Smart grid and ICT impact issues

Overview of the French situation

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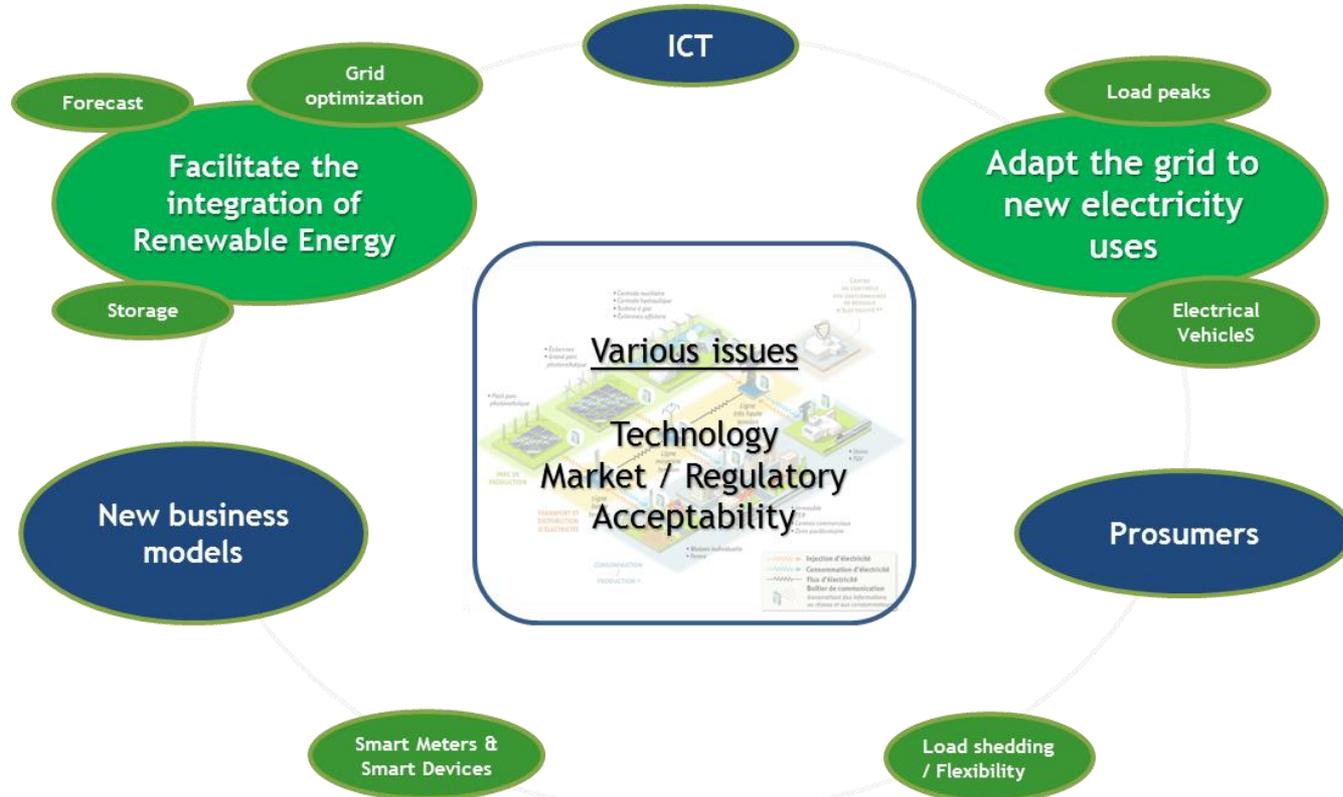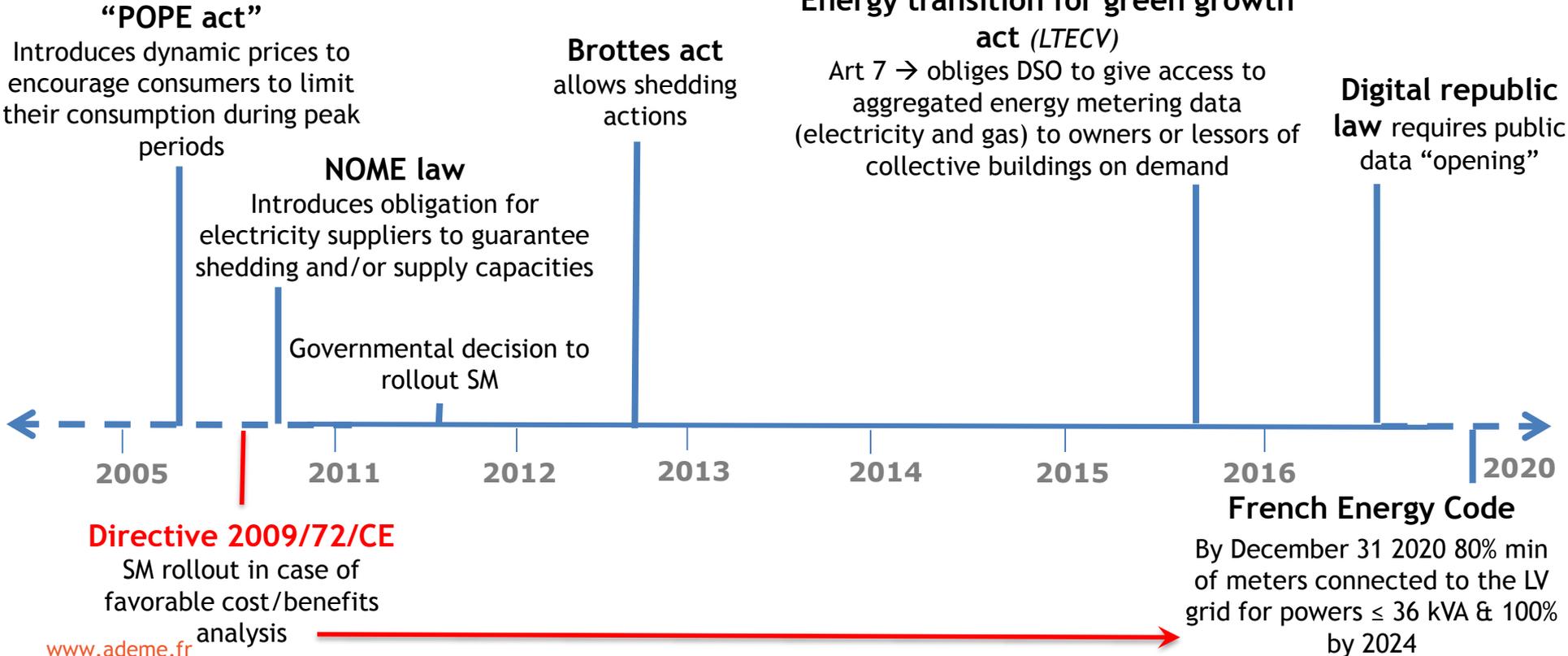
Marion BERTHOLON

Bucharest, October 18th 2018

- Context
- Main lessons from demonstrators supported by ADEME
- Focus on demand management
- Environmental impact of ICT

ICT: keyplayers in the energy transition

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"POPE act"
Introduces dynamic prices to encourage consumers to limit their consumption during peak periods

NOME law
Introduces obligation for electricity suppliers to guarantee shedding and/or supply capacities

Governmental decision to rollout SM

Brottes act
allows shedding actions

Energy transition for green growth act *(LTECV)*
Art 7 → obliges DSO to give access to aggregated energy metering data (electricity and gas) to owners or lessors of collective buildings on demand

Digital republic law requires public data "opening"

2005   2011   2012   2013   2014   2015   2016   2020

Directive 2009/72/CE
SM rollout in case of favorable cost/benefits analysis

French Energy Code
By December 31 2020 80% min of meters connected to the LV grid for powers ≤ 36 kVA & 100% by 2024

The "Investments for the Future" programme

- **€57 billion investment programme** launched by the French government in 2010 to support economic growth by investing in R&D and innovative projects, technological research institutes, technology transfer companies and clusters

- **€3 billion led by ADEME over 2010-2017** to foster the emergence of innovative products/services in the field of energy and environment, and create and maintain jobs, by supporting financially their development and experimentation

- **€138M granted to smart grids**

  Control and manage energy demand

  Favour the integration of renewable energy

  Anticipate the evolution of existing electrical grids

  Create new business models

For more information on the programme see the study case performed in the framework of the EU project EPATEE https://epatee.eu/case-studies
www.ademe.fr
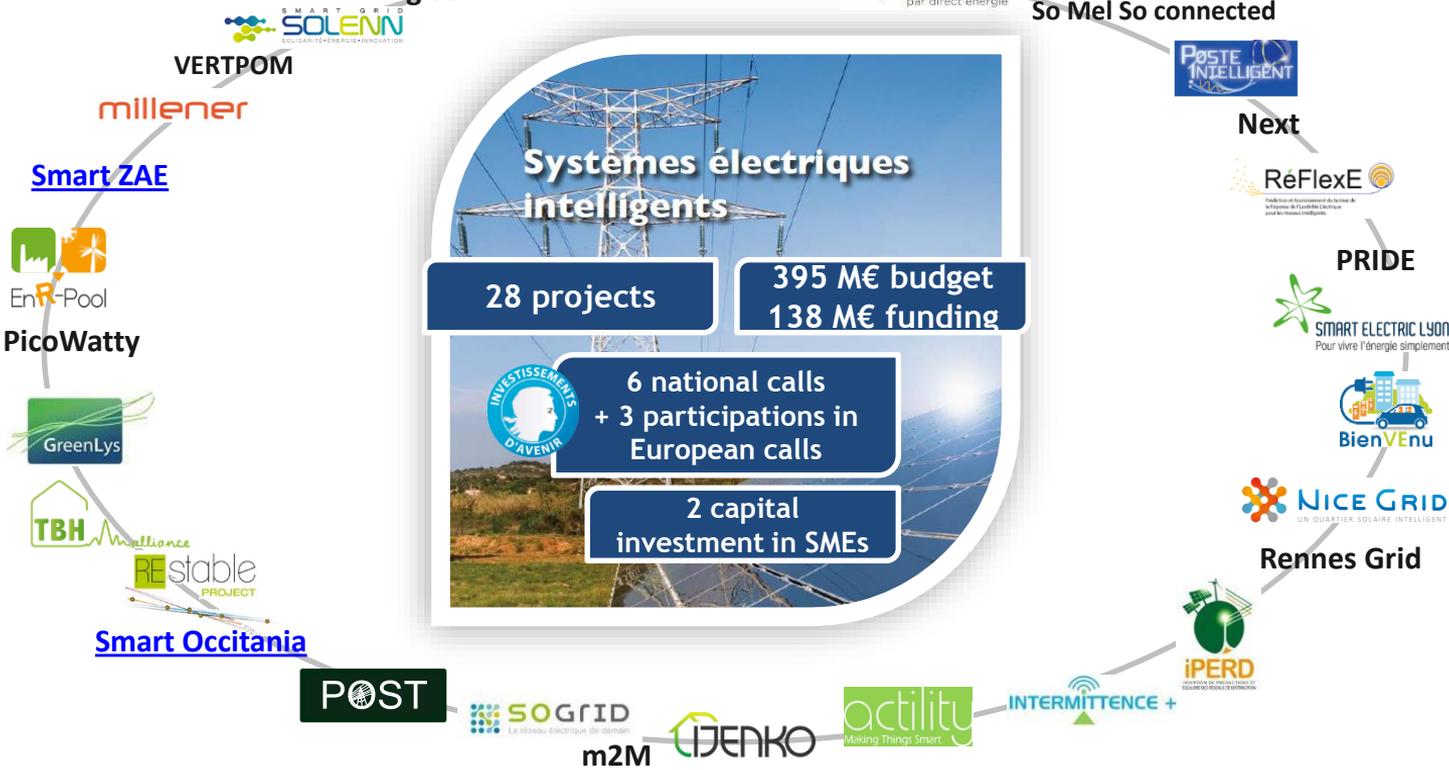
Overview of Smart Grid projects

Click on the icon to get more information about each project

Systèmes électriques intelligents

28 projects

395 M€ budget
138 M€ funding

6 national calls
+ 3 participations in European calls

2 capital investment in SMEs

Digisol · enteea · smart GRID VENDÉE · MODELEC par direct energie

So Mel So connected

SMART GRID SOLENN SOLIDARITÉ•ENERGIE•INNOVATION

VERTPOM

POSTE INTELLIGENT

Next

millener

RéFlexE

Smart ZAE

PRIDE

SMART ELECTRIC LYON Pour vivre l'énergie simplement

EnR-Pool

PicoWatty

BienVEnu

GreenLys

NICE GRID UN QUARTIER SOLAIRE INTELLIGENT

Rennes Grid

TBH · alliance · REstable PROJECT

Smart Occitania

iPERD

POST

SOGrID Le réseau électrique de demain

IJENKO

actility Making Things Smart

INTERMITTENCE +

m2M

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28 projets since 2009

- In October 2016 :
  - Publication of a report and a summary of the results of the 12 most mature projects at the end of 2015
- Documents available in the library on ADEME's website
  http://www.ademe.fr/en/smart-grids-first-results-from-french-demonstrators
- On 4 different topics :

Control and manage energy demand

Favour the integration of renewable energy

Anticipate the evolution of existing electrical grids

Create new business models

Smart Grids

First results
from French
demonstrators

Summary
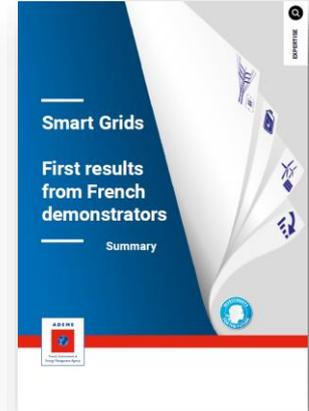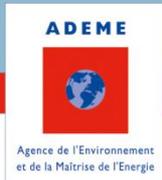
Information for consumers on their energy consumption
- **Energy Savings** (1% to 10% depending on the technical devices)
- Need to increase **the « energy knowledge »** of households

Support & advice
- Support and personalized advice to make behavior changes last
- **Concept of power demand and grid constraints not known by the consumers** (notably in the residential or tertiary sectors)
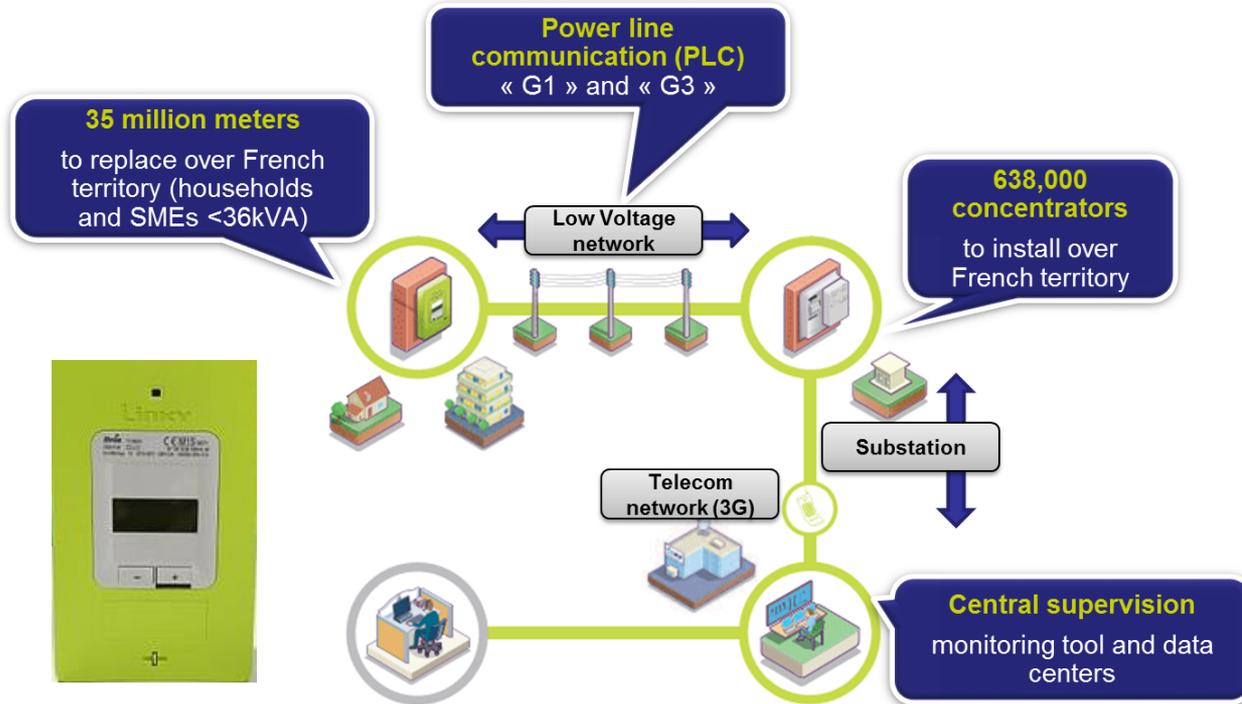
Demand side management in the residential sector :
- Load shedding potential about **1kW / household** (beware of technical issues)
- **Acceptability** quite high among the customers
- Loading shedding operations are generally subject to **few overrides** (<5 %)
- Should be linked with information on the consumers consumption in the management of their energy consumption
- **Using the smart metering infrastructure** as far as possible to limit the cost of the equipment

The smart meter rollout

Power line communication (PLC) « G1 » and « G3 »

35 million meters to replace over French territory (households and SMEs <36kVA)

638,000 concentrators to install over French territory

Low Voltage network

Substation

Telecom network (3G)

Central supervision monitoring tool and data centers

Target : at least **80% of smart meters** connected to LV grid (≤ 36 kVA) by **2020** & **100% by 2024**

Signals propagation through the existing electrical cables ➔ energy & material savings

Description of the study supported by ADEME

Scope

- 4 domains (SM, SH, SVEL & SRPD)
- Assessment of data flows & equipment volumes
- Evaluation of annual energy cons.

Method

- Interviews & workshops with keyplayers of the value chain
  Domains & use cases definition
- Modelling

Smart Metering (SM)

Smart Home (SH)

Smart Public Distribution Grid (SRPD)

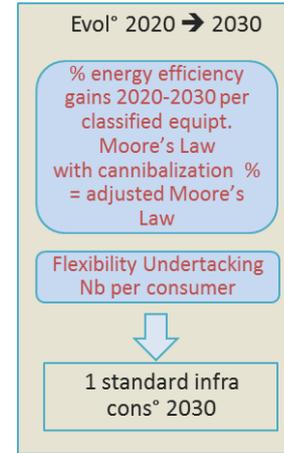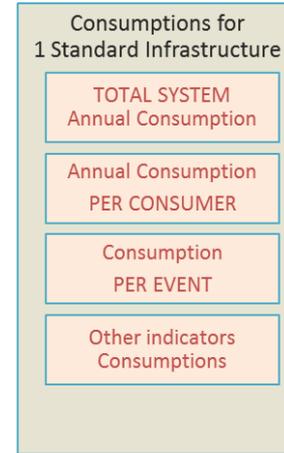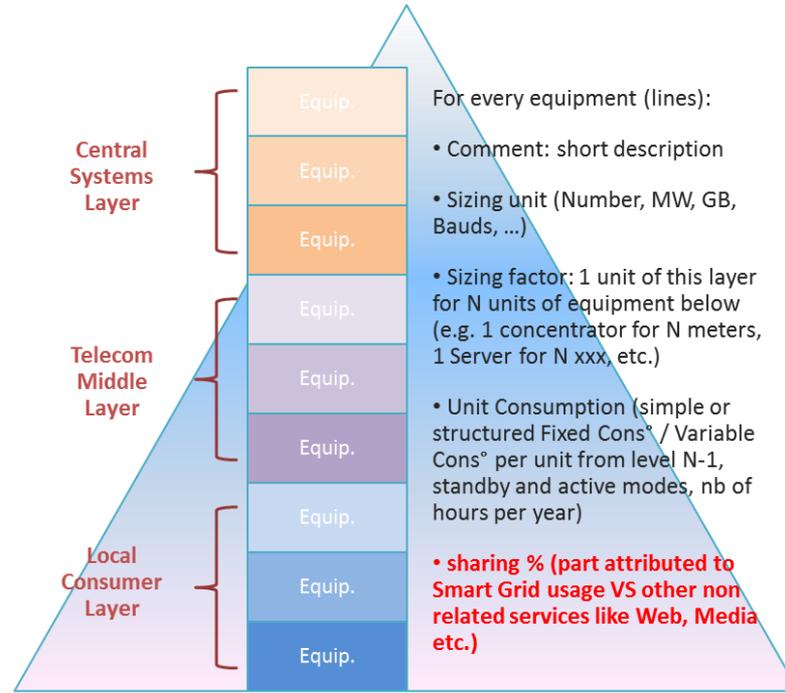Smart Charging of Electric Vehicles (SVEL)

Classification & Unit Consumptions ⟷ **Entire Standard Infrastructure**

Central Systems Layer

Equip.
Equip.
Equip.

Telecom Middle Layer

Equip.
Equip.
Equip.

Local Consumer Layer

Equip.
Equip.
Equip.

For every equipment (lines):

• Comment: short description

• Sizing unit (Number, MW, GB, Bauds, …)

• Sizing factor: 1 unit of this layer for N units of equipment below (e.g. 1 concentrator for N meters, 1 Server for N xxx, etc.)

• Unit Consumption (simple or structured Fixed Cons° / Variable Cons° per unit from level N-1, standby and active modes, nb of hours per year)

• **sharing % (part attributed to Smart Grid usage VS other non related services like Web, Media etc.)**

For 1 infrastructure : sizing
CLIENTS NB, LOAD SHEDDING EVENTS NB, etc

Consumptions for 1 Standard Infrastructure

TOTAL SYSTEM Annual Consumption

Annual Consumption PER CONSUMER

Consumption PER EVENT

Other indicators Consumptions

Evol° 2020 ➔ 2030

% energy efficiency gains 2020-2030 per classified equipt. Moore's Law with cannibalization % = adjusted Moore's Law

Flexibility Undertacking Nb per consumer

⬇

1 standard infra cons° 2030

Extrapolation to France 2020 & 2030

Penetration rate 2020

Penetration rate 2030

Extrapolation to France 2020

Idem
In proportion to the nb of consumers

Extrapolation to France 2030

Idem
In proportion to the nb of consumers

Total electricity consumption

Electricity consumption	Unit	2020	2030
Average scenario [2]	**GWh**	**766**	**996**
High scenario [3]	GWh	851	1535
Without technical improvment (current unitary cons.) [1]	GWh	992	3410

(1) Moore's Law states that ICT consumption is halved every N months (N depending on the kind of equipment)
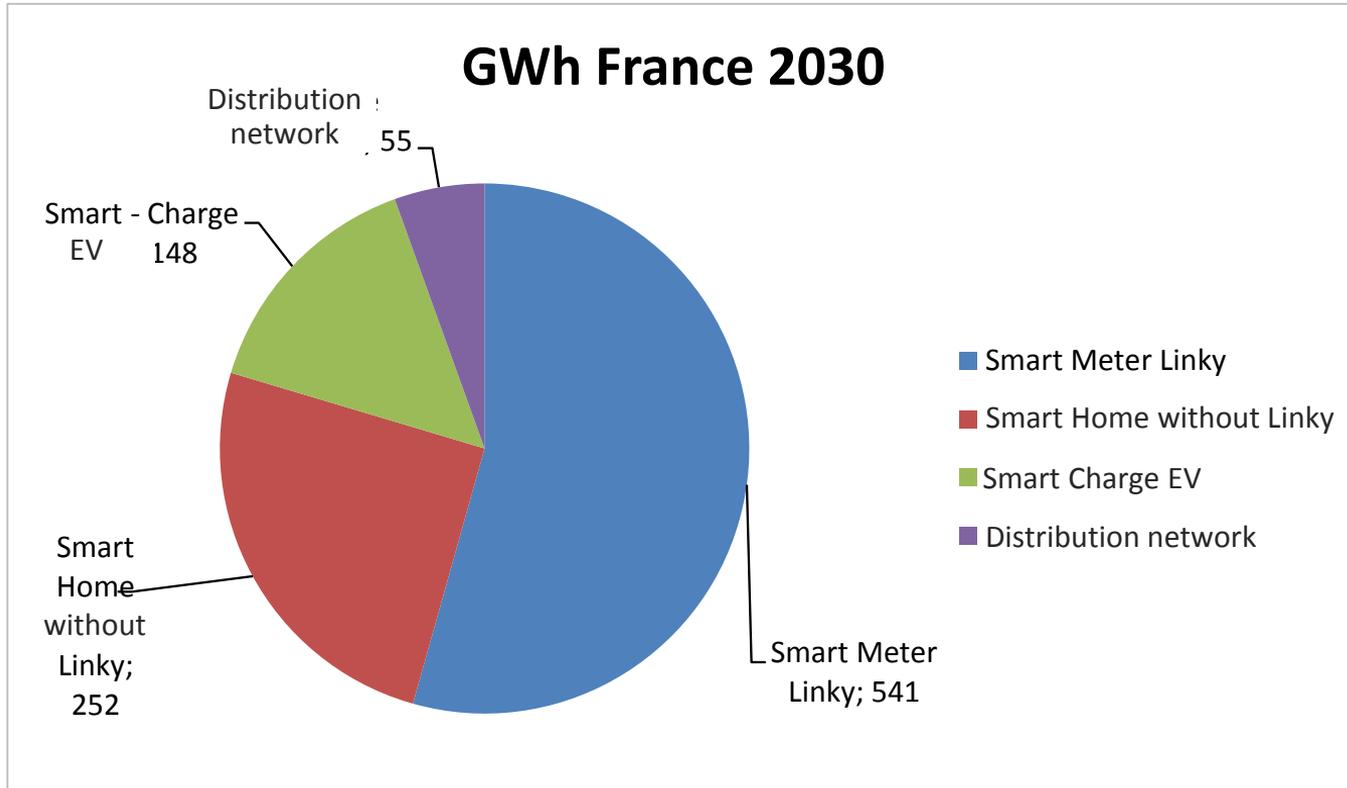(2) With a cannibalization rate of 50%
(3) With a cannibalization rate of 75%

> About 5% of the current electricity consumption
> for multimedia and computing equipment in France
> (around 20 TWh, source: 2014 forecast balance of the National
> Electricity Transport Grid, RTE)

Potential energy consumption distribution in 2030

GWh France 2030

Distribution network 55

Smart - Charge EV 148

Smart Home without Linky; 252

Smart Meter Linky; 541

- Smart Meter Linky
- Smart Home without Linky
- Smart Charge EV
- Distribution network

Flexibility potentials in 2030

2030 consumptions (average scenario)	Total GWh for France	kWh per consumer	Wh per flex event & object
TOTAL Smart Grid ICT layer	996	33	
Linky Smart Meter	541	15	
Smart Home incl. Linky	496	31	9
Smart Home wo. Linky	252	16	4
EV Smart Charging	148	37	113
Distribution Grid	55	2	

Each EV charging point consumes energy continuously for its ICT while it performs less than a full charge per day on average

Data flow and other impacts

- **"Smart Grid Sphere" ➜ 0.1 to 1 gross exabyte per year**

Digital Sphere for the all sectors ➜ about 100 exabyte per year (Mainly due to videos / Increasing trend due to including for domestic uses like security)

➜ **Smart Grids : 0.1% to 1% of the data created by the country**

- Need to open the study to a whole cycle Life approach (not only electric consumption)
- Question the electronic device waste
- Have a quantify approach of the positive impacts of the Smart Grid ICT to calculate clearly energy and CO_2 return time

Recommandations

• Prioritize reduction in consumption and equipment downsizing / Develop "communicating" boxes that **can modulate their activity and easily switch to idle mode**

• Ecodesign software/algorithms

• Develop **know-how in algorithms** that auto-adapt to locally available time, calculation and memory capacities

• **Promote knowledge transfer in terms of ultra-low consumption from Energy Harvesting** objects towards objects with batteries

• Encourage **open standards**, interoperable

• Benefit from the interest of households to security or health, to provide them energy efficient related services.

• **Mutualize equipment, particularly for domestic uses.**

• Motivate clients and operators to use their equipment as best as possible, not only for flexibility but also to generate energy savings

www.ademe.fr

For more information on smart grids

🌐 The specific webpage of ADEME dealing with smart meters

https://www.ademe.fr/particuliers-eco-citoyens/habitation/bien-gerer-habitat/compteurs-communicants-linky-gazpar (in French)

🌐 The ADEME's point of view on smart meters

https://www.ademe.fr/compteurs-communicants-lelectricite-linky (in French)

🌐 Assessment of electricity cons. in the ICT layer from Cap Gemini for ADEME

https://www.ademe.fr/assessment-of-electricity-consumption-in-the-ict-layer-in-smart-grids (synthesis available in English)

🌐 Smart Grids : First results from French demonstrators (Synthesis available in English)

https://www.ademe.fr/systemes-electriques-intelligents-premiers-resultats-demonstrateurs

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Thank you for your attention

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ANNEXES