LCA study by RDC environment

Comparison of the greenhouse gas emissions from heating with gasoil and natural gas in Belgium and the effect on global warming

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What is a life cycle assessment (LCA) study?

- A life cycle assessment (LCA) study examines the total environmental impact of a product during its entire life cycle

- In this case, it concerns an investigation into the total greenhouse gas emissions from heating with gasoil and natural gas from the extraction of the raw material including production and transport up to and with the final combustion

The LCA study of RDC Environment

- RDC Environment supports policy makers on waste management decision-making, sustainable development and circular economy. They are experts in quantifying the impact on the environment using life cycle assessments.
- The 2020 LCA is a new study that takes into account the current market situation and technology. Similar studies were also carried out in 2005 and 2012.
- It has been subjected to a critical review (peer review) in accordance with ISO 14040 and 14044 standards. This was done through a panel of experts:
  - Angélique Léonard, full professor at the University of Liège (chairman of the
  - Jo Van Caneghem, professor at the KULeuven
  - Stéphane Barbier and Thomas Deville , from bureau

LCA 2020 study of greenhouse gas emissions of heating with gasoil and natural gas

1. Subject of investigation
2. Purpose of investigation
3. Methodology
4. Results
5. Conclusions

1. Subject of investigation

Answer to the following question:

« What is the impact on climate change of a new central heating boiler installed in 2020 on fuel oil or natural gas in Belgium ?»

Or else formulated…

« Should the government prohibit the installation of new fuel oil boilers and only allow natural gas boilers because of the impact on the climate change »

2. Purpose of investigation

What do we want to know:

« What is the influence of the greenhouse gases emitted from heating with gasoil and natural gas in Belgium on global warming considered over the full life cycle of both energy sources »

3. Methodology: Principles

If one energy vector is forbidden in favor of another energy vector , then this means concretely :

- A switch to a boiler with a different energy as fuel for a period of at least 20 years
- A shift in energy demand from one energy source to another (in case of fuel oil to natural gas)
- A difference in the global greenhouse gas emissions of one energy vs. . By another with an impact on climate change

3. Methodology: Parameters

- From extraction to final combustion:
  - Heat production with condensing boiler on fuel oil and natural gas same level playing field
  - Taking into account the sources of supply in Belgium now and in the future
  - International transport to Belgium
  - Refining in Belgium
  - Distribution and consumption in Belgium
- Unified Functional Unit
  - « The production of 1 kWh of useful heat in a house with a household heating system ≤ 70 kW in Belgium today and in 2030 »
- Calculated environmental impact categories
  - The greenhouse gas emissions and the global warming potential (GWP) at 100 years and 20 years
  - According to a methodology as prescribed by the EU Commission

Equivalent technology: oil and gas condensing boilers

Seasonal energy efficiency

- EU Regulation 811/2013

Class regarding seasonal energy efficiency of space heaters	Seasonal energy efficiency of space heaters ηs in %
A+++	ηs≥150
A++	125≤ηs<150
A+	98≤ηs<125
A	90≤ηs<98

- 90% in 2018 and 93% in 2030

- Correction factor for the real return
  - -5%
- Conversion rate Hs/Hi

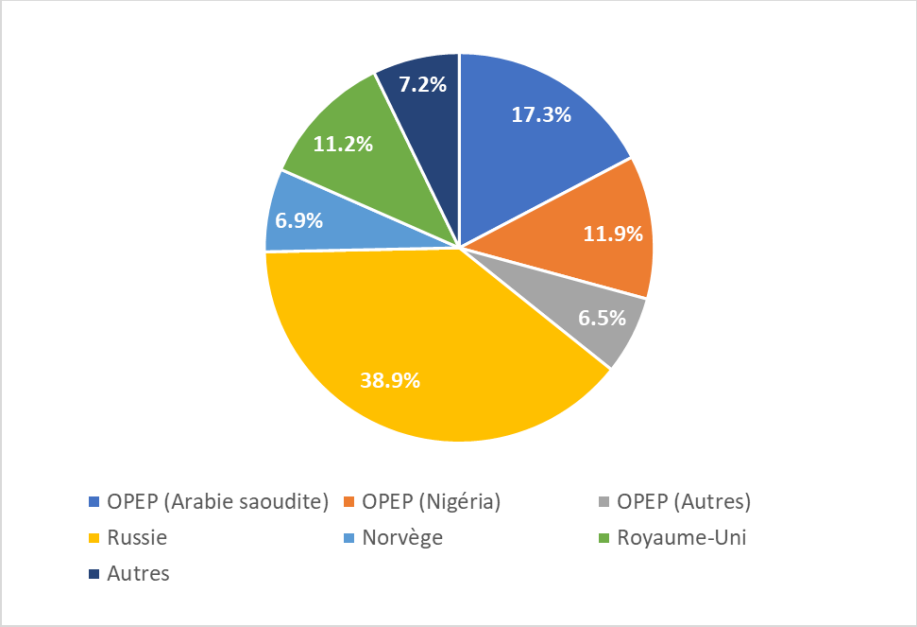
Hi		Hs	Hi/Hs	Source
LNG	10,46 kWh/Nm³	11,59 kWh/Nm³	0,903	Fluxys 2019 [1]
Natural gas L	9,31 kWh/Nm³	10,14 kWh/Nm³	0,909	
Natural gas H	10,37 kWh/Nm³	11,48 kWh/Nm³	0,903	RDC Environment based on Fluxys 2019 (arithmetic mean of the five natural gas terminals with a difference in type of approximately 0.15 kWh/m³)
Gasoil	11,86 kWh/Nm³	12,68 kWh/Nm³	0,935	informazout

Emission Factors of combustion in the boiler

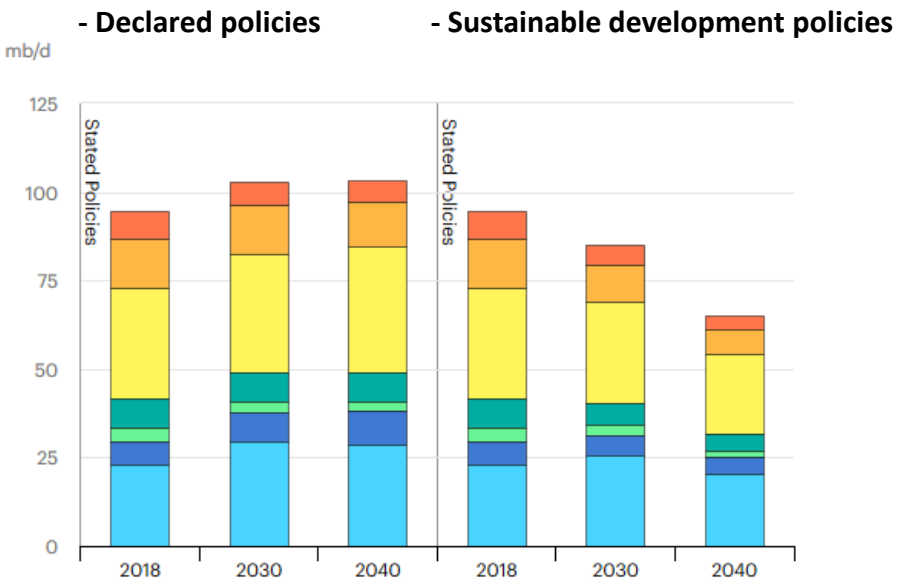
NOx (EU Regulations 813/2013)

- 56 mg/kWh Hs per consumed gaseous Fuel
- 120 mg/kWh Hs per consumed liquid fuel

Petroleum mix now and in 2030



Input of crude oil in Belgium (2018)



Expected crude oil production by region and per scenario (2018 to 2040)

Natural gas mix in 2030: marginal vs attributional gas mix

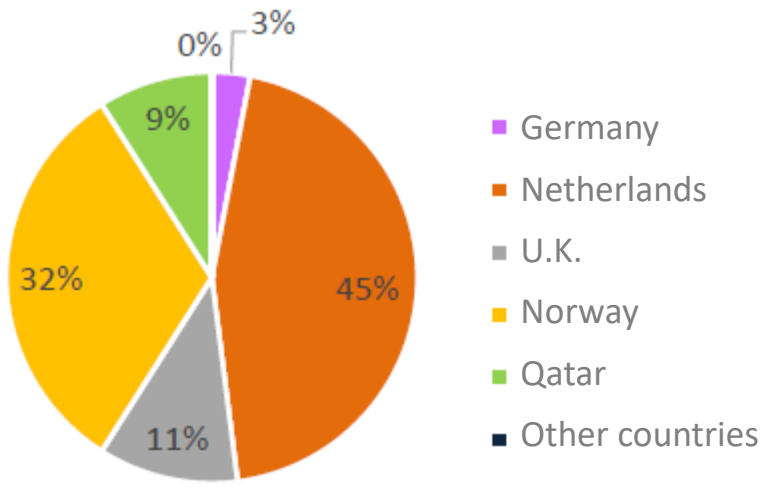
The marginal mix the most realistic scenario:

- Dutch natural gas in Belgium will be phased out from 2020 and will stop by 2030.
- These imports will be replaced by imports of natural gas from other and further areas where the Netherlands will still function as a transit country because of the existing infrastructure.
- In addition, new sources of supply will be needed if a switch from fuel oil to gas boilers is used

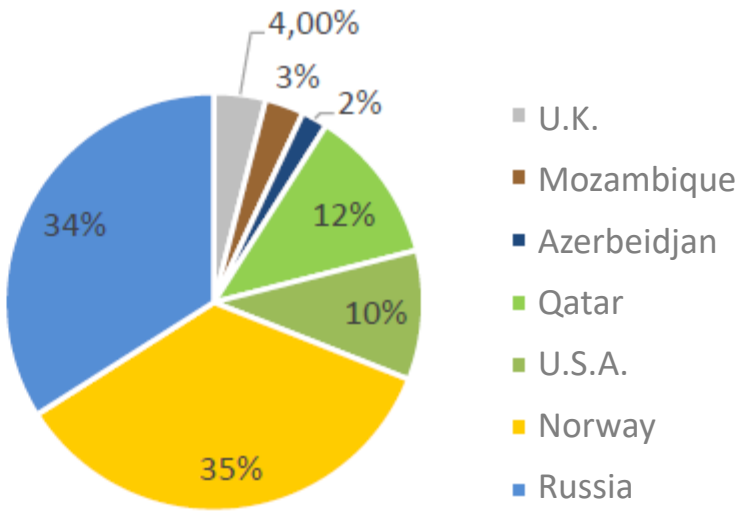
The attributional mix the business as usual model:

- The study also includes this mix but is highly unlikely
- The current sources of gas supply will guarantee the Belgian increased consumption of natural gas due to the possible switch from oil to gas.

Petroleum mix now and in 2030: attributional gas mix

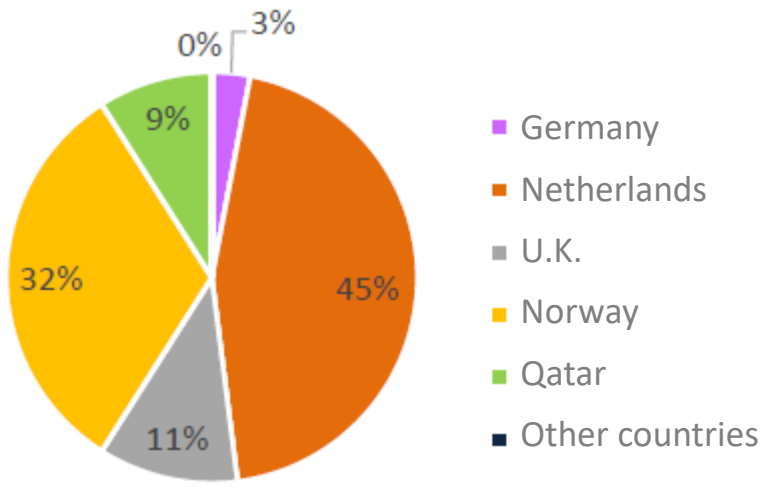


Input of natural gas in Belgium (2014-2018)
Netherlands = 45%



Attributional gas mix in Belgium (2030)
(Netherlands =0%)

Petroleum mix now and in 2030: marginal gas mix



Input of natural gas in Belgium (2014-2018)
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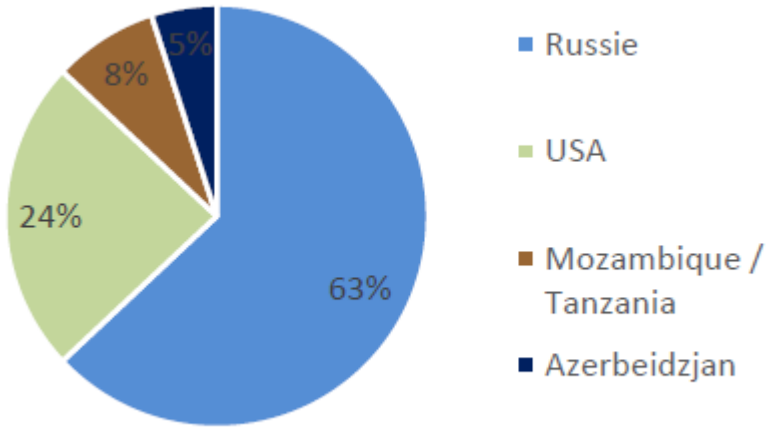
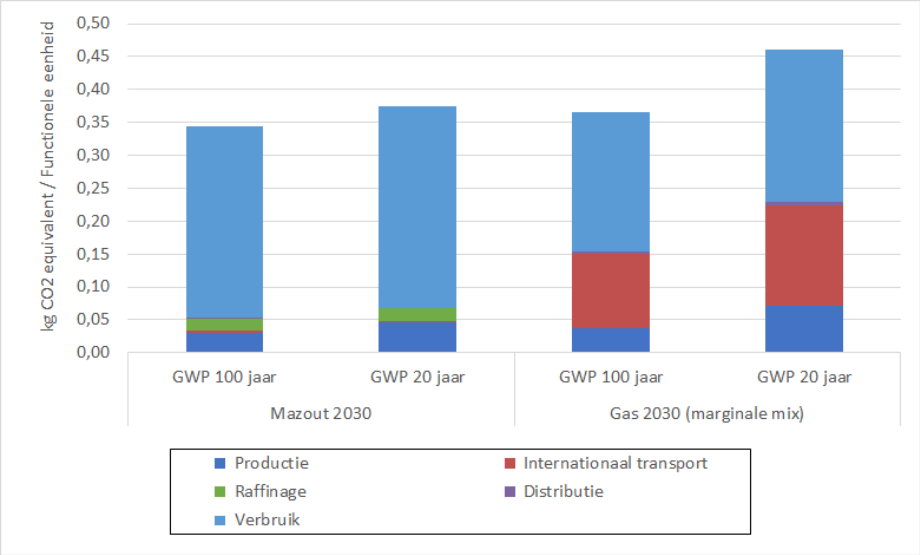


Attributional gas mix in Belgium (2030)
(Netherlands =0%)

Results : GHG emissions fuel oil and natural gas with the marginal gas mix

Climate effect (GWP) at 20 years and 100 years with a marginal 'mix for natural gas'



The most realistic scenario by the end of the import of Dutch natural gas into Belgium.

The effect on climate change is with a Global Warming Potential (GWP) of 20 years higher than with a GWP of 100 years in all scenarios examined. The climate change with a GWP of 20 years leaves a see a short-term effect.

The effect on climate change (GWP) at 20 years is 22% bigger by heating with natural gas heating than with fuel oil.

But even at 100 years, the effect on the climate change (GWP) from heating with natural gas 6% higher than with heating oil

Methane emissions are higher during the life cycle of natural gas than that of fuel oil, especially during the production and the international transport phase. This is valid in particular for gas of Russian origin, which will make up a large part of the marginal gas mix in 2030.

5. Conclusions

- In the realistic future model for Belgium in which the Dutch natural gas is replaced by natural gas of other origins such as Russia, the United States, Africa and the Middle East will reduce the negative effect of heating with natural gas for the climate
  - at 20 years 22% higher than with heating oil–
  - at 100 years 6% higher than with heating oil

- The business as usual scenario with the same supply mix in 2030 as now is not realistic to estimate the global climate impact of heating on natural gas and fuel oil to be determined at 20 and 100 years. The supply mix of natural gas will change significantly in the coming years.

5. Conclusions

- To reduce greenhouse gas emissions, a ban on the placement of fuel oil boilers in the replacement market does not contribute to achieving of the climate goals and this policy measure is counterproductive.

- Replacing outdated central heating boilers (both fuel oil and natural gas) with condensing boilers contribute much more to the reduction of CO2 emissions than a fuel switch.