

Discovering the differences in climate calculations of energy use in Swedish buildings

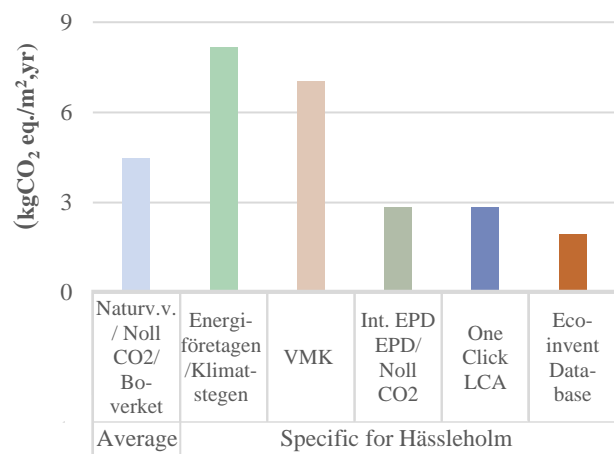
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How do current climate calculations' emission data, and methods for electricity and district heating, differ? Is there a national method to follow when calculating the climate impact of heating a building? We try to find the most common methods used in the industry when doing a climate calculation of the energy used for heating a building. We also compare different methods in a climate calculation for a building to show the impact of choosing different methods.

The study showed differences in emission data and methods based on the collected material. For emission data related to district heating, there are differences in the weighting of carbon dioxide, methane, and nitrous oxide to get the total carbon dioxide equivalent, also known as global warming potential (GWP). When fuel is burned in heating plants, water is heated and subsequently distributed to our homes. Cogeneration plants go a step further by utilizing the steam generated through heating, with e.g., a turbine, which generates electricity. Cogeneration plants must consider the climate impact of both the hot water and the electricity they produce. How, and if, this is considered varies among different emission data sources, resulting in different values among them. Data sources also vary in how they present their information. Some sources may report data separately for different waste categories such as household waste, recycled wood waste, and rubber waste, while others may combine them all under a general category like "waste." This inconsistency makes it challenging to determine the specific components included in those using collective terms, and it further complicates the process of comparing and utilizing the data for personal climate calculations.

When analysing emission factors related to electricity, there are differences in which countries are included in the electricity mix. When considering only the electricity mix of Sweden, the climate emission value appears relatively low. However, if the Nordic countries are included in the calculation, the climate emission value tends to be higher. The variation also arises if the mix is considered origin-labelled electricity, where renewable energy sources are guaranteed, or residual electricity which is the energy mix after the origin-labelled energy is deducted. We also found that emission data for electricity sources, such as wind, water or nuclear, differ significantly.

When considering methods for climate calculations, certain methods include various scenarios for projecting changes in energy use and sources over a building's lifespan, while other methods do not explicitly include such scenarios. For instance, the calculation then might involve replacing outdated heating systems with more energy-efficient alternatives in the future to reduce a house's energy use. Alternatively, it could involve shifting from fossil fuel-based energy sources to renewable ones, such as burning from oil-based heating to wood-based heating.



The figure illustrates a climate calculation for a house located in Hässleholm, which uses 80 kWh of energy with district heating per square meter and year. The results demonstrate variations among the different climate calculation methods of the heating energy for the house. In some methods, both average values (applicable to all of Sweden) and specific values for Hässleholm may be used in the climate calculation, leading to different outcomes. The variation between the higher values provided by Energiföretagen and VMK, and the lower values presented by International EPD, One Click LCA, and Ecoinvent Database lies in the fact that the methods with lower values do not incorporate emissions from waste incineration when determining the climate emissions associated with energy sources.

The difference in CO₂ emissions depending on which method and emission factor you choose is a clear example of why national methods and guidelines, are needed for climate calculations.