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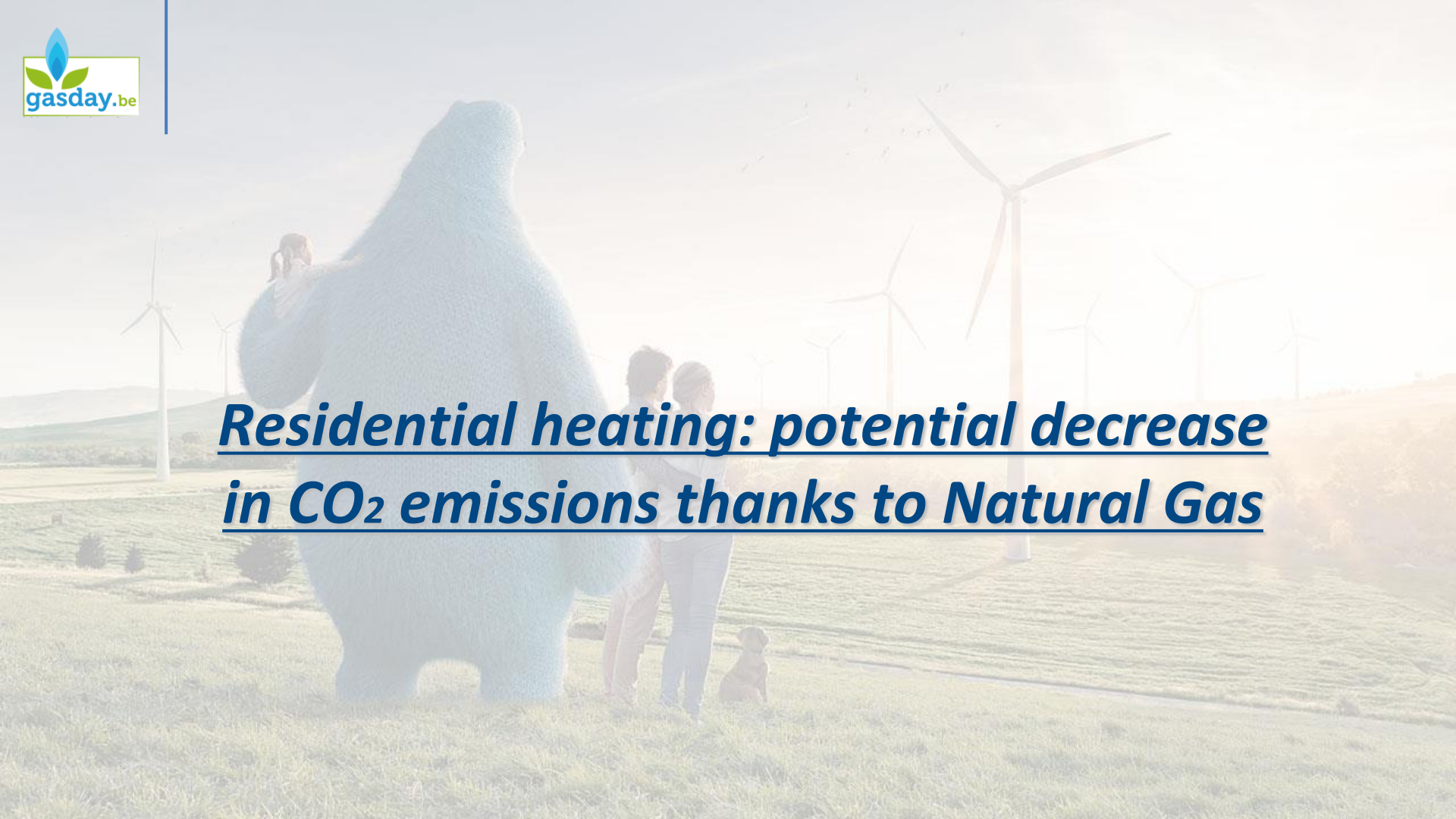
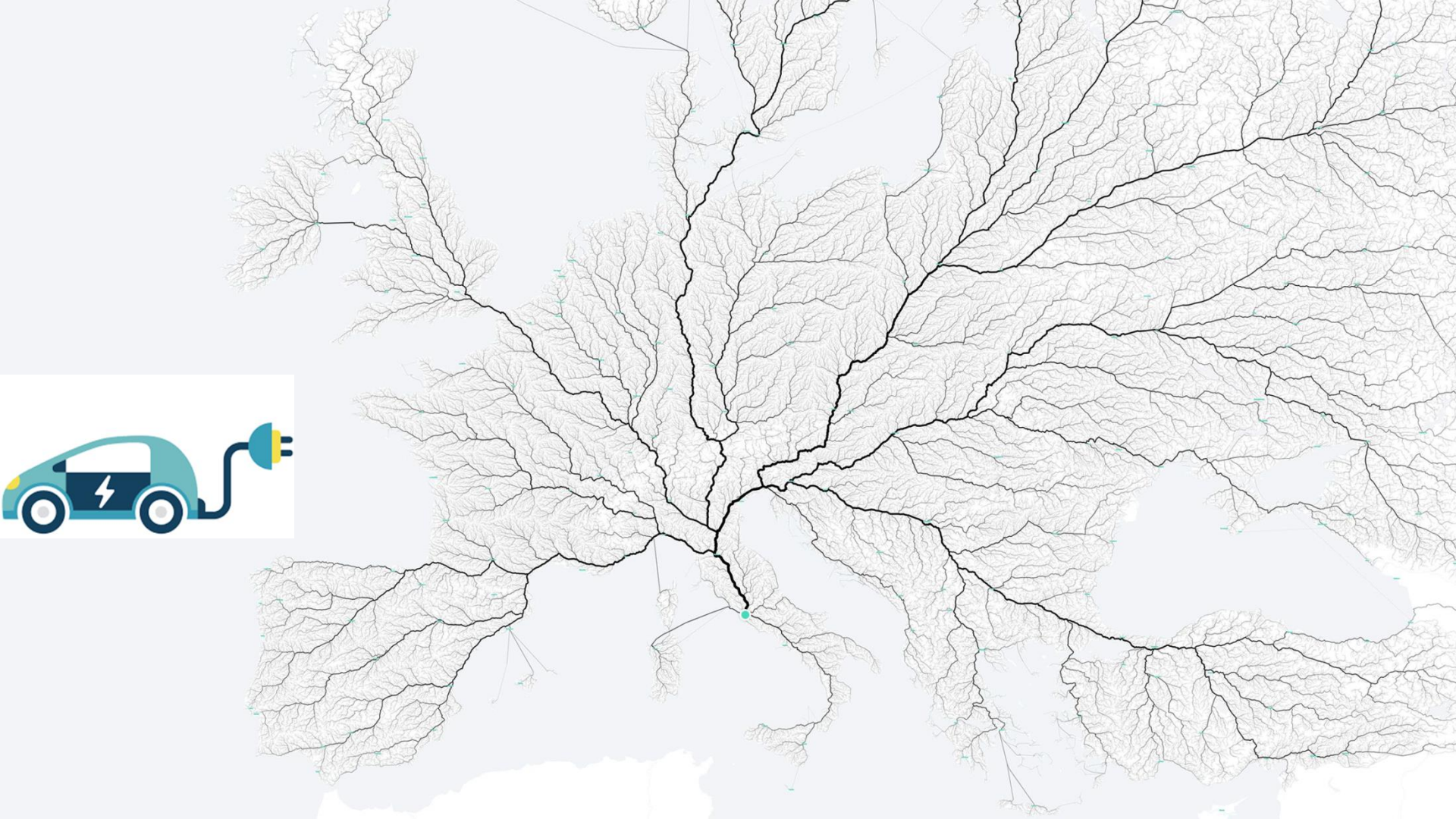
Professor

UGent



Residential heating: potential decrease in CO_2 emissions thanks to Natural Gas



Setting the scene

- **EU CO_2 reduction target (per year):**
  - - 1,5% between 2015 and 2030
  - - 4,6% between 2030 and 2050
- **Buildings in EU;**
  - 40% energy consumption,
  - 36% CO_2 emissions
- **IEA (2014); decarbonisation of electricity use in buildings is key + *near-term* recommendation to mandate the use of gas condensing boilers**
- **Decarbonisation & synchronicity?**
- **What to do with expected overproduction of renewable electricity generation (at zero marginal cost)?**

Table 1 – Housing stock with dominant heating technology

	Number (2017, Belgium)	Heating technology	
Apartments	1 300 000	*Gas*	*70%*
		Heating oil	*20%*
		Electricity	*10%*
Detached houses	1 400 000	*Gas*	*40%*
		Heating oil	*57%*
		Electricity	*3%*
Semi-detached houses	970 000	*Gas*	*60%*
		Heating oil	*37%*
		Electricity	*3%*
Terraced houses	1 350 000	*Gas*	*70%*
		Heating oil	*26%*
		Electricity	*4%*

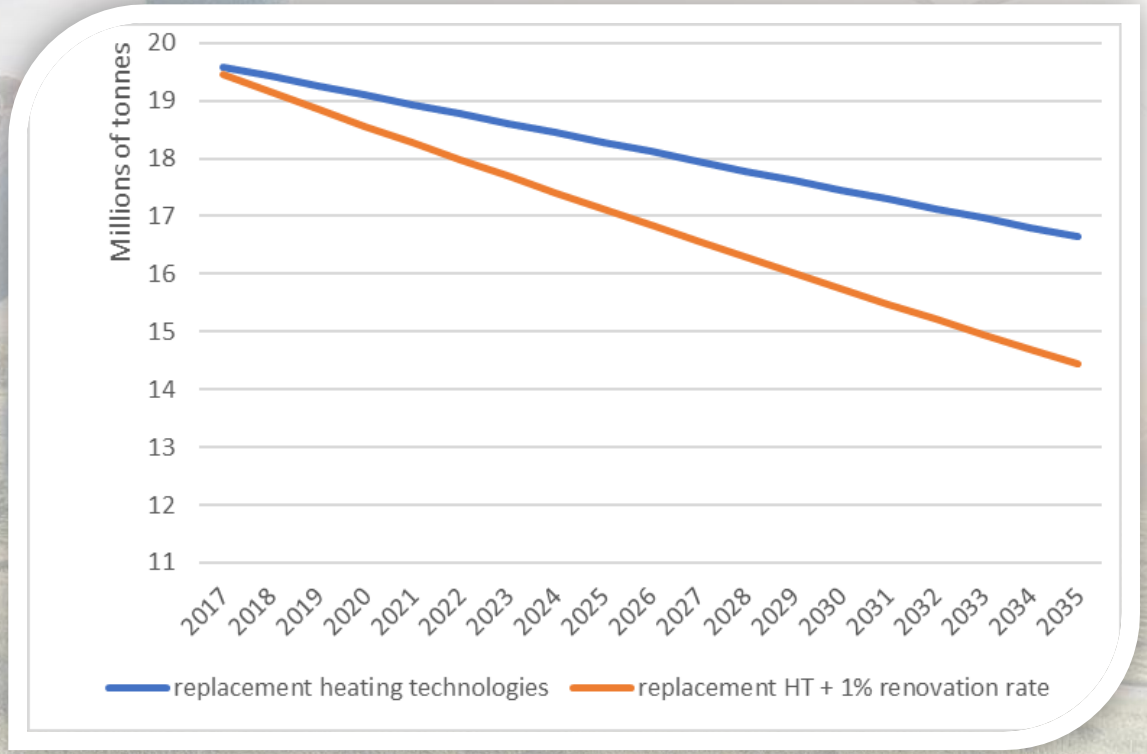
Potential energy savings and CO_2 reductions

- **CO_2 reduction between 40 and 60% achieveable by 2050**
- **Main drivers;**
  - renovation rate +
  - depth of renovation +
  - CO_2-emissions factor for electricity
- **Replacing old heating technologies; cost-effective CO_2 mitigation option (but no radical reduction potential)**
- **Renovation loans; on the decline (partly due to price increases of old inefficient houses)**

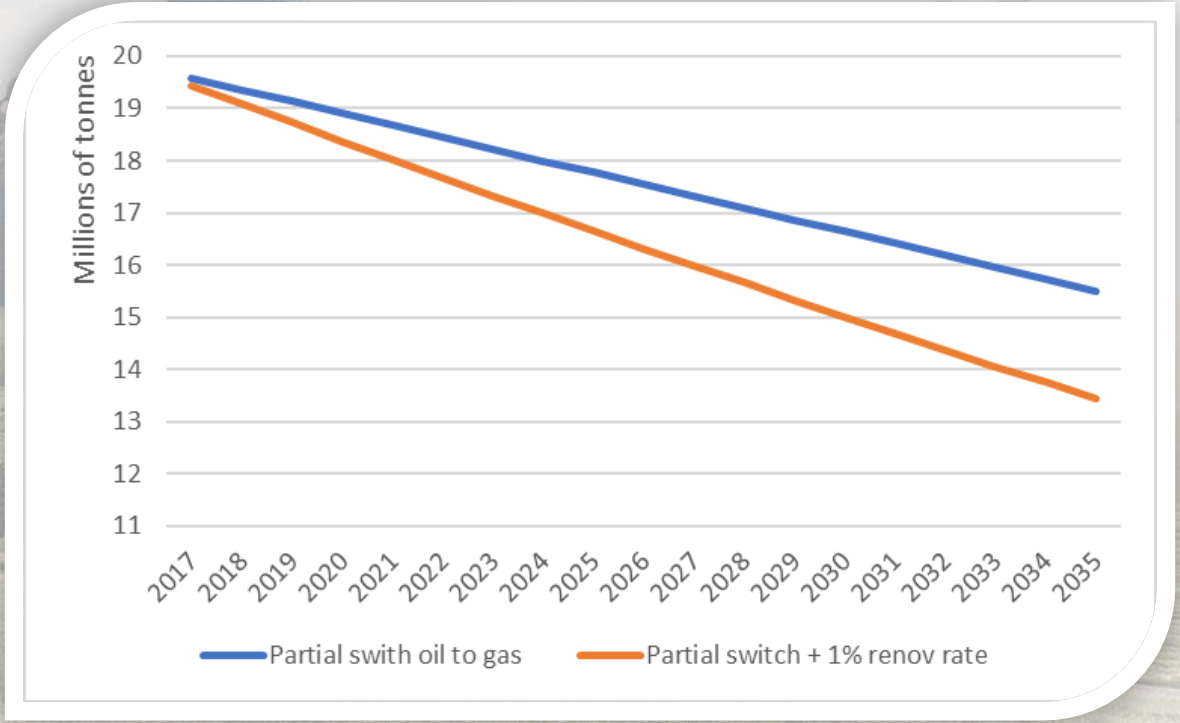
Replacement of heating technologies with/without additional renovation efforts

- Replacement ; no switch to other technologies
- Switch from heating oil technologies to gas technologies
- Switch from heating oil to electricity (& gas to gas)
- Switch from heating oil and gas to electricity
- 4 scenarios with/without additional renovation efforts

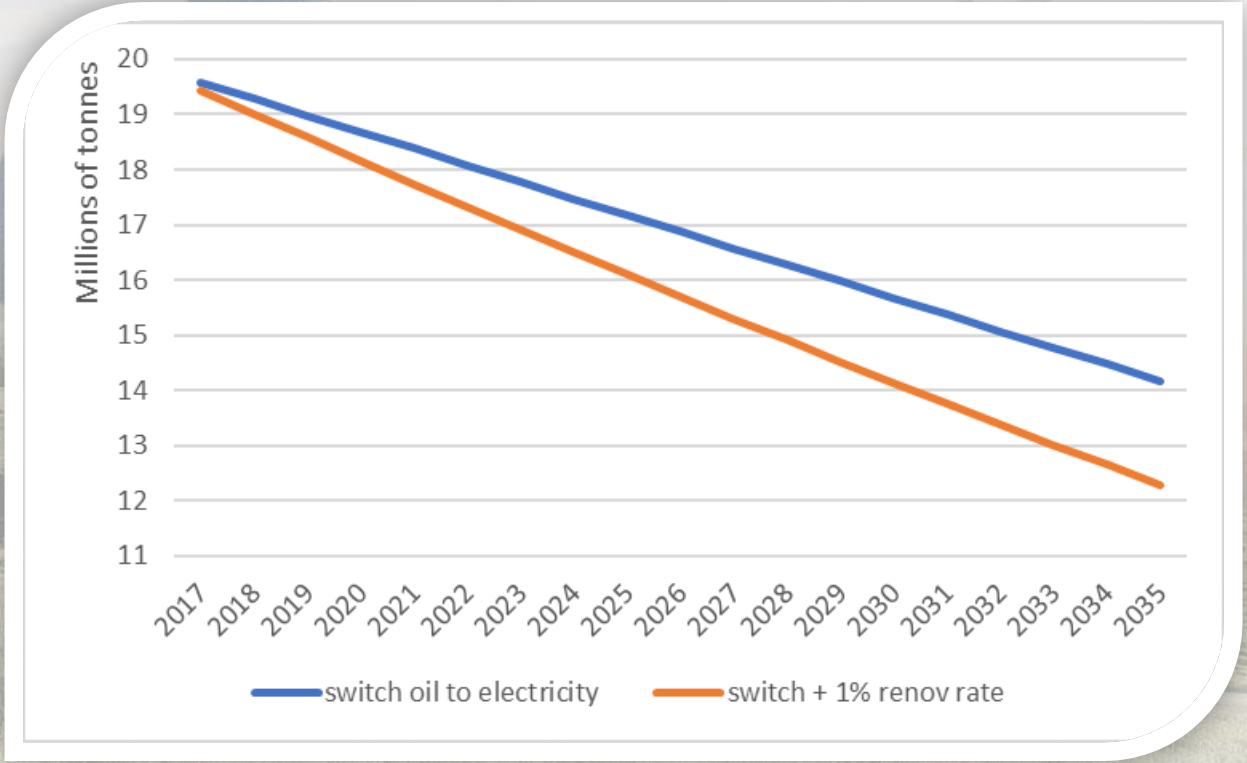
Replacement; no switch to other technologies (-14% ; - 26%)



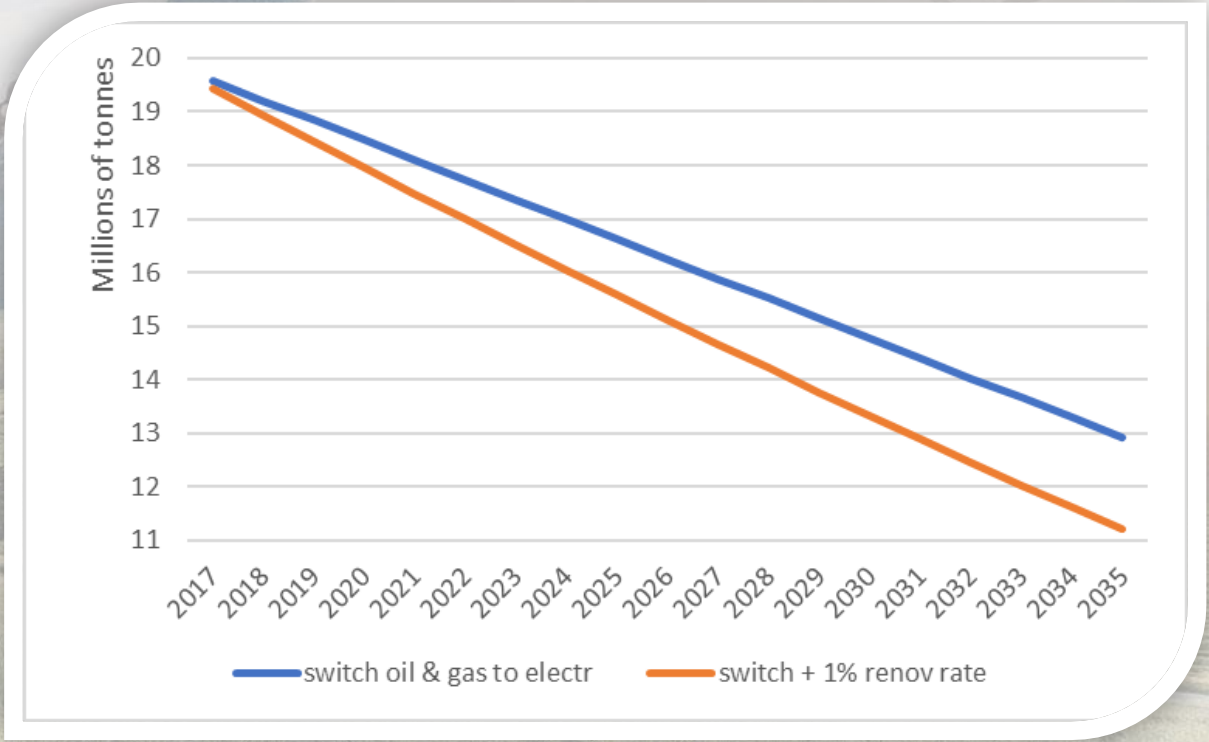
Switch from heating oil technologies to gas technologies (-21%; -32%)



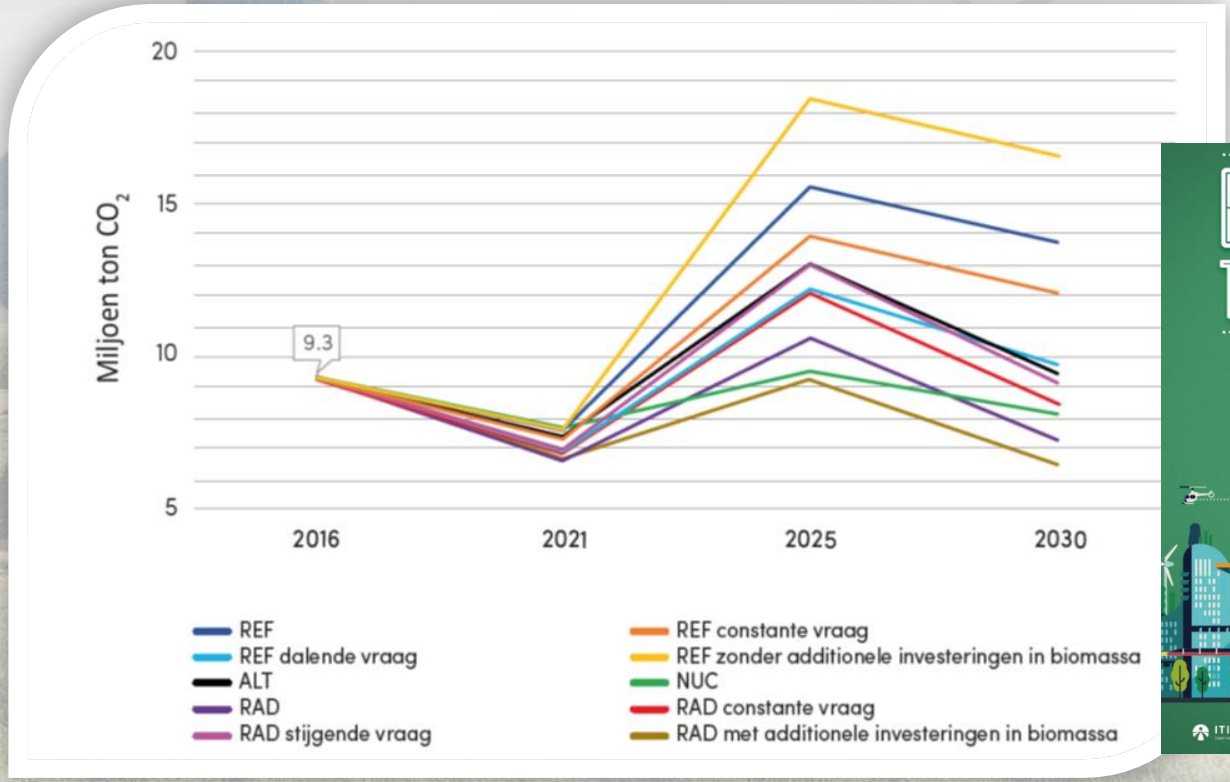
Switch from heating oil to electricity & gas to gas (-28%; -27%)

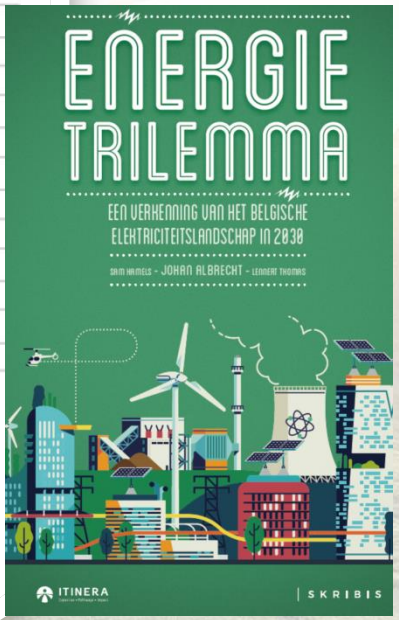


Switch from heating oil and gas to electricity (-34%; -43%)

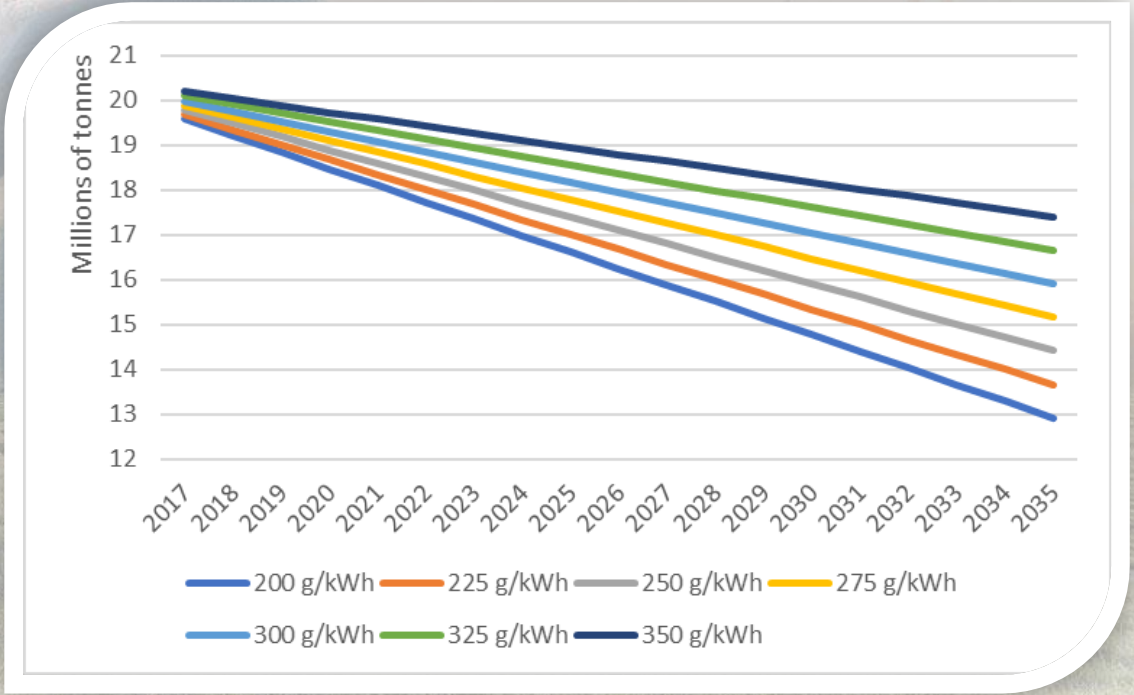


CO_2-intensity of electricity generation after the (partial) nuclear phase-out?





Variation in CO_2-intensity per kWh and CO_2 emissions of housing stock with only replacement of heating technologies; full switch from heating oil and gas to electricity



Conclusions

- Extrapolation of current replacement dynamics yields a reduction of CO_2 emissions of 14,4% / 26% by 2035
- Switch from heating oil technologies to new gas technologies; CO_2 reductions of 21% and 32% (including renovations)
- Although not realistic nor desirable from a cost-effectiveness perspective, higher CO_2 reductions are obtained when all old fossil heating technologies are replaced by new electrical technologies: 34% and 43% respectively.
- However; CO_2-intensity per kWh should not exceed 275 g/kWh after phase-out