



Electric floor heating powered by the sun

– An attractive and affordable Net-Zero solution

Electric floor heating powered by solar cells is now an attractive alternative to traditional heat pump and water-based solutions. A Danish demonstration project proves the indoor comfort and high energy efficiency of the solar-powered solution in a one-family home designed to meet the Net-Zero requirements.

Even though the history of electric heating has been turbulent, the comfort and convenience of electric heating has never been questioned. Now solar energy paves the way for a revival of electrical heating solutions fulfilling the targets of Net-Zero Energy Homes or even Energy-Plus homes. But is it really feasible? A recent demonstration project in Denmark with a climate similar to the UK says yes. A one-family standard low energy home was equipped with electric floor heating powered by solar cells and combined with solar panels for hot water. After seven months of close monitoring, the home meets the Net-Zero targets, and in the longer run the home is even heading for Energy-Plus status.

- The Danish Net-Zero Energy Home proves that electric floor heating powered by solar cells and combined with solar panels for hot water more than meet the Net-Zero targets. At the same time the solution is clearly affordable compared to a standard low energy home. And the owners, a family of four, are highly satisfied with the indoor climate that offers a constant and pleasant temperature, says Greg Tracy, UK Product Manager DEVI Electric Heating.

Net-Zero homes – competitive today

The measurements of the Danish Net-Zero demonstration project dispel the myth that Net-Zero or Energy-Plus homes are much more expensive than ordinary new builds.

- It is a widespread belief that energy efficient solutions are more expensive, but this is not the case if we look at the long term costs through the entire life cycle of the building. In the case of the Danish home, the initial investment was about 12,000 Euro higher than the standard low energy home offered by the contractor, but in the 30 years global cost analysis the Net-Zero home is about 10,000 Euro cheaper, explains Greg Tracy emphasizing the further advantage of the electric floor heating solution being virtually maintenance-free for 30-50 years.

The financial attractiveness of Net-Zero homes depends on a number of factors, such as the opportunity to store and balance energy in the grid in a financially attractive way and the price development on solar power systems. However, the general trend is for energy efficient solutions to become more and more competitive. For solar cells the price is expected to drop by 50 per cent every five years in the foreseeable future.

The home owners are satisfied

As part of the evaluation of the demonstration project, the family who owns and lives in the Net-Zero home was interviewed about their satisfaction with the solar-powered electric floor heating solution.

- We are happy to see that the family finds the indoor climate very pleasant. They have no problems with over-heating, and they enjoy the constant temperature so that the house is never too hot or too cold. They would highly recommend the electrical floor heating combined with the solar installation to their friends and family, says Greg Tracy.

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Facts about the Danish Net-Zero Energy Home:

- The solution is carried out on a 196 m2 two-storey standard low-energy home, which is normally heated by a heat pump and water-based floor heating.
- In the demonstration project the heat pump is replaced by a 7.2 kW solar power system and a 4.9 m2 solar thermal system for domestic hot water. The slope of the roof is 45 degrees and the orientation is almost south.
- The water-based floor heating is replaced by an electric floor heating system from DEVI in all rooms. On the ground floor, the electrical heating cables are embedded into 10 cm concrete slab as a wet system. On the first floor, the electrical heating mats are installed as a dry system directly under the wooden floor. The electric floor heating solution is maintenance-free for 30-50 years with no need for service or replacement.
- The ventilation rate is 0.325 l/s per m2 with 82.5 per cent heat recovery.
- The energy consumption has been monitored for seven months so far, and will be monitored for 24 months in total.
- The measurements so far indicate that the home will end up as an Energy-Plus home, producing 16 per cent more energy that it consumes for heating and domestic hot water.
- Energy performance (based on 7 months monitoring):

Be10 calculations for 196 m2 kWh/ m2 year @ 20 C	Heat	DHW	PV	Solar thermal system	Primary Energy (Factor 2.5)
The standard low energy house	13.2	16.2	0	0	29.0
HP replaced with electrical heating	16.5	16.0	0	0	87.7
and added 6 kW solar power system	16.5	16.0	27.3	0	19.4
and 4.9 m2 solar thermal system	16.5	16.2	27,3	10.4	-5.0
Real: at 22°C indoor temperature	21.5	16.2	27,3	10.4	7.5

Please note:

- Be10 is the Danish Energy Performance calculation tool
- The official energy performance must be calculated with an indoor temperature of 20 degrees. At this temperature the home in case is an energy-plus home. However, to get a more realistic estimate of the demand, the indoor temperature is raised to 22 degrees.