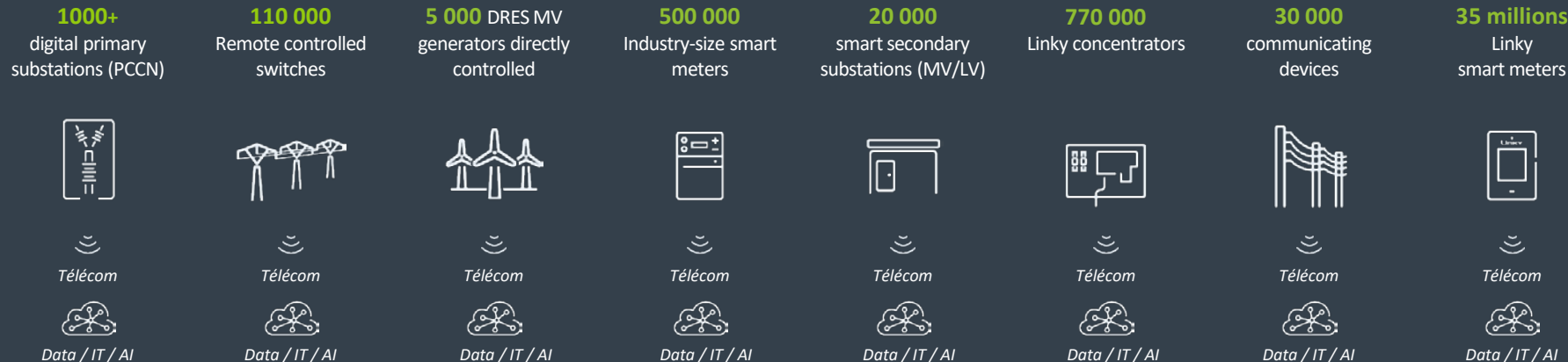
Enedis has adopted a 3 step approach :

- A development based on an incremental, industrial approach and **Open Innovation**
- A return on experience shared with partners through **experimentations** and **European Demonstrators**
- **Industrialisation and targeted roll out** of the best technical and economical smart grid solutions, especially in the West and the South-East of France



Enedis: massive digitalisation of the distribution grid by 2022

Observability and automation through new, smart sensors including Linky.

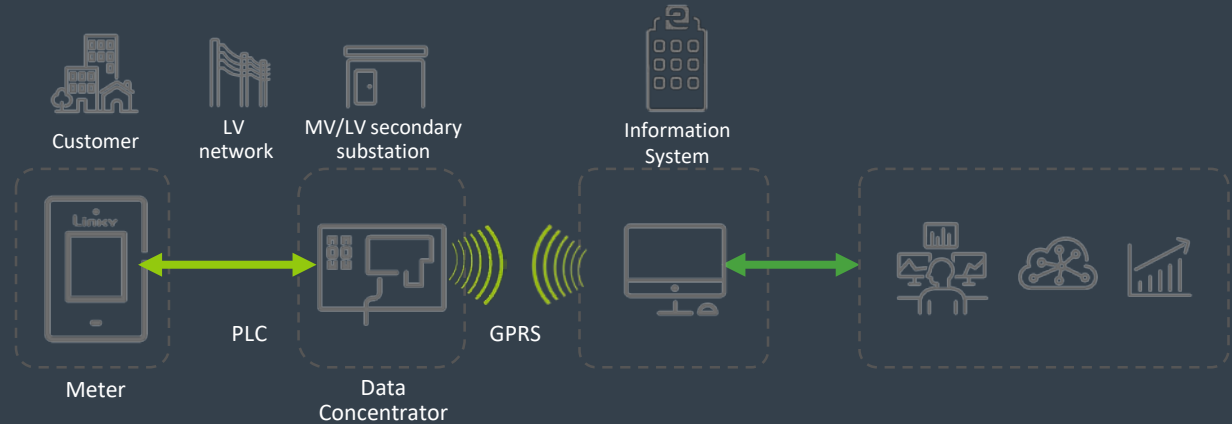


With growing supervision and maintenance for IT and Telecom infrastructure

Linky smart meters system : a pillar of smart grid

Take advantage of the **technical possibilities offered by Linky Advanced Metering Infrastructure**

to improve network development, operations, and quality of supply



1 Use the communication system to collect data from meters and data concentrators

2 Qualify and process measurements, to convert them into alarms

3 Use alarms/measurements

- to detect and manage faults on LV or MV networks,
- to improve quality of supply monitoring
- to improve network planning
- to update databases and cartography

Overview of distribution grid services based on Linky AMI



MV operations

- Transmit remotely information from sensors / fault detectors
- Be notified of the power loss of a Data Concentrator



LV supervision

- Detect and locate an overvoltage situation
- Be notified of a fuse failure or a phase loss



Customer Call Management

- Interrogate remotely a meter to perform a diagnosis in case of a customer call



Quality of supply

- Process customer complaints faster and more efficiently
- Identify solutions to solve quality of supply anomalies through field interventions



Cartography & databases

- Improve the reliability of customers geographic position and their association to network assets

Smart solutions for better network performance

NEW NETWORK SERVICES USING LINKY



Benefit from all the possibilities of Linky for the network

- Detection and analyze of MV and LV faults (LV individual power outage, MV or LV collective power outage...)
- Enriched quality of supply monitoring with data from Linky smart meters

IoT & BIG DATA



New sensors
Data analytics
AI

- Detection of : fault indicators, flood, connected power generators
- Optimised asset management : maintenance and investments

INNOVATIVE TOOLS FOR FIELD OPERATORS



Drones, virtual reality...



- Improved training and professionalization,
- Reinforced security of the interventions,
- More efficient collection and input of the data

Smart solutions for Grid Users and renewable resources integration (1/2)

Enedis develops innovative grid connection solutions designed for Grid Users

Manage renewable resources
impact on the distribution system



Alternative
Grid
Connection
Offer for MV
Producers



Local voltage
regulation law
for MV Producers
integrated
in network planning
tool

Assess network constraints generated
by grid connections



Web Portal for simplified grid connections
feasibility studies available for LV producers and
consumers

Smart solutions for Grid Users and renewable resources integration (2/2)

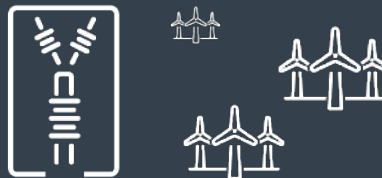
Enedis facilitates DRES integration

Anticipate networks constraints and provide Enedis with a vision of network operations for the benefit of Grid Users



Operational Planning for work programmes
deployed in 29 Regional Dispatching Centres

Control voltage on the MV network in a dynamic way in the presence of renewable energy



Dynamic MV Voltage Control
experimented at 10 HV/MV primary substations

Conclusion and key messages



- Moving towards 2.0 network, **Enedis has successfully rolled-out 21 million Linky smart meters** in France in September 2019 with a target of 35 million by 2021
- In order to **face new challenges** (such as renewable energy and electrical vehicle integration), Enedis has developed **smart grid solutions**, which are being **rolled-out**
- **Roll-out of smart grid solutions is in progress** in France since 2016
- These solutions are concerning **all DSO's activities**, including operations, maintenance, planning and grid connection activities
- In France, **two pilots of large scale deployment of smart grid solutions are being held** in the West and in the South-East of France
- **EDF International Networks'** expertise comes from **Enedis**, the French DSO.
- **EDF IN is leading distribution projects in many countries abroad**, in particular in China, India, Latin America, Africa and Europe