

Technical Challenges for electricity Utility in Europe



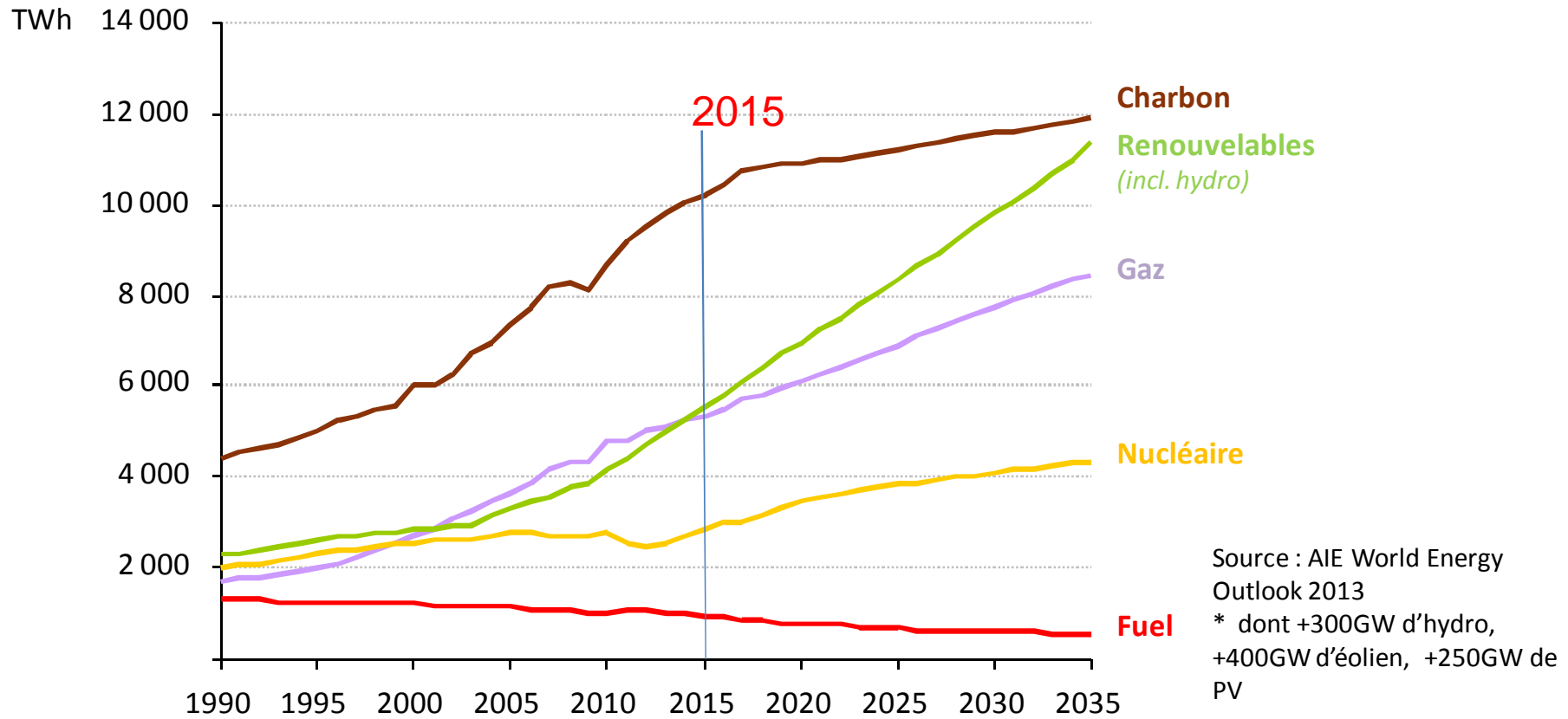
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Agenda

- **Overall challenges**
- **Technical Challenges**
 - **Generation**
 - **Grids**
 - **Sales**
- **Conclusion**

Overall Challenges in Europe : Climate Change



CO2 Management

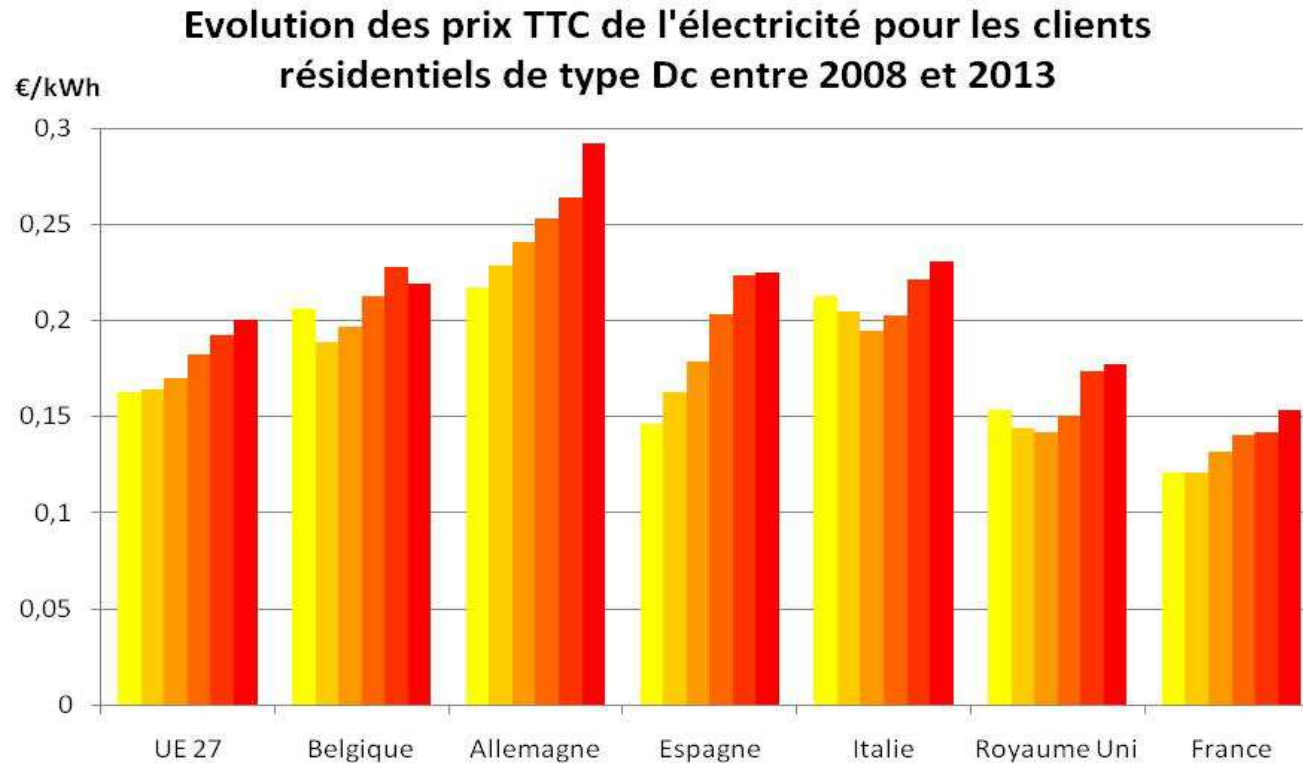


Renewables development

Energy Efficiency

Overall Challenges in Europe : Prices and market design

- Increase of retail prices for small customers : significant impact of renewables costs taxes



- CSPE Tax in France

Source : EUROSTAT

2003: 3€/Mwh - 2014: 14 €/Mwh - 2025 : 30 €/Mwh

(source CRE report october 2014)

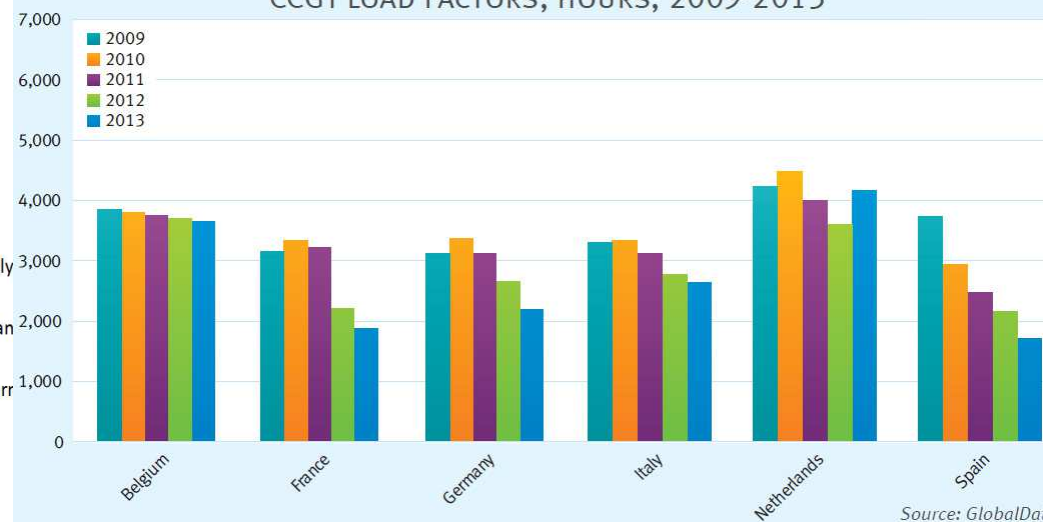
Overall Challenges in Europe : Prices and market design

- Decrease of market prices for generation company driven mainly by a stalling overall demand, renewables capacities growth, and overcapacities for gaz generation:
 - Evolution of wholesale market prices
 - Evolution of the Load of CCGT in Europe

€/MWh Evolution of wholesale market prices (calendar Y+1, baseload)



CCGT LOAD FACTORS, HOURS, 2009-2013



Source: GlobalData

Overall Challenges



**Climate Change
Market Design**

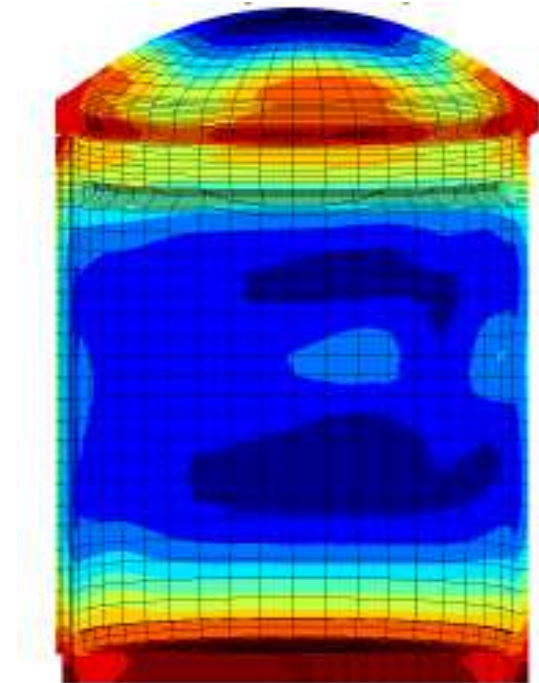
- Innovation is a key element to overcome those challenges and to succeed the energy transition
- Innovation is every where: generation, grids , retail and sales
- Innovation for existing assets improvement and new assets development,
- Innovation for market design

Generation : Existing nuclear Safety and Life management

Example : Concrete structure of Nuclear Power Plant



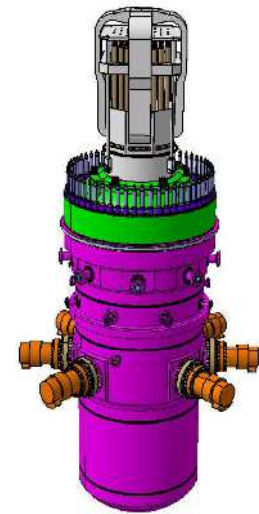
Construction of a 1/3 mock-up of a reactor building in order to assess the aging of concrete structure



Simulation of the behaviour and upgrade of the model

Generation : New nuclear

- **Generation 3 reactor** : Severe accident management / Foak project underway (France : EPR, USA: AP1000, China: Hualong, Russia: newVVER)
- **SMR reactor**: small size, modularity, several technical and economical deadlock to overcome
- **Generation 4 reactor**: overall management of the Uranium cycle



Generation : Thermal plant Capture and storage of CO2



Together with Alstom, Ademe and other partners, EDF a built on the coal plant of Le Havre, a pilot demonstrator of CO2 capture system.

This pilot a captured 1 ton of CO2 per hour with a specific solvent provided by Dow Chemical.

The assesement is about the chemical efficiency of such a solvent and about the penalty of the overall yield of the plant

Still a long way to go...60% of Electricity generation worldwide is coming from fossil thermal plant

Generation : Existing Renewables Projects

EDF EN : a leader for Renewables development

Multi technology expertise



Wind
On and off shore



PV

- + Biomass
- + Marines energy
- + Concentration Solar

Other RES

Generation

- **7 190 MW** built (gross)
- **2 320 MW** construction underway
- **11,1 TWh** electricity generated in 2013

Other Activities

- **10 100 MW** operation and maintenance

Generation : New Renewables

IPVF : Institut Photovoltaïque d'Ile de France

Challenges

- Developing innovative technology concepts for a cost-effective photovoltaic industry meeting industrial needs.
- Bringing partners together into a high value-added research program, with a leading edge infrastructure and an international reference.



- Was granted the ITE (Institutes of excellence for carbon-free energy) **Institute of Excellence** label by the Commissariat Général à l'Investissement.
- **7 stockholders** : TOTAL and EDF, Air Liquide, Horiba Jobin Yvon and Riber, *industrial shareholders* CNRS and Ecole Polytechnique, *academic shareholders*.
- Eventually, about **150 researchers located** on the Saclay plateau for a total budget close to **M€150**.

Grids : Turning Digital

- Smart Meters deployment
- A major digital change, first step of the smart grid system

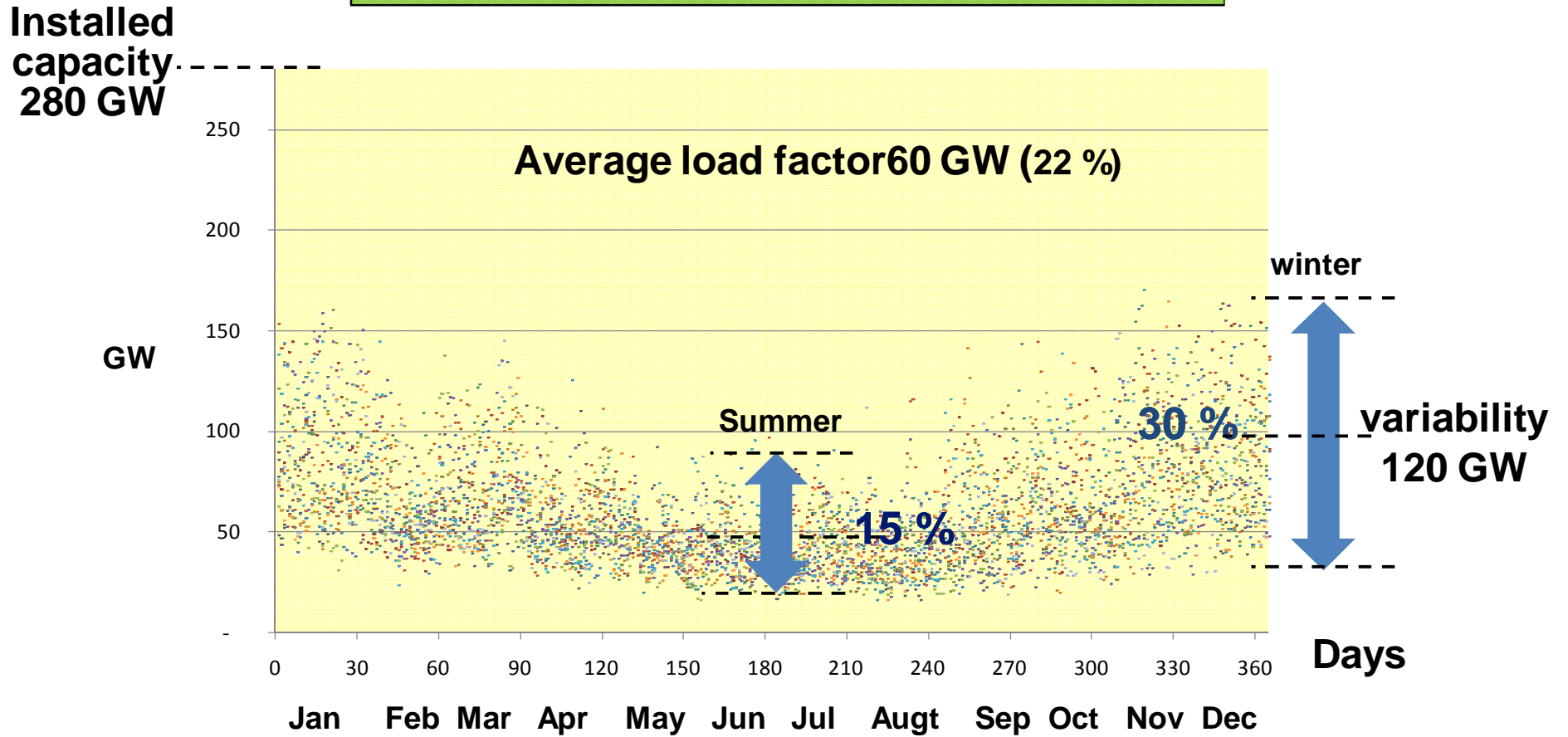


Linky smart meter in France

- ERDF decided end of July to implement a first set of 3 millions smart meters Linky in France
- It is a first batch of the **35 millions meters to be implemented before 2021**
- Main technology of communication between the meters and the concentrators is PLC G3
- A first trial of **300000 meters** has been successfully implemented in Lyon and Tours with high level of performances

Grids : Intermittency management

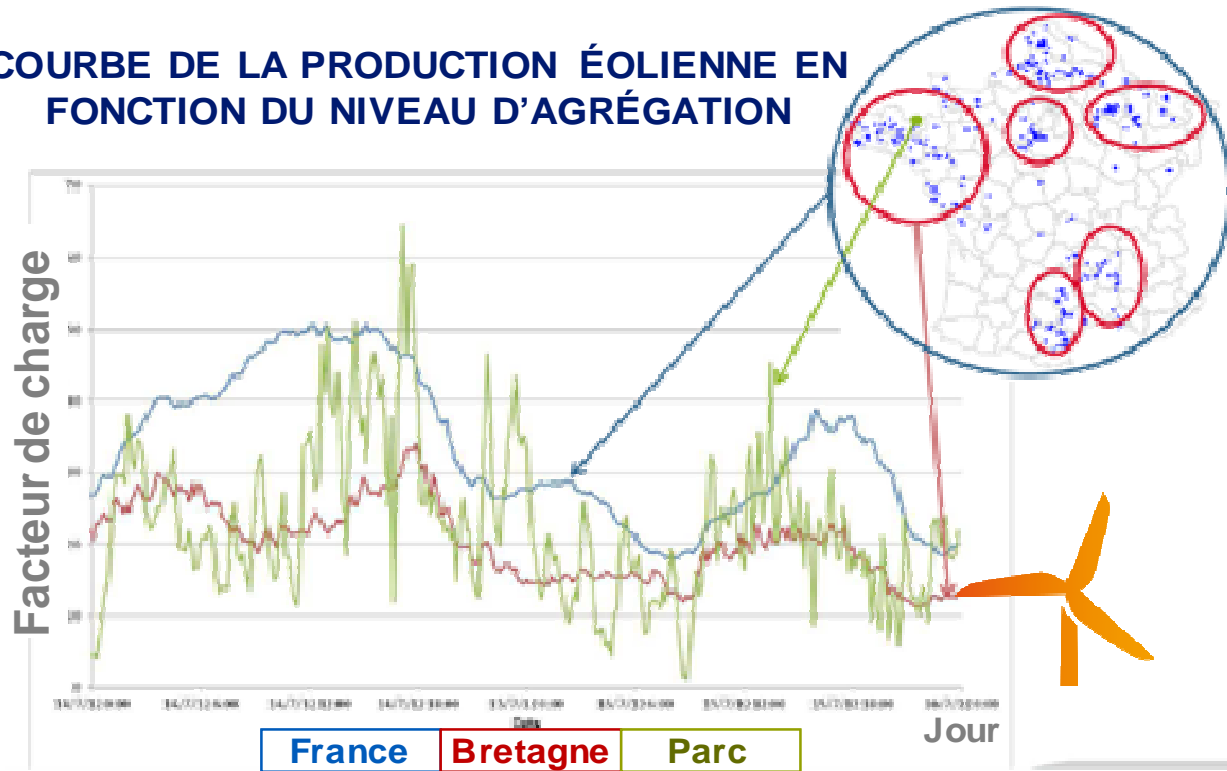
High variability of On Shore wind Generation
(Simulation performed on European landscape)



Grids : Intermittency management

Management of intermittent generation at large grid level smoothens its variability

COURBE DE LA PRODUCTION ÉOLIENNE EN FONCTION DU NIVEAU D'AGRÉGATION



Source RTE 2013

Site level : **intermittency** of the generation profile

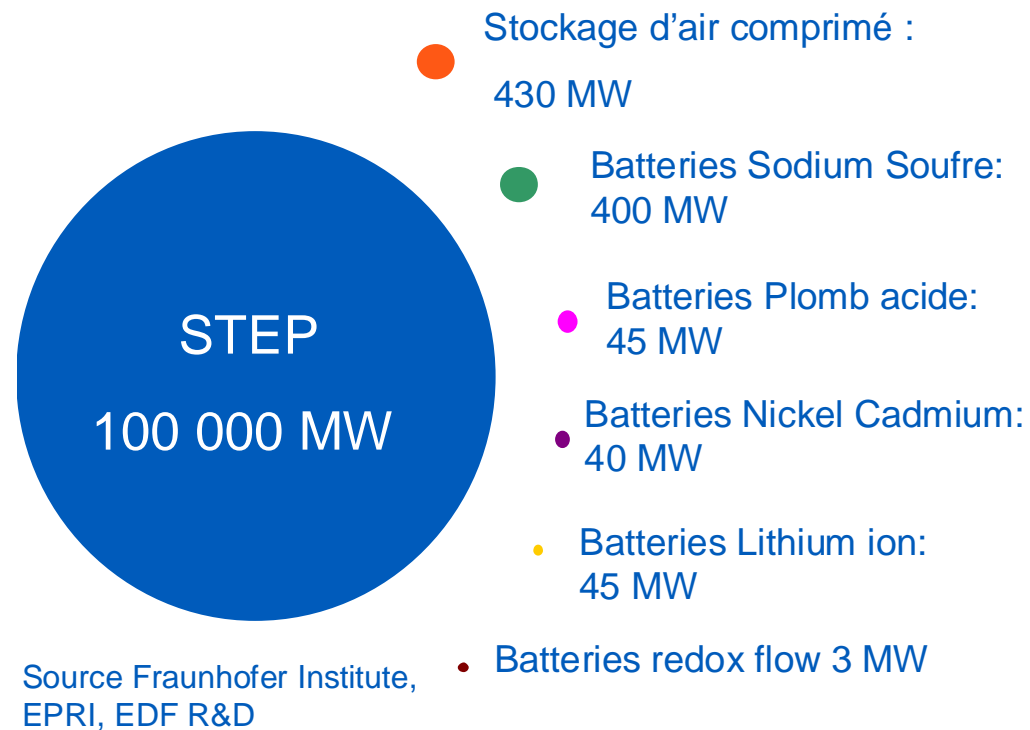
Region level / country level : **variability** of the generation profile

Grids : Storage, a new frontier

Storage : Today some 2% of total installed capacity

Pump storage far ahead by capacity

Batteries : Big technical challenges to reduce cost (still \$500 /kwh, decreasing)



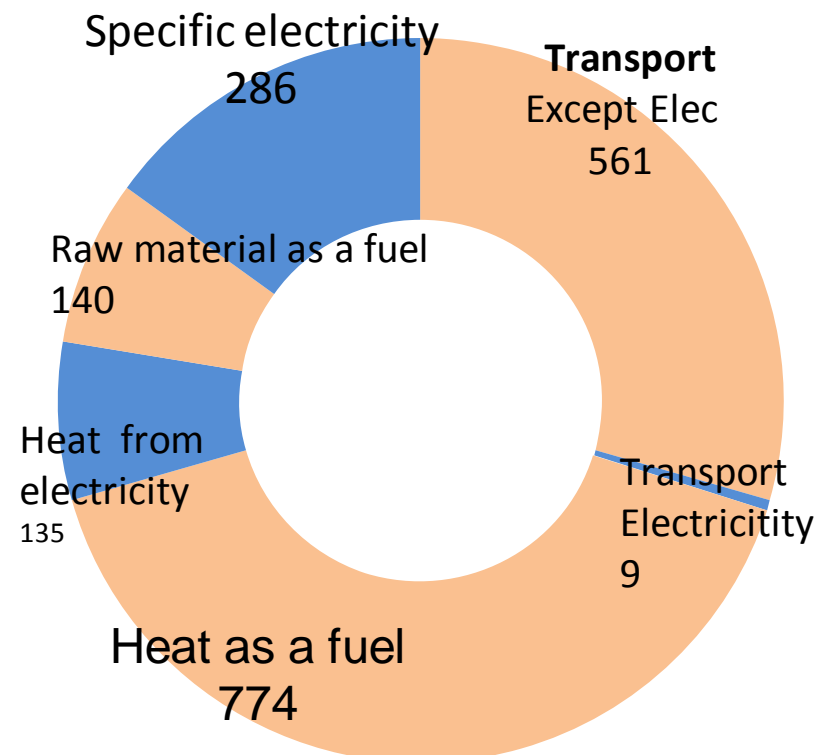
Sales : Energy Efficiency

A key driver of the energy transition

Five mains topics to adress

1. **Buildings envelopes** : Buildings represents 40 % of energy consumption in France and more than 60 % of electricity consumption
2. **Industry** : (30% of energy consumption in France) → Heat Pumps to recover heat or cold loss
3. **Transportation** : (30% of energy consumption in France) → turning electric
4. **Energy management** : digital systems / agregation of uses / smart territories
5. **Customer behaviour**

France 2010 (TWh)



Electricity is less than ¼ of energy consumption

Sales : Digital transformation

Opportunities

- Customer relation (invoicing, power change, ...)
- Big data : new services for customers (load curves analysis, energy saving advice)
- Internet of thing: home energy management systems

Risks and limits

- Cyber security
- Personal data protection

.....And what about new ideas ?

Sales : New uses of electricity / electrical vehicles

Transportation uses 570 TWh of energy every year, 71% oils products

Electrical mobility is a way

1. To reduce oil imports
2. To improve air quality in the city
3. To boost batteries industrial manufacturing

But requires:

- To develop charging infrastructure (may have a grid impact)
- To avoid charging at peak period (7 pm)

Key figures

- 2.5 Twh/ million VE
- Normal charging plug : 3kVA (need several hours) → power of a flat
- Fast charging plug: 40 kVA (30 mn) → power of a whole building

Sales : smart territories

Opportunities

- Growing urbanization : 70% of the world population will live in cities by 2050; the majority of energy customers will be urban citizens
- Trust is more and more focused on local governance ; the power of local authorities on energy topics is growing

Innovation challenges

- A city is a « complex » system to be optimized: electrical grid, renewables, energy efficiency for buildings, electrical mobility, heat or cold network, wastes...
- Which business model for electrical utility ?

To conclude

Innovation is key

*And young engineers to make it
real are welcome !*

Thank you