A TIMES model for Wallonia: description of the modeling approach and analysis of an ambitious mitigation target: -55% GHG in 2030

Preliminary results

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Introduction

Wallonia had **no detailed model**

→ we developed one (with government funding)

Moreover: New government → New target: **-55% in 2030** (compared to 1990)

→ we **optimize** TIMES-Wal to meet the target

→ analysis of such an ambitious target in the near term & sensitivity analysis

1) **description of the model**

2) **preliminary results of the optimisation**

TIMES-Wal: general structure

- **Single region model**

- Reference **year: 2014**

- **24 representative time slices**

- **7 main sectors** (which represent most of the regional combustion emissions):
  - residential, commercial, industrial, transport, agricultural, supply and electricity generation sector

Description of the sectors

Residential sector

- **20 different categories of buildings** depending on the period of construction and on the number of facades. For each category, the number of **m² of buildings** is described and the **net needs (PJ/m²)** for space heating and hot water are differentiated. In order to satisfy all the demands, a **set of technologies is defined.** There are also 4 types of **retrofitting options.**

Commercial sector

- Similar as RSD. Divided into **7 subsectors**. The demands are only defined here in PJ (of heat, hot water and others) and not in m².

Transport sector

- Freight and passengers transportation. Road transport is very detailed with data on the actual park of technologies.

Description of the sectors

Industrial sector:

- Many sub-sectors: chemicals, cement, paper (and pulp), food (potatoes, sugar, …), etc. Demands expressed usually in Mt of final products. Specific new technologies are described.

Electricity generation :

- Sector is defined with historical data on individual plants. Complete database of new technologies.

Supply sector:

- Mining (local production of biomass, wastes,…), import and export processes. For future years, there is a detailed representation of biogas and hydrogen production.

Main hypothesis

- **taxes, delivery costs and subsidies**

- increasing **price for ETS emissions**

- **no** new **coal** power plants, **no** new **nuclear** plants and **no CCS/CCU**.

- maximum **annual retrofit rate** of 3%

- general **discount rate of 1.8%**

- no behavioral measures

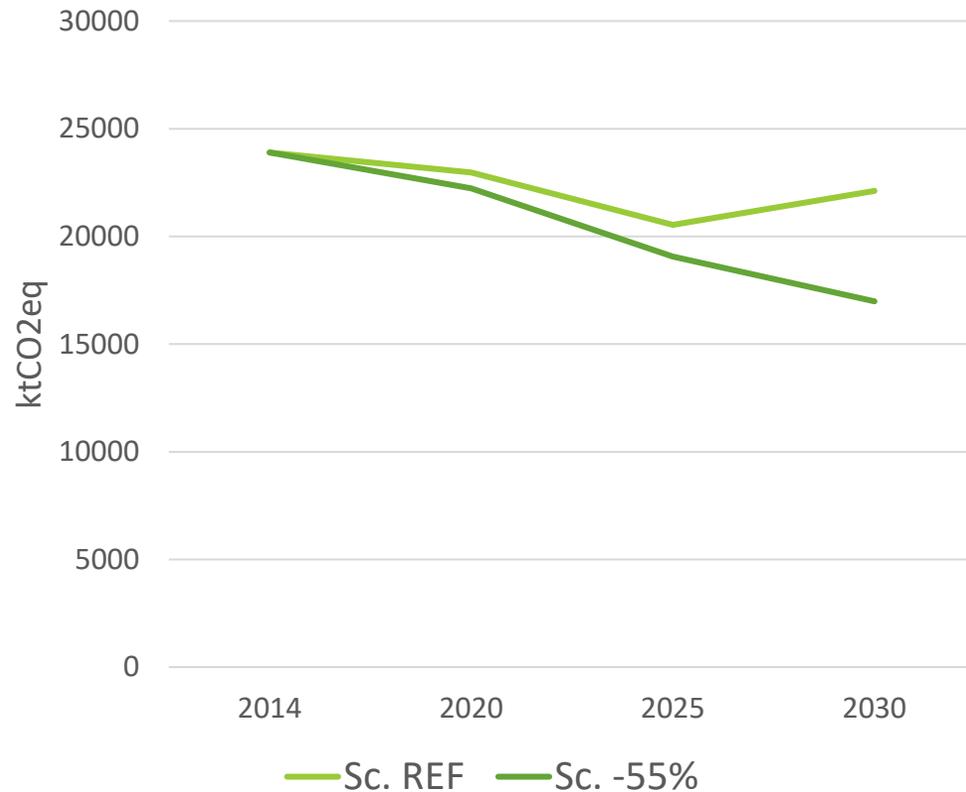- constraint on **pollutants** -SOx, NOx, PM2.5, COV and NH3-

Optimisation of the model: 2 scenarios

1) **Reference Scenario,** "**Sc.REF"**

2) **Constrained Scenario,** "**Sc.-55%":**
- -55% in 2030 (considering the emissions covered by the model and compared to 1990)
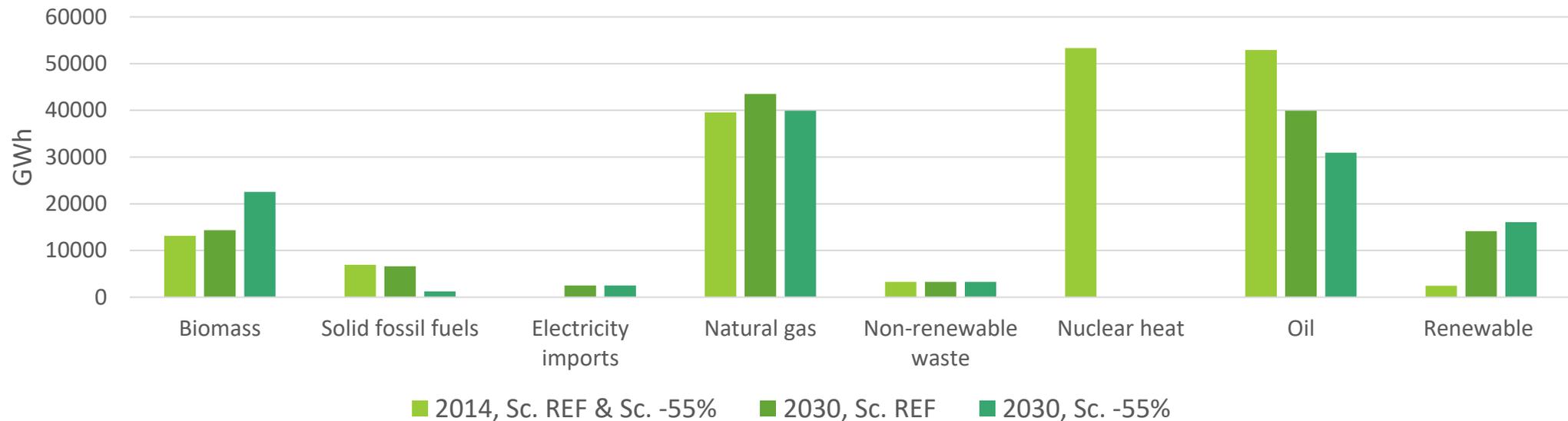- carbon budget

Results: GHG emissions

Similar path without a CO2 budget and with different discount rates (only slightly more concave)

→ acting now is necessary and cost-effective

Results: primary energy

Importance of **renewable** (**+558%** in Sc.-55%!) and **biomass** in meeting the GHG target in a cost-optimal way. **Fossil fuels use decline** with the **exception of natural gas**.

→ Similar results as EU Commission study (Tsiropoulos Ioannis et al., 2020) concerning the main evolutions of the primary energy mix in 2030 (even though the growth of variables renewables is higher in our Sc.)

Results: electricity generation
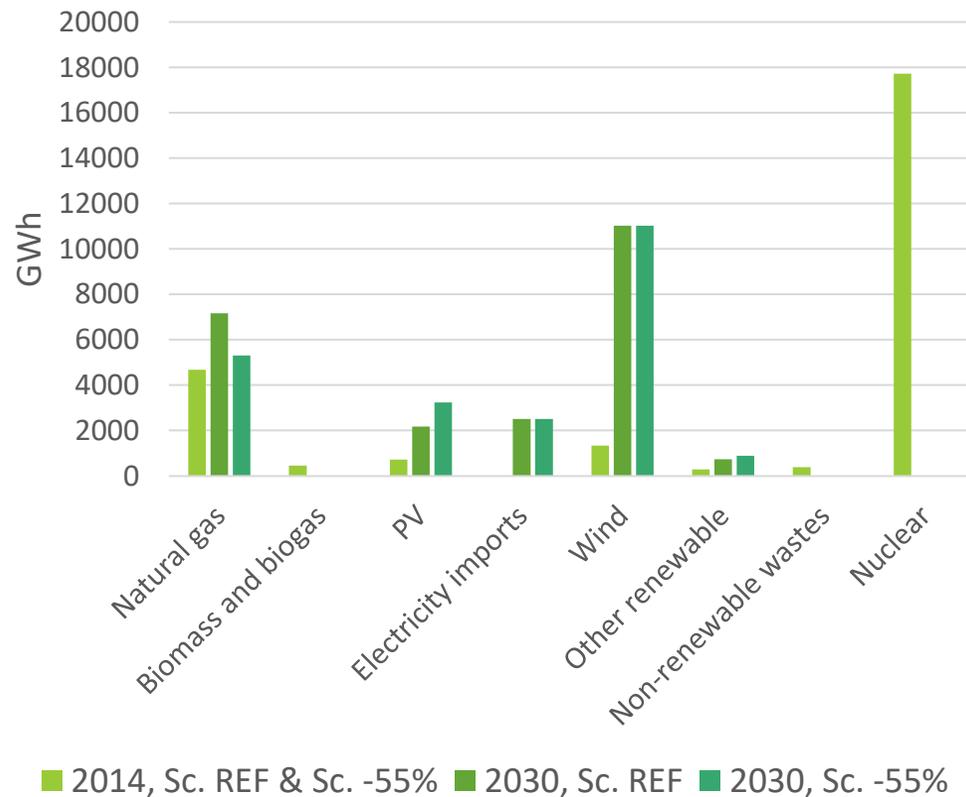
Almost the **maximum potential of windmills** in both scenarios

Shutdown of nuclear plants → renewable sources are not sufficient. → **Importations + new gas plants too**

Those results (for Windmills and PV panels) are not (much) affected by the ETS price and by the discount rate

Chart legend: 2014, Sc. REF & Sc. -55% | 2030, Sc. REF | 2030, Sc. -55%

Categories: Natural gas, Biomass and biogas, PV, Electricity imports, Wind, Other renewable, Non-renewable wastes, Nuclear

Y-axis: GWh (0 to 20000)

Results: building sector

Every type of renovation in **both scenarios**: window, wall, roof as well as ground renovation.

There are massive investments in both scenarios but the **constrained scenario goes further.**

The amount **of retrofitting is very much influenced by the discount rate** even though there is **still a lot of renovation with high discount rates**.

Concerning technologies, the main outcomes in both scenarios are the investments in **new and more efficient gas boilers** and the use of **district heating**. In Sc.-55%, **ground heat pumps** appear as well. There are also some new biomass boilers.
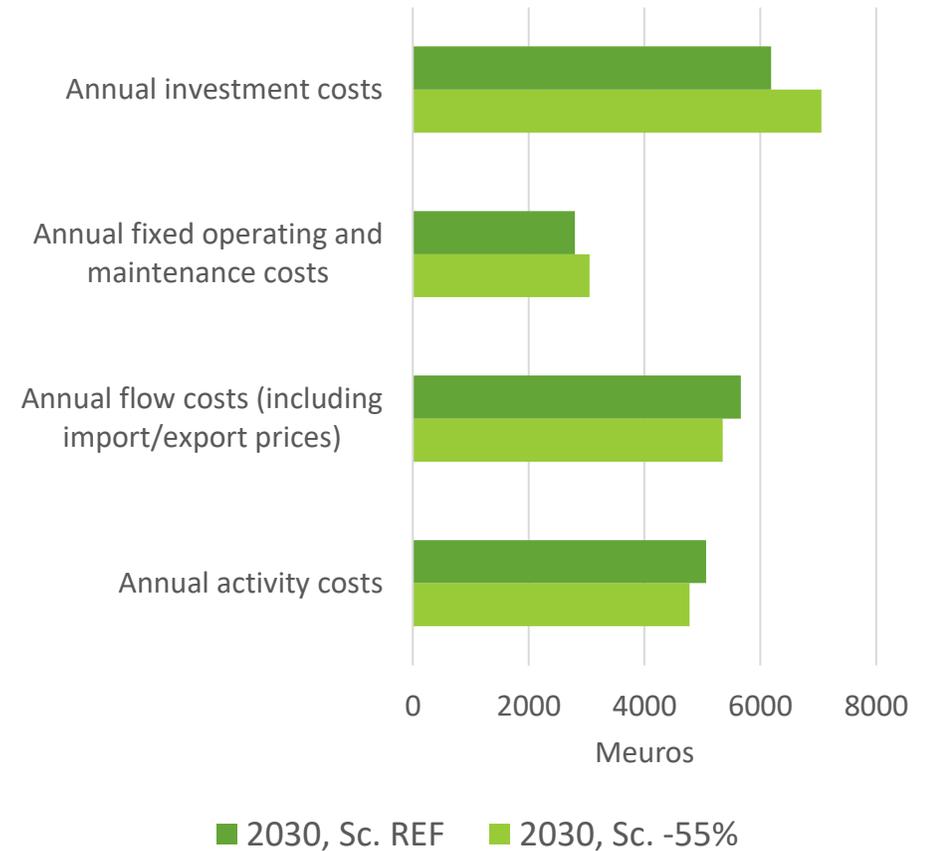
Retrofits in the residential sector: energy savings in 2030 (PJ)

- Sc.-55%, no budget
- Sc. REF
- Sc.-55%
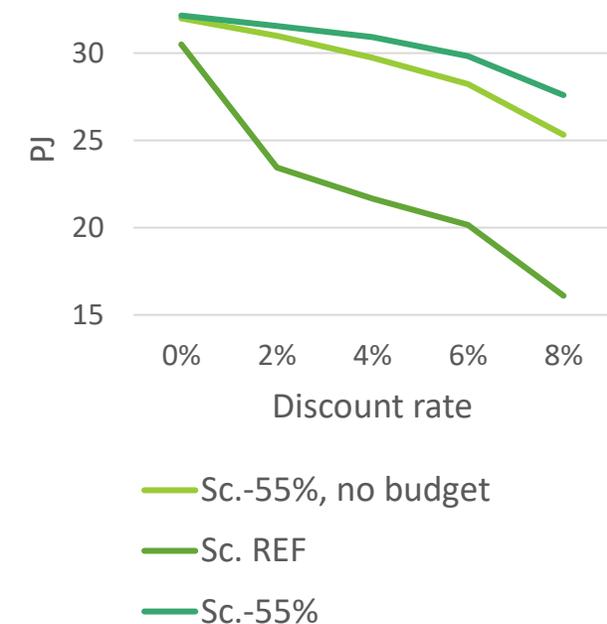
Results: costs

Discount rate	Total increase in energy system costs (discounted)
0.01%	1.27%
2.00%	1.81%
4.00%	2.08%
6.00%	2.21%
8.00%	2.48%

Year	2020-2025	2030
Shadow price of emissions	Below 60€/t	219€/t

Bar chart — horizontal axis "Meuros" (0 to 8000):
- Annual investment costs
- Annual fixed operating and maintenance costs
- Annual flow costs (including import/export prices)
- Annual activity costs

Legend: ■ 2030, Sc. REF ■ 2030, Sc. -55%

Conclusion

- The **energy mix considerably changes**. Renewable sources and biomass become significant sources of primary energy while fossil fuels use decline, except for natural gas.

- **Planned shutdown of the nuclear plants → massive investments in windmills and in PV** panels (which are cost-optimal technologies even in the unconstrained case). In the building sector, lots of **renovations** (which are cost-optimal in both scenarios).
→ The choice of **the discount rate does not change the main technological conclusions.**

- Certainly **2030 is very near,** but we do **not need to invest in uncertain alternatives** to reach -55%**.**

- The **cost** of Sc.-55% is only about **1.5% higher** than Sc. REF.

- **Efforts and investments must start as soon as possible in order to stay on the cost-effective path**.

Thank you for your attention!

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