Belgium in 2030:
on track towards a carbon neutral economy in 2050?

BU Benelux Strategy & Engie Impact

Presentation for inspiration
TF scenarios Elia

Two fundamental Questions:

1. If Belgium follows its NECP, will it be – in 2030 – **on track** to reach a carbon neutral economy in 2050**?**

2. Decarbonisation path till 2050: **concretely** what does it mean and what's in it for me**?**

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Scope – Key Messages

- **Energy Uses** (71%) and non-energy emissions from Industry (14%) are the main sources of GHG emitted.

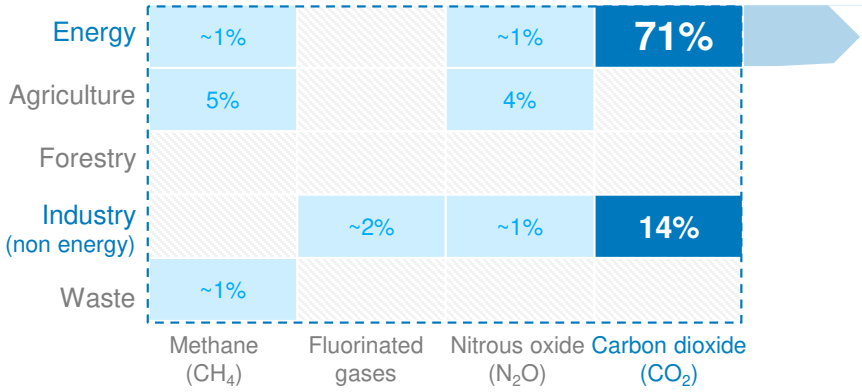
- By following its current NECP, Belgium is not on the right track to achieve its emissions reduction targets.

- **Two scenarios** built on NECP measures allow to reach a carbon neutral economy in 2050.

Major part of CO_2 emissions results from combustion of fossil fuel for energy use and industrial processes.
This is also where NECP concentrates most of its decarbonisation efforts.

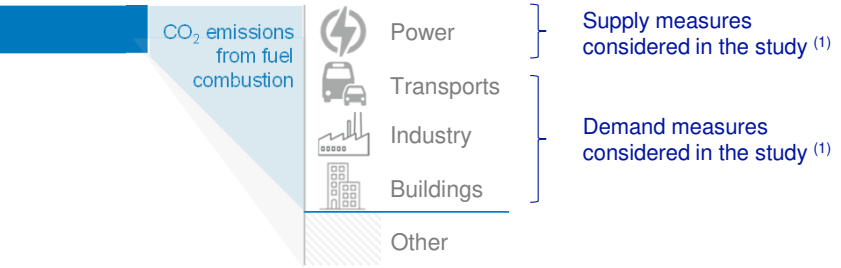
Definitions and scope of the study

① What are the Greenhouse gases emitted in Belgium, 2017



Source: EEA

② Where does CO_2 emissions from energy come from



xx Key focus of NECP and our analysis

xx Also considered in NECP

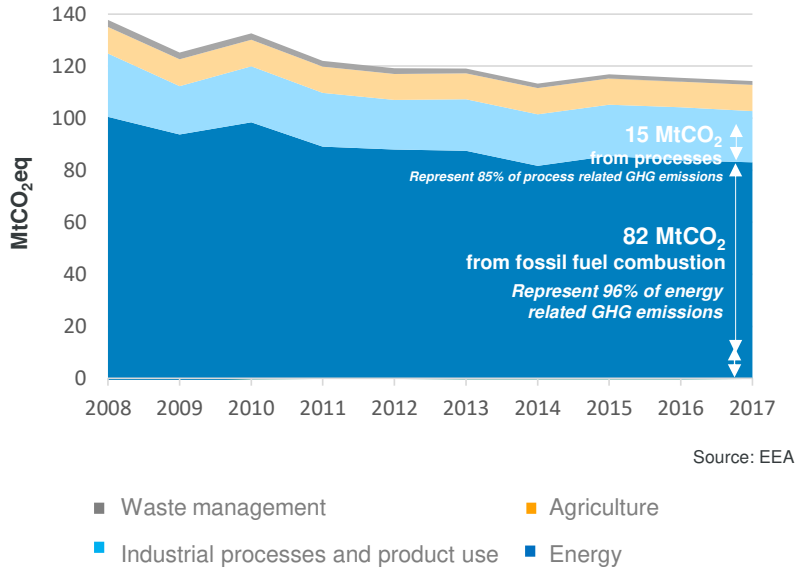
No significant emissions

(1) Given ENGIE field of expertise, the following study will focus on decarbonization of energy related CO_2 emissions (from fossil fuel combustion) and industrial processes. Other emissions might be the hardest ones to abate (e.g. GHG related to Agriculture).

Over the last 10 years, Belgian emissions have stagnated at around 110 $MtCO_2eq$ a year.
Industry and Transport are the 2 biggest CO_2 emitter sectors.

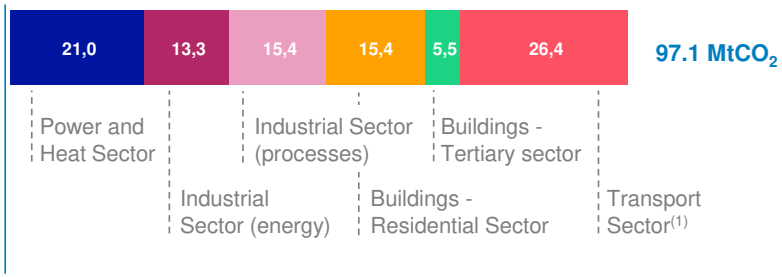
Where does Belgium stand in GHG emissions

① Past evolution of Greenhouse gases emitted in Belgium



Source: EEA

② CO_2 emissions from fuel combustion & industrial processes in Belgium in 2015:



Source: Belgian NECP

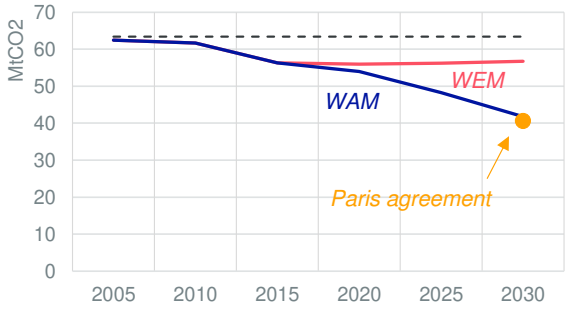
(1) Excluding international aviation and maritime transportation as not part of Belgium national emission accounting nor NECP measures.

According to the NECP, GHG emissions in BE will increase this decade, making a carbon neutral economy in 2050 highly unlikely

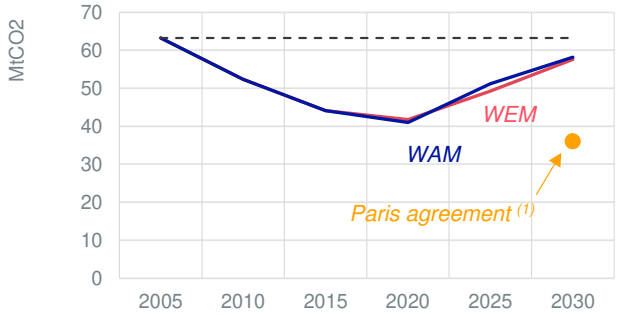
Evolution of Energy & Processes related CO_2 emissions in NEPC

How does it compare to Paris agreements and EU Green Deal

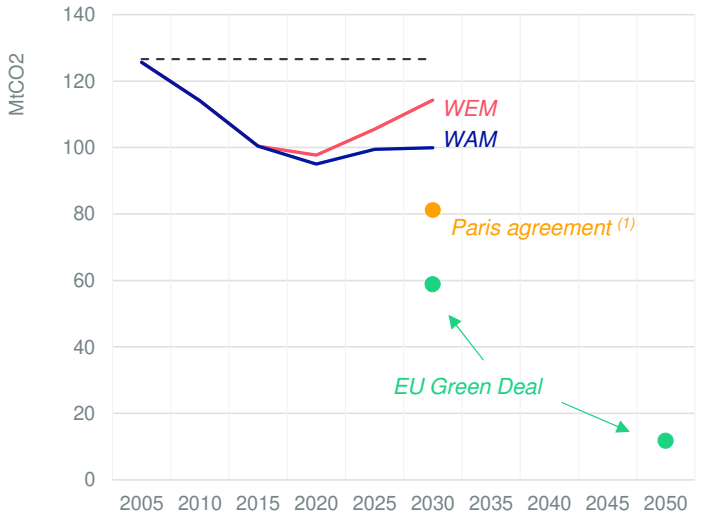
Non-ETS sector



ETS sector



All sectors



We put forward two scenarios that allow for a much-needed acceleration during the decade 2020 to 2030

Rationale for the proposed scenarios considered for a carbon neutral economy:

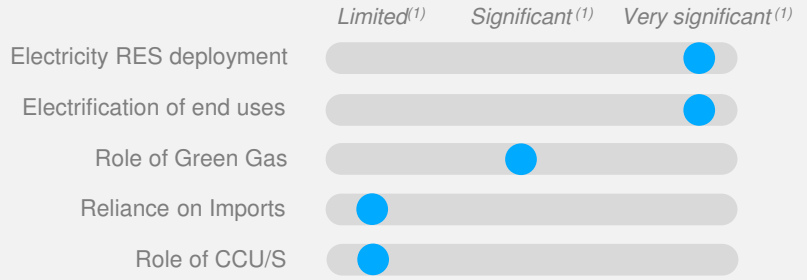
- Today, 3 major energy vectors represent more than 95% of total final energy demand in Belgium:
  - Oil (~230 TWh)
  - Gas (~120TWh)
  - Electricity (~80TWh)

- Given limited resources, both physical and financial, the decarbonization of the entire Belgian economy will have to come from:
  - Downstream:
    - The reduction of overall energy needs
    - A switch away from oil, esp. in mobility
    - Further electrification of end uses
  - Upstream:
    - The decarbonization of the Power and Gas consumed

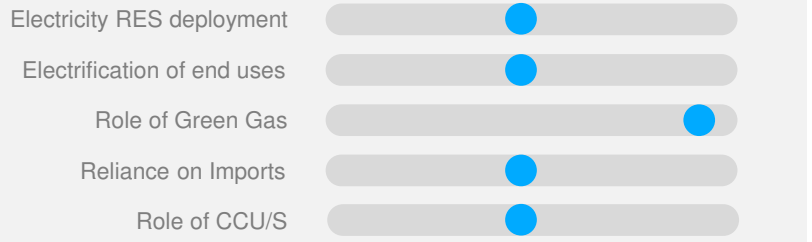
- We put forward two scenarios with a strong common core up to 2030, to quantify two possible decarbonization pathways to carbon neutrality in 2050, putting most efforts of the transition on electricity (Scenario 1) or Gas (Scenario 2)

Both our scenarios are in line with the Paris agreement, as **emissions levels do not exceed 75 Mt CO2 in 2030**

1. **Scenario 1 - Focus Green Electricity**, realizing decarbonisation mainly through the power vector.



2. **Scenario 2 – Focus Green Gas,** combining decarbonisation of power and greening of gas usage.



(1) vs today

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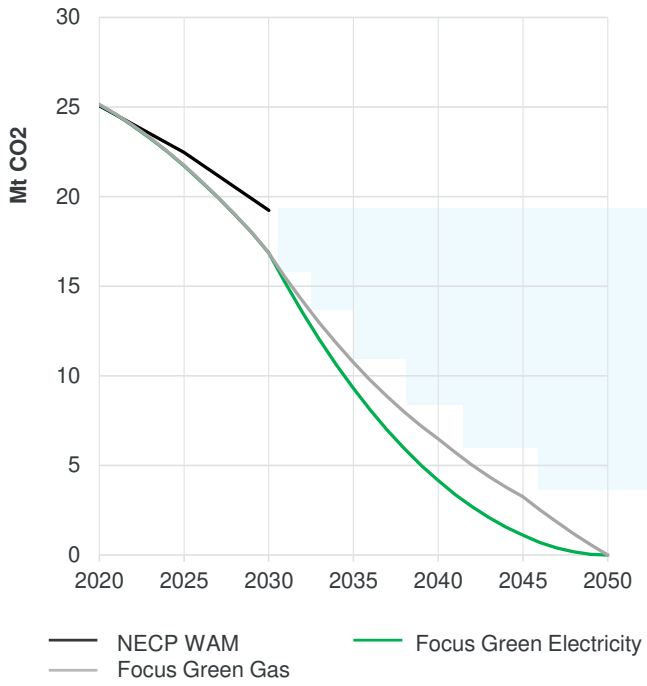
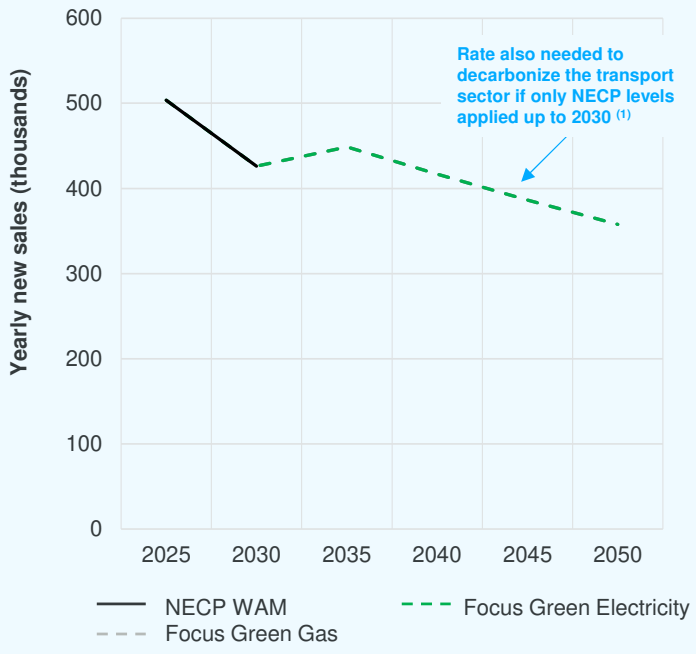
Current NECP assumptions for the transport sector put us on track for a realistic transition towards 2050

Evolution of CO_2 emissions



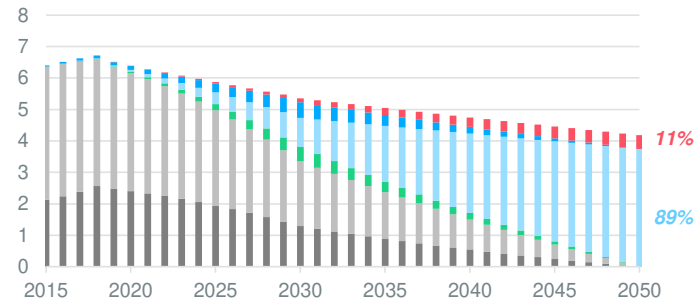
Low or zero emission vehicle sales rate needed for carbon neutrality by 2050

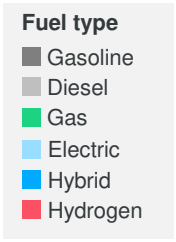


NECP trajectory is on track for 2050, but significant efforts will still be needed.
EVs will always be a major component of the mix but H_2 (and gas in a green gas focussed scenario) will be essential for decarbonisation of trucks & busses.

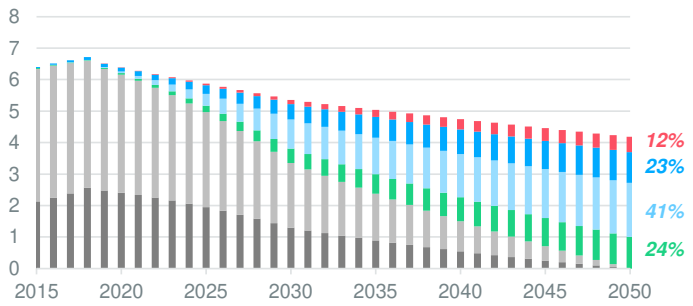
*Evolution of **road transport vehicle stock:** private cars, LDV, HDV and busses*

Scenario 1 – Focus Green Electricity



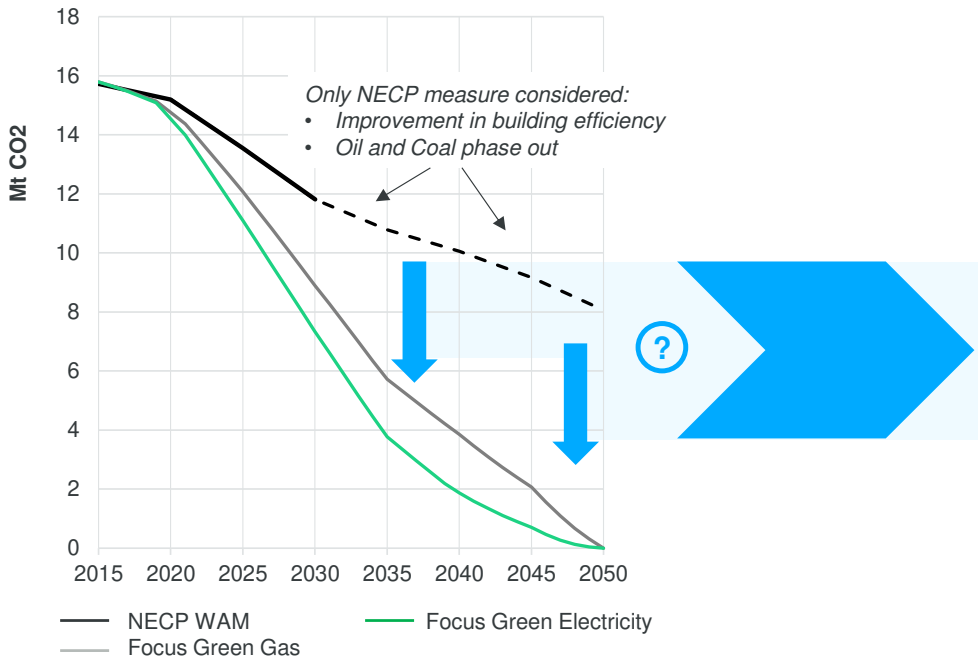


Scenario 2 – Focus Green Gas



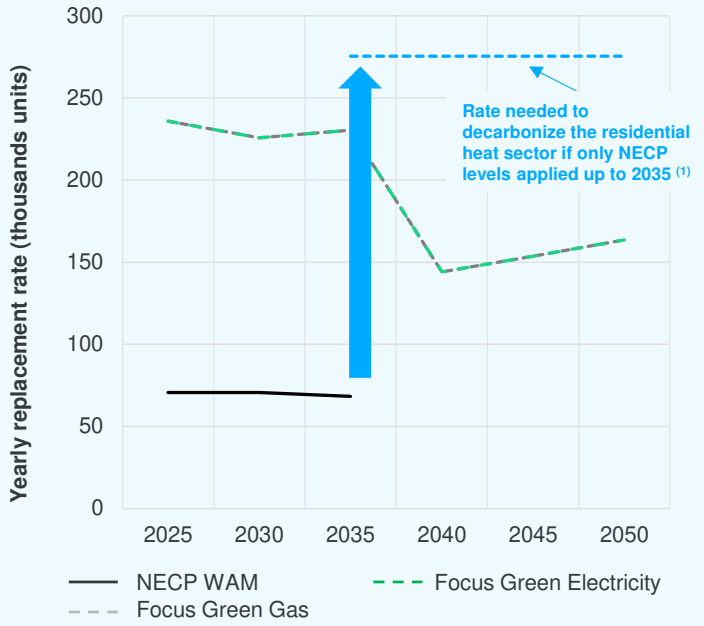
Beyond coal and oil replacement, additional fuel switching should be considered already today for realistic replacement rate trajectory to reach carbon neutrality ambitions by 2050

Evolution of CO_2 emissions



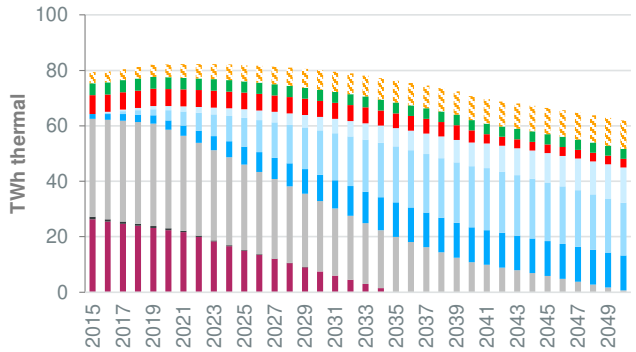
Installation rate needed for carbon neutral by 2050

Fuel switching rate within old and renovated building. Installation rate of heating assets in new construction excluded.

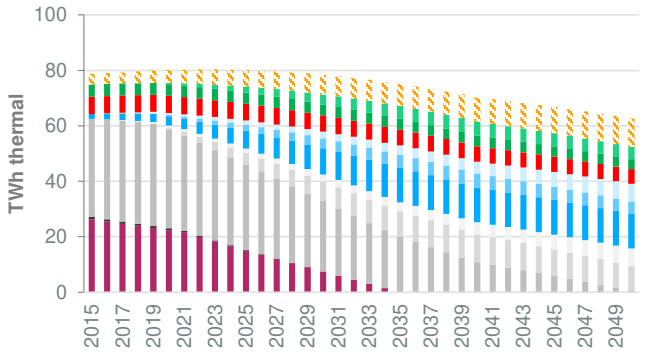


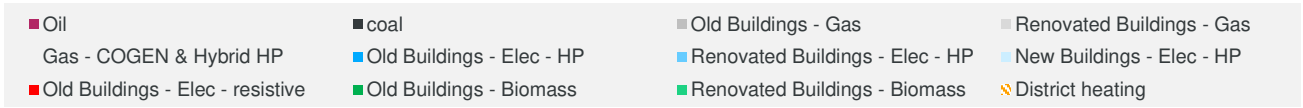
Beyond oil and coal phase out for residential heat up to 2035, a more ambitious increase of RES heating in new and renovated buildings will be needed for carbon neutrality by 2050.

Scenario 1 – Focus Green Electricity



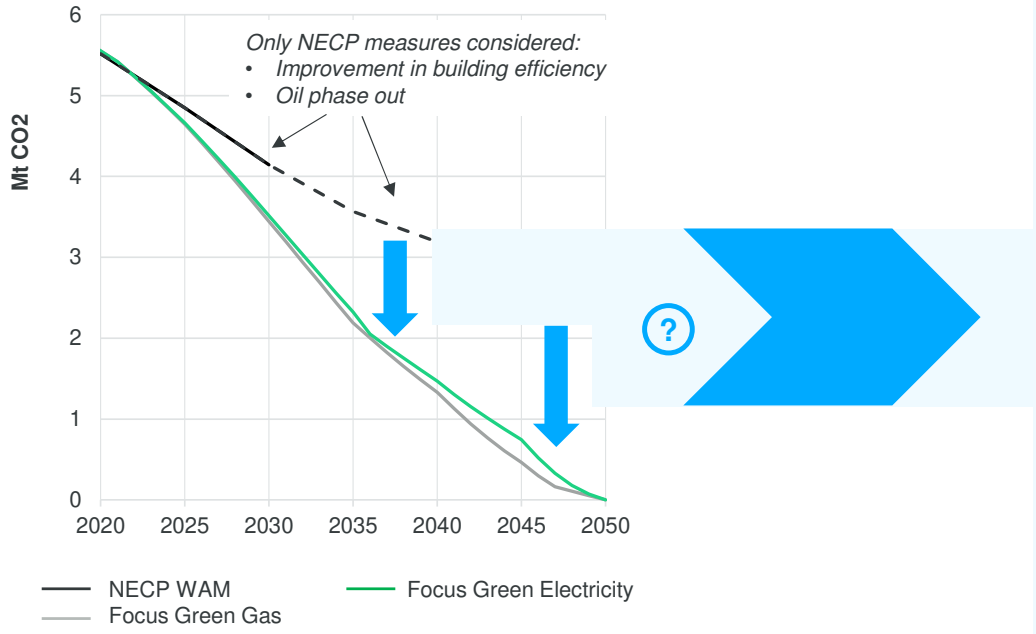
Scenario 2 – Focus Green Gas





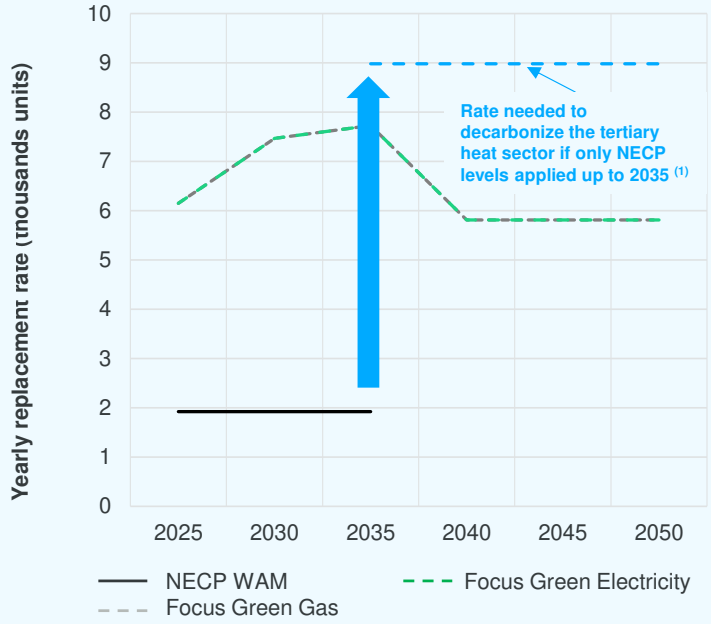
Beyond oil replacement, additional fuel switching should be considered already today for realistic replacement rate trajectory to reach carbon neutrality ambitions in 2050.

Evolution of CO2 emissions



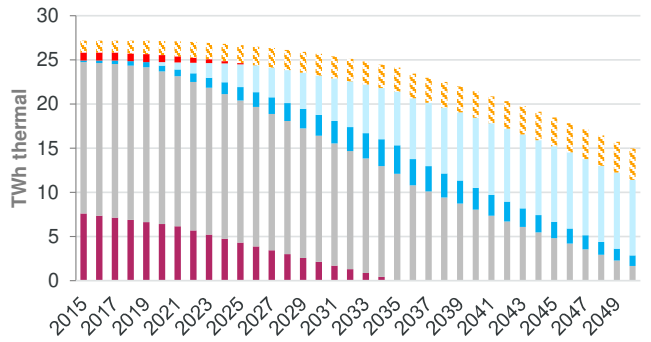
Installation rate needed for carbon neutral by 2050

Fuel switching rate within old and renovated building.

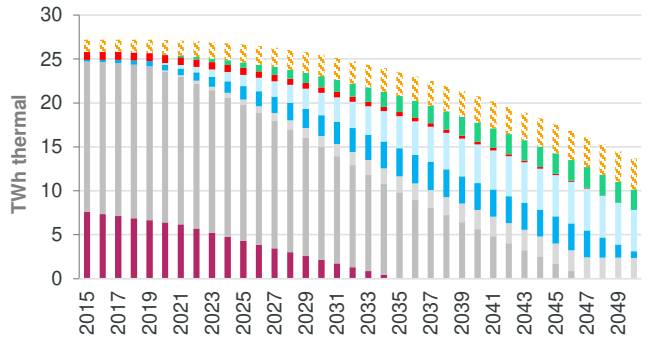


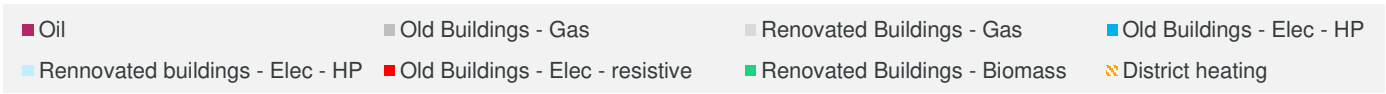
Beyond oil phase out for tertiary heating up to 2035, a more ambitious increase in share of RES heating in renovated buildings will be needed for carbon neutrality by 2050.

Scenario 1 – Focus Green Electricity



Scenario 2 – Focus Green Gas

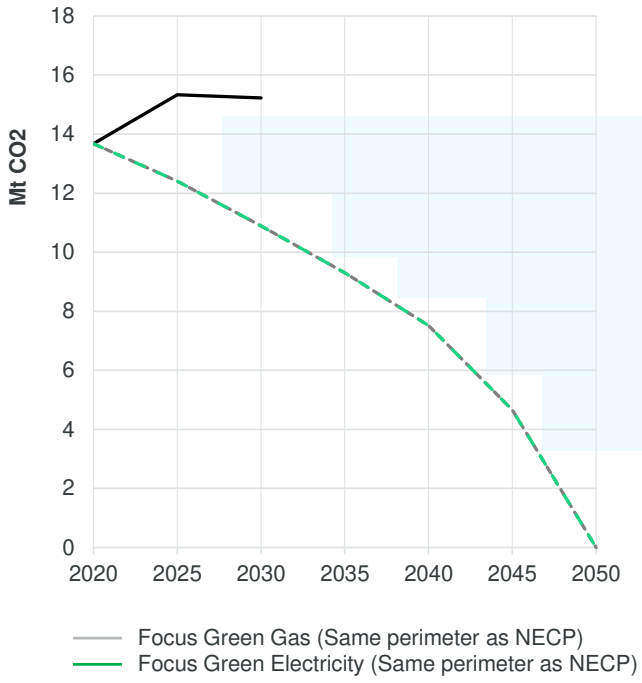




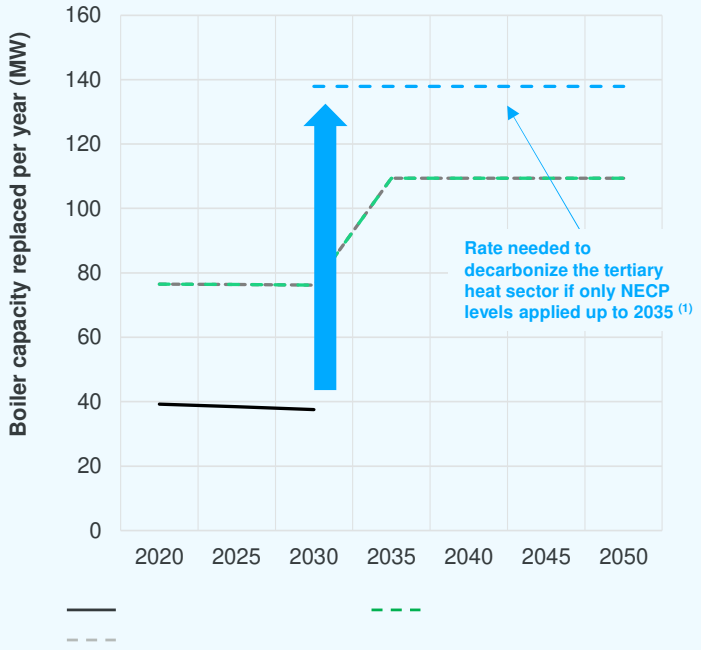
Current NECP assumptions for the industrial sector also imply an unrealistic transition in 2030-50.

Evolution of CO_2 emissions

All industrial sectors combined: ETS and Non-ETS



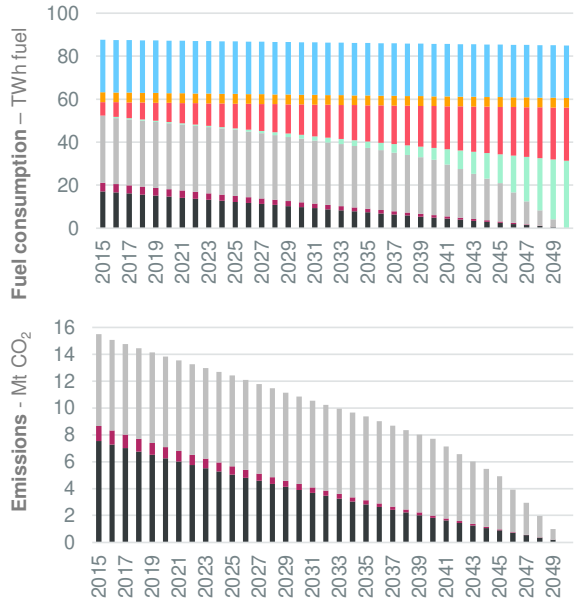
Installation rate needed for carbon neutrality by 2050 :



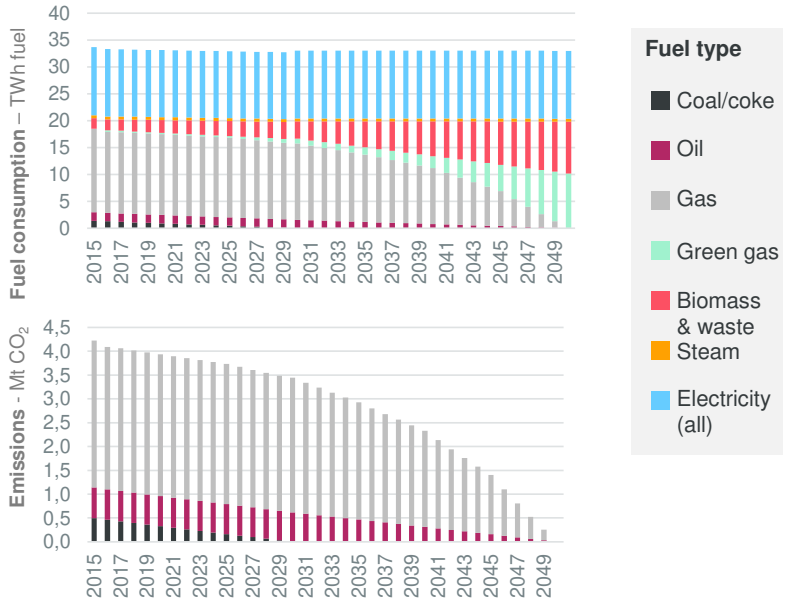
Full decarbonization of industry is only possible if we accelerate the switch from coal to biomass and the use of green gas.

Zoom on heat mix in the industrial sector: *(common in both scenarios)*

EU ETS Industry sectors



Non-EU ETS Industry sectors



Additional fuel switching from 2030 is required to reach carbon neutrality in 2050.

Biomass (mostly) and other RES consumption will increase from 9 TWh in 2030 to 38 TWh in 2050.

The share of green gas in the natural gas mix will need to increase from 6% in 2030, to 18% in 2040 and 100% in 2050.

ENGIE Impact

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Supply of Energy – Key Messages

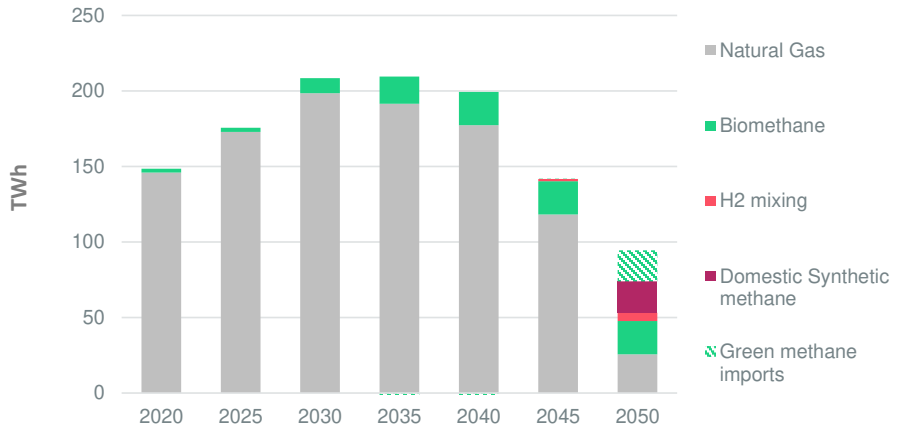
- Power: both scenarios require **significant investments in renewables** (especially PV in the *Green Electricity* scenario), limit the role of gas plants to peaking units beyond 2045 and need net imports.
- Methane: limited domestic production of biomethane implies **imports of green methane** (specifically important in the *Green Gas* scenario).
- Hydrogen: need for zero-carbon H_2 sharply increase as from 2030 and is met by a **mix** of **blue**, **green** and **imported** hydrogen.

ENGIE Impact

Increasing share of green gases, to ~ 70% in 2050, will be needed to be on track for carbon neutrality in 2050. Primarily based on production of biomethane and imports of green methane.

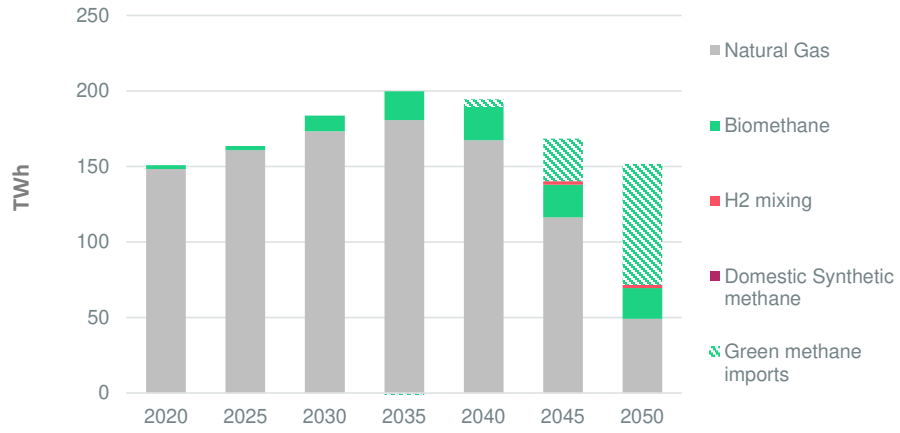
Scenario 1 – Focus Green Electricity

Evolution of composition of methane used (1)



Scenario 2 – Focus Green Gas

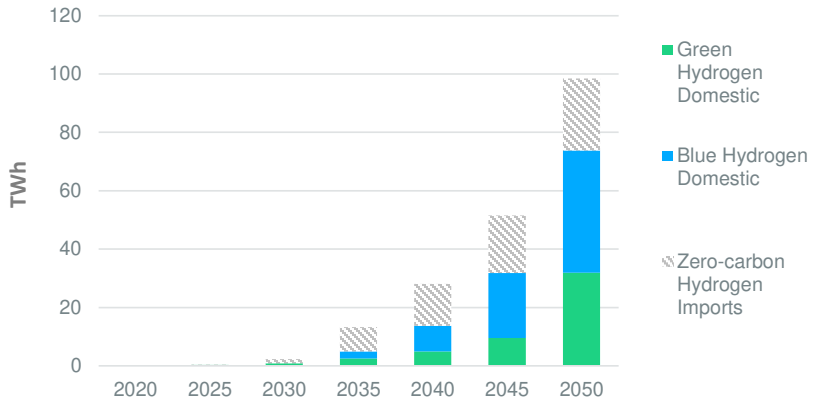
Evolution of composition of methane used (1)



Due to greening of industrial processes, H_2 demand in expected to sharply increase from 2030.
Whilst electrolyser and RES capacity are being build up, need for zero-carbon H_2 (could be blue or green) imports will be strong.

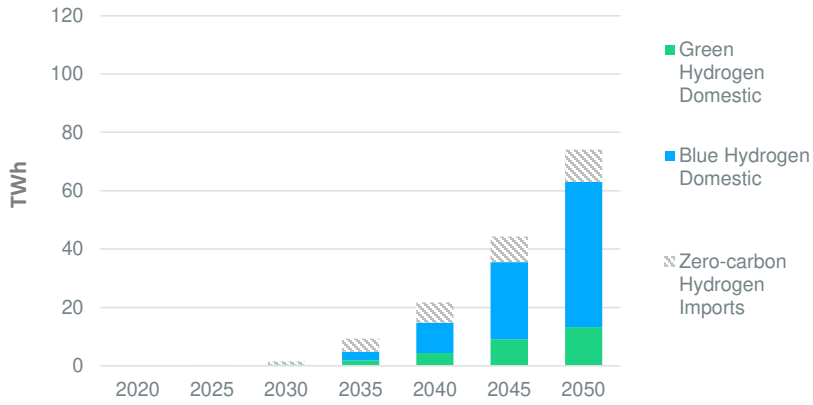
Scenario 1 – Focus Green Electricity

Evolution of the need for zero-carbon Hydrogen



Scenario 2 – Focus Green Gas

Evolution of the need for zero-carbon Hydrogen



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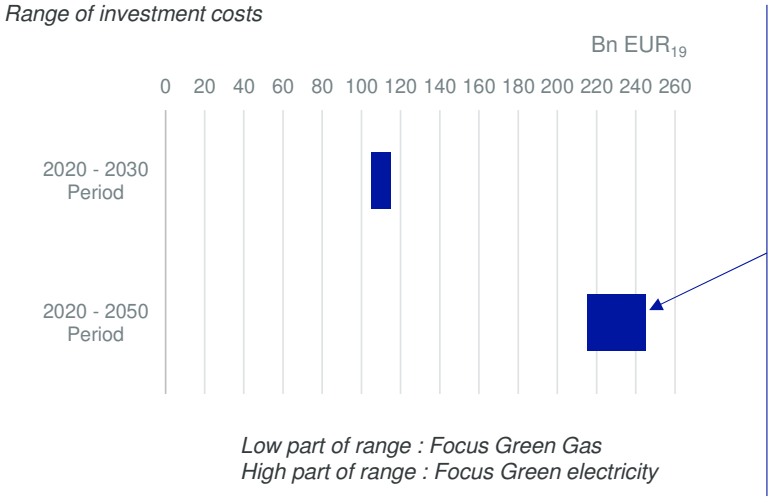
Costing, additional Benefits & potential Barriers – Key Messages

- Costing: an **accelerated transition** spreads the cost over time and is financially and operationally **more feasible**.
- Additional Benefits: 100-160 k new green jobs, reduced dependency on fuel imports and reduction of premature deaths due to air pollution.
- Potential Barriers: several barriers exist and consequently **multiple enablers** (i.e. mitigation measures) **are needed** to make this accelerated transition possible.

ENGIE Impact

An accelerated transition spreads the cost over time and is financially and operationally more feasible

Total investment costs required for scenarios implementations



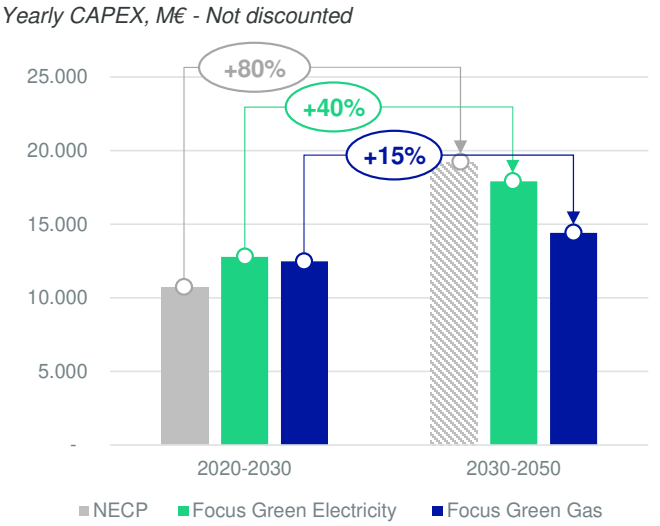
Of which:

100 - 110 €bn — For building renovation and fuel switching

70 - 80 €bn — For road transport decarbonisation

30 - 40 €bn — For Power & Gas decarbonisation

Comparison of capital expenditure with NECP



If only NECP measures are considered until 2030, a **significant catch up in CAPEX outlay will have to be done afterwards** to reach full decarbonisation of the economy by 2050.

Postponing major needed investment by following a more conservative trajectory up to 2030 will not lead to lower overall capital expenditure than in our scenarios.

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Conclusions – Key Messages (1/2)

- By following its current NECP, **Belgium is not on the right track** to achieve its emissions reduction targets. The current NECP assumptions would imply an **unrealistic transition** for the 2030-2050 period.

- The **2 scenarios** proposed allow to reach this carbon neutrality by 2050.
  Although different, they have the following **large common essence**.

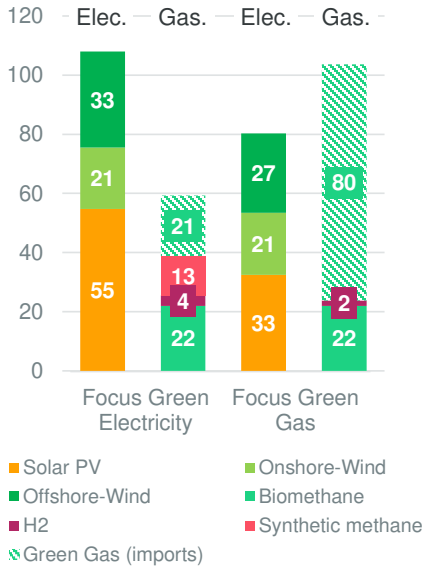
ENGIE Impact

What are the major differences between our two scenarios ?

If overall ambitions are similar in our two scenarios, differences lies in level of ambitions per energies used.

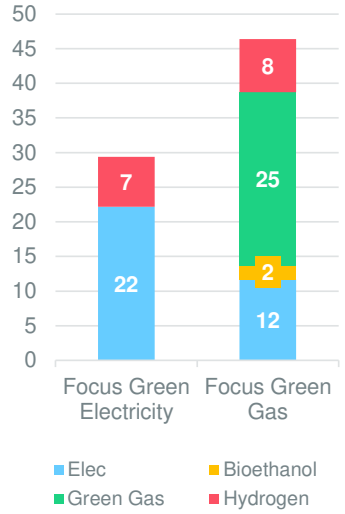
Power & Gas

2050 power & gas generation,
Selected fuels, TWh



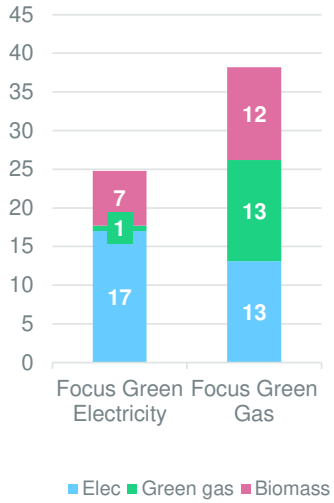
Transport

2050 energy demand,
Selected fuels, TWh



Residential

2050 heat demand,
Selected fuels, TWh

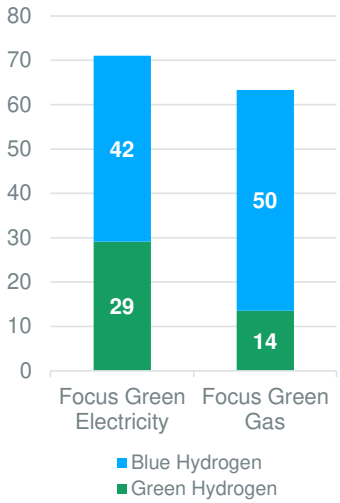


Tertiary

2050 heat demand,
Selected fuels, TWh

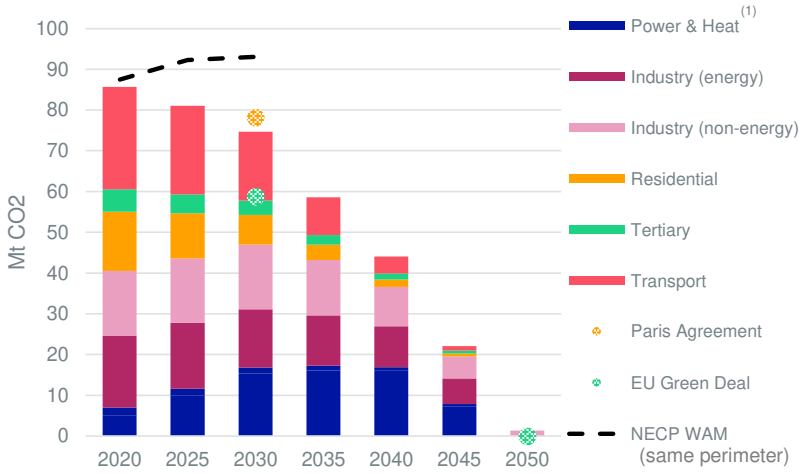
Industry

2050 Hydrogen demand,
TWh

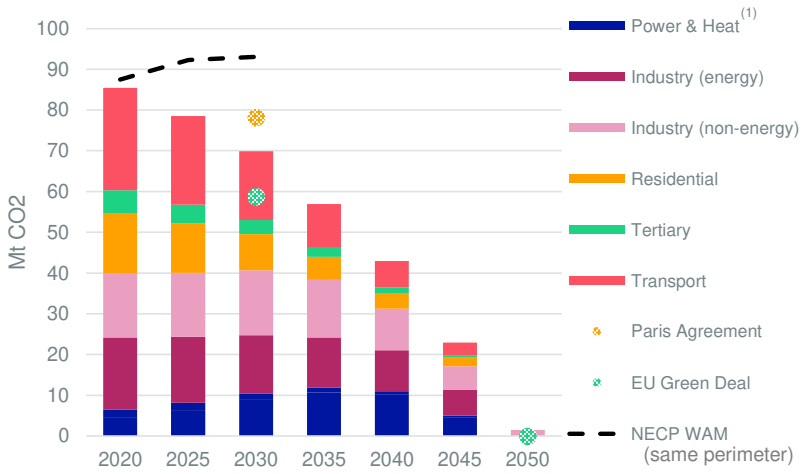


An accelerated transition is possible and would put us on a credible path towards a carbon neutral economy in 2050

Scenario 1 – Focus Green Electricity



Scenario 2 – Focus Green Gas



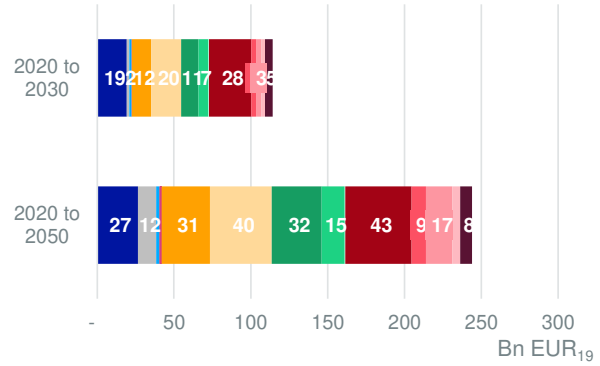
We propose two different scenarios. Both set us on a path to a carbon neutral economy in 2050 and would see total Belgian emissions decrease in the coming decade.

(1) Split between Power & Heat and Industry slightly differs from NECP as some of the heat generated on industry site have been included in industry rather that NECP Power and Heat category

An accelerated transition spreads the cost over time and is financially and operationally more feasible …

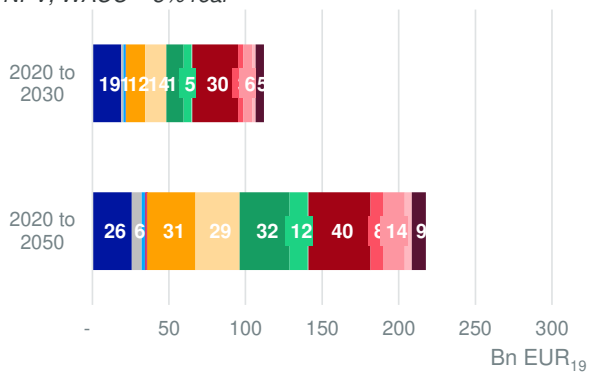
Scenario 1 – Focus Green Electricity

NPV, WACC = 5% real



Scenario 2 – Focus Green Gas

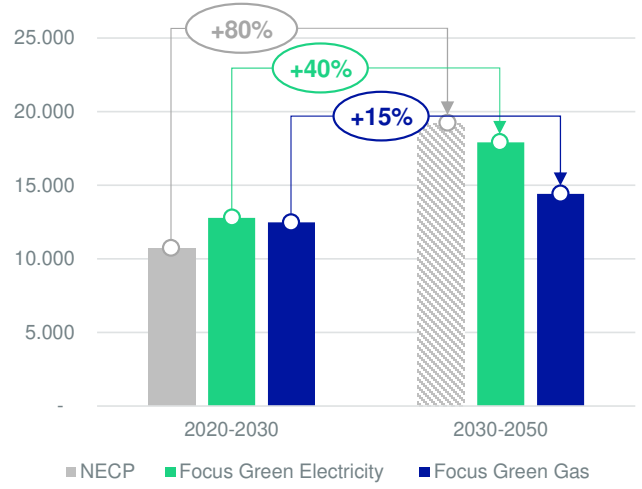
NPV, WACC = 5% real



Power sector
Green gases (green H2 & synth. CH4)
District heating network
Industry - fuel switching
Industry - processes
Residential - insulation
Residential - fuel switching
Tertiary - insulation
Tertiary - fuel switching
LED public lighting
Mobility - Private cars
Mobility - LDV
Mobility - Trucks
Mobility - Busses
Mobility - charging infrastructure

Comparison of capital expenditure with NECP

Yearly CAPEX, M€ - Not discounted



If only NECP measures are considered until 2030, a **significant catch up in CAPEX outlay will have to be done afterwards** to reach full decarbonisation of the economy by 2050.

Postponing major needed investment by following a more conservative trajectory up to 2030 will not lead to lower overall capital expenditure than in our scenarios.

Conclusions – Key Messages (2/2)

- Common essence:
  - **Acceleration** – starting now – of the implementation of the necessary measures.
  - **Phase out** of coal and oil.
  - Further **electrification** of the end uses.
  - Significant investment in **renewable power generation**.
  - **Net imports** of renewable electricity and green methane.
  - Need for a **mix** of blue, green and imported **hydrogen**.
  - Use of **CCS/U**.
  - Financially and operationally **more feasible**.
  - A series of several and diverse barriers implying a **mitigation willingness** and **strategy**.

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Conclusions – "No-regret" Actions (1/2)

- In a nutshell, for the coming decade 2020-2030, the following **"no-regret" actions** should be implemented **now**:
- Transport:
  1. Individual mobility: promote mainly **electrical** vehicles.
  2. Heavy transport: develop **H_2** and **CNG/LNG**.
- Buildings (residential & tertiary):
  3. **Insulate**, insulate & insulate even more.
  4. Accelerate **fuel switching**.

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Conclusions – "No-regret" Actions (1/2)

- Industry:
  5. Intensify **fuel switching**.
  6. Prepare **CCS/U** for specific processes.

- Supply:
  7. Boost **Solar PV** and **Offshore Wind** developments.
  8. Start greening of gas through **biomethane**.

And Warm Thanks for Your Attention !

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Appendix

Acronyms & Abbreviations

Acronym	Explanation
CAGR	Compound Average Growth Rate
CCU/S	Carbon Capture Utilisation/Storage
CNG	Compressed Natural Gas
ETS	Emissions Trading Scheme
EV	Electrical Vehicle
FCEV	Fuel Cell Electrical Vehicle
GHG	GreenHouse Gas
HDV	High Duty Vehicle
HP	Heat Pump
LDV	Light Duty Vehicle
LEV	Light Emissions Vehicle

Acronym	Explanation
LNG	Liquid Natural Gas
LOHC	Liquid Organic Hydrogen Carriers
NECP	National Energy Climate Plan
NOx	Nitrogen Oxides
NPV	Net Present Value
PHEV	Plug-in Hybrid Electrical Vehicle
PM2.5	Particle matter (of 2,5 micron)
PV	Photovoltaic
RES	Renewable Energy Source
WACC	Weighted Average Cost of Capital
ZEV	Zero Emission Vehicle