ENGIE
Roads towards an affordable energy transition in 2050

February 2019

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Engie’s Profile & Strategy

ENGIE's profile

155,100
employees worldwide

Operations in more than **70** countries

€65 billion
revenues

€9.3 billion
EBITDA

23% renewables installed capacity (1)
+35% between 2015 and 2017.

7% coal installed capacity (1)
-53% between 2015 and 2017.

€16 billion growth investments over 2016-2018 including
€1 billion
in innovation and digital

Figures as of 31 December 2017

(1) Installed capacity : at 100%

A priority given to our three growth engines

Building on its wide expertise and strong international positions in the fields of **electricity**, **natural gas** and **energy services**, ENGIE focuses on three growth engines:

02

The Energy Transition

Energy world is undergoing deep transformation

1. Energy efficiency

2. Decarbonization

3. Decentralization

4. Digitalization

Boost **Energy Efficiency**.

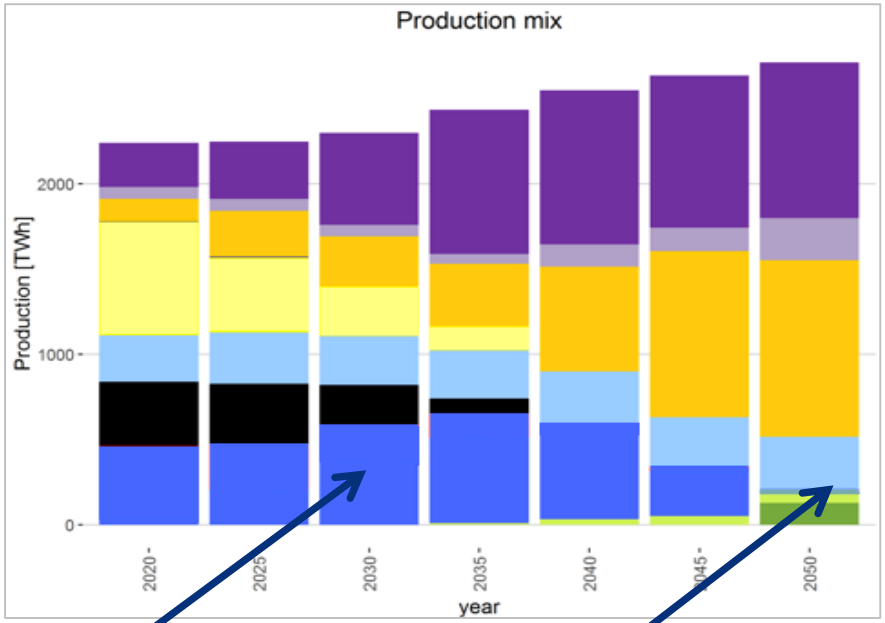
Enable the energy transition to a low Carbon economy **reducing the CO2 emissions**.

Continuously monitor and **adapt the regulatory framework** needed for the RES integration ensuring security of supply.

Manage the energy transition in a cost efficient way safeguarding the **affordability of the system**.

Optimized Path Towards 100% RES Power in 2050

Natural gas plays a key role in the transitional mix



Significant investment in new CCGT to ensure transition

Part of them remain available in 2050, favoring a higher green gas penetration, in 2050.

Open choice :

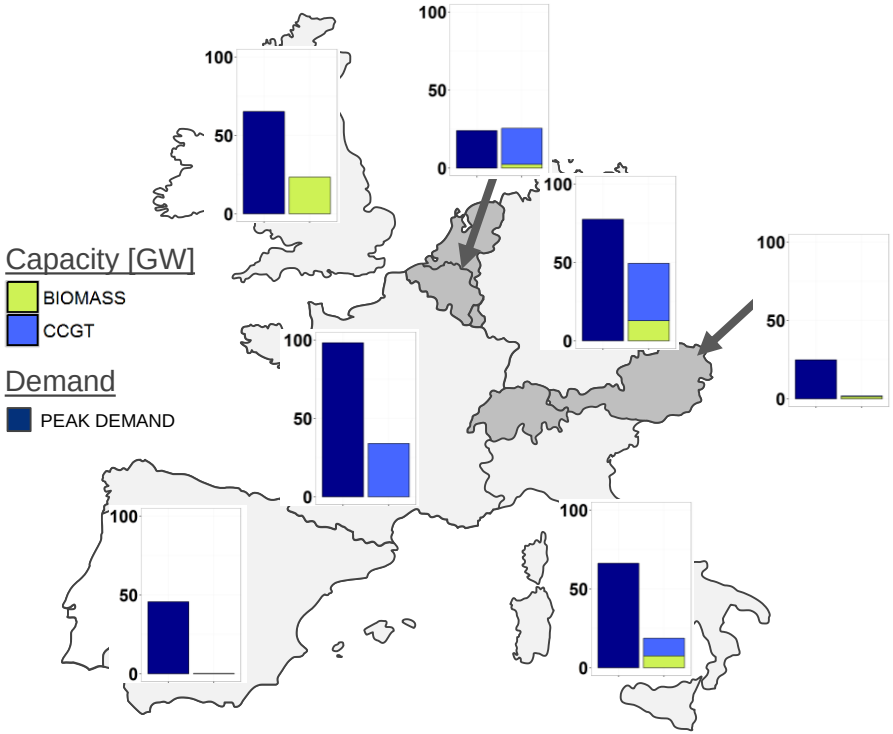
- Biogas
- Syngas
- H_2-CH_4 mix

Source : ENGIE Tractebel, CEEME

Long-term flexibility is mainly ensured by thermal back-ups

- Need to compensate for **seasonal PV variations** and **periods with low wind** production
- The system deals with it thanks to:
  - **Thermal plants** (synthetic fuels or bioenergy)
  - **Large hydro reservoirs**
- The actual development of this CCGT capacity, subject to low and unpredictable running hours, will be conditioned to the definition of a **market design adapted** to this reality.
- Thermal Investments:
  - CCGT (biogas/syngas)
  - steam turbines (solid biomass)
  - Backup operation (Limited running hours)

Installed capacity of biomass plants and CCGT needed in 2050 to pass the peak demand

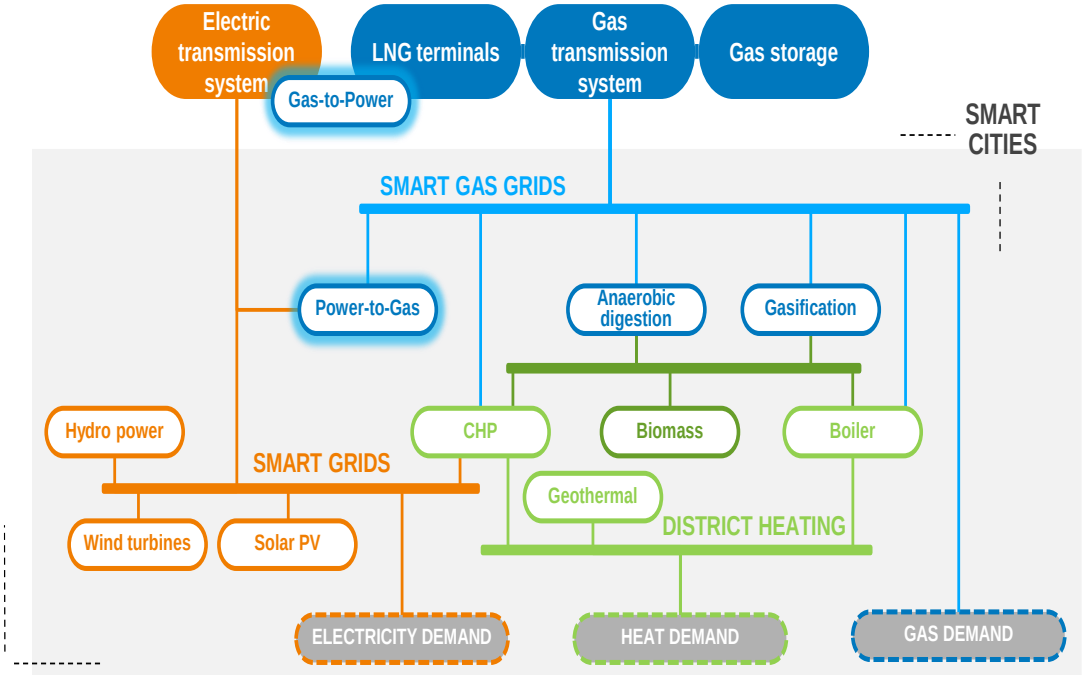


Source : ENGIE Tractebel, CEEME

03

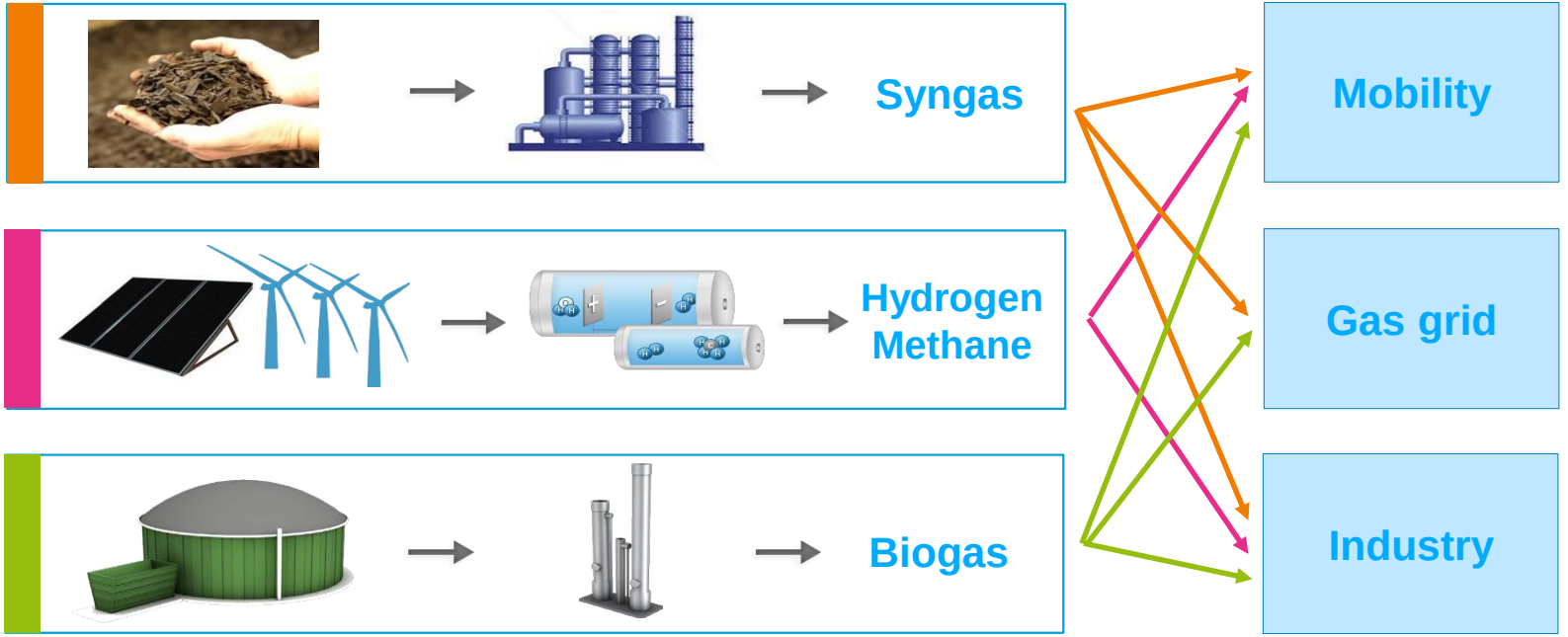
Green gas : a key factor

The cost-optimal energy transition combines green electricity with green gas using existing gas infrastructure



- **€138 billion cost savings** or EUR 600 per household annually by 2050 compared to decarbonisation without green gas ("Gas for Climate" study)
- **Security of supply** through local production of green gas and inherent resilience and flexibility of the gas network making green gas demand-responsive and thus complementary to variable renewable electricity.
- **Additional societal benefits** such as rural development, circular economy, etc.

A key element to decarbonize different sectors of the economy



Green gas development needs:

- **Visibility for investors** through binding targets
- **Financial support** for local green gas production
- Green gas tracking: **guarantees of origin**
- Dedicated **R&D support**
- Proper **accounting of CO_2 savings**
- Recognition of the **role of gaz in the sustainalble mobility** : light & heavy duty, maritime.

Conclusion

- **We believe in full decarbonation in the 2050s**
- **We help our customers, I&C, Cities and Regions to achieve this goal**
- **Complementarity of gas and power networks is more and more recognized**, particularly with high level of wind and solar power.

  « The Forum agrees with the need for planning the future gas and electricity infrastructure in an interlinked approach, in order to contribute to the overarching goal of decarbonizing the European system. » Fourth Energy Infrastructures Forum » ; Copenhague

- **Thermal RES** (burning solid biomass, biogas or synthetic fuels) play a key role as **long-term back-ups** in a 100% RES system, avoiding huge and costly overinvestments. In the short to medium term they will run on Natural Gas. To play their **capacity back-up** role they need an **adequate market design**.
- In the long run **up to 50% of natural gas in Europe could be substituted by green gas**, thus reducing further GHG emissions..
- **European policies** and gas market design **must support the development of green gas** and encourage European States to do so.

Thank you.