Scaling up EU's green gas potential for tomorrow's energy system

IFRI Energy Breakfast Roundtable – April 24th, 2019

Martin Jahan de Lestang

Managing Director Gas Chain Metier

1. Gas, a critical vector for all low carbon energy systems

- **491 bcm gas consumption** in EU (2017).
- **Major role in power generation** (19% share), **industry** (33%), **space heating** (35%) and **growing role in transport** :
  - competitive solution for space heating & industry processes (especially high temperature)
  - credible low carbon solution for heavy duty mobility.
- Offers **seasonality coverage at least cost** : existing storage, avoidance of additional hefty investments.
- Gas makes it possible to **get quick wins** (air quality in cities for example).
- **Gas itself is becoming more and more renewable:**
  - **Biomethane** can be blended with natural gas without any impact on processes
  - **Power-to-gas** opens up new **systemic optimization** possibilities.
- **Green gas is not merely about energy** :
  - Waste management
  - Territorial energy autonomy
  - Sustainable agriculture
  - Local jobs

Positive externalities of biomethane: 55-85€ / MWh (ENEA).

2. ENGIE’s vision for 2050

- **Electrification alone will not ensure the deep decarbonization of the European system without massive extra costs** that would put at risk the security of the energy system, the industry and the purchasing power of Europeans. Numerous studies show the interest of ensuring an optimal mix between:
    - energy efficiency,
    - electrification of uses,
    - greening of gas and heating networks,

  depending on the potential of each country, to achieve full decarbonization at the lowest possible cost.

- **The main technologies of gas decarbonization considered today are:**
    - biomethane,
    - gasification of biomass,
    - power-to-gas (renewable hydrogen or synthetic methane),
    - CCSU.

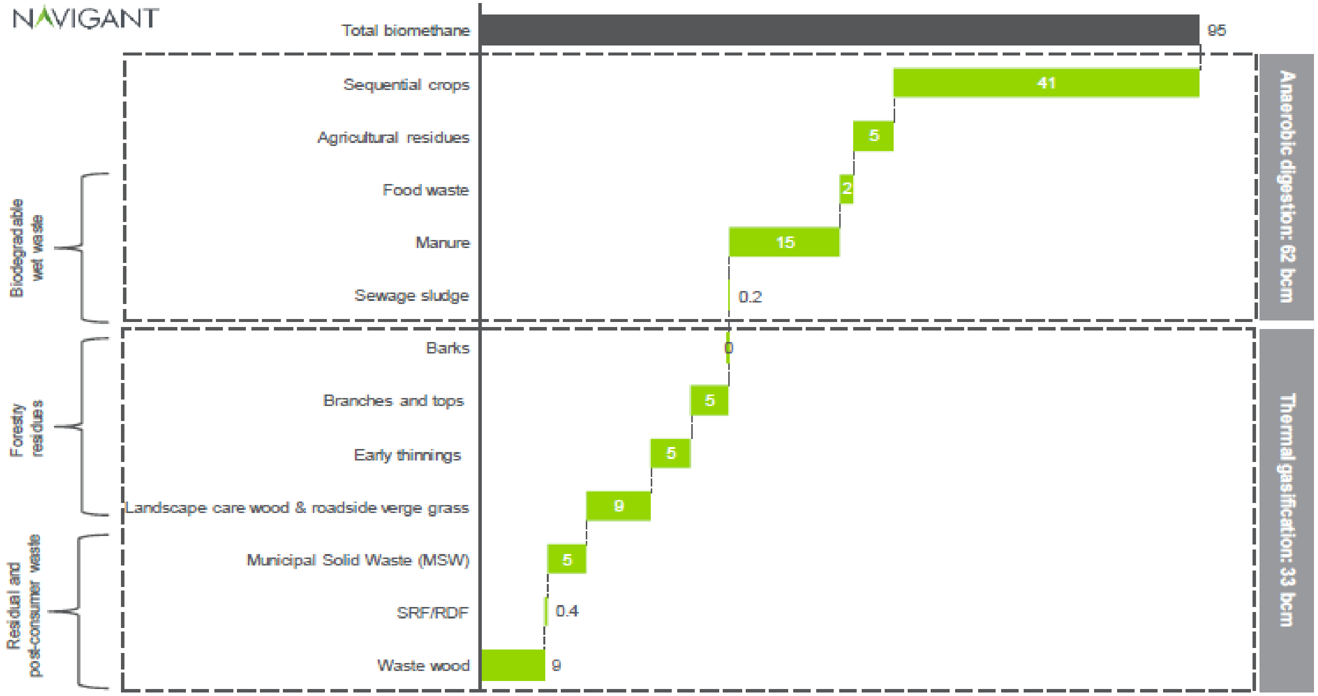
- **For France, which has a massive potential for agricultural and forestry biomass, ENGIE estimates that it is possible to target 100% green gas in 2050 for volumes that could reach up to 300 TWh** of final demand if the French society and State are mobilized around the ambition of a decentralized and solidary energy transition, closer to the resources of each territory.

3. European green gas potential: Europe could target massively decarbonized gas by 2050

According to the *Gas for Climate* study, total potential of renewable gas by 2050 within the EU:

- **1,170 TWh (~95 bcm) of renewable methane :** 62 bcm based on anaerobic digestion; 33 bcm from gasification
- **1,710 TWh (~160 bcm) of green hydrogen, demand driven.**

EU biomethane potential per conversion technology and feedstock type (in bcm) by 2050



Source : Navigant, Gas for Climate. *The optimal role for gas in a net-zero emissions energy system*, March 2019.

4. A multi-vector based decarbonation is clearly the best option

ENGIE’s internal assessment of full decarbonization in Central-Western Europe

- Different scenarios taking into account the European biomethane potential from the JRC-EU study, with a rather conservative approach (using 820 TWh).

Results:

- **Gas demand can be up to 100% decarbonized, depending on the part of imported green gas,** which could reach a price level of 75€/MWh.
- Both the balanced multi-vector scenario as well as the more electrified one fully use the biomethane potential, together with 500 TWh hydrogen. The complement is brought :
    - by green gas imports in the balanced multi-vector scenario
    - by additional H2 production in the highly electrified one.
- **A multi-vector based decarbonization scenario:**
    - **accelerates energy transition**
    - **allows to decarbonize per end use and per vector**.
- **Decarbonization pathways based on high electrification rate lead to higher economic cost.** PV of cost difference with multi-vector scenario: **+ 520 G€***.
    - **Electrification** (notably of space heating) **increases peak demand**. => significant investments in dispatchable firmed capacity (with low operating hours)
    - Energy expenditures mainly increase for households in country with limited wind and solar yields/potential.
    - **Biomethane (1G and 2G) is more competitive** than synthetic gas. In all scenarios, the biomethane potential is **fully used**.

(*Quantification not including additional cost required for T&D networks reinforcement in the highly electrified scenario, notably to cover the peak in 2035-2040.)

5. A key challenge : bring green gas technologies to a competitive cost level with natural gas

- **Industrialization levers for the biogas sector :**
  - optimization of feedstock mix and biology to increase productivity with digital AI solutions
  - demand aggregation and equipment tenders
  - standardized, optimized designs to decrease CAPEX
  - predictive maintenance to reduce OPEX and improve availability
- **Still some work to be done…**

… but we are firmly convinced that green gas production can be industrialized to decrease costs while responding to local situations.

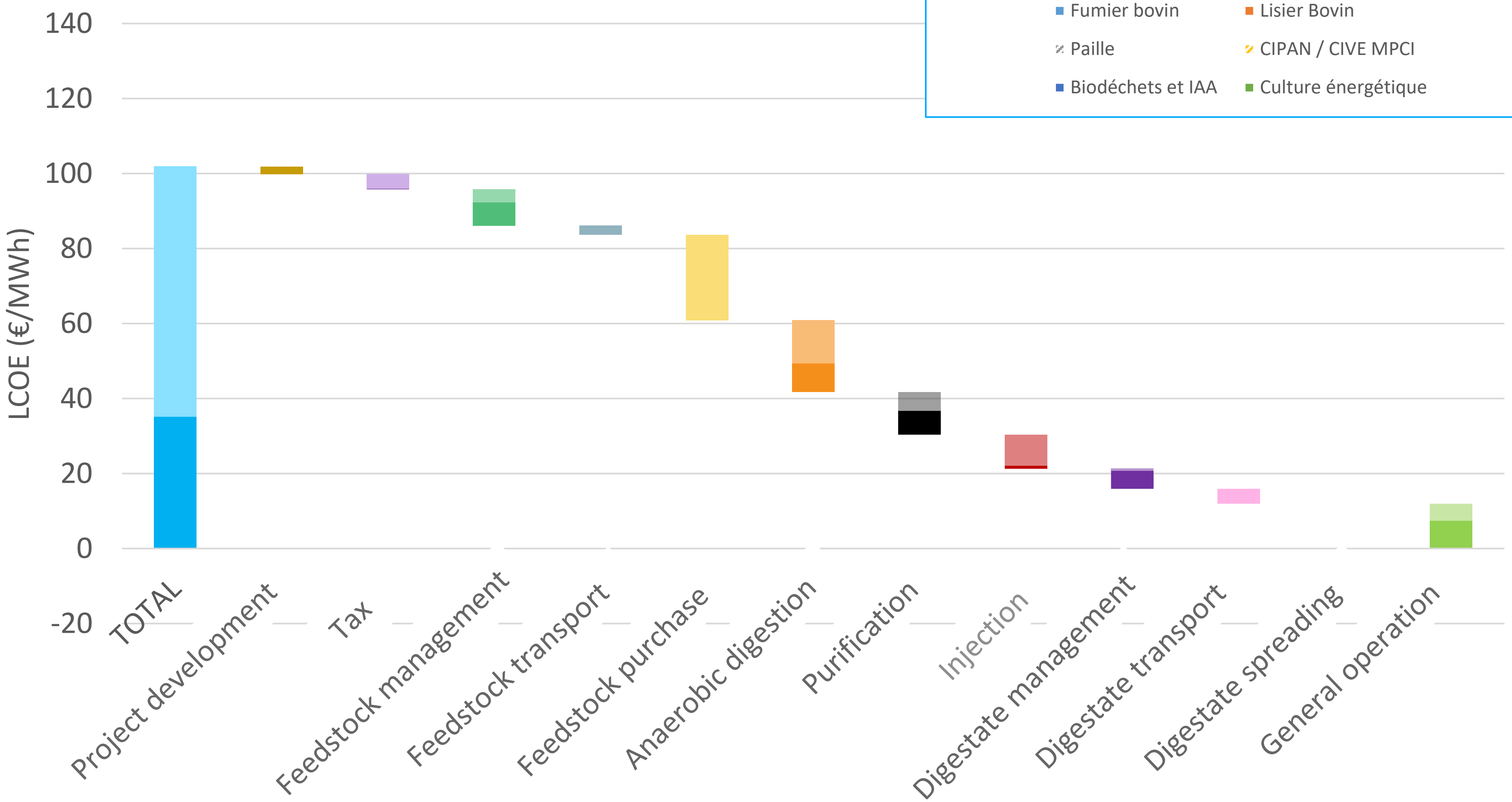
Depending on the technologies, we expect that green gas will ultimately reach a competitive cost level, between 50 €/MWh and 75 €/MWh if imported.

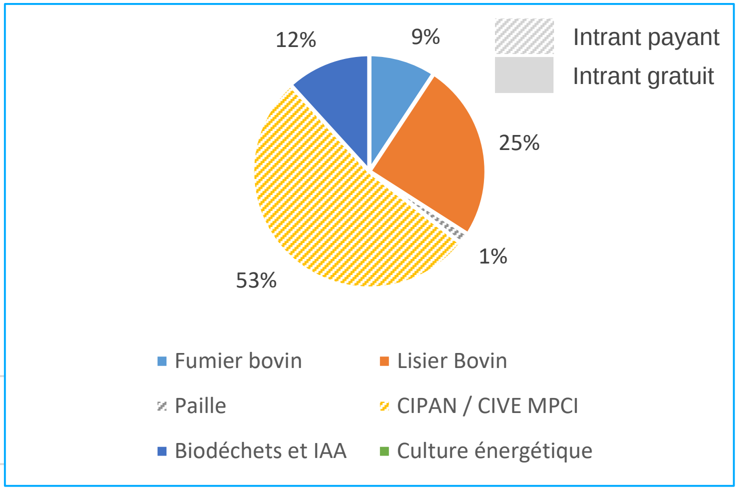
- **For France, ENGIE's roadmap for development:**
  - **being market maker in biomethane:**
    - 800 M€ mobilized to develop biomethane units and support the biogas sector. Target : 15% market share in France;
    - Ongoing work to unlock projects in their starting phase; including mobilizing additional financial means (guarantee fund, equity fund)
  - **betting on green H2 development,** underpinned by a strong cost decrease for electrolysers, similarly to the battery cost curve (~1000 €/kW => ~400 $€_{2015}$/kW in 2050)
  - **exploring all chances of succeeding in gasification.**

6. Costs: playing on different levers

Waterfall LCOE 200 Nm³/h

Collective farm profile - FR





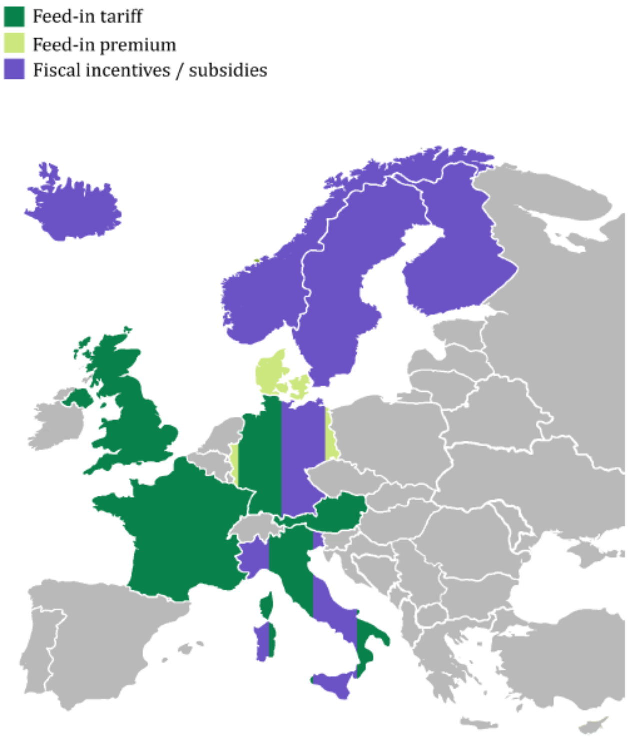
Source : ENEA study (ongoing)

7. Market design

Our challenges:

- cover the current extra cost of renewable gas (objective of parity with natural gas + CO2 tax by 2030 in France) and develop sufficient volumes;
- reconcile an integrated European market and a logic of circular, local economy (favor local production).

Nowadays, solutions are essentially designed at national level and vary across Member States.



EBA statistical report 2017
Geographical distribution of the support schemes in force in the EU for biomethane in 2016

We need an integrated European framework with:

- the **same definition** and the same value for renewable gases;
- a **shared vision of the potential**, which will enable to accelerate the anchoring of renewable gases in the European regulation (RED2, future regulations);
- **Integration of the best experience feedbacks** from Member States **for an adapted support framework** (tariffs, obligations…) avoiding market distortions.

Conclusions: Green gas development needs

- **Visibility for investors** through green gas target(s) at EU level
- **Cost-effective financial support** for local green gas production while limiting impact on consumer bills
- Green gas tracking through **guarantees of origin**
- Recognition and valorization of **positive externalities**
- Dedicated **R&D support**
- Proper **accounting of CO2 savings**
- Recognition of the **role of gaz in sustainable mobility:** light & heavy duty, maritime.

Thank you for your attention!

APPENDIX

Biomethane ressources (1G+2G) are fully exploited in both scenarios. In 2050, the remaining gas supply consists of external green gas imports or production of synthetic fuels (leading to doubled H_2 production)

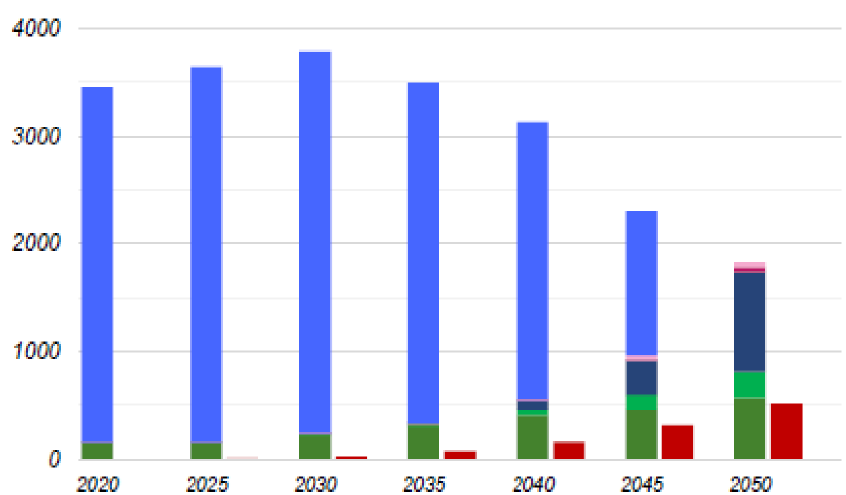
Import of green gas starts in 2040 and reachs 50.1% of supply in 2050, while domestic e-gas is only competitive to supply 5.6%of the demand (=93 TWh).

Production of 510 TWh of Hydrogen.

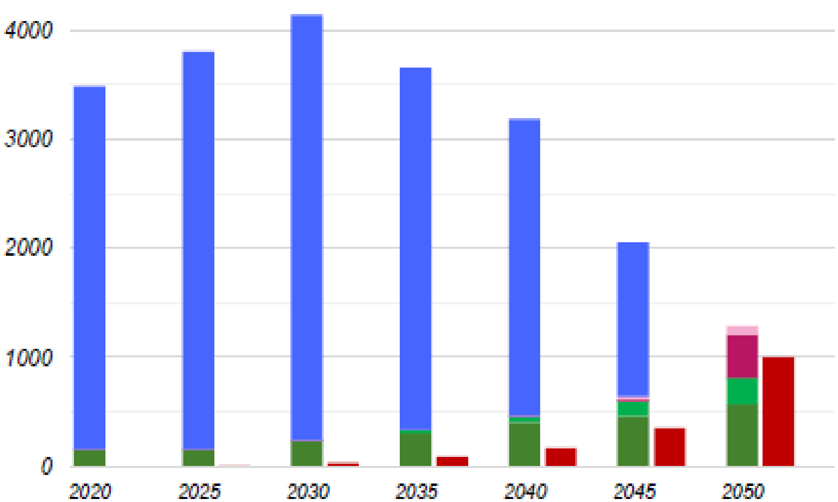
Biomethane fully exploited in 2050. Domestic e-gas reaches 37% of total gas supply in 2050.

Production of 1005 TWh of hydrogen.

C-WE Gas supply in "External Green Gas" [TWh/yr]



C-WE Gas supply in "Early Electrification" [TWh/yr]

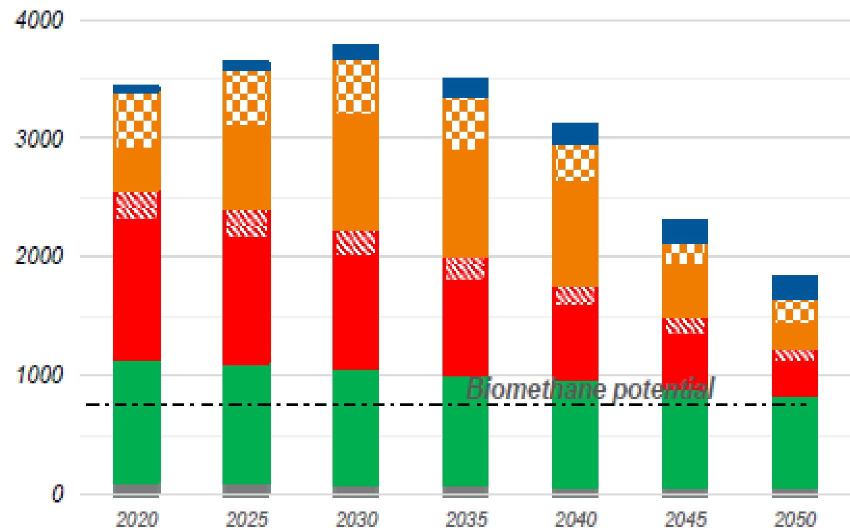


In both scenarios, gas consumption increases until 2030 due to a higher generation of gas power plants. It then drops significantly to reach full decarbonization, thanks to decreasing heating and power generation usages.

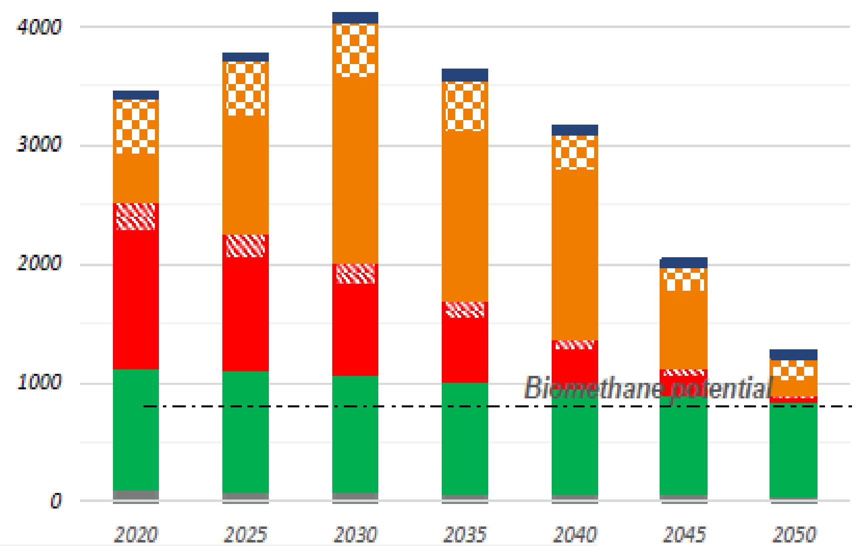
Gas demand drops by 47% in 2050 in "External Green Gas". In terms of final energy share, gas is stable in the industrial sector, decreases but remains as a vector for heating (20% of buildings) and partially decarbonizes transport (18% of trucks).

Gas demand drops by 63% in 2050 in the "Electrification" scenario. In terms of final energy share, it is used almost only in the industry (negligible demand from the residential and tertiary sector) and in the power sector.

C-WE Gas demand in "External Green Gas" [TWh/yr]



C-WE Gas demand in "Early Electrification" [TWh/yr]



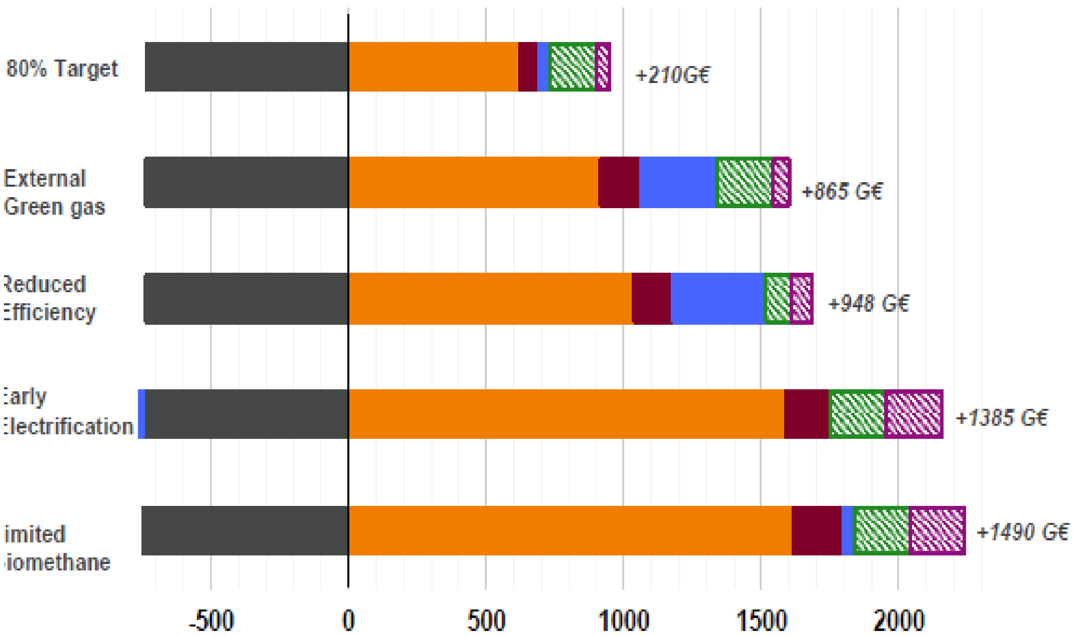
Transport | Gas-to-Power: Elec., CHPs | Buildings: Heating, Others | Industry | Others

Decarbonization leads to a shift of oil expenditures towards electricity (and hydrogen). The increase in gas depends on the scenarios pathways.

Oil | Gas | Electricity | H_2 | Retrofiting | DSO reinforcement

Energy system* costs compared to "Current policy"**

[ΔG€*** in net present value]



- Strong energy efficiency allows to decrease energy expenditures of full decarbonization. Those benefits mainly materialize at the end of the transition.
- Full decarbonization based on high electrification increases significantly energy system cost: Early Electrification" is + 520 GEUR more expensive than External Green Gas.
  - The increase is due to an increase in electricity expenditures, facing both a volume (switch from gas to power) and a price effect as electrification leads to higher share firm capacity required (notably in winter to cover episodes with low wind production).
- Not developing domestic biomethane futher increases the decarbonization cost by +105 GEUR, as it leads to higher gas expenditures in the fully decarbonized system.

** Energy system cost = Energy expenditures – CO_2 tax revenues + Building retrofitting costs + Electric grid reinforcement for DSO. Energy Expenditures: expenditures taken from wholesale markets (incl. CO_2 tax for fossil fuels). For oil, only crude oil is included (i.e. not the cost of refining/distillation). For gas, subsidies and revenues (due to limited potentials) of biomethane are also included, as well as network upgrade cost required for the injection. Electric Grid reinforcement cost: first estimation based on peak demand increase in RES/TER sector (deeper and local analysis needed).*

*** Current policy: scenario accounting for current climate policy up to 2030 and leading to -30% decarbonization.*

**** Net Present Value using a 5% discount rate taking 2050 values as final steady state situation.*

TRACTEBEL engie

The European regulatory framework : a work in progress. A need to better aknowledge the role of gas, then green gases in deep decarbonization

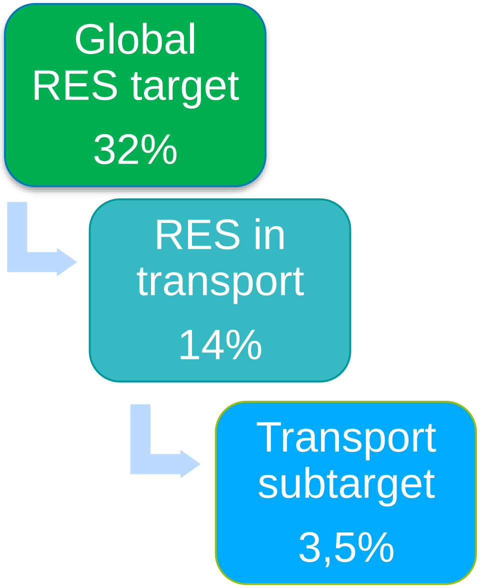
No dedicated renewable gas target in the Renewable Energy Directive (RED II) but several measures should support its deployment.

No dedicated renewable gas target but…

global target of **32% RES in final consumption by 2030** and :

- a technology-neutral, indicative target to **increase the share of RES in heating & cooling sector by 1,3% per year**
- a binding target of 14% RES in transport by 2030, with a **binding sub-target for advanced liquid biofuels and biogas of 3,5%.**

Renewable gas is eligible next to other RES solutions and its **actual role will depend on implementation** choices by each Member State (deadline for transposition of RED II : 30 June 2021)



→ Need to ensure during implementation at national level that renewable gas is promoted as a solution to reach RES targets.

The RED II is only "half of the story": a "gas package" will also deal with renewable gas.