Passive house in Arctic climate

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A passive house is a standard for a low thermal energy consumption building (annual heat demand should not exceed 15 kWh/(m2∙a)).  It focuses on reducing heat losses, solar gain and heat recovery in the ventilation system. Passive house technologies have shown considerable results in energy efficiency for Europe and Northern America. To compare with these regions, the Arctic has extreme environmental temperature values, strong winds, permafrost and completely different solar performance that make a large impact on heat loss through the building fence and foundation. [1] The idea of this work is the identification of the practices to improve energy efficiency in the Arctic buildings, based on the fundamental definition of a passive house.

The key metrics that are important for energy service in buildings are reducing thermal transmittance, heating loads, thermal insulation, infiltration, an airtight envelope, also avoiding thermal bridge effects and increasing heat recovery in a ventilation system. [2]

There are few examples of passive houses in the Arctic. The exploitation of the low-energy house in Sisimiut, Greenland has shown a significant difference in energy consumption between simulation and real conditions.[3]

Commonly, passive houses use renewable energy technologies to reduce CO2 emissions. Sub-arctic example of a passive house in Tuolluvaara, Sweden house additionally uses energy-smart water-recycling showers and heat from sewage pipes. [4]

Drawing attention to the topic of passive houses in the Arctic could lead to the development of well-insulated building components, materials, technologies and more efficient ventilation systems. In addition, the use of passive buildings provides an opportunity to improve the indoor microclimate and the health and safety of Arctic residents in extreme climate conditions. [5]

**References**

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