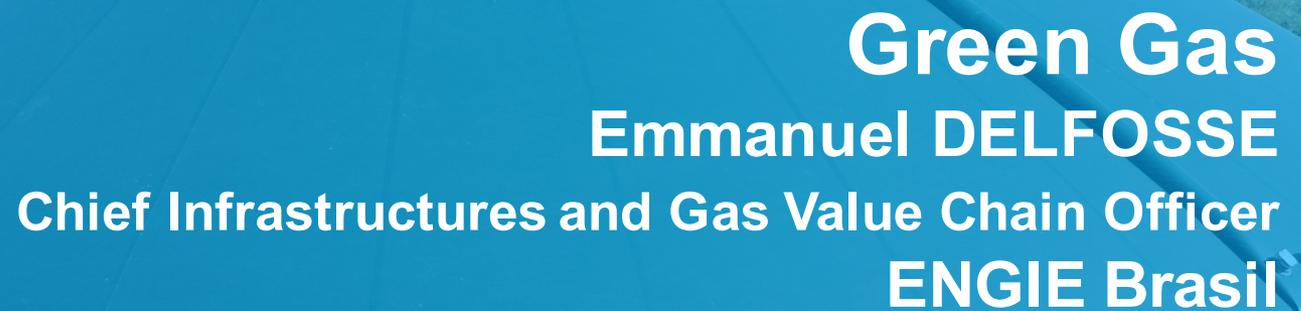




ENGIE

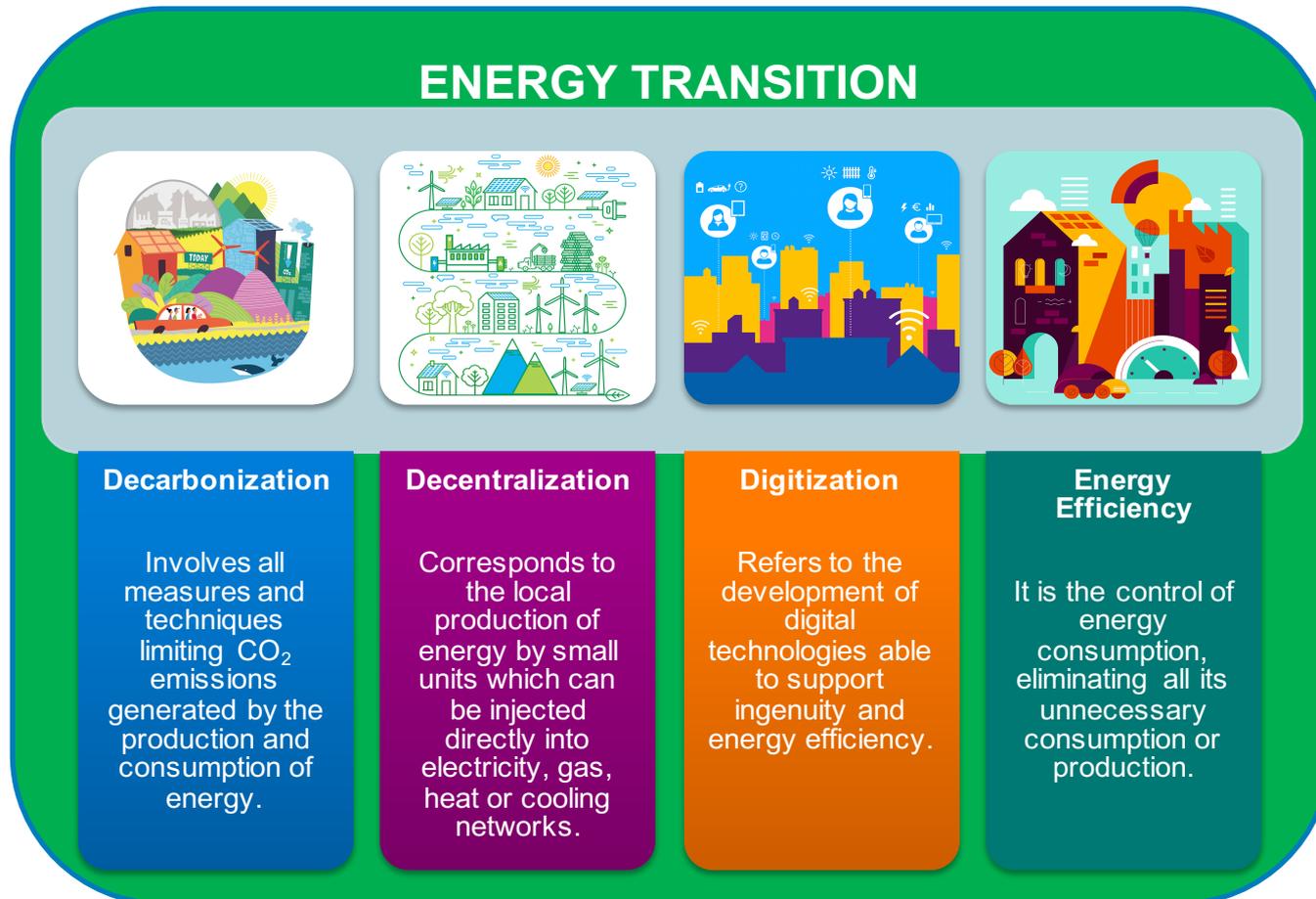


Green Gas
Emmanuel DELFOSSE
Chief Infrastructures and Gas Value Chain Officer
ENGIE Brasil



- ENGIE develops its businesses (power, natural gas, energy services) around a model based on responsible growth to take on the major challenges of **energy's transition to a low-carbon economy**: access to sustainable energy, climate-change mitigation and adaptation, security of supply and the rational use of resources.
- The Group provides individuals, cities and businesses with highly efficient and innovative solutions largely based on its expertise in four key sectors: renewable energy, energy efficiency, liquefied natural gas and digital technology.

- *To successfully complete the energy transition, ENGIE focuses on Decarbonization, Decentralization and Digitization to reduce CO₂ emissions and achieve Energy Efficiency.*

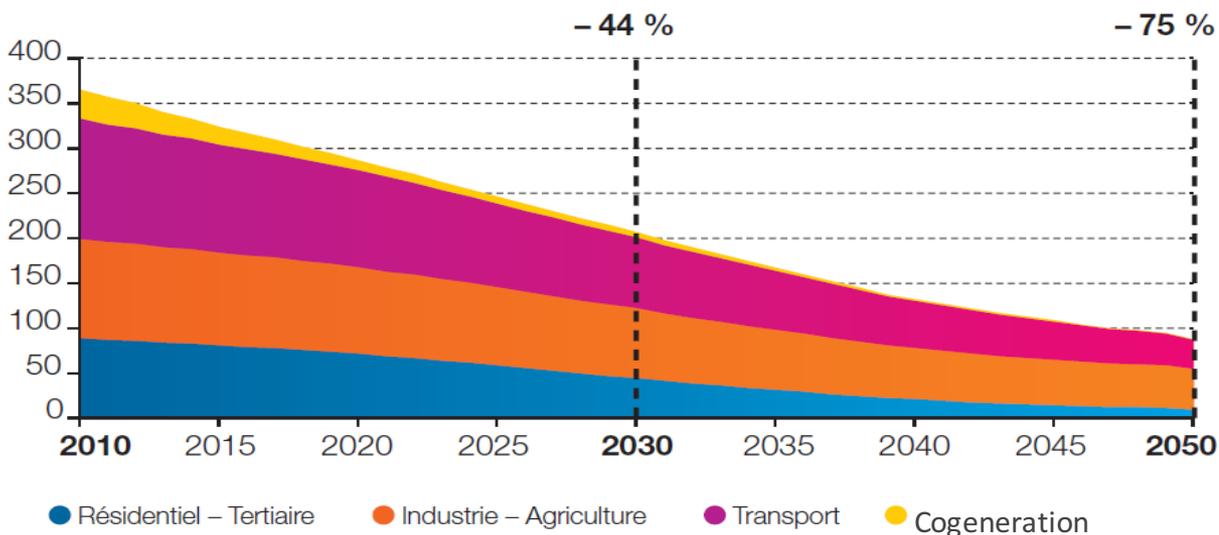


2050 French Energy scenarios

How to meet the 2050 carbon emissions targets Factor 4 ?

- ⇒ more consumers consuming less
- ⇒ energy efficiency in industry
- ⇒ green mobility
- ⇒ **biomethane produced locally**

Direct CO₂ emissions by sector [MtCO₂/year]



Biomethane injection ambition

An ambitious
roadmap target:
30 TWh
biomethane
injected into gas
grids in 2030

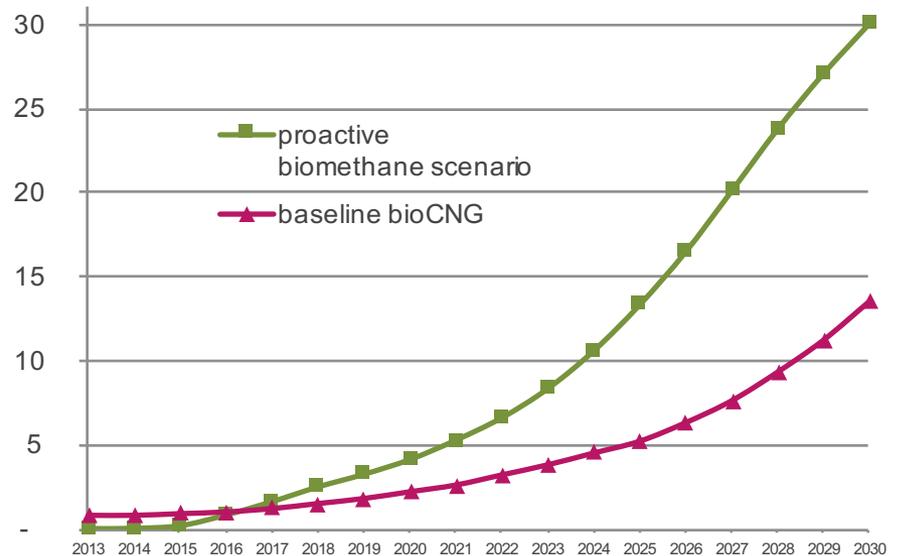
2030 – business as usual
12 TWh PCS (1 Mtep) ~ 500
injection sites

2030 – proactive scenario
30 TWh PCS (2,3 Mtep)~
1400 injection sites

Biomethane-to-grid
development offers new
outlook to NGV in France

IKEA and Carrefour both
launch bioNGV logistic
solution in French main
cities

TWh Biomethane previsions- 2030 target



The French Minister of Ecology, Sustainable Development, and Energy has set a target of **6-8 TWh in 2023** and **10 % of injected biomethane in the total gas consumption by 2030**. This 10% goal is based on the French biogas roadmap in 2013 which foresees 30 TWh biomethane injected into gas grids by 2030.

Legal and regulatory framework evolution

8 decrees published in November 2011. Main measures :

- ⇒ Biomethane from landfill or produced with agricultural, agro-industrial and urban waste is allowed to be injected into the natural gas grid.
- ⇒ If technically feasible, LDC is obliged to distribute biomethane
- ⇒ Producer is guaranteed to sell its biomethane to a gas supplier (eventually the “ultimate buyer” at a regulated price rate for 15 years - Biomethane buyers = gas suppliers
- ⇒ Guaranties of origin will help tracking biomethane once injected into the grid. Those should encourage gas suppliers to develop green gas offers.
- ⇒ Feed-in tariffs:
 - Landfill : between 45 and 95 €/MWh
 - Methanisation : between 69 and 134€/MWh

In 2013-2014, additional texts were published, to enable:

- « Double valorization » for both electricity and biomethane production with a specific feeding tariff
- Biomethane from sewage sludge

Biomethane framework a perpetual construction

Locally: linking and meshing downstream consumptions

- closing/opening a valve over winter/summer
- building bonds between 2 zones that did not use to be connected

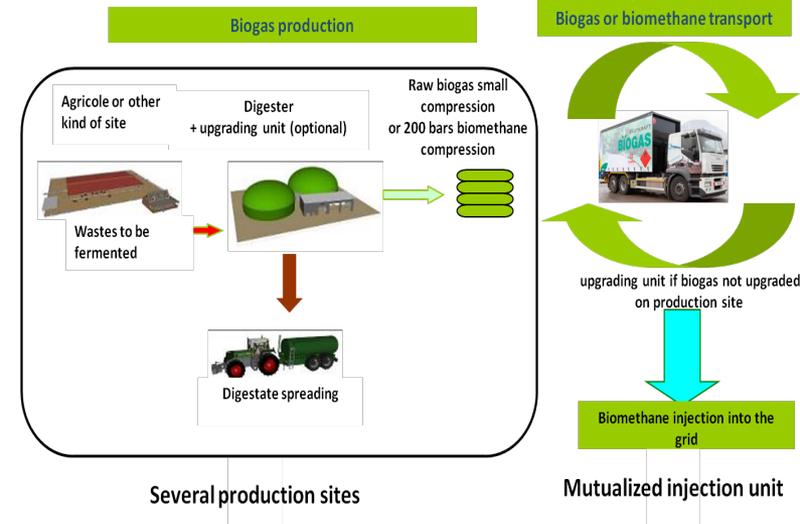
At the grid(s) level: studying overall solutions such as reverse (upstream) flow

- Compressing the gas in order to jump up from one pressure level to a higher one, thus reaching larger consumption zones.

When injection does not turn to be feasible :

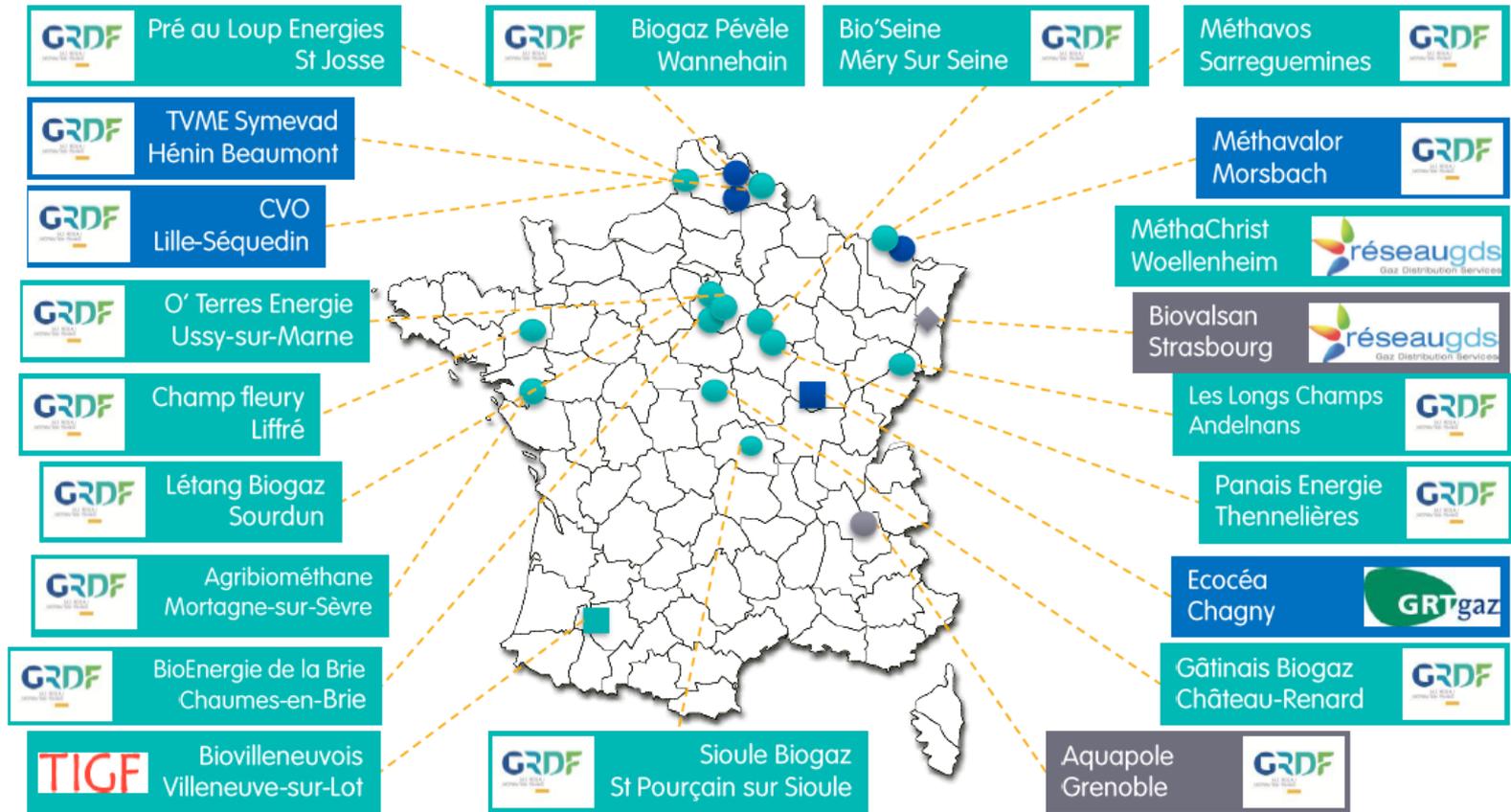
- propose more adequate location
- develop centralized injection

Since 2011, the Working Group « Injection » (*) has been pivotal to coordinate the sector's development and to frame a shared agenda between the administration and the industry



In addition to network technical solutions to increase biomethane absorption, bioCNG development will be necessary to reach 30 TWh target

Injection points in ENGIE French distribution grid



- Urban waste
- water-treatment plants
- Agro / Agro-industry waste

21 biomethane-to-grid plants inject over 336 GWh/year (~28 000 households)