SMAP

SMART GRID PARC NATUREL

Project presentation

The first **rural** smart grid demonstrator

with **citizen producters and actors of their consumptions** in the energetic system

External
Presentation

AURA region

SMAP, la première démonstration « Smart Grid » en zone rurale portée par des partenaires engagés :

Les financeurs :

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- Impact of photovoltaic generation on low voltage network
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Goals

- Project issues
- An organisation view with 3 main dimensions
- Technical solutions simulated and tested in SMAP
- Some concret examples of achievements
- Schedule

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1- Context

Context:

SMAP, in keeping with « Centrales Villageoises »

- The « Centrales Villageoises » are **local compagnies** which develop renewable energies in a territory **combining citizens, local government and local actors**.
- Developed in **15 territories** with the regional agency of energy and environment in Rhône (RAEE) including **8 operational and 16 coming**.
- But, from a certain amount of renewable energy integration, it's necessary to plan to do **electricity network reinforcements**.
- Reinforcement financial costs could **impact network investments** and photovoltaic projects (SAS CVRC for example)
- SMAP is the first smart grid demonstrator **minimising reinforcement cost combining the different actors of the system**.

Context:

SMAP partners from different horizons (community, associations, compagnies, university)

Regional agency of energy and environment

Distribution Network Operator of public network

« *Pilat* » Natural Park

« *Les Haies* » town hall

HESPUL association

Energy federation of Rhône

G2Elab Laboratory (Grenoble INP)

« SAS Centrales Villageoises » in Condrieu region

Compagny – Solutions of LV network instrumentation

Compagny – Solutions of MV nework instrumentation

Financing

40% FEDER* (on average)
60% self financing from project partners

Total
812 K€
(1/3 equipment, 1/3 thesis, 1/3 time ressources)

** FEDER = « Fond Européen de Développement Economique et Régional »*

Context:

A replicable project focus on Les Haies village

*TEPCV = « *Territoire à Energie Positive pour la Croissance Verte* »

1 — Area of SMAP municipality

2 — Aerea of municipalities community

3 — Area of TEPCV*

LES HAIES

772 inhabitants

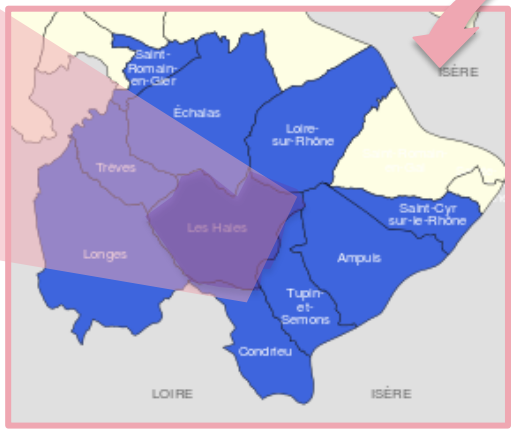
Photovoltaic « *Centrales villageoise* » = **76 kW**

Integrated in a **TEPCV*** project

A high level of involvement of regions

A **rural town** (school, nursery, etc.)

Municipalities community bringing together **9 municipalities** with « *Les Haies* »



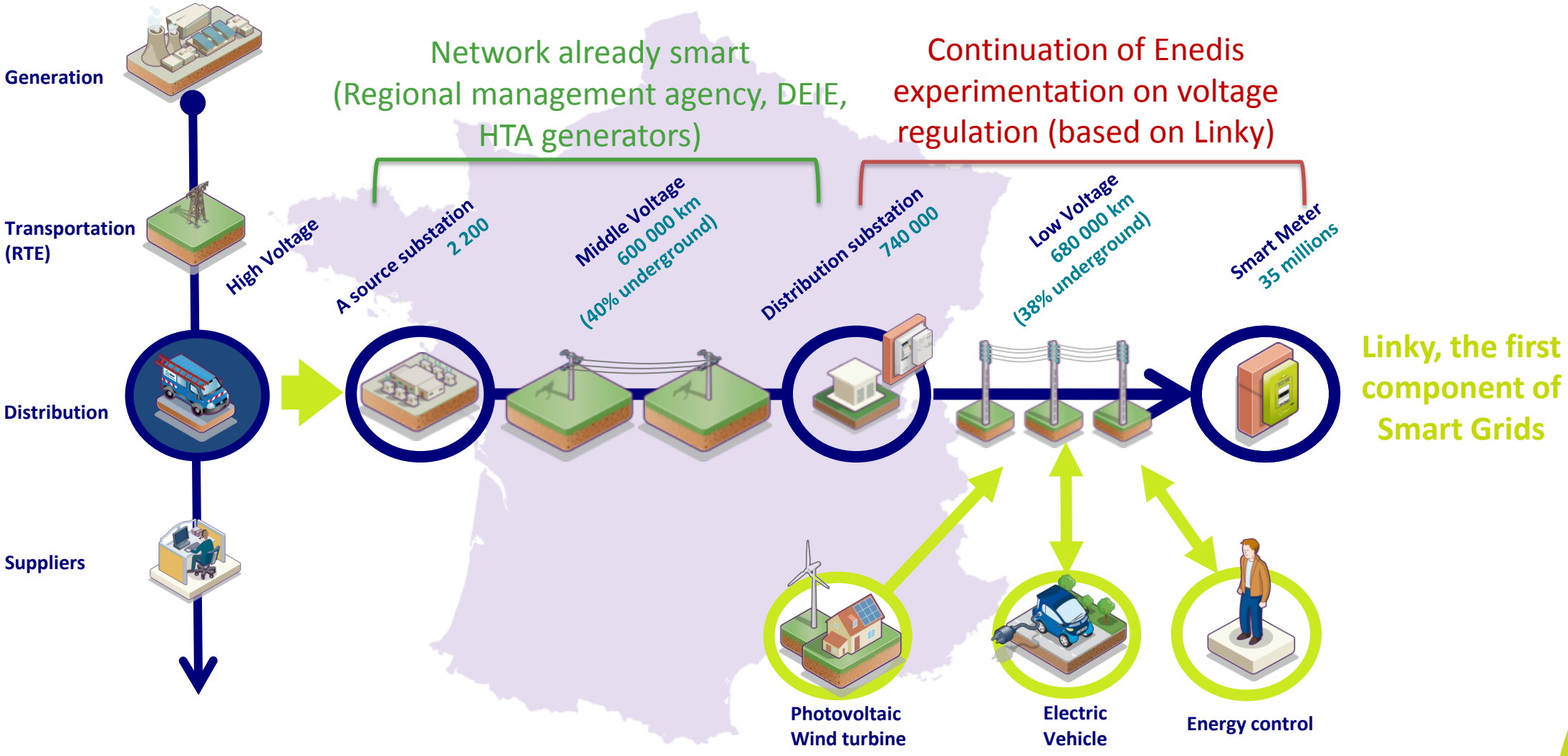
86 municipalities form the TEPCV* « Pilat Park Naturel St Etienne Conurbation »

Zoom

Parc naturel régional du Pilat

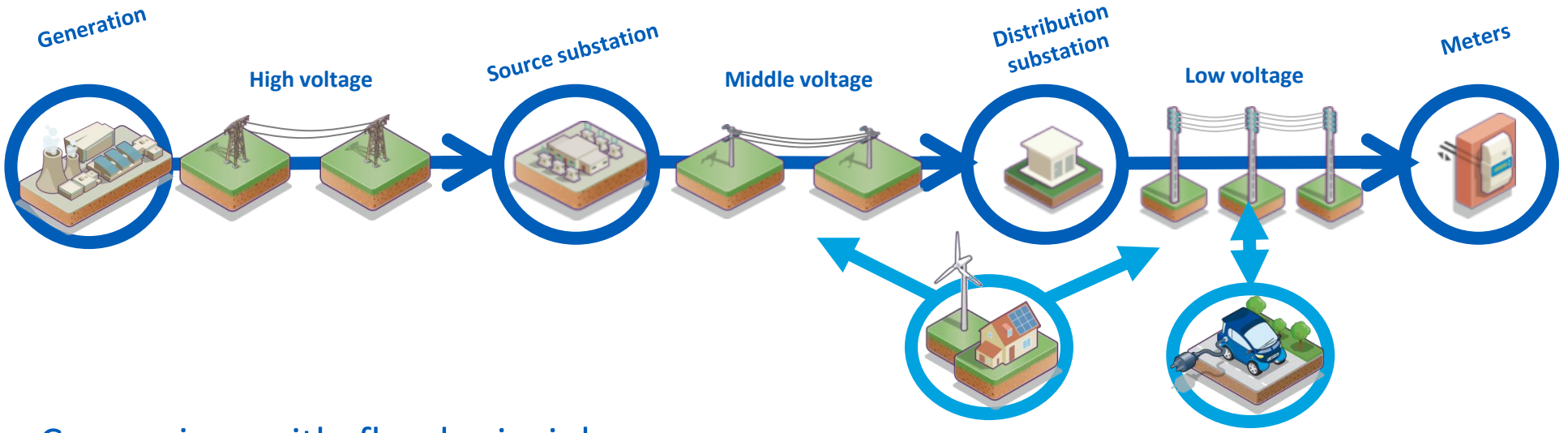
Context:

Smart grid continuity on low voltage network

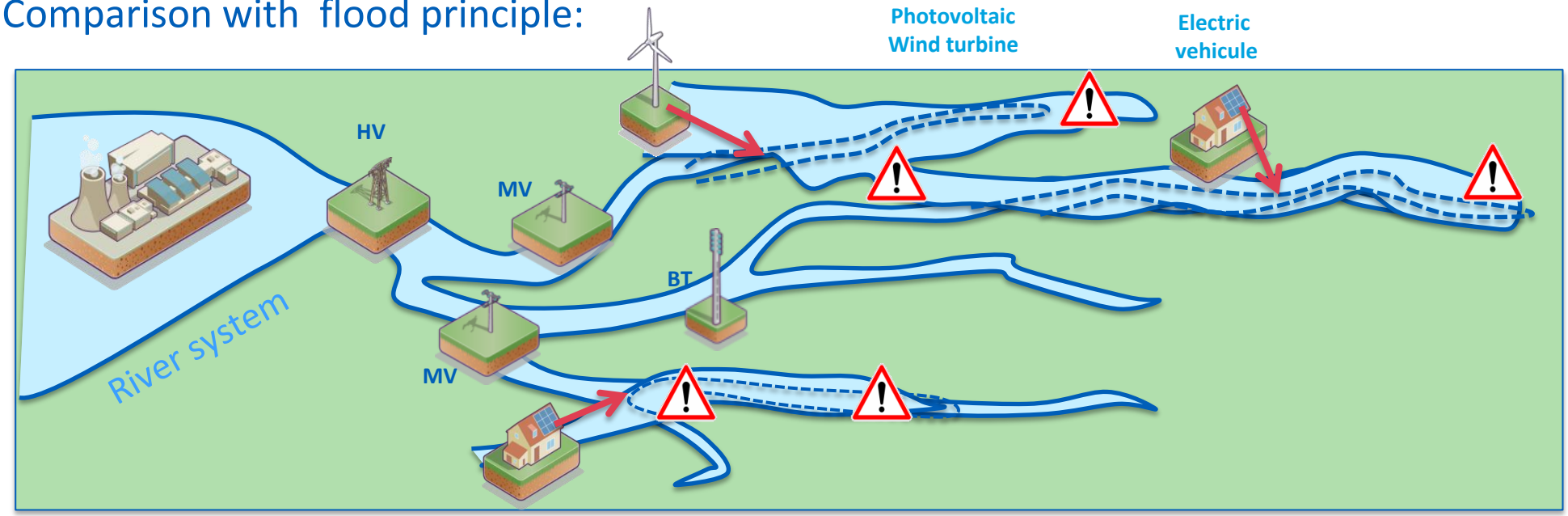


Context:

Paradigm shift on the distribution network



Comparison with flood principle:

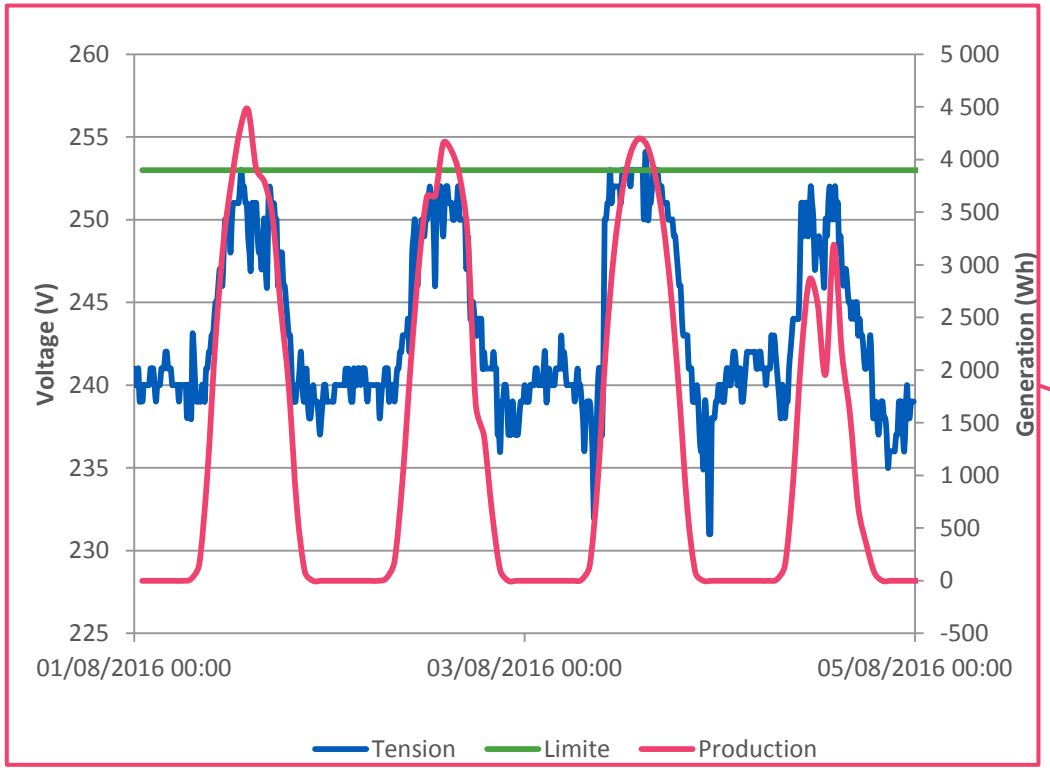


Context:

Voltage variation according to PV generation

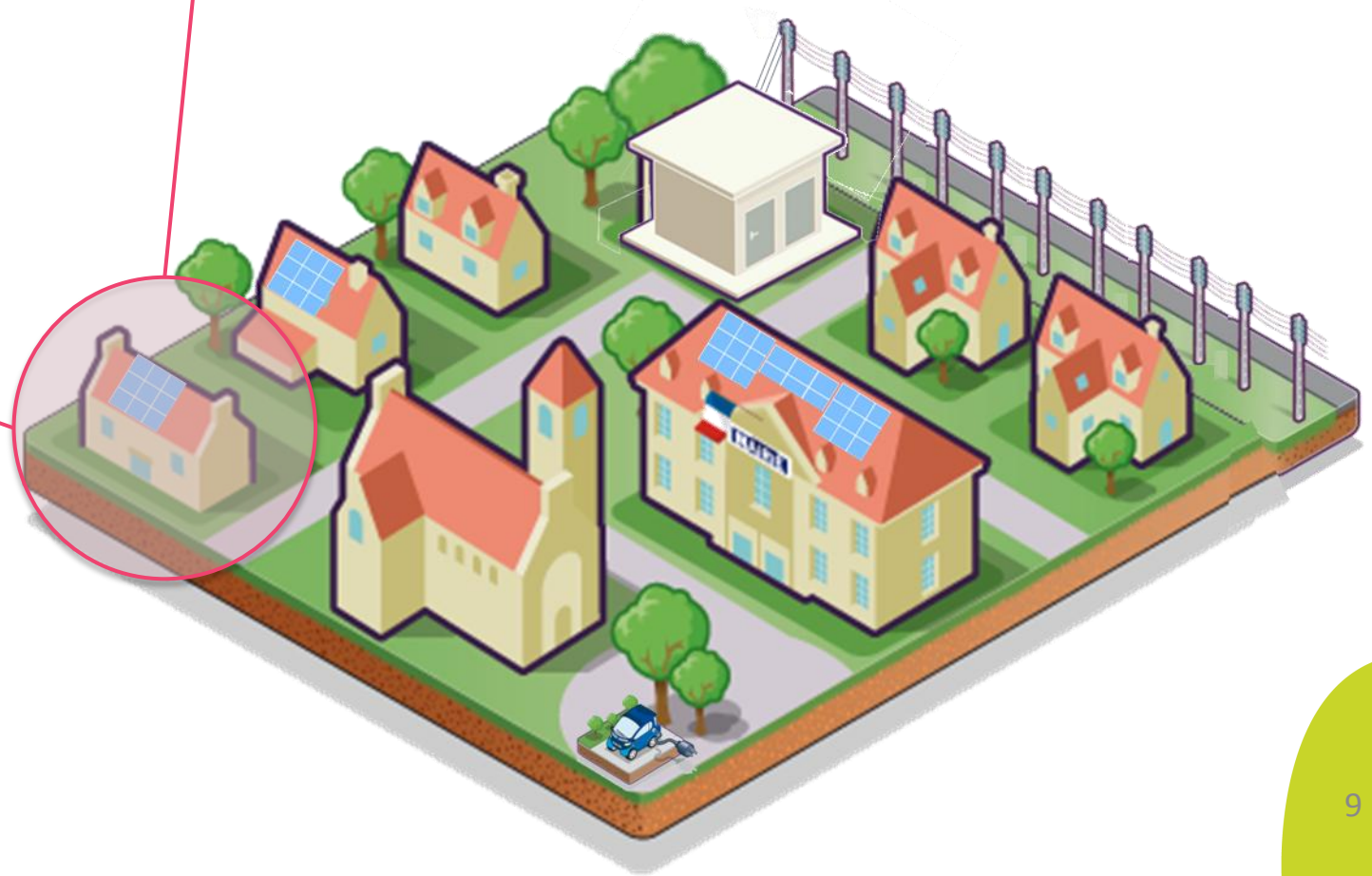
Please clic to access to more details

Strong dependance between PV generation and voltage owing to low volume of consumers on the network.



Generation site at the end of the line

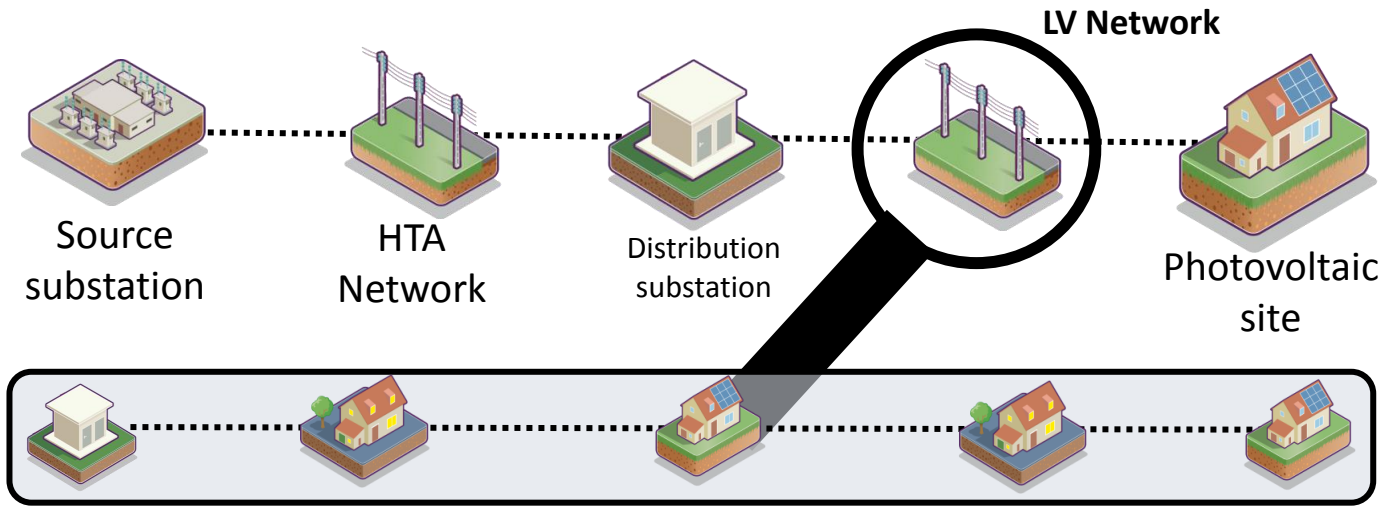
Some voltage values upper or equal to 250 V ***(in keeping with CRE norms)***

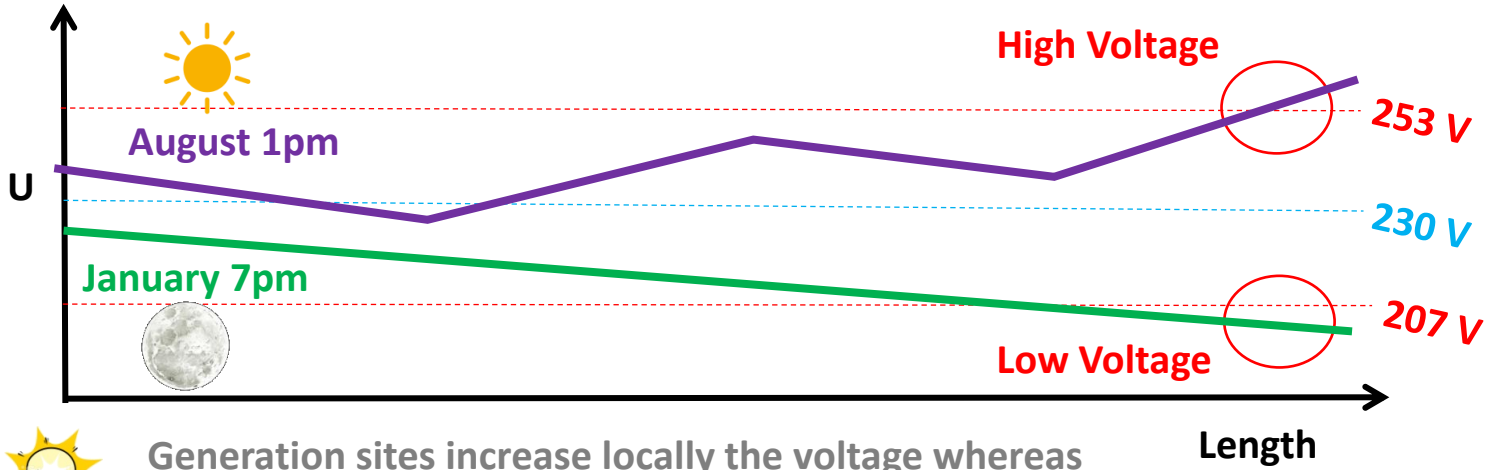


Context:

Impact of photovoltaic generation on low voltage network

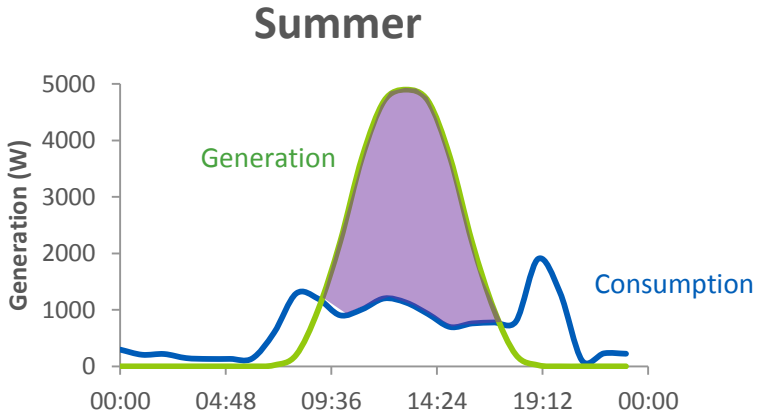
Photovoltaic : **Uncertain** and **irregular** generation



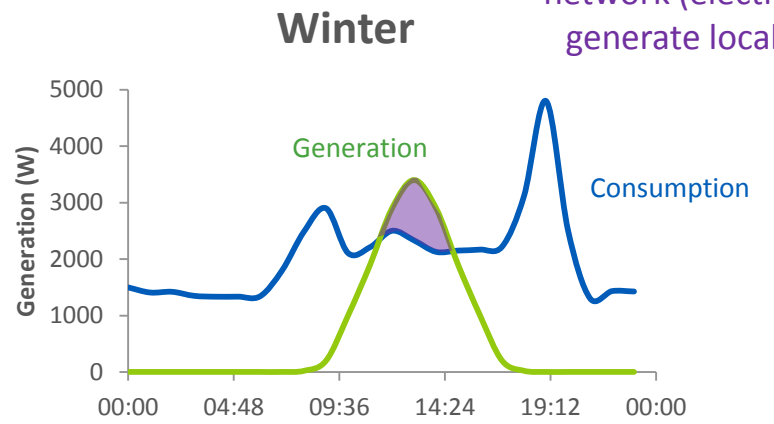


Generation sites increase locally the voltage whereas consumption sites reduce it

Generation and consumption peaks don't match (different profiles)



Backflow to HTA network (electricity generate locally)



Generation can be disturbed thanks to **storage**

→ Still too expansive

Context:

Enedis and consumers consequences

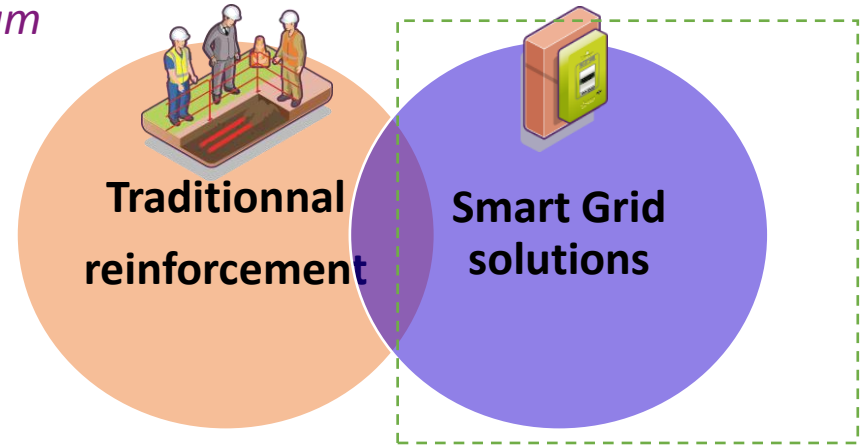
Study of rural network is interesting owing to weak consumption during hours where solar generation is important (working persons worked mostly in cities)

If nothing is done:

- Chance to damage network installations
- Chance to damage consumers electric appliances
- Chance of power cut increased → reduction of quality of supply
- Backflow (*generation > consumption on a network*)

Inconsequential phenomenum

Possible solutions:



Solutions tested in SMAP to limit network reinforcement cost linked with PV deployment on Les Haies network

2- Goals

Goals:

Project issues

- This demonstrator project targets to **facilitate renewable energies in rural area**, and for develop and test innovative solutions leaning on the « Centrales Villageoises » from Les Haies village **in coherence with territories policy**
- Trials and results will have influence on **Smart Grid industrialization methodology**
- The 3 main issues are:
  - Optimization of renewable energies development in low voltage electricity network in rural areas without any major impact on networks
  - Improvement of the balance between local consumption flows and local electricity generation
  - Citizen awareness to energy management and change behaviour management accross their active implication for a local project with national and international economic impacts

Goals:

An organisation view with 3 main dimensions

Facilitate renewable energy development in rural area by testing innovate solutions which could have an influence on smart grid industrialization methodology

A « 3D » project

Network dimension:

Please clic to access to more details

- Have a better understanding of the network, with smart equipment
- Better forecast renewable energies development on the network
- Drive the network in accordance with local constraints
- Understand link costs

Community dimension:

Please clic to access to more details

- Balance consumption flows and local electricity generation
- Raise awareness among the population

Territory dimension:

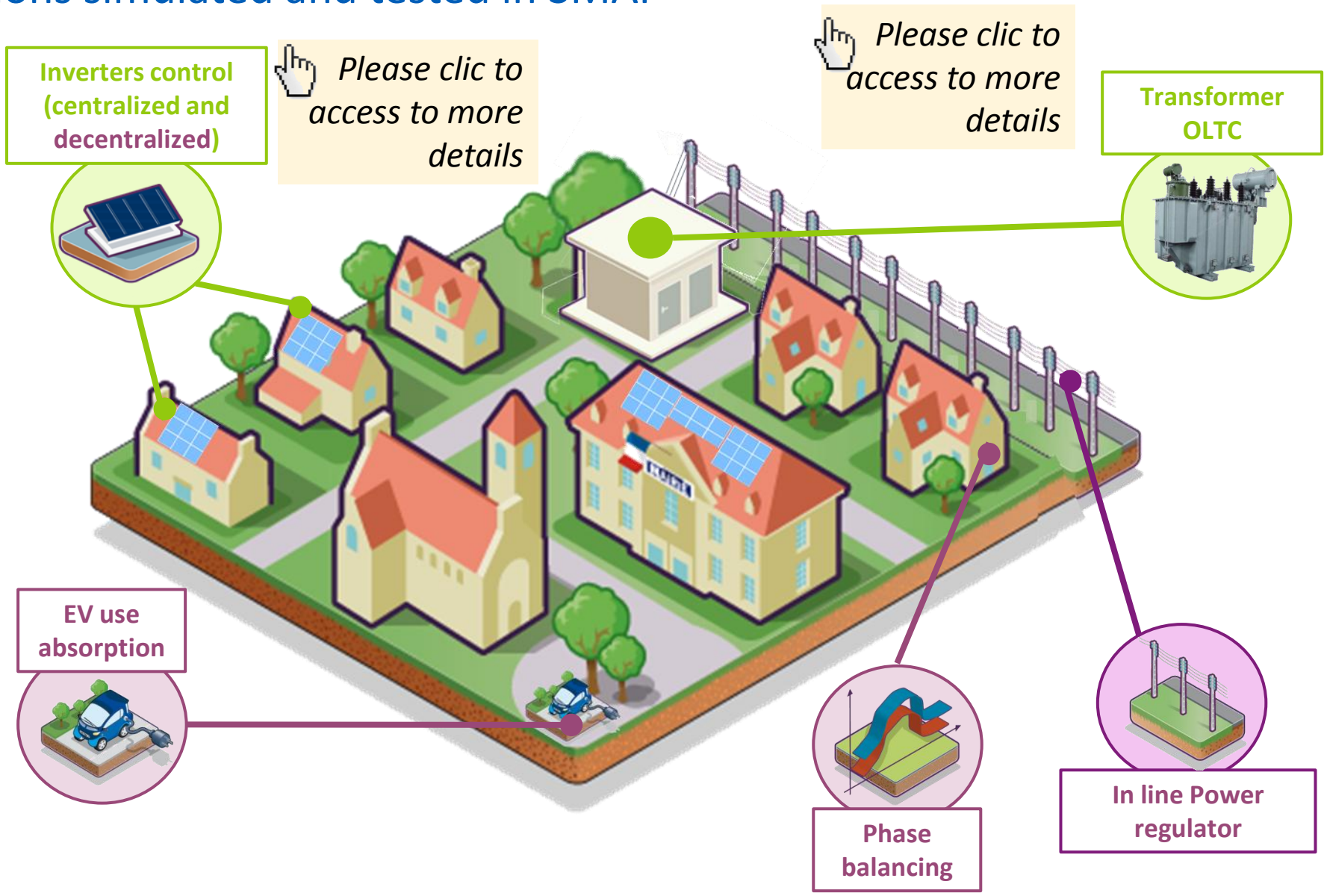
- Assist territories (Municipalities community, TEPCV) to better plan renewable energies development to reach their energetic goals

Goals:

Technical solutions simulated and tested in SMAP

Solutions simulated and tested on the network

Solutions simulated



Goals:

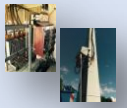
Some concret examples of achievements

Behavioral achievements

Data monitoring web portal

« Solar Energy Family » contest

Voltage regulation and inverters control



Electric Vehicle

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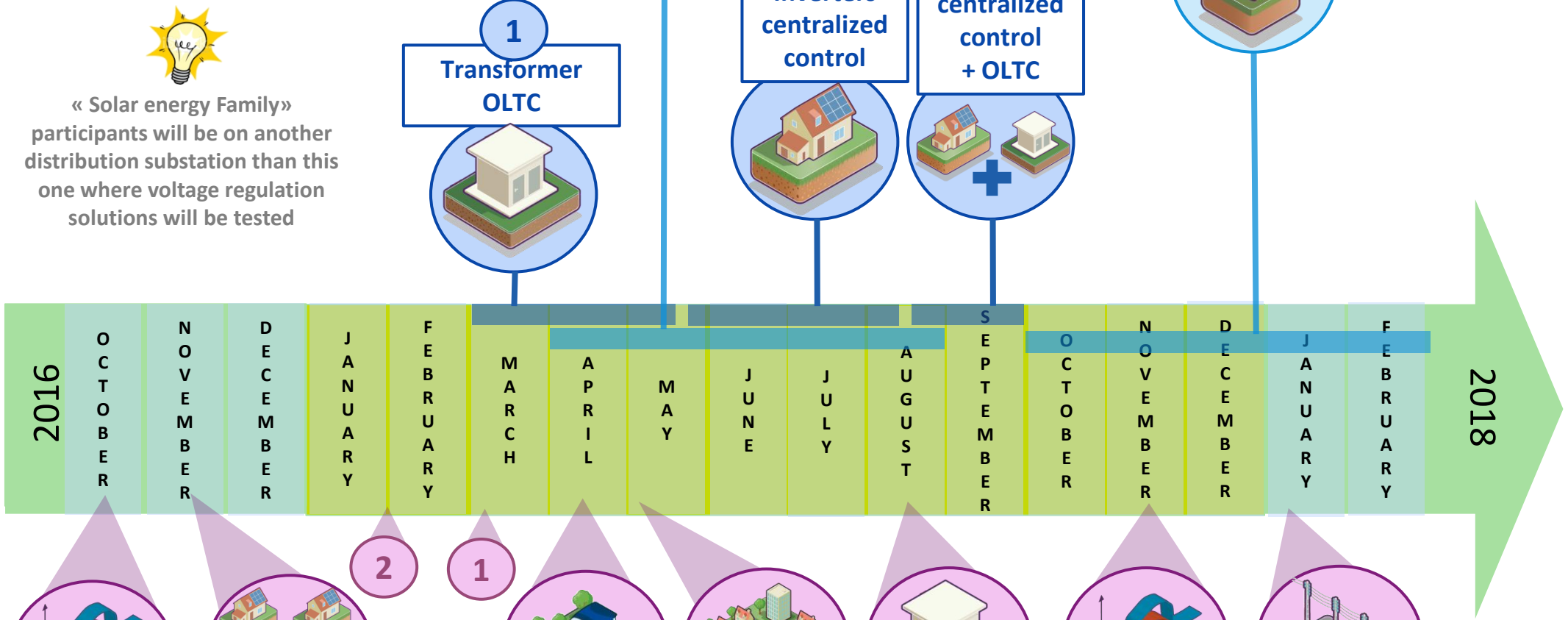
Technical achievements

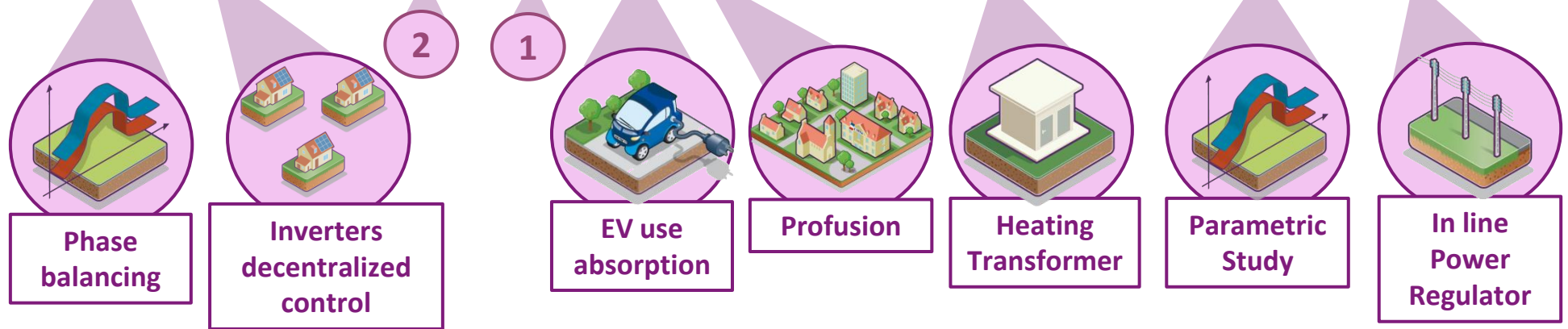
Goals:
Schedule

Tested solutions

« Solar energy Family» participants will be on another distribution substation than this one where voltage regulation solutions will be tested



Simulated solutions



A flagship project

Visibility in relation to the cooperative model and to the TEPCV

COP21 · CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE

Evidence calls:

- AURA Region (*Connected and Digital Territories fair*)
- Smart Grids France *(Think Smart Grids)*
- *Smart Energy UK*
- International (*Energy Globe Awards*)

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Thank you for your attention

Project contacts

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A- Appendices

Appendices:

Inverters control

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Control based on Linky's data

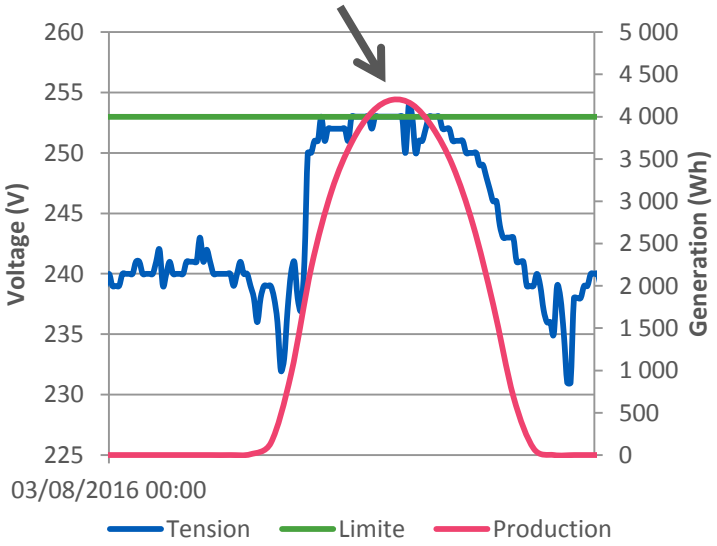
Three-phase inverter

Cluster controller

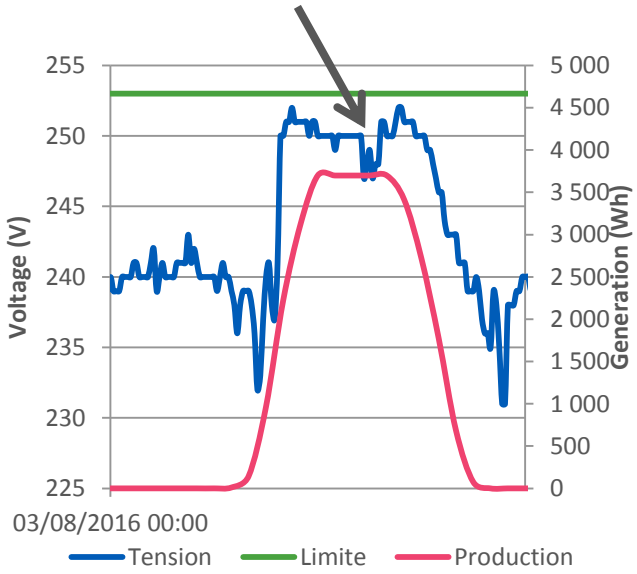
SMA

Control via active power

Voltage constraint just when generation peak



Voltage local decrease during a lapse to remove the constraint



Control via reactive power

- Q according to P → tan(phi) regulation
- Q according to U → Q=f(U) régulation

3 kinds of control

- **Decentralized** for 1 producter
- **Centralized** for 1 producter
- Centralized for n producters

Appendices:

Transformer On Load Tap Changer

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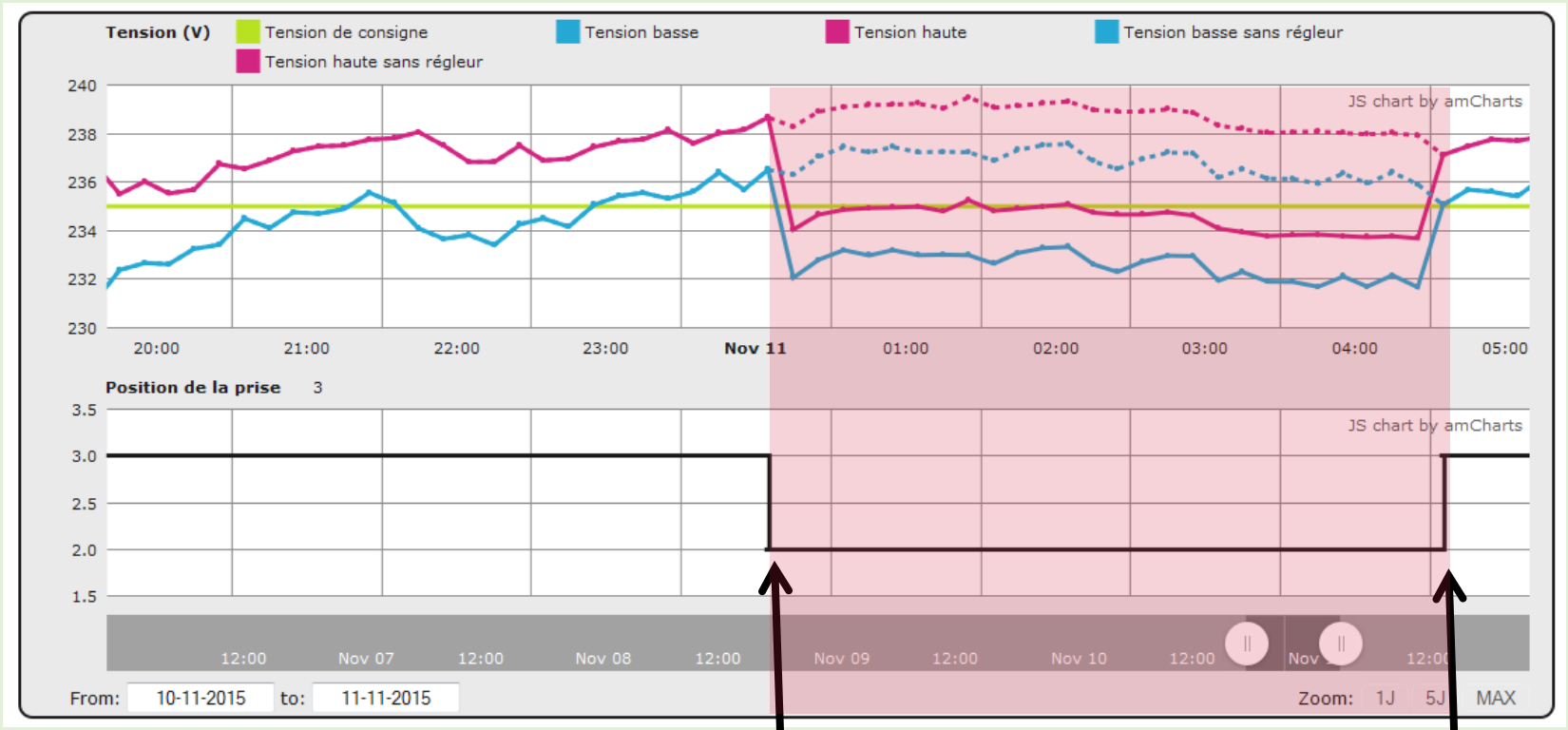
SMAP characteristics

Control ased on Linky's data

Greenlys example



Source: Enedis

Tap change (High Voltage)

Voltage is stabilizing around set value (235V)

Tap change (Low Voltage)

Appendices:

A schedule split in 3 phases

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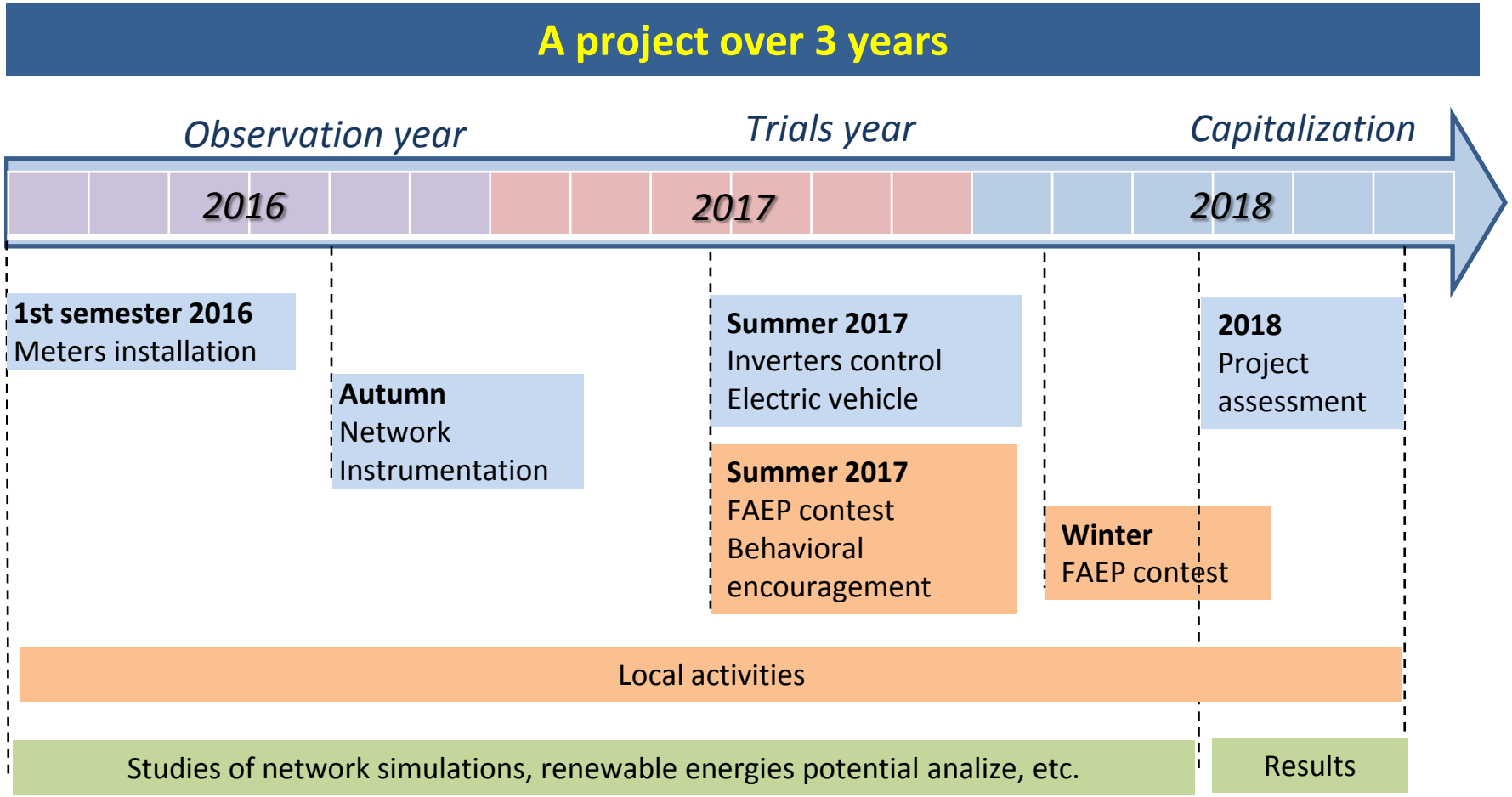

Appendices:

Project bundles

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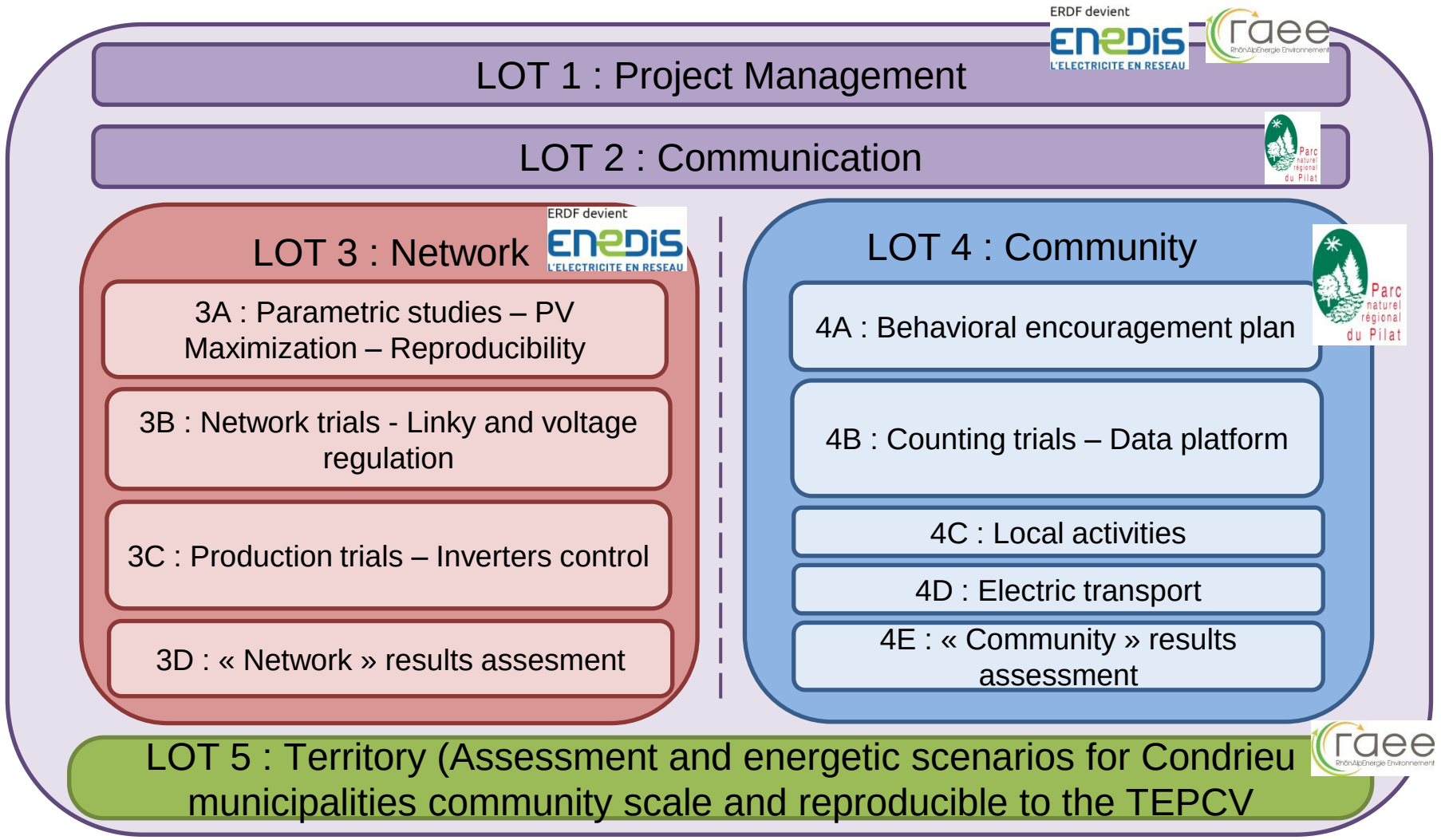

Appendices:

Technical structure for LV regulation

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