Mix énergétique et territoires

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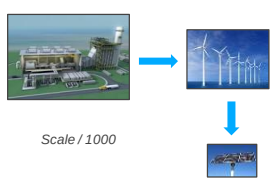
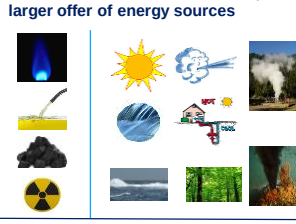
The ongoing ruptures

Smaller and decentralized systems

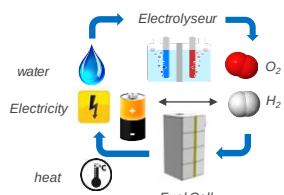


The stakeholders are interested by a **larger offer of energy sources**

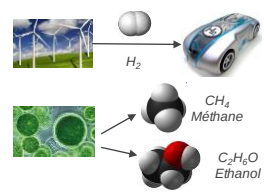


Price ⇔ environnement

Gas and electricity grids are no longer independent, storage becomes key



New aternatives: ENR / H2– biogas / Mobility, Biomass/



Digital: clients are no longer passive, they want to control and to optimize.

The 3D

The new energy world is characterized by **decarbonization**, **decentralization** and **digitalization** (the 3 "D").

DECARBONIZATION

Worldwide renewable energies: annual additional capacity to grow by +70% in 2030 vs 2015

DECENTRALIZATION

Decentralized solutions to more than double by 2030

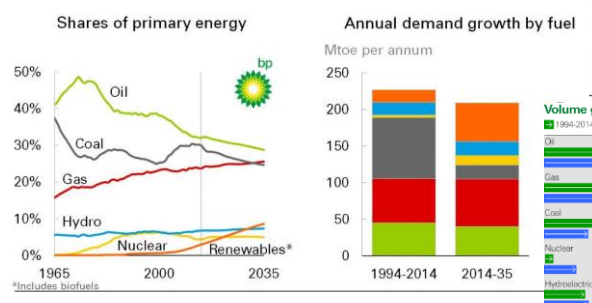
DIGITALIZATION

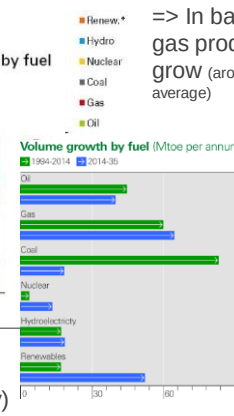
Digital disrupts energy systems and improves customer offers

Open questions:

- Decarbonization: at which speed ?
- Decentralization: which is the right territory size ?
- Digitalization: data ownership ?

Energy forecast: Growth and decrease by sources





=> In barrels, or toe, the oil and gas production will continue to grow (around 2 Mb/day, twice its 10-year average)

Brend price :
60 +/- 10 $ for one year

Oil price over the last 5 years

PB prevision horizon 2035

Fossil shares decrease: 25% each (primary energy)
Renewable increase: 10%
Other analysts expect a faster decrease of coal and stronger increase of renewables

Territory and energy autonomy

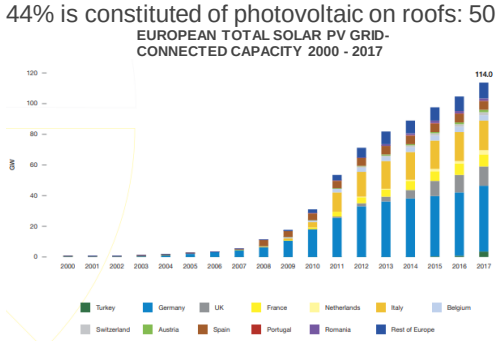
- Thinking about energy and decentralisation, various sizes are possible
  - The country (for France: nuclear + good balance of the purchases + gas storage)
  - The region
  - The cities
  - The house
  - Eventually the island

How to secure energy supply
24 h /day; 7 days/weeks
if the intermittent sources (solar, wind, marine) are not neglectable

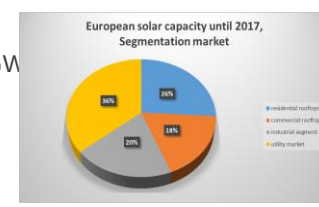
Today, 50% of PV capacity in Europe is on buildings

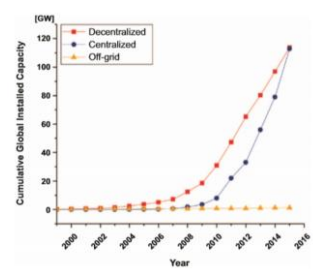
Nevertheless, plenty of roofs are still empty

- In 2017, European photovoltaic capacity exceeds 114 GW
- 44% is constituted of photovoltaic on roofs: 50 GWp



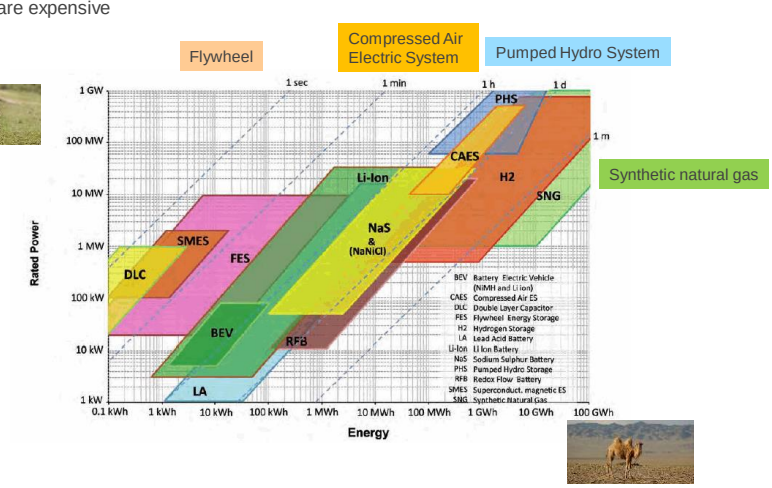
Ref: Solar Power Europe, 2018





Electrochemical electricity storage is not working at large scale

- Some solutions, as the lithium ion batteries have a very large range of use but remain limited in power as in energy + are expensive



Island: Decentralized energy system

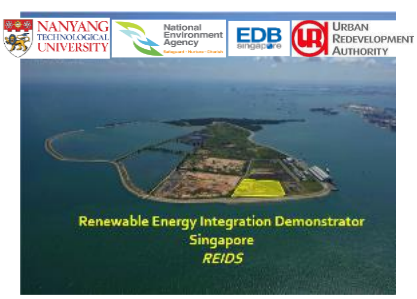
- Local production: Solar + Wind
- Local storage: Battery + H2
- Local use: electricity + mobility (H2 fuel car)

What we test with our partners

Schneider Electric

- Material
- Power Management System
- Energy Management System

Current issues arise when working on the interface between EMS and PMS and SCADA on the breakdown of functionalities and added value to the whole system.



The boundary EMS&PMS is not standard in the industry (both time and functionalities), although <15 min:
• Characteristic time for stabilization of a variation of load/production: ~ a few seconds
• Automation and real time control deals with issues on that particular time scale, so targets for the next 15 min is not sufficient as the information supplied to the PMS is too limited for the PMS to rely completely on it and have stability

MODELING

1 Energy/Mobility co-optimization

- Assess business case of e-mobility offers considering both mobility and energy dimensions

2 Multi-Fluid

- Assess value of synergies in multi-fluid energy systems (Power2Heat; Power2Gas)

3 3D Territories (decentralized; decarbonized; digitalized)

- decarbonization energy scenarios for cities/territories thanks
- Link with Siradel 3D tool for visualization

4 Energy Community

- Support new offer development in local energy community/P2P energy sharing.

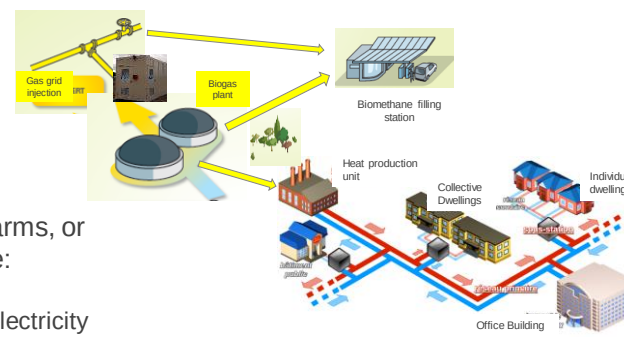
5 Rural Electrification

- Arbitrage between mini-grid and grid reinforcements/extensions to electrify villages

6 New algorithms

Stochastic Optimization and Forecasting	Assessment of business case of DER applications considering impact of forecast errors and uncertainty
Multi-agent	Assessment of value sharing among actors for different interaction/market models on flexibility services

Role of Green Gas



District heating Network

Lilibox

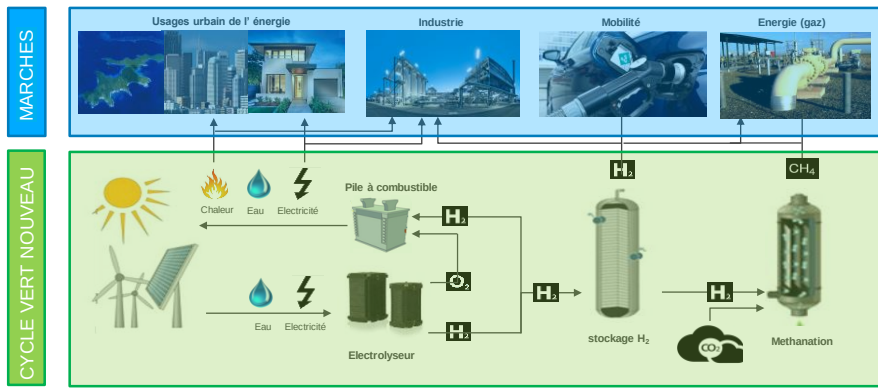
Biogas produced in the farms, or from the wastes, could be:

- Used for cogeneration (electricity or/and heat)
- Processed and injected in the grid
- Processed and use as fuel

When it is not possible (grid saturated or too far) one may store the gas.

→ Little Liquefaction Box

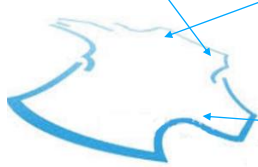
Hydrogen: the link between the electricity and gas grids



Green H_2: fluel and raw material

Projet Enefield

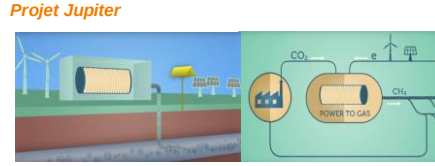
Test de plus de mille piles à combustibles au niveau européen dont certaines en Alsace



Projet Ghryd

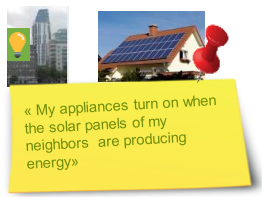
Production d'hydrogène pour le mélanger avec du méthane et le tester dans des applications urbaines (maisons, bâtiments et mobilité)

Projet Jupiter



Production d'hydrogène pour injection dans le réseau de transport de gaz et production de méthane à partir d'émission CO_2 de la zone industrielle de Fos

Energy Community: codesign of the solution



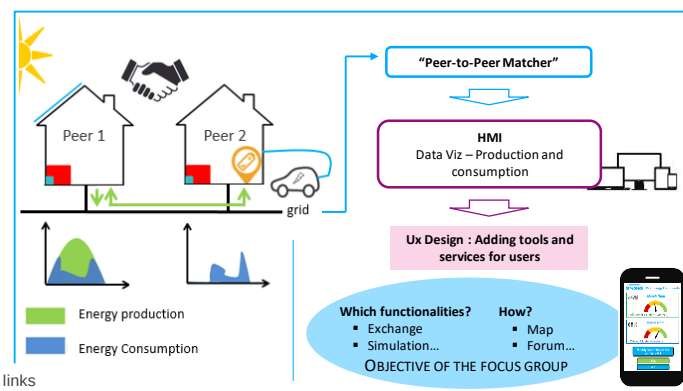
- **Customer start expressing** wishes and needs energy communities and show that **many local initiatives** are being launched
- Customer survey in Belgium show **(very) positive reactions towards « sharing its energy »**
  - Very favorable RES energy producer ready to share its energy
  - Favorable consummer, ready to become RES energy producers and share its energy
- Key reason to share its energy is **to valorize its investment**, environnemental concerns comes in second position but is important for few of them

ENGIE developed since 2016 a Proof Of Concept in Belgium

Objective of the focus group
Define the functionalities of the MVP App

Key-messages:

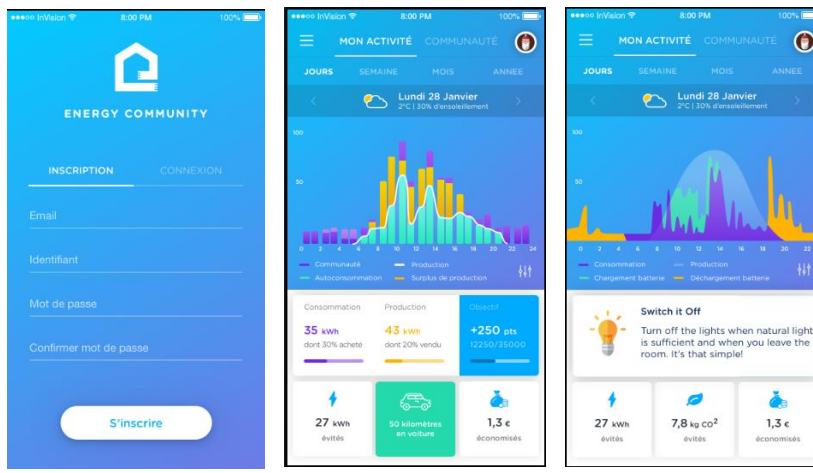
- Financial profitability
- Anonymity
- Large clusters
- Right of disconnexion



Recommandations:

- Anonimity and distant interpersonal links
- Functionnalities mainly automatized
- Integration of « little pros » (independant professions, retailers…) to enhance optimization
- Ensure equivalent interest for both producers and consumers

Example of potential HMI / Me



To conclude: one need to be present along the overall chain to find the right solution

- Costumers have to design the territories of tomorrow
- Production / distribution / storage / exchange they have to choose
- The "circuits courts" are not always the cheapest ones but may be the more "vertueux"
- Since the electricity storage is today roughly expensive and inefficient, Power to Gas & P2G2P are parts of this future; pilots and research efforts are mandatory.