Contradictions
of
low-emission nZEB
buildings

Krisztina Severnyák
Debrecen University, Doctoral School of Earth Sciences

SBE19 GRAZ

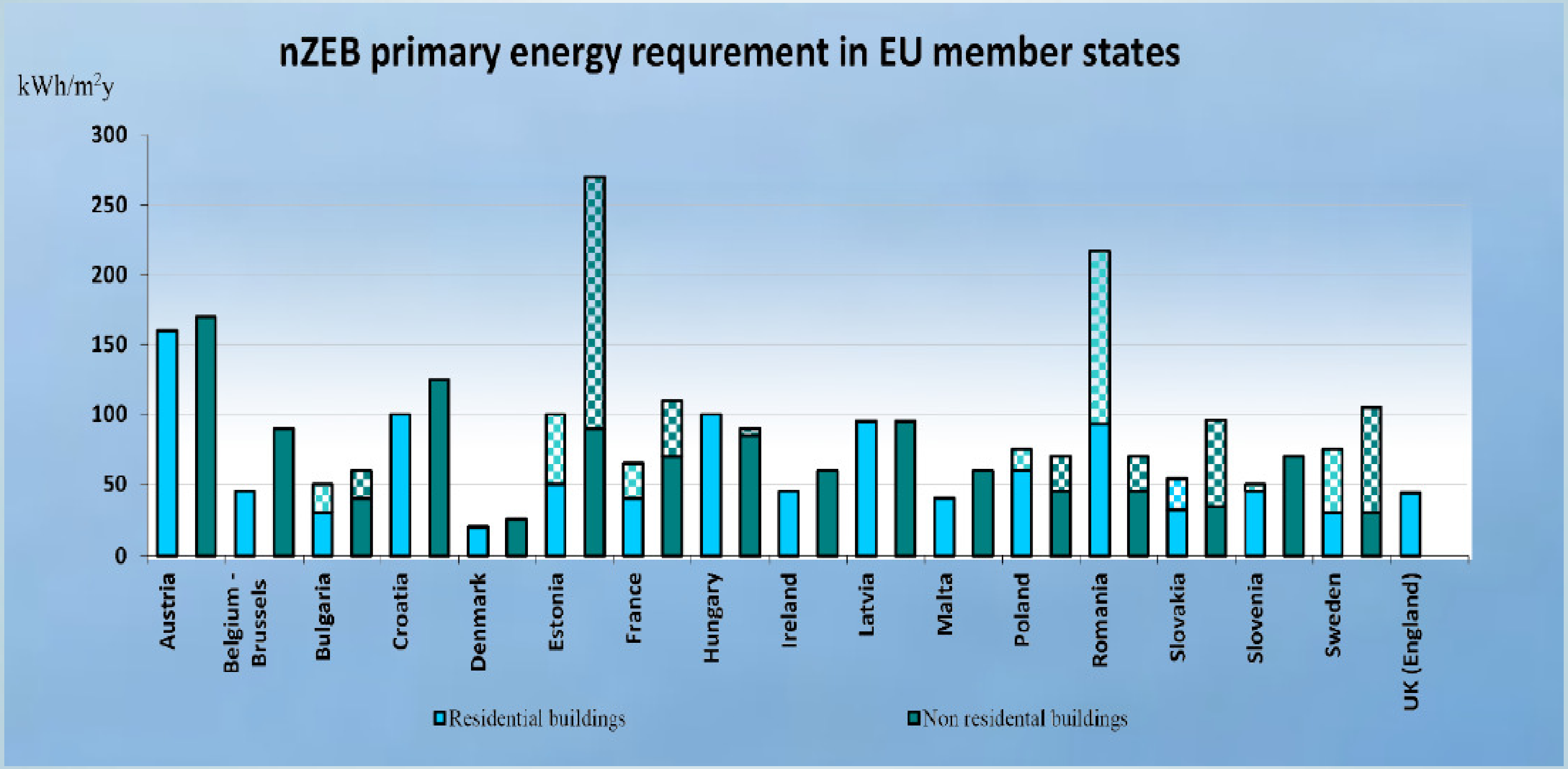
INTRODUCTION

Based on the European Parliament’s directive(2010/31/EU) published in 2010, all new buildings built after 31 December 2020 within the EU should meet the requirements of nearly zero-energy buildings.

According to the definition, these buildings must be characterized by low energy consumption and extensive use of renewable energy.

The European Union has entrusted the Member States to set a maximum primary energy consumption requirement for nearly zero-energy buildings, which varies from one Member State to another.

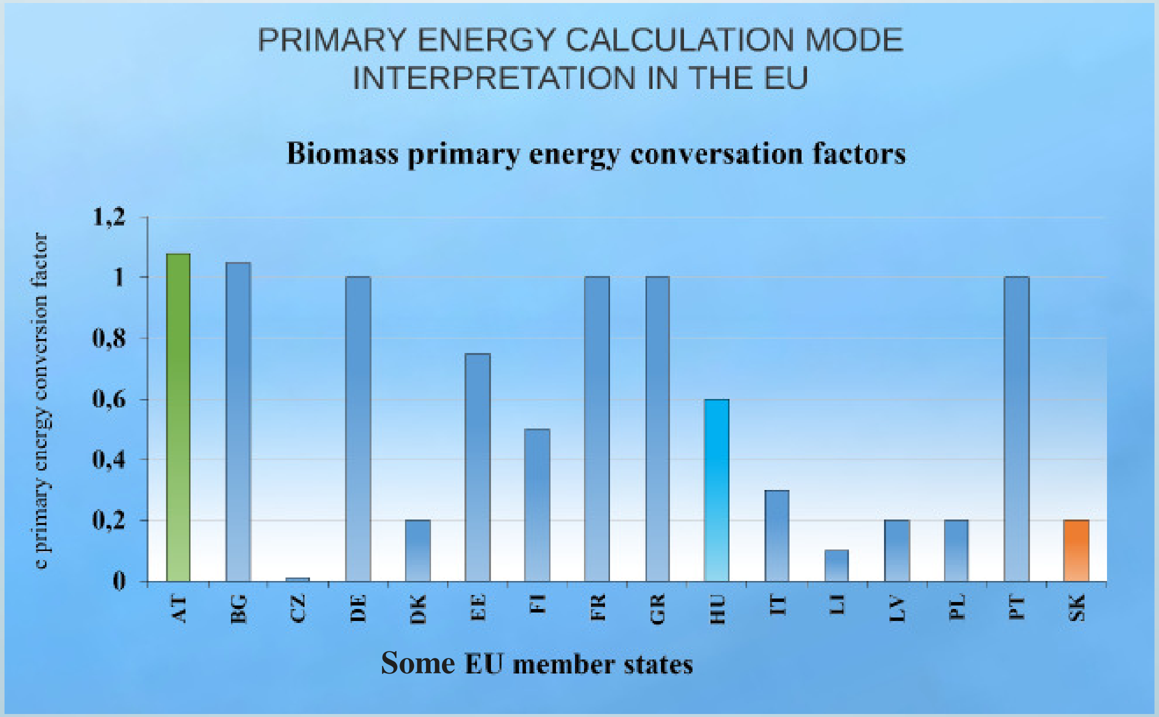
INTRODUCTION



The maximum value of the energy consumption of nearly zero-energy buildings is determined per year and floor area in primary energy. The method of calculating the yearly energy consumption is determined by the Member States individually

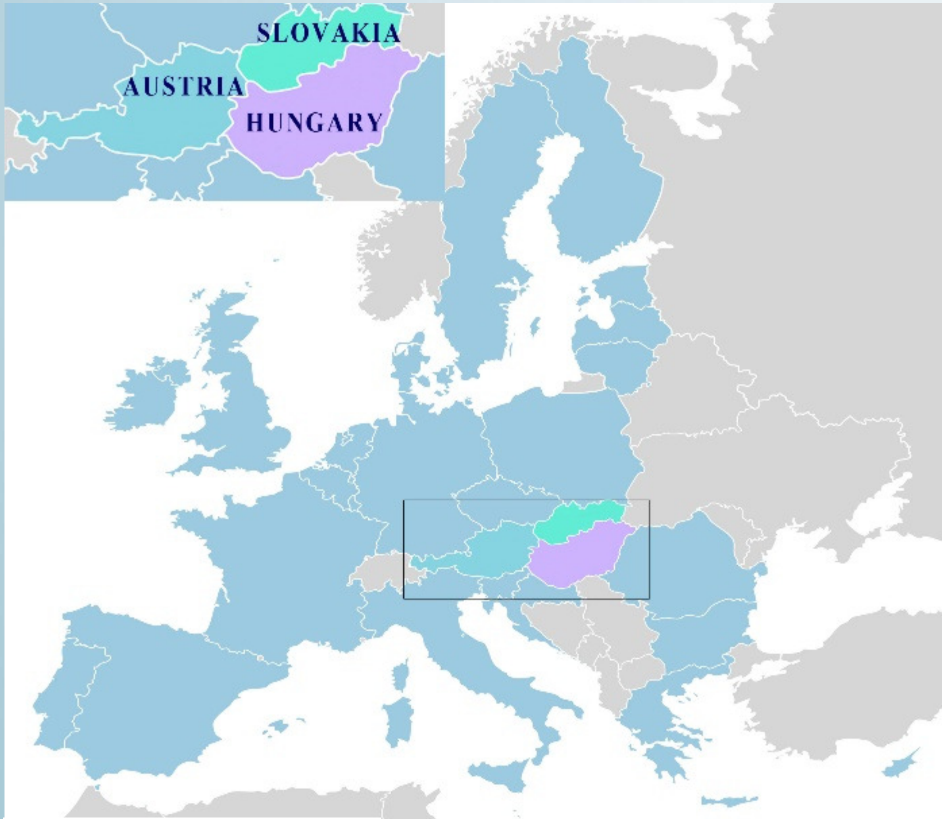
INTRODUCTION

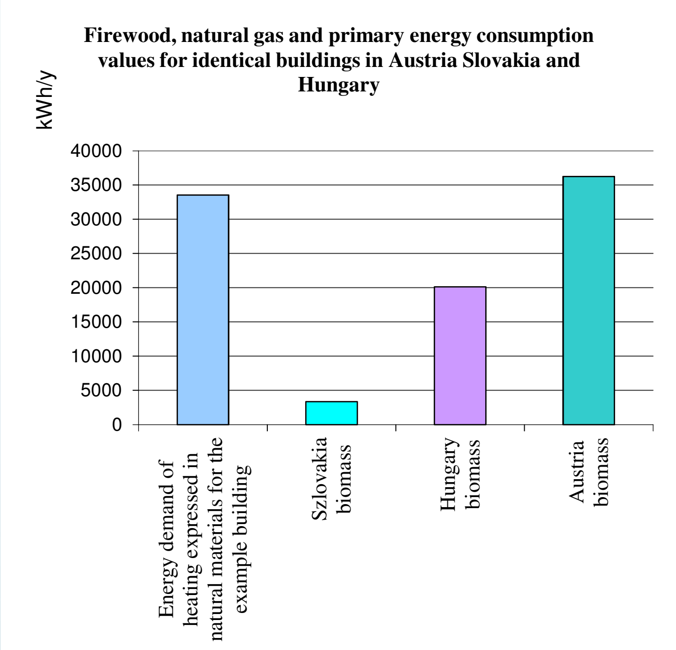
Member States of the European Union use primary energy conversion factors (e) with different values for the same energy carrier, that is, they determine their primary energy consumption individually depending on the energy, loss and other factors of the conversion of energy carriers. At the same time, these conversion factors may conceal central subsidies or other incentives that may cause energy consumption results to be subjectively distorted in individual Member States.



CALCULATIONS

The sample building is a one-story single-family house with a floor area of 100 m2 made from manually built building blocks, widely used in Hungary between 1960 and 1980. Assuming the same environmental conditions the primary energy demand for heating the building is not the same in the three countries if biomass is used.

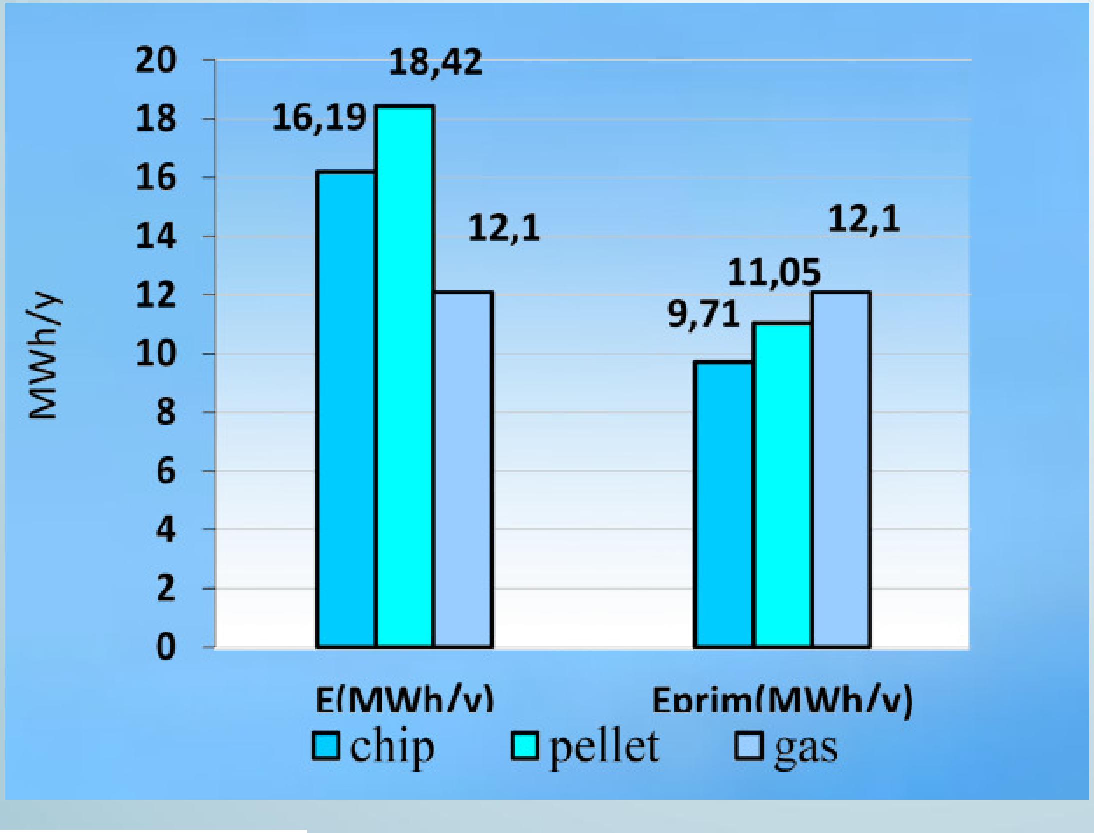




Energy need in identical buildings in identical climatic zone- from left to right: in delivered energy, in primary energy in Slovakia-Hungary-Austria

CALCULATIONS

The truth is when different fuels are used, consumption of the sample Hungarian building shown in figure 5, taking into account the efficiency of the system, and the primary energy conversation factors more primary energy carrier is needed when using biomass.

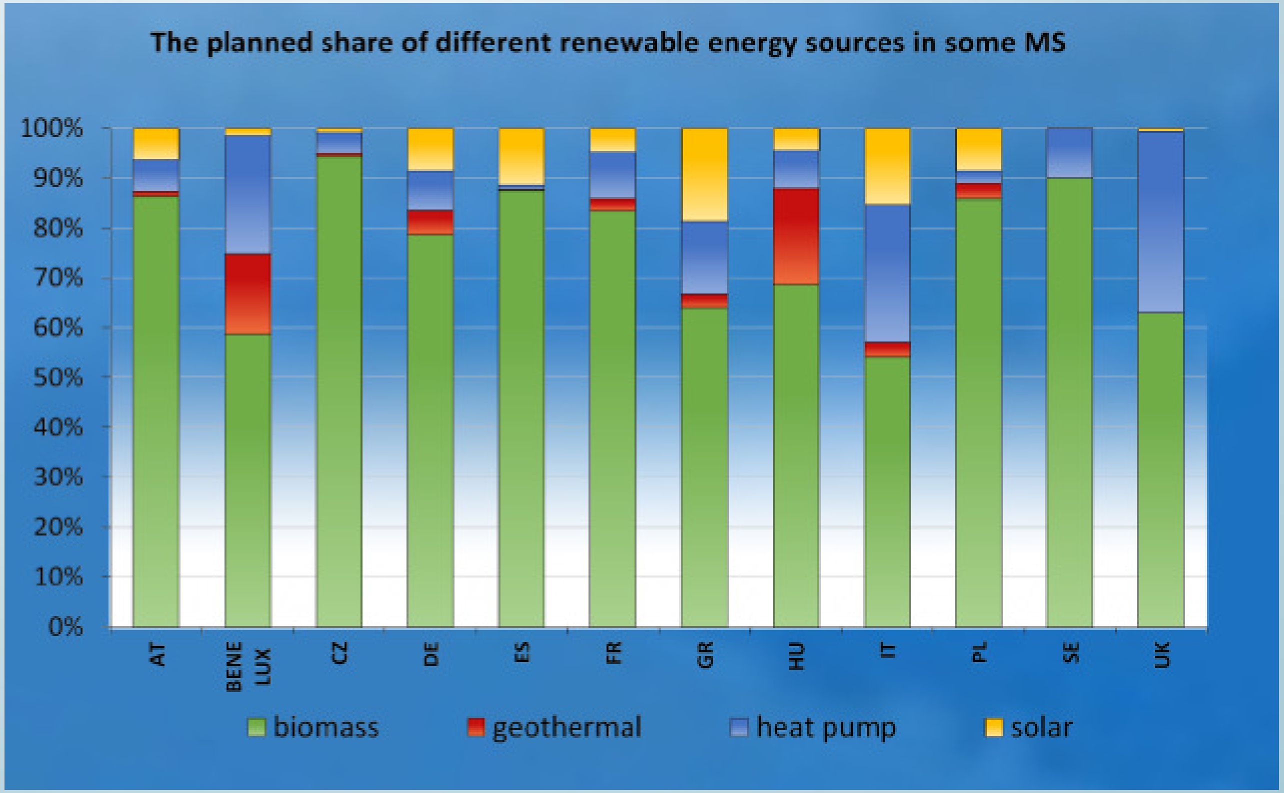


30 year lifetime
Primary energy and energy carrier consumption of the sample building

CALCULATIONS

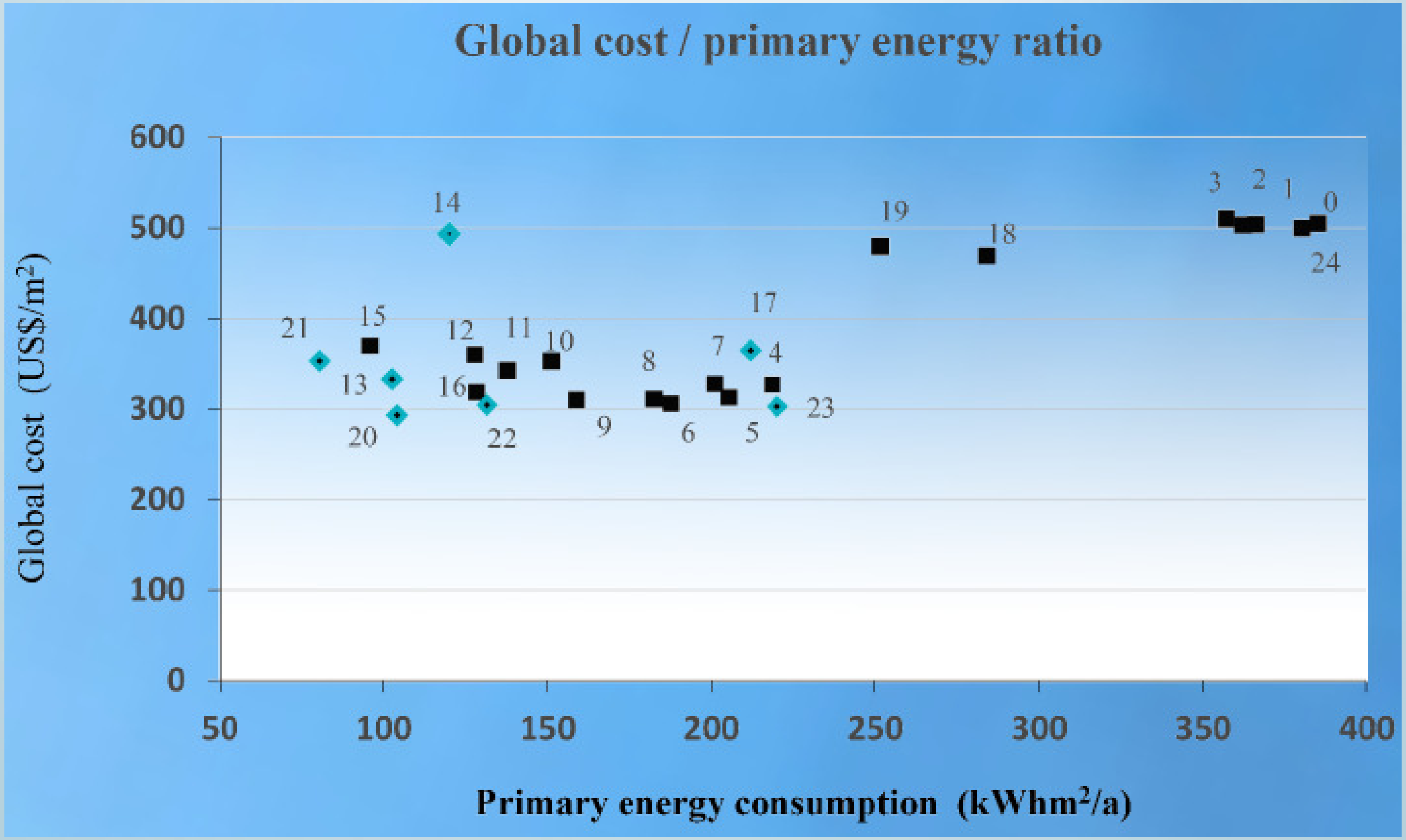
Biomass use is expected to be the key to solving the problem of high renewable share of nZEB buildings. Biomass as an energy source can be renewed, but it has limitations. If we only look at the heat demand of buildings, it is likely that the growing demand for biomass poses a risk to resources and will result in rising prices (not to mention the biomass needs of thermal power plants, which is an important source of green electricity in Europe)

The acquisition of biomass fuel in the European Union is difficult for many Member States, e.g. GB imports from the USA, whilst Denmark from the Baltic States.



CALCULATIONS

In the reference single family house, we looked at 24 really feasible alternatives for modernization. For combinations, see table 1. The results of the analysis are given in figure 9. The optimum solution No.20 is a complex refurbishment, based on wood heating.



CALCULATIONS

Biomass production

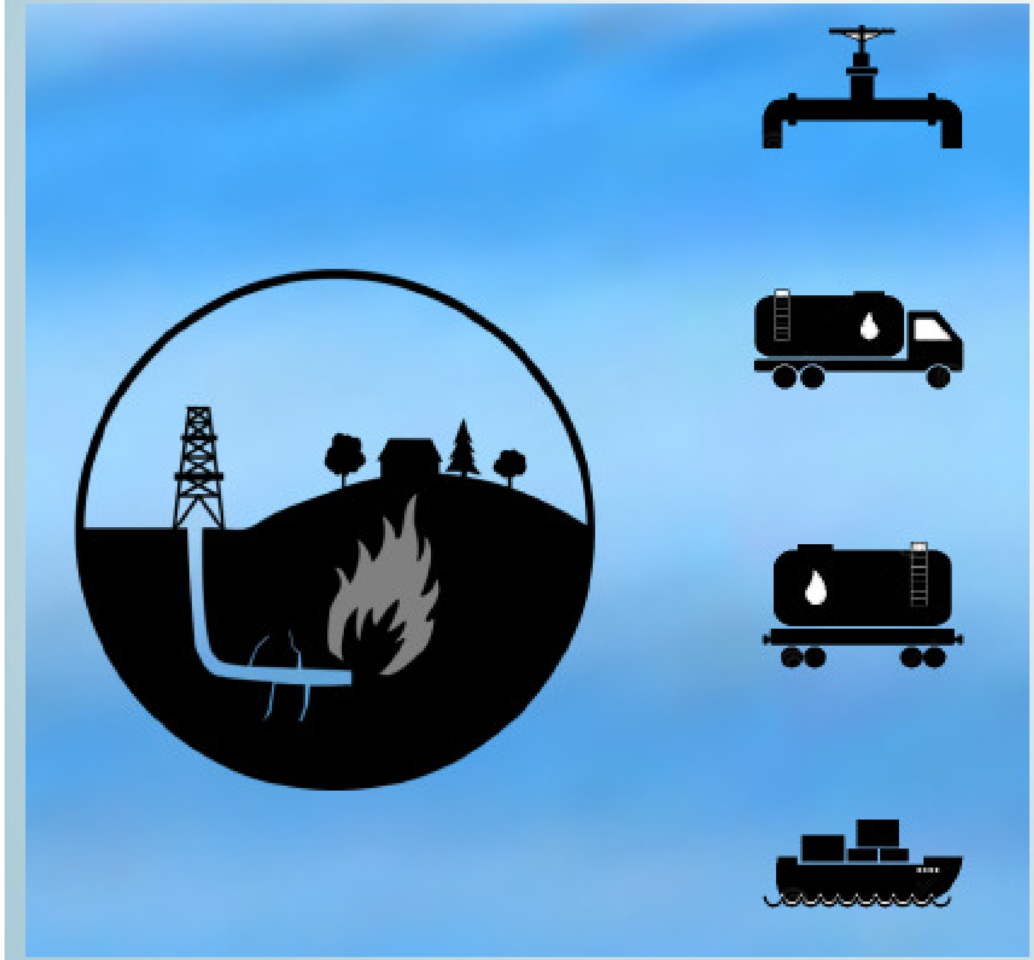
Pellet production

1, Corp production (fully for firing)
2, Harvesting
3, Raw material transport (by land to place of processing)
5, Biomass processing / conversion to chip
4, Drying (artificial,)
5, Biomass processing / conversion to pellet
6, Fuel transport (by land to storage)
7, Storage
8, Fuel transport (by land to place of use)

Chip production:

1, Corp production (fully for firing)
2, Harvesting
3, Drying (artificial, natural)
4, Raw material transport (by land to place of processing)
5, Biomass processing / conversion to chip
6, Fuel transport (by land to storage)
7, Storage
8, Fuel transport (by land to place of use)

CALCULATIONS



Natural gas production:

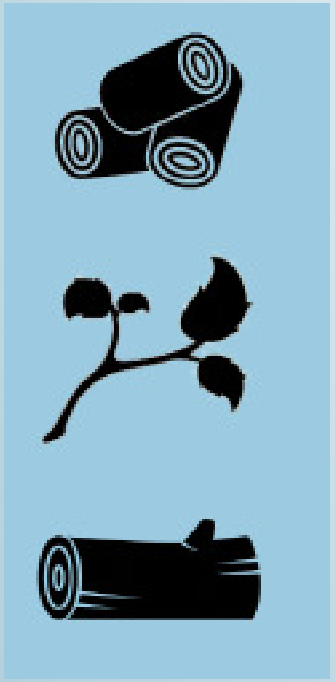
1, Fuel distribution and storage
2, Fuel production
3, Feedstock recovery
4, Gas leaks and flares
5, CO2, H2S removed from NG

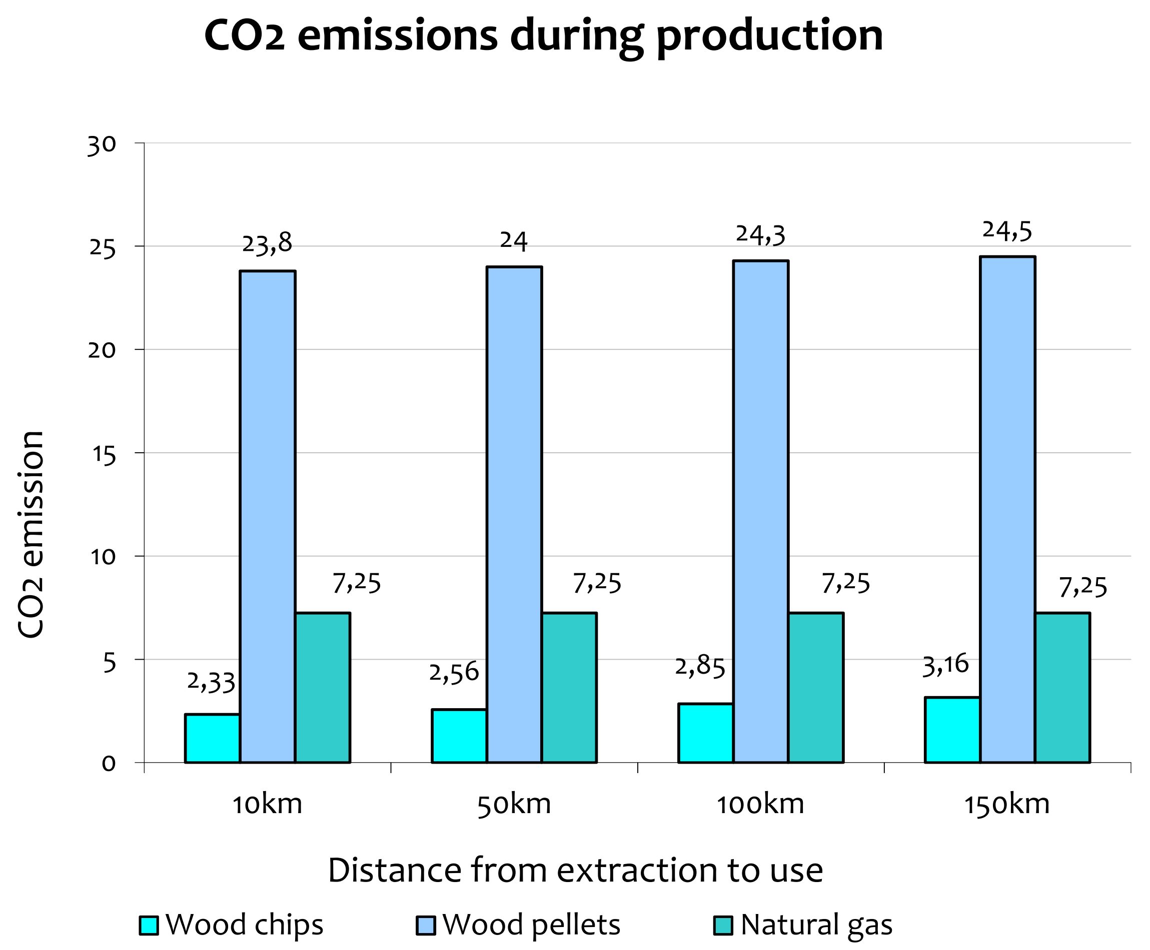
Emission value for producing natural gas

Natural Resources Canada	g CO$_2$eq / MJ fuel
Natural gas upstream emissions	7, 25

CALCULATIONS

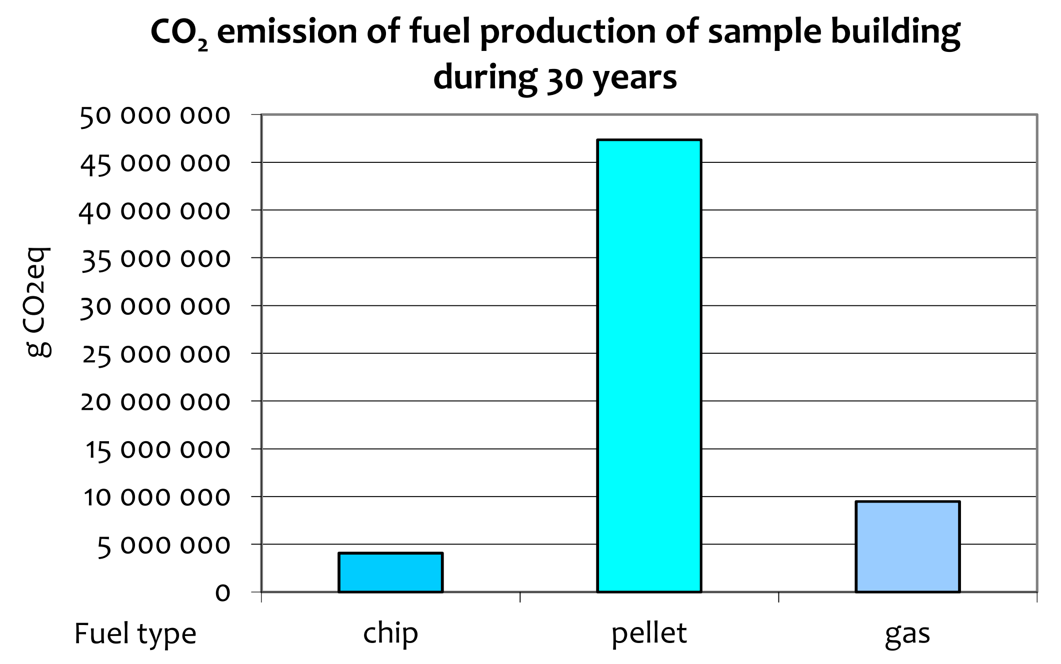
CO_2 neutrality of biomass production





CALCULATIONS

The amount of carbon dioxide produced during the combustion of wood was constraint during the growth of tree. This constraint in the forest has improved the air quality of the environment. During combustion, emission happens in a residential environment (if not power plant use), so that the emitted pollutants return to the living environment and pollute it. The final results are aggregated to give CO2 emissions values for producing natural gas and biomass during 30 years lifetime of the sample building.



Domestic hot water + Heating production	Energy demand E(MWh/y)	Energy demand E(MJ/30yrs)	Fuel carbon intensity (g CO2eq / MJ fuel)	CO2 emission of fuel production of sample building during 30 years (g CO2eq)
chip	16,19	1 748 520	2,33	4 074 020
pellet	18,42	1 989 360	23,80	47 346 768
gas	12,1	1 306 800	7,25	9 474 300

SBE19 GRAZ

SUMMARY

Taking advantage of regulations in many Member States, the amount of yearly primary energy demand is favorably influenced by the low primary energy conversion factor determined by the very states; besides the annual heat demand does not decrease in naturals. Therefore, nZEB buildings may use more energy through biomass firing than in gas heating.

The CO2 neutrality of biomass is not real. It is true that the emission of gas firing far exceeds that of wood firing, but emissions from the production of natural gas might be lower than that of the production of certain wood products. Overall, the lifecycle-based emission of biomass firing for the most converted fuels is already significant. In the case of wood combustion, the local pollutant emissions are significant, while the CO2 constraint occurs in the forests.

Thank you for your attention!

severnyakk@yahoo.co.uk