

Gas Heating vs Electrical Heating using different electricity mixes

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The objective of this case study is to compare a residential heating system using a gas conventional boiler with other using electrical heaters at the point of use. This was done taking into account the heating needs of a normal house and a low energy house. The use of different electricity mixes showed that the use of electrical heating has significant environmental advantages in countries with an electricity generation based on hydro or nuclear power.

The electricity grid mixes from the average EU25, France (predominantly Nuclear) and Poland (predominantly coal) were used, as well as an approximation of the EU 2020 grid mix counting 20% of renewable energy sources.

The environmental impact is highly dependent on the electricity generation mix. Primary energy consumed by using a gas boiler is lower than using an electric heater, however it must be noted that the efficiency at the point of use is much higher in the case of electric heaters. Furthermore, the investment for an electric heating system is about two to five times lower than for a gas heating solution and with an even longer lifetime. Electric heating has also a lower maintenance, no need for regular verification by an expert, no chimney sweeping, no purging of the pipes. This cost reduction makes it possible to invest in better insulation and ventilation in the house, therefore reducing the heat demand. This

investment could also be done on renewables (not taken into account for the moment) arousing an even better (cleaner) situation for electricity.

Another alternative is the integration with heat pumps. That would cut primary energy consumption by a factor 3 as electric heat can be stored with about 95% efficiency, compared to 50% for hydrogen or 70-80% for batteries. This would mean a great advantage for its ability to assist deeper penetration of intermittent renewables into the electricity grid.

In terms of CO₂ emissions, the use of electric heating is preferential in countries like Austria and France. Even in the EU25, the CO₂ emissions difference is marginal and could be easily annulated by improving building insulation or the efficiency of electricity generation/distribution.

The order of magnitude of CO₂ emissions substantially differs from country to country due to the different sources of primary energy used to generate electricity. France (Nuclear power) and Austria (Hydro power) have lower CO₂ emissions. Power generation using coal has higher CO₂ emissions, being the case for Poland (56% coal and 37% lignite)

Taking the approximation of the EU grid mix by 2020 (counting 20% RES), CO₂ emissions are almost the same as

the ones of gas heating. Taking into account the improvements in the efficiency of electricity generation and building insulation, and Carbon Capture and Storage, electric heating can be more efficient and might have the extra added value of serving as a buffer for renewables integration.