



Non Technical Losses in France

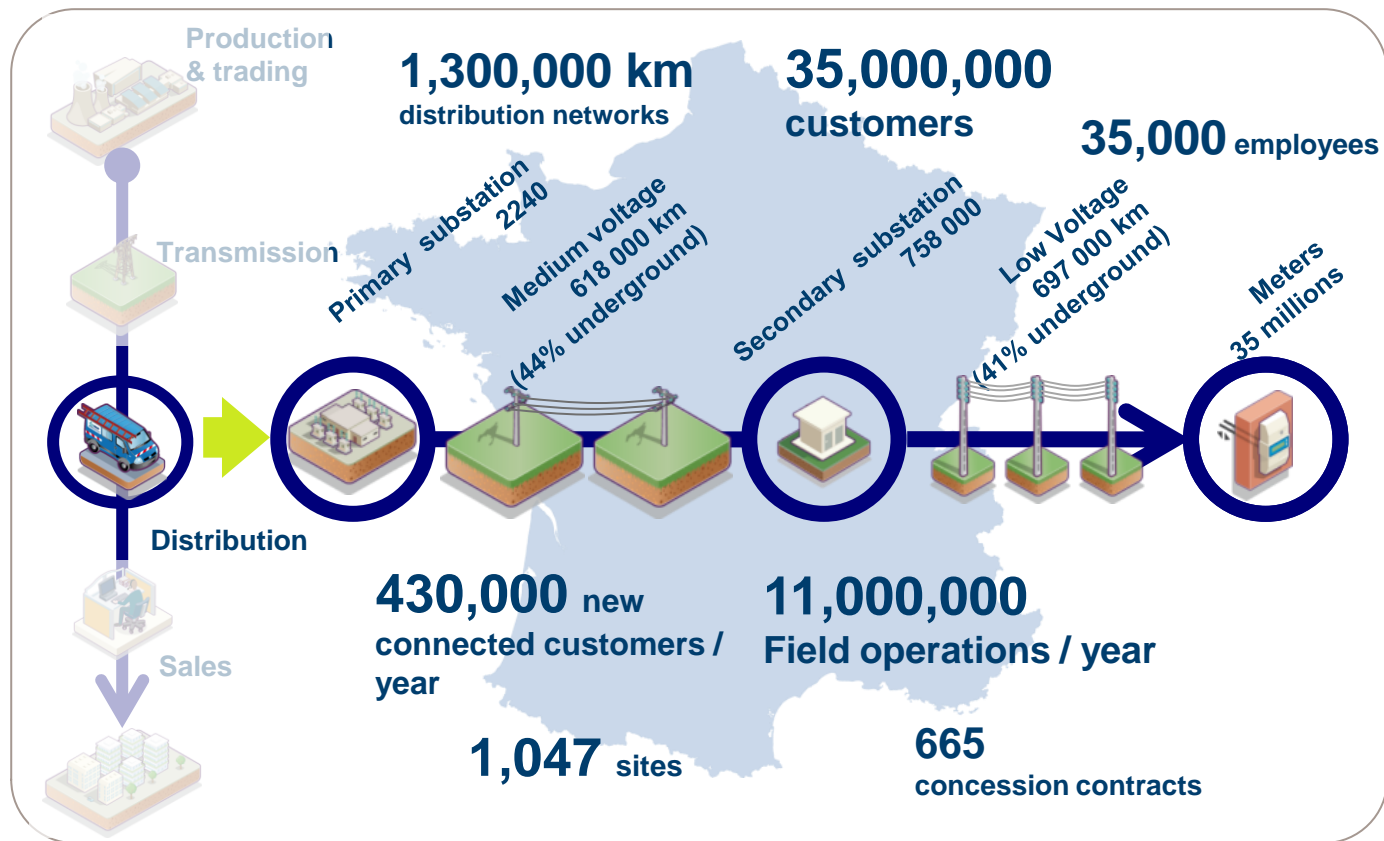
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WSUTA CONFERENCE

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At a Glance : ERDF is the first electricity distribution network operator in Europe

*ERDF is in charge of 95% of electricity distribution in France
ERDF is a fully owned subsidiary of EDF*



Key figures 2012

Financial results :

- € 13,3 billion revenues (+8,6% vs 2011)
- € 3 billions investment (+8,8% vs 2011)
- € 3,4 billion EBITDA (+23% vs 2011) and € 831 million net profit

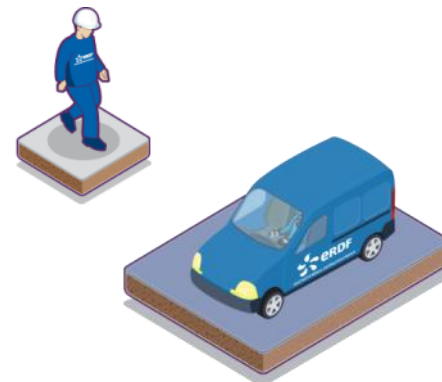
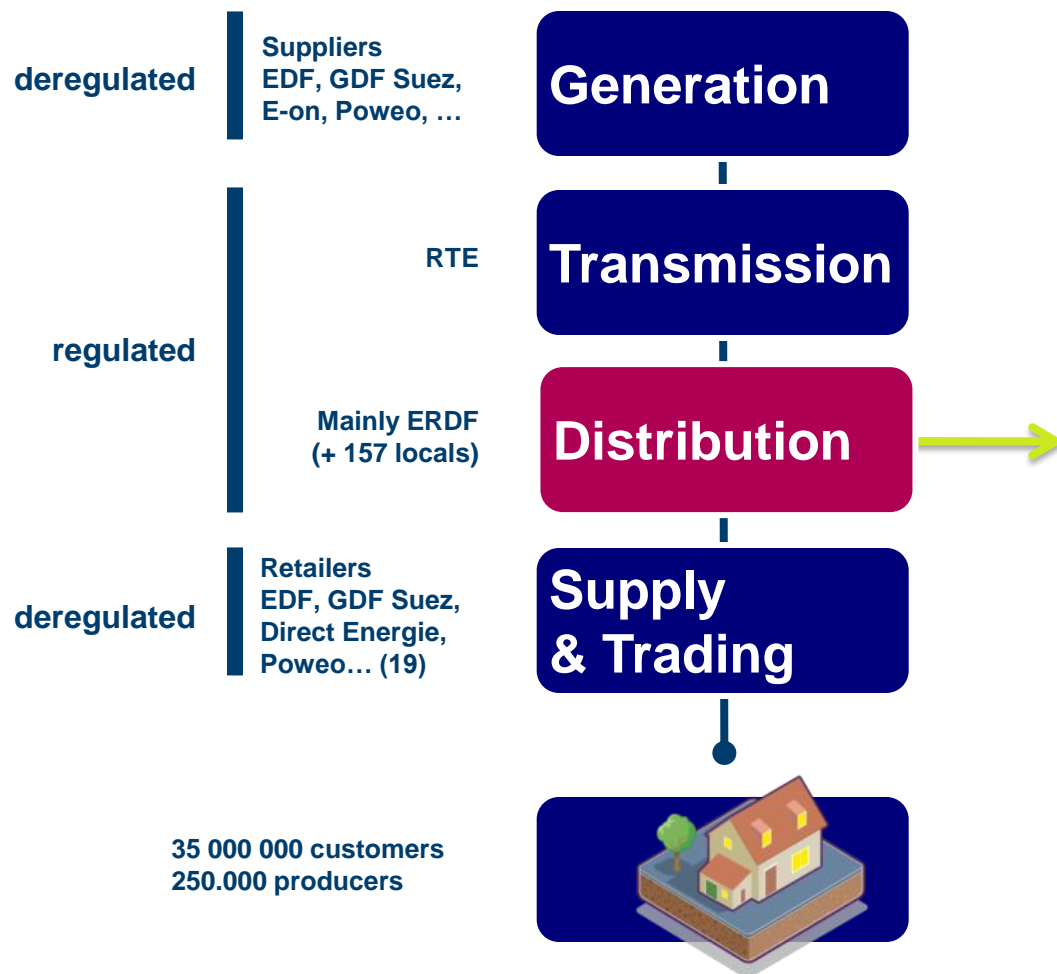
Technical performance

- 355,7 TWh delivered with 6,4% losses
- 10 GW of renewable energy production connected (+ 1,6 GW in 2012) and 29,5 TWh of local generation
- SAIDI 75 mn



French Market Overview

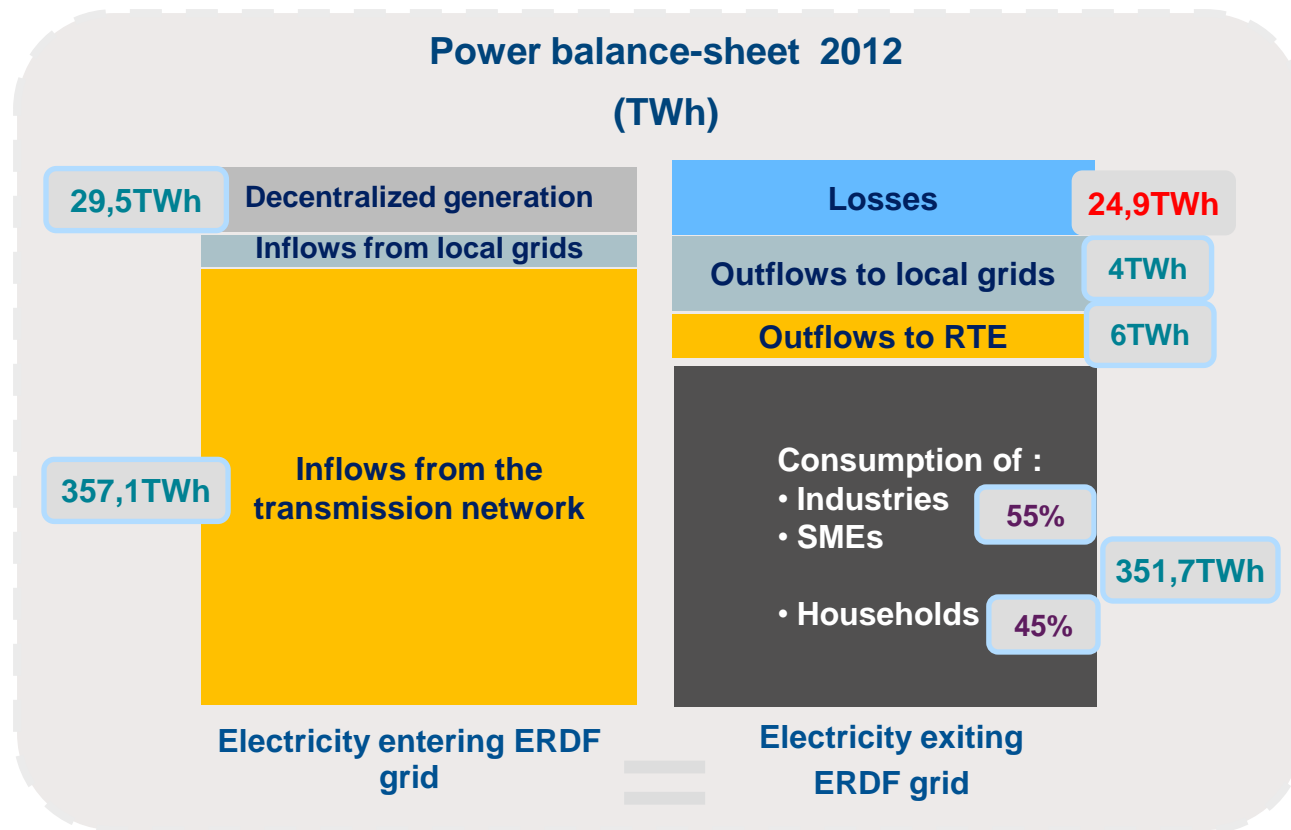
The french electricity market



Under the rules of the « local authorities contracts » :

- IIII Connects users to the network
- IIII Designs and builds electrical infrastructure
- IIII Operates and maintains the network
- IIII Field operations for the clients
(meter reading, daily operations, outages)
- IIII Reconstitutes electric flows for the market (in charge of metering and responsible for losses)

The Power Balance Sheet summarizes energy flows on ERDF grid



Real Losses = Deducted by completion



DSOs in France must purchase energy to compensate for losses

Since 2004, ERDF has to purchase energy on markets in order to compensate for its grid losses

- |||| « Losses » stands for technical and non-technical losses
- |||| Losses are compensated at a 30 minutes pace
- |||| Purchases are made Over The Counter by call for bids for long term (up to 3 years) and day-to-day contracts
- |||| ERDF has to declare its losses forecasts to the Electricity Transmission Network (RTE) at least one hour before time.

As losses are not directly measurable, their real value for a moment are considered differently depending on time horizon

- |||| Regulator imposes performance criteria to ERDF in order to make it master grid losses

From D-Day to M+12

Differential Process

→ Losses estimated by a model

After M+14

RecoTemp Process

→ Losses calculated by completion



Major evolutions on Distribution

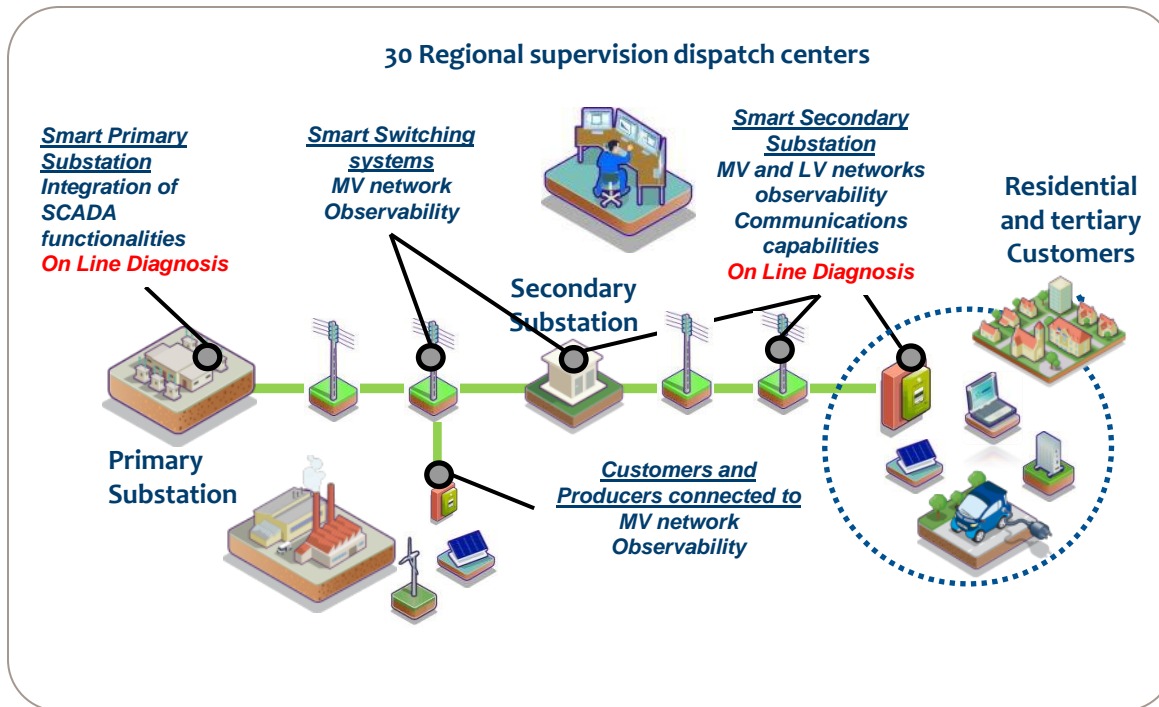
- Smart Grids
- Smart Metering

The development of Smart Grids is not an option, it is necessary in order to take advantage of existing networks

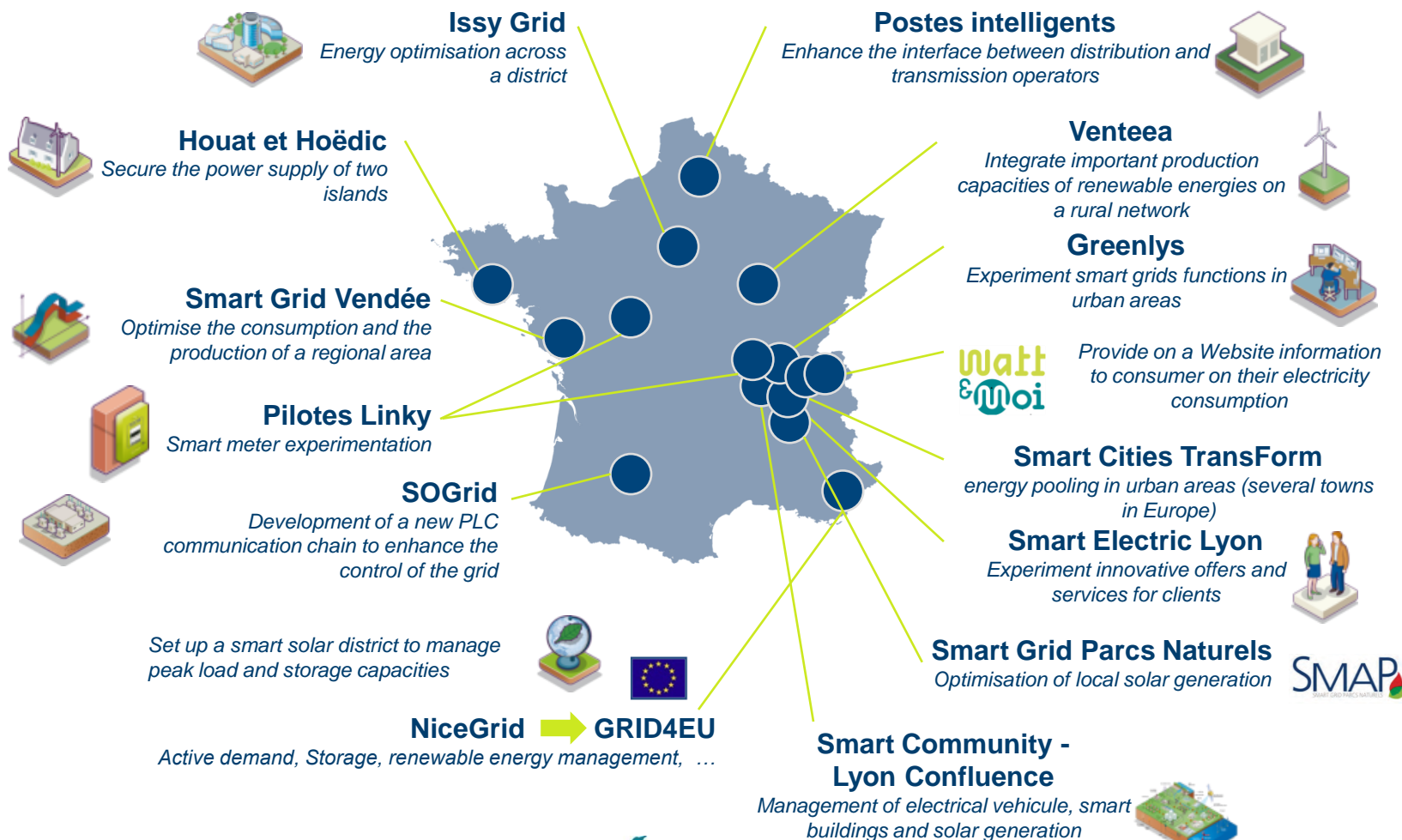
Smart Grids = design industrial solutions based on advanced softwares, remotely controlled devices and communication technologies

Expected benefits

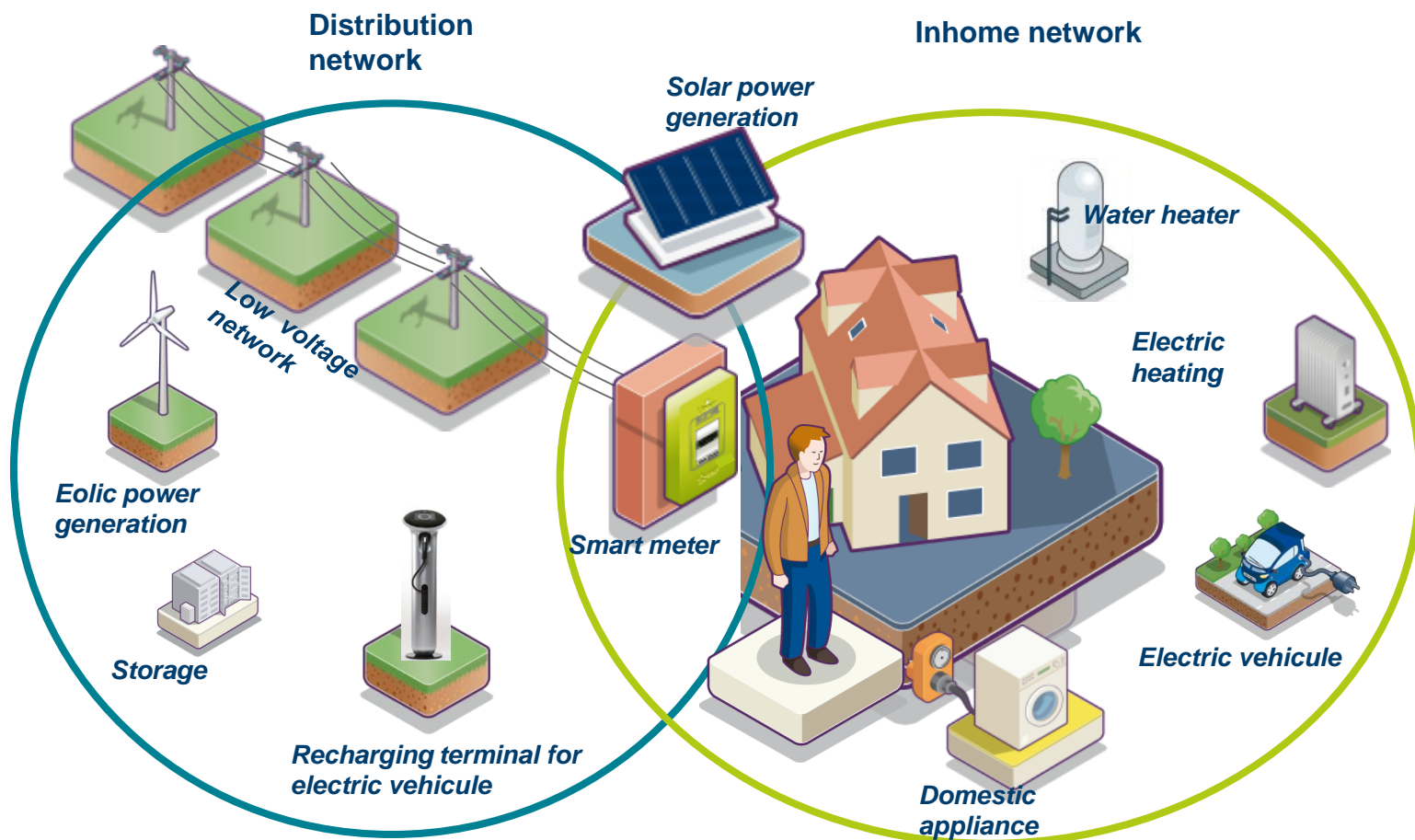
- Provide **capacities** to host **RES production** sites and **recharging terminals** for electric vehicle
- Provide **flexibility** to manage the networks (storage, dynamic tariffs, peak shaving programs...)
- Enable **energy efficiency**
- Optimize **maintenance** and extend **life time** of the assets
- Enhance **security** and **reactivity**
- Reduce the average time of **power cuts**



In this perspective ERDF innovates and participates to 15 pilot projects to develop new technologies ...



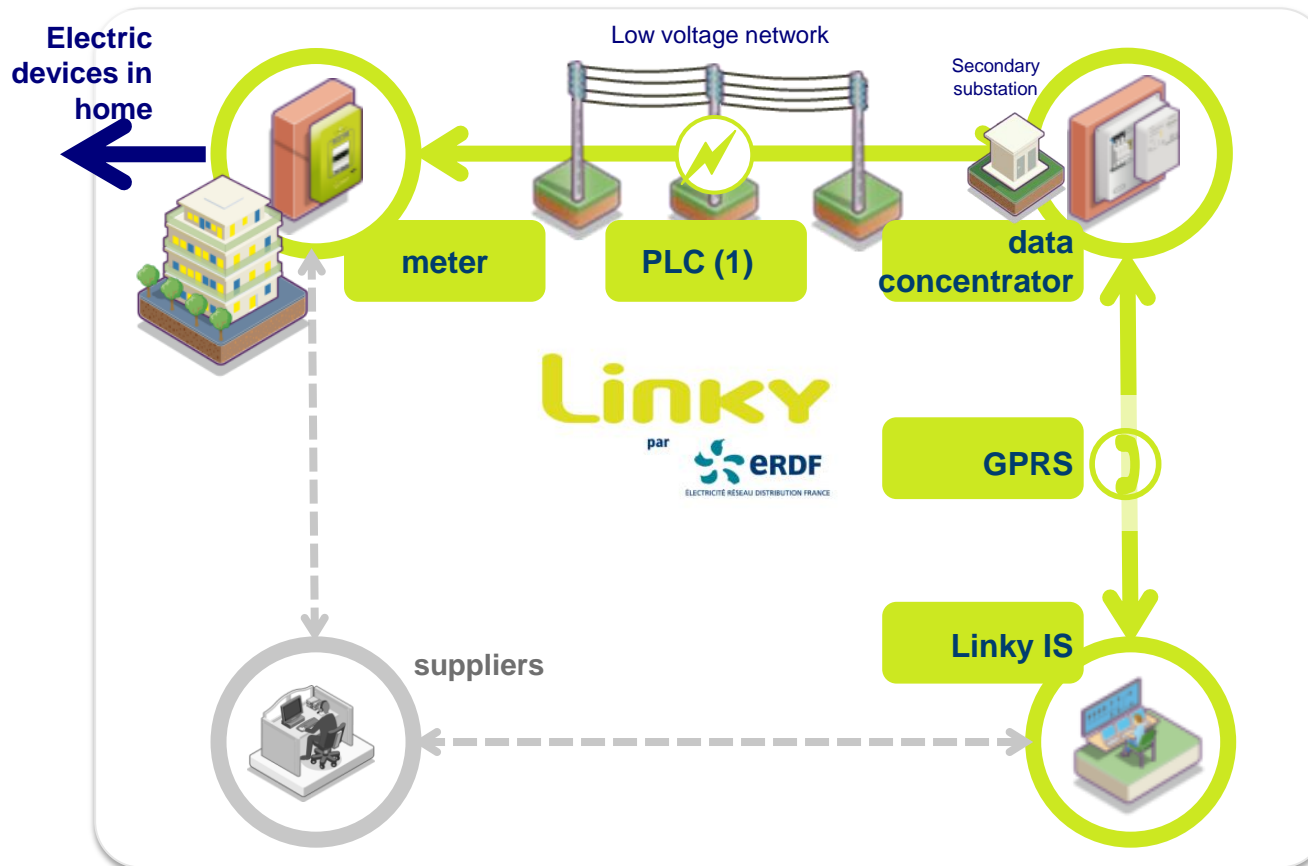
Smart meters are a fundamental brick to develop « smart grids » and will help to tackle the challenges of distribution networks



« Linky » is the name of Smart Meter designed by ERDF



Linky smart metering system takes advantage of the LV network and will contribute to enhance observability and control



Main characteristics

- 1. Bi-directional communication** (to and from the meter)
- 2. Scalable**
each component can be upgraded separately
backward compatibility approach
- 3. Interoperable**
exchangeable equipments,
standardized protocols of communication

(1) **Power line communication** carries data on the existing power line grid

Embedded functionalities into the meter

- III Designed from electronic meter functionalities
- III In the same volume as this,
- III With 5 main supplementary attributes
- III Responding to customer expectations.



CBE (electronic meter)



1

PLC modem



2

clock



3

improved software



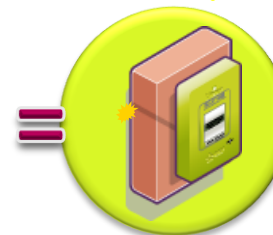
4

switch



5

encryption



Linky

New advantages for the client, today...



Without Smart meter

|||| Invoices bases on estimations

|||| Be at home for the reading

|||| Be at home for interventions

|||| Time between a demand and an intervention



With Linky

Simplification of customer services

- Bills based on measured consumption
- Quicker re-energizing
- Access to consumption information (tablets, ...)
- Remote service (commitment to less than 24h for service performed in 5 days)

Energy transition and Smart Grids

- Ease the integration of distributed generation and electric vehicle
- Demand Side Management (up to 8 interfaces)

A successful pilot

III 3 main targets

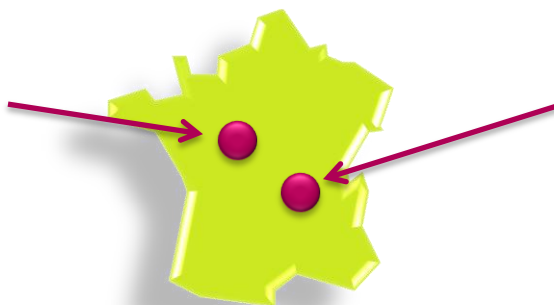
Check
the roll-out
processes

Build
the Linky IS

Confirm
financial
hypothesis

III 300,000 customers & 2 regions

III Touraine
100.000 customers
Mainly rural
33 inh / km²



III Lyon
200.000 customers
Urban
1.750 inh / km²



III A 24 months pilot (fully operational)

III It takes 30 mins to replace the meter



Decision of roll-out has been made on July 9 2013

PARIS, 9 juillet 2013 (AFP)

An RFP will be launched this summer to roll-out 3 millions of smart meters Linky in France by 2016, has announced the PM Jean-Marc Ayrault.

The Prime Minister has confirmed the objective to replace all meters, i.e. 35 millions of devices, by 2020, for a total investment of 5 billions Euros.



Management of Non technical Losses





Context : what are Non Technical Losses ?

||| A definition from the Power balance-sheet :

||| Non technical losses are losses of energy that are not classified as physical/thermal losses (copper or iron) in energy settlements.

||| Concretely, NTL represent :

- ||| All the “missing” consumption of energy that is not measured and/or not invoiced (including tampering)
- ||| All uncertainties in invoicing or in the calculation of energy settlements (models, generation metering, metering errors,)

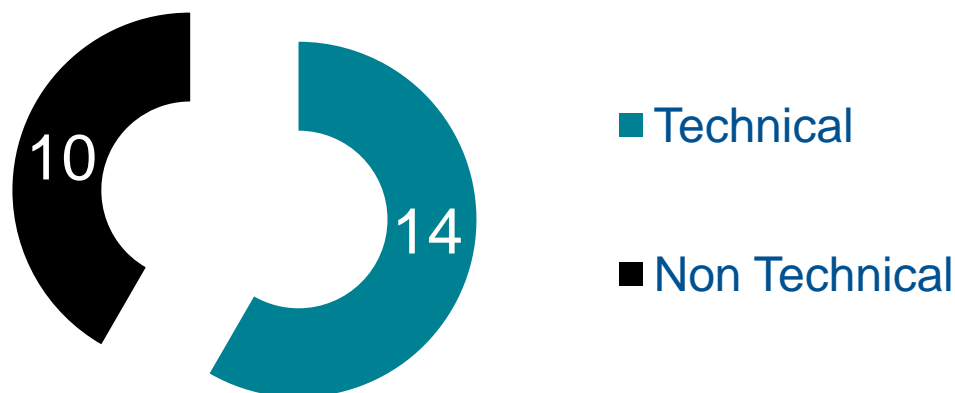


Context : what are Non Technical Losses ? (*cont.*)

|||| Key figures for ERDF (approx.)

- |||| Losses level at ERDF are comprised between **6,2** and **6,5%**, depending on the weather conditions (ie high impact of the electric heating)

Energy losses (2012) TWh





ERDF typology for Non Technical Losses (1/2)

Frauds

- ||| Metering tampering by customer
- ||| Direct connection / By-pass
- ||| Illegal re-connection

Customers without contracts

- ||| Energy delivery without meter
- ||| Unknown delivery point in customer database
- ||| Consumption for customers supposedly disconnected



ERDF typology for Non Technical Losses (2/2)

Consumption not invoiced

- ||| Generation auxiliary
- ||| TSO secure feeding
- ||| DSO secure feeding

Defects of metering

- ||| Defective meter
- ||| Defect on tariff relay (peak/off-peak TOU)

Pricing errors

- ||| Error on tariff
- ||| Error in the contract setting
- ||| Difference between files setting and metering settings



Examples of sources of Non Technical Losses

|||| **Typical NTL sources**

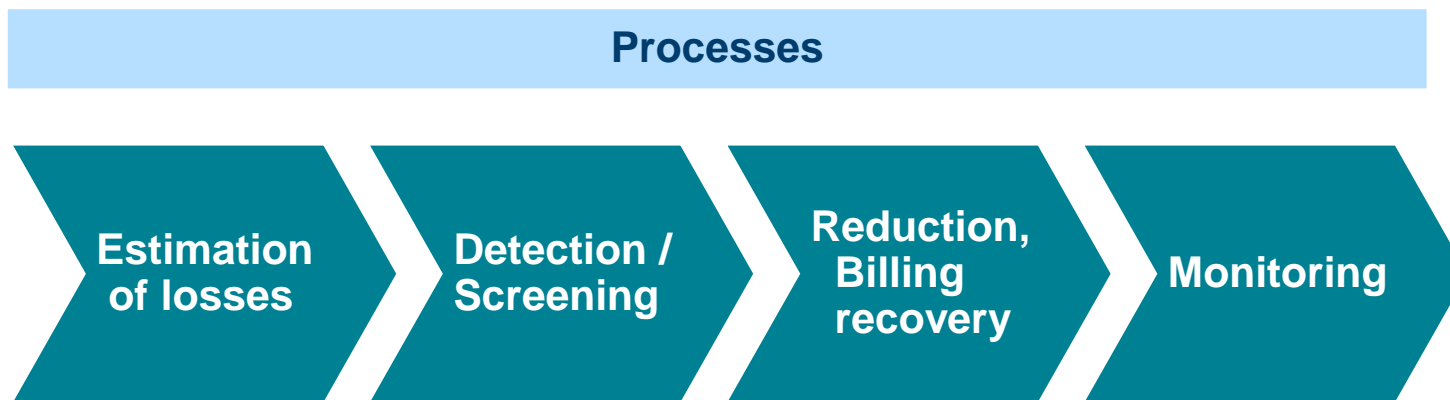
- |||| Public Lighting feeding points (often ill-known in GIS database)
- |||| Auxiliary consumptions of generation sites
- |||| Untypical connections : temporary connections...
- |||| Customers without suppliers

|||| **Customers without suppliers**

- |||| The DSO is accountable for the losses of energy for customers that have not subscribed to a retailer
- |||| The DSO shall recover both for network and energy costs
- |||| The common practice in France is to continue to supply houses when its inhabitant moves out > new occupants are temporarily “without contract”

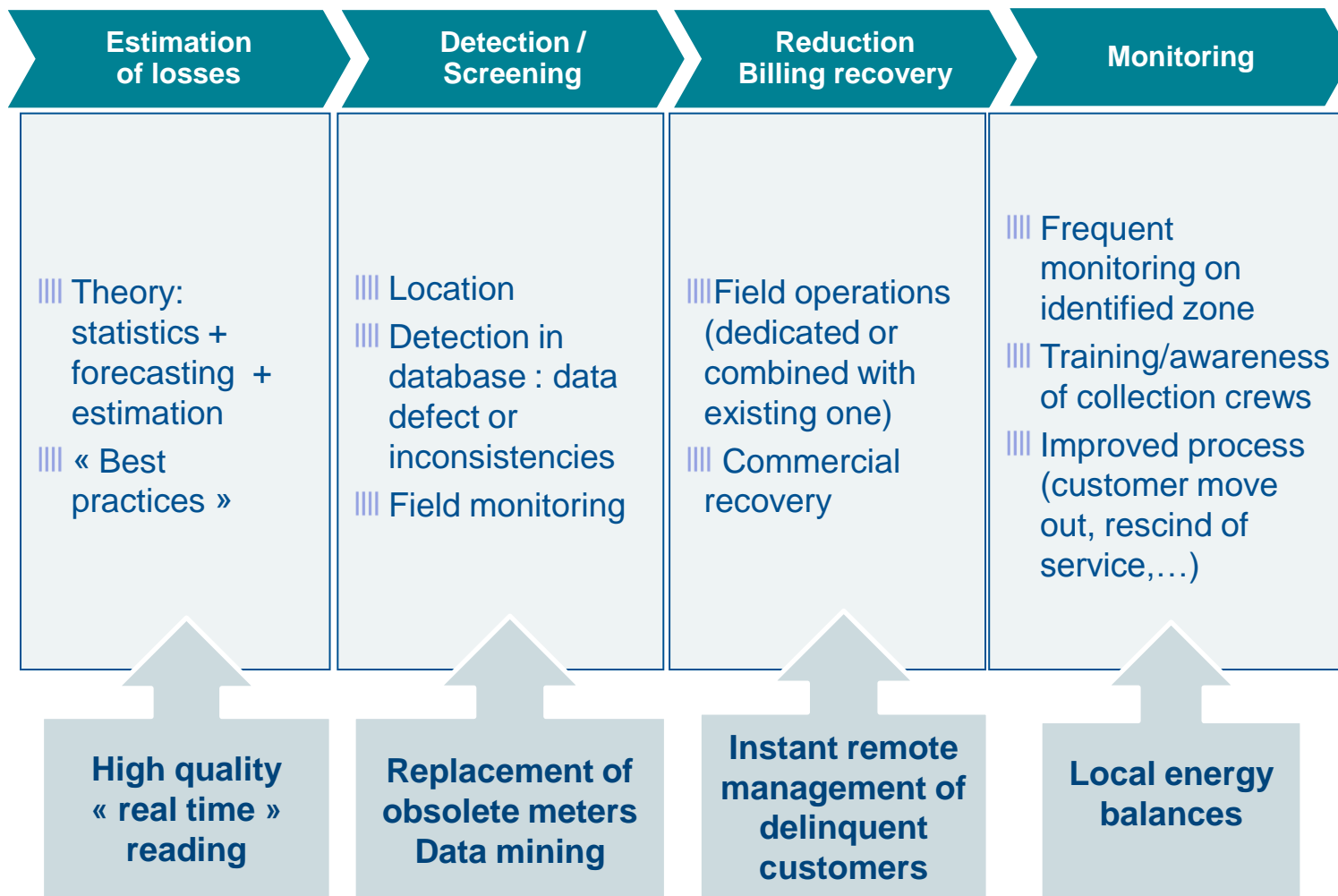
**Recovered volumes from the past represent 1 TWh per year,
distributed on residential and commercial markets**

Smart meters : a game changer for NTL reduction ?



- **Smart metering, monitoring and all intelligence that could be embedded in network management could improve :**
 - ✓ **Estimation and detection of losses ... at lower costs**
 - ✓ **Securing/monitoring to prevent any later increase of losses**
- **What are the reasonable volumes to reduction ?**
- **What part on smart metering, data analytics, network monitoring ?**
- **At what costs ?**

Smart metering potential improvement for losses recovery



Benefits of Smart metering

Example of losses reduction functionality with the smart meter Linky

Example : alarm linked to a meter intrusion

REGISTRE D'ERREUR

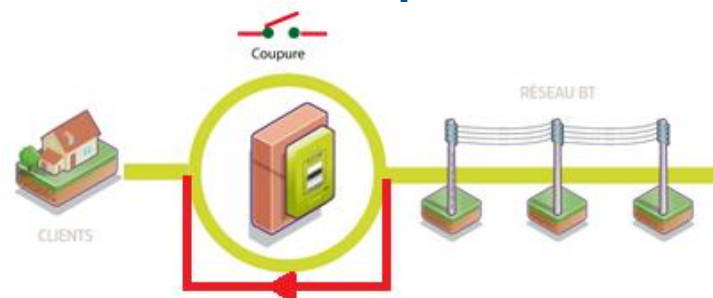
Valeur du registre :

1312

Fonctions	Etat
Mémoires de travail défaillantes	0
Mémoires de stockage de données défaillantes	0
Déclenchement du chien de garde « logiciel »	0
Déclenchement du chien de garde « matériel »	0
Défaut de l'organe de coupure	0
Ouverture cache-bornes	1
Défaut capteur mesure	0
Défaut contact-sec	0

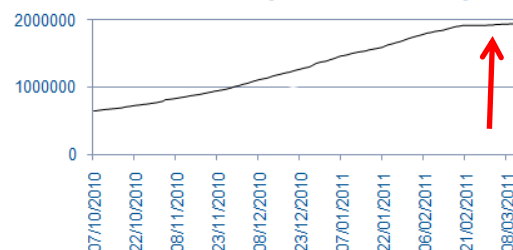
Source : Control room Linky

① NTL suspicion



② NTL check

Consumption follow up



New information collected with Linky has to be processed by Big Data capabilities :

- Big data should process specific detection cases
- New data-mining methods is needed (ex : clients scorecards)

Power step down functionality succeeds with the smart meter Linky to recover significant losses

The smart meter includes a remote control of the breaker power

Contractual power step down to 1 kVA (nb : after a testing period step down to 3 kVA)

Remote cut and reset (according to procedures)

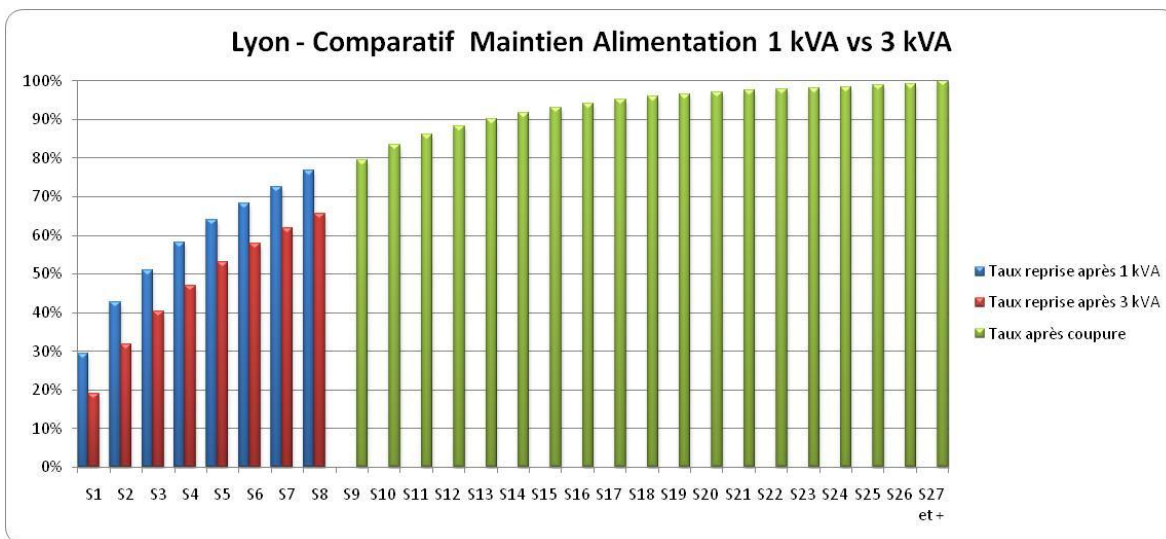
An efficient incentive to prevent NTL for « client without contract»

Quasi-eradication of NTL

Direct access to electricity for a majority of new clients

Reduction of cost for ERDF with remote actions

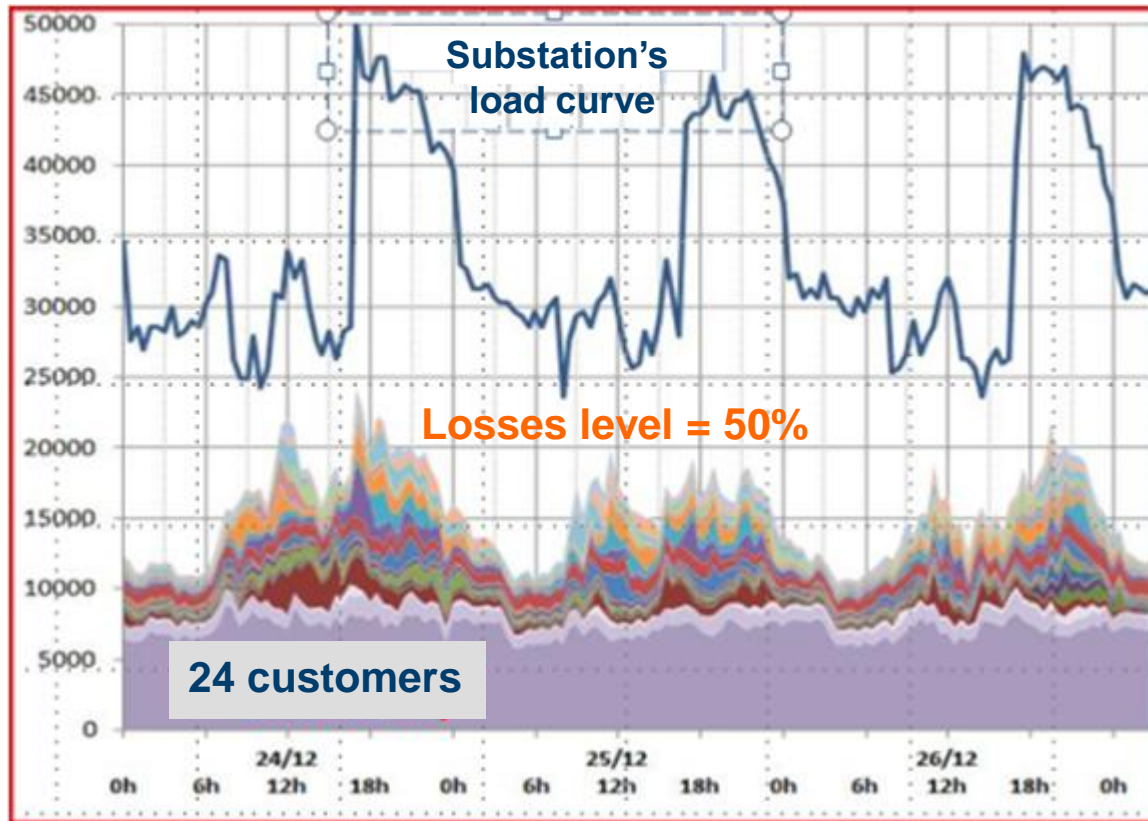
% per week of new contracts declared after a termination in Lyon



Before 8 weeks
(with a 1 kVA stepdown) :
80% of sites with a new
contract declaration

After 8 weeks (cutoff) :
no more NTL situation

Smart meters monitoring empowers losses detection : example over a distribution substation with 24 customers



Diagnostics :

- 7 ill-connected Customers in GIS databases
- Detection of a public lighting point

Source : Energy Settlement Dept



Conclusion

- **Non technical losses recovery is a complex process** that includes financial, technical (electrical, data), operational issues ...
- **Smart metering offers fantastic opportunities to reduce losses** with new statistics analysis, dedicated and targeted actions ... **if utilities grasp the economics to build profitable business cases**
- **Smart metering would modify in the long term some sources of NTL** on which utilities should be rightly informed to properly react
- **Sharing of good practices among utilities is key** : ERDF is looking forward such utility networking