The increasing number of heat pumps is not growing the peak power demand in Finnish electricity system

The number of heat pumps is increasing fast. This affects the electricity consumption in buildings. Gaia studied the impacts of the common types of heat pumps to the electricity peak demand in Finland. The study was commissioned by the Finnish Heat Pump Association SULPU.

Heat pumps decrease the total energy consumption on an annual basis but might increase the momentarily electric power demand during the heating season, if the heat pumps replace other heating sources than electric heating. On the other hand, by using heat pumps to replace electric heating, the power demand can be decreased. In addition to the number and sixing of heat pumps, the impacts of heat pumps depend significantly on the heating systems to be replaced and how the pumps will be operated.

Gaia's simulation tool was used for modelling two alternative future scenarios. The results indicated that the increasing use of ground-source heat pumps and air-to-air heat pumps in single-family houses decreases the peak power demand by 10 – 17 % in typical cold winter conditions compared to the current situation. The reasons for this include many elements, such as, replacing electric heating by heat pumps, design for full heating capacity becoming more common especially in new ground-source heat pump installations, as well as the development of the technology, which increases the advantages of heat pumps in cold climate.

Even during the coldest periods, heat pumps will reduce the power demand in the existing single-family houses in the future. On the other hand, new houses built by 2030 will increase the overall peak power demand in the studied house stock by 1 – 8 % during the coldest hours, if power loads will not be controlled in an optimal way.

"The study indicated that even if the number of heat pumps increases significantly by 2030, and they collect 3 – 5 TWh renewable energy annually from the surroundings of new single-family houses, the electric power demand will even decrease. In addition, when the role of electricity increases in the energy system, further potential for smart control systems of power and energy will emerge." rejoices SULPU's Executive Director Jussi Hirvonen.

In addition to space heating, power peaks in house stock are caused by other simultaneous electricity loads, which could include, for example, electric stove and sauna. The colder the outdoor temperature is, the more important it is to control the electricity demand during the hours of concurrent loads.

"The power has become key issue in the Nordic electricity market that currently is based on energy-only pricing principle. Heat pumps and other electricity loads can be used to

increase demand flexibility. The need and importance of smart control is increasing in the energy system where end-users prefer electricity over other energy sources." says Aki Pesola from Gaia.

The study included ground-source heat pumps and air-to-air heat pumps in existing single-family houses and in new houses that will be built by 2030.

More information:

Report, Lämpöpumppujen vaikutukset sähkötehon tarpeeseen (in Finnish)
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FG Finland Oy, Gebwell Oy, NIBE Energy Systems Oy, Nivos Oy, Onninen Oy, Opti Automation Oy, Rototec Oy, Scanoffice Oy, St1 Oy, Stiebel Eltron Oy, Finnish Heat Pump Association SULPU