

INTRODUCTION:

The question of the used energy systems has become even more important because of the current energy crisis. Therefore it is interesting to investigate the chances of heat pumps for domestic houses in Ireland. Air-to-water heat pumps are using electricity but also environmental energy in the air to heat the water. That is the reason, that heat pumps have a way higher efficiency (3-4) than traditional oil-powered boilers.



Picture of a heat pump

OBJECTIVE

The main objective of this research is to investigate the chances of a modern heating concept (heat pump and photovoltaic) for a representative Irish house. In the center of the investigation are **environmental** and **economic** effects.

METHODOLOGY:

1. Data Collection (dimensions of the house, construction details, using details)
2. Modelling status quo based on 1.
3. 1. Simulation of status quo
4. Adapting new energy system
5. 2. Simulation of the new energy system
6. Analysis of both simulations



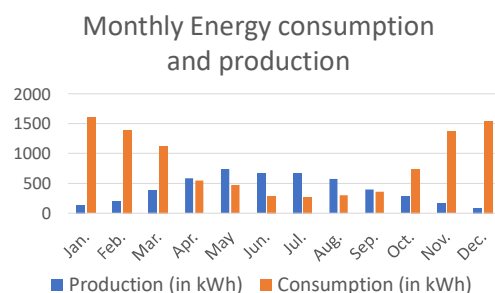
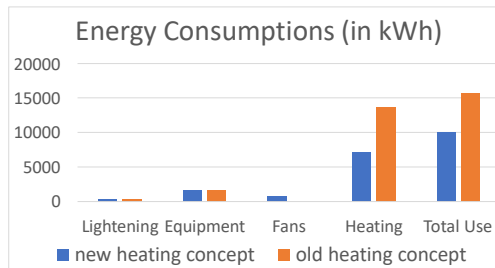
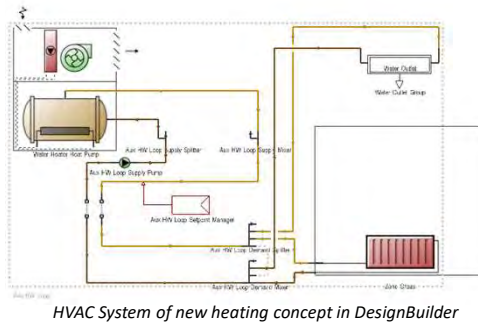
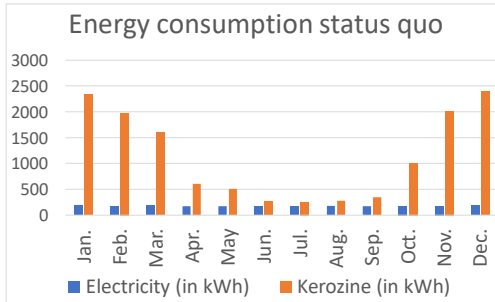
Picture of modelled House



Model of the House in DesignBuilder

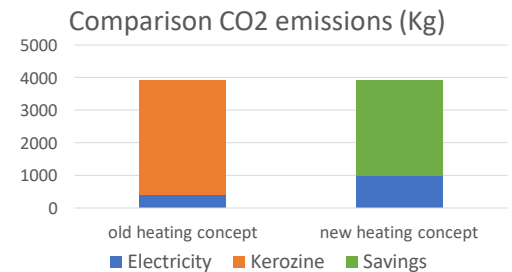
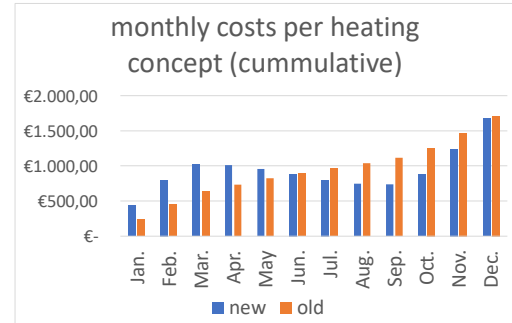
MODEL SIMULATION:

Two simulations have been done on an annual basis. In the first simulation, the current Energy system (oil-powered boiler + radiator) has been simulated. For the second simulation, the HVAC system has been changed (heat pump) and Photovoltaic panels have been added.



SIMULATION RESULTS:

Using a heat pump instead of traditional heating systems (oil-powered boiler) the total energy consumption could be **reduced by 5000 kWh**. Also, a heat pump would **save 2940 Kg of Co2 emissions** each year. Because Energy consumption and energy consumption are anti-cyclical, the price of selling electricity is cheaper than selling electricity, and purchasing Electricity is more expensive than heating oil, the possible **savings each year** are just **40€**.



INTERPRETATIONS:

In Conclusion, heat pumps are a good chance to reduce CO2 emissions of buildings efficiently. Also, they allow buildings to become independent of fossil fuels. From an economic perspective, an investment (ca. 20.000€) in a heat pump in combination with photovoltaic can not be recommended based on the current prices of energy. But, governments could consider supporting investments economically, because of the listed advantages of heat pumps for the environment.

REFERENCES:

Alli, Usman, Mohammad Haris Shamsi, Mark Bohacek, Cathal Hoare, Karl Purcell, Eleni Mangina, and James O'Donnell. 'A Data-Driven Approach to Optimize Urban Scale Energy Retrofit Decisions for Residential Buildings'. *Applied Energy* 267 (1 June 2020)
<https://www.forestresearch.gov.uk/tools-and-resources/ftthr/biomass-energy-resources/reference-biomass/facts-figures/carbon-emissions-of-different-fuels/>
<https://www.linquip.com/blog/heat-pump-efficiency/>