

Finland: Heat Pump Market Outlook

Jussi Hirvonen, Finnish Heat Pump Association

Finland recently reached one million heat pump installations. With a population of 5.5 million, Finland's per capita heat pump sales and stocks are among the greatest in the world. Heat pumps produce over 12TWh/a, or 15% of the Finnish heating market. Investments in heat pumps now amount to EUR 6 billion. Last year, heat pump sales continued to grow. Over 600 million euros were invested in more than 100,000 heat pumps. According to recent studies, in 2030 heat pumps will produce 22TWh/a with two million heat pumps. The Finnish government announced recently that Finland will be carbon neutral by 2035, which means a very challenging 35 TWh/a target for heat pumps.

Introduction

A heat pump is by far the most popular form of heating in new single-family houses, and heat pumps are increasingly replacing oil and electric heating as well as district heating in old buildings. The significance of heat pumps has also grown in multi-storey buildings as well as large service-facility buildings, such as shopping centres and logistics centers. Also, the use of heat pumps is continuously increasing in heat-recovery and process solutions as well as in the production of district heating and cooling. The role of heat pumps as a producer of Finnish renewable energy is even today much greater than that of solar and wind power, for example.

The Heat Pump Market in Finland

On a European scale, the Finnish heat pump market is substantial and quite unique. When looking at the number of heat pumps per type, the heat pump market is dominated by air-source heat pumps, while ground-source heat pumps lead the market when looking at the figures in euros or as in RES. 75% of single-family house builders choose a heat pump. Heat is already being extracted from 150,000 geothermal wells, the combined depth of which totals over half of the earth's circumference (25,000 km).

The main reason behind the success is clear. In Finland, heat pump systems are a highly profitable investment.

Cumulative Heat Pump sales in Finland (pcs)

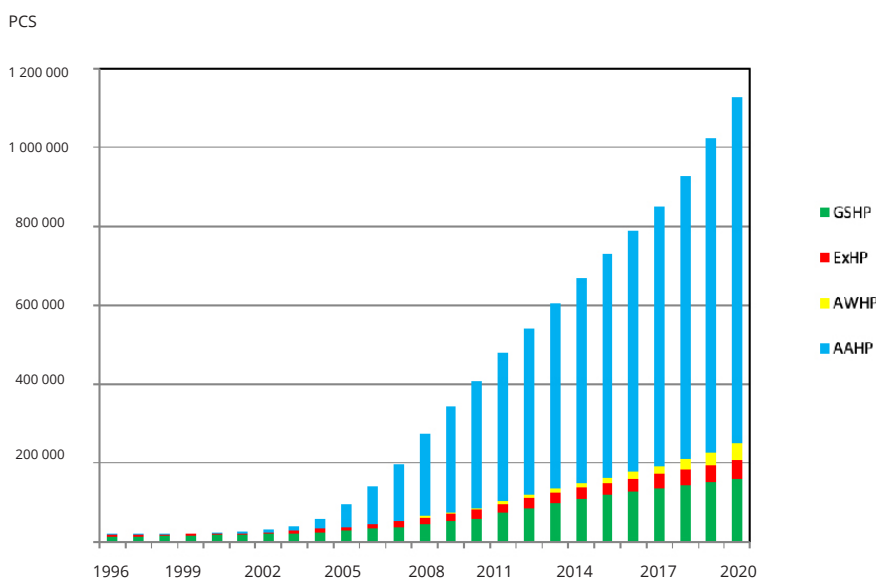
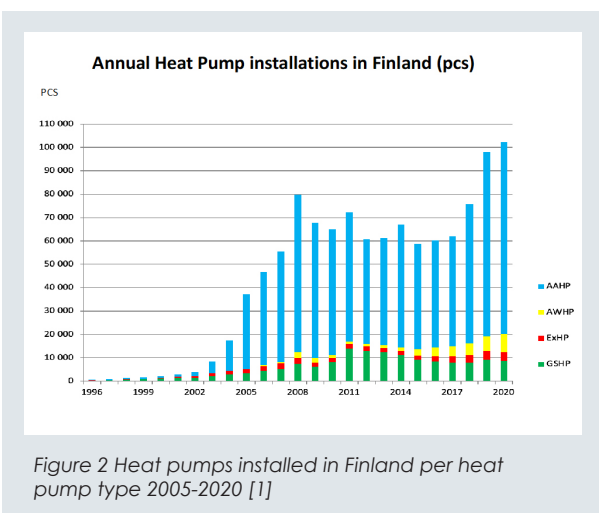


Figure 1: Number of heat pumps installed in Finland, cumulative 1996-2020 [1]



The return on capital invested is often 10-15% per year. The Finnish government offers only very limited subsidies to heat pump projects, apart from a household tax deduction that can be claimed for the labor needed to install a heat pump.

The role of cooling in the Finnish climate is not great. However, the demand for it in housing, too, has increased due to living-comfort reasons as well as nearly zero-energy buildings. This is beginning to have an impact on the profitability of investments, since heating and cooling are provided through the same investment.

The threshold of 100,000 hp exceeded

According to Finnish Heat Pump Association (SULPU ry) statistics [1], 102,000 heat pumps were sold in 2020. The number of air-source heat pumps sold was just over 80,000, ground-source heat pumps 9,000, air-to-water heat pumps 8,000, and exhaust-air heat pumps 3,500. Aid granted to replace oil heating drove sales, especially of air-to-water heat pumps. Sales increased by 25%. Sales of ground source heat pumps showed a slight decrease of 4%, but as the size of delivered heat pump systems grew significantly, sales in euro within the sector increased.

Deployment of large heat pumps

Ground-source and exhaust-air heat pumps and their combinations are rapidly becoming more widespread in apartment buildings. They usually replace district heating. Approximately 500 apartment buildings have already been fitted with heat pumps that recover the heat of exhaust air. This reduces as much as 50% of the building's district heating or other energy consumption. A growing number of housing companies have decided to install ground-source heat in conjunction with an exhaust-air heat pump and to switch completely from district heating to a heat-pump-based heating and cooling solution.

Key role in electricity demand response

The fact that heat pumps are the perfect tool for demand

response and for managing the grid's electricity demand will be vital in the future. A heat pump provides a unique bridging technology between heat and electricity. This technology has the ability to use volumes of water, buildings, energy wells as well as bidirectional cooling/heating features as storage. With heat pumps' thermal power linked to demand response, heat pumps would already be able to provide approximately 5,000 MW of thermal power and, last year, about 500 MW more was generated. As much as roughly 1,500 to 2,000 MW of controllable electric power would already be available through the current heat pump stock.

An untapped potential in apartment buildings

There is certainly potential for heat pumps. In Finland, about 120,000 to 150,000 houses are oil heated. Every two hours, 30,000 apartment blocks release a houseful of 23-degree exhaust air outdoors, all year round. If, for instance, 100,000 users of oil heating are encouraged to switch to clean heating and exhaust-air heat pumps are deployed to recover the waste heat from exhaust air in 10,000 apartment blocks [3], this would mean fast-track viable investments that provide local employment at a value of approximately EUR 3 billion. With political will, this investment could realistically be carried out in five years, with the help of a reasonably light-handed carrot-and-stick approach and financial instruments. Most of this "carrot money" will return to the state in the form of VAT and other taxes, employment, economic resurgence as well as exports. In these two examples alone, we are talking about approximately 5 TWh of emission- and combustion-free production per year and a cut in emissions of several million tonnes of CO₂-eq.

Summary

The heat-pump industry has become a significant renewable-energy business in Finland. Over 1,000,000 heat pumps produce 12 TWh/a of energy. This already represents as much as 15% of the heating energy of all Finnish buildings [5]. The prospects for heat pumps are good, and the market will certainly develop in the future. The heat pump business can be described as an integrator or bridge technology that operates amidst and between renewable energy, electricity, and heating and cooling production. Heat pump technology and its applications can also be seen as an interface to a carbon-free age.

According to a survey [2] in 2030, there will be 2 million heat pumps in Finland producing 22 TWh of heating energy. By then, a total of over EUR 10 billion will have been invested in heat pumps. More pressure or possibilities for heat pumps have been created by the political promise to make Finland carbon neutral by 2035. For this purpose, the Smart Energy Transition consortium has published a study estimating that heat production by heat pumps should be increased to 38 TWh/a by 2040 [4]. In the Finnish heating system, district heating plays a significant role, about 50% of the heating market. Decarbonization of the heat market by heat pumps means a lot of heat pumps in the production of district heating

Annual Heat Pump investments in Finland (MEUR)

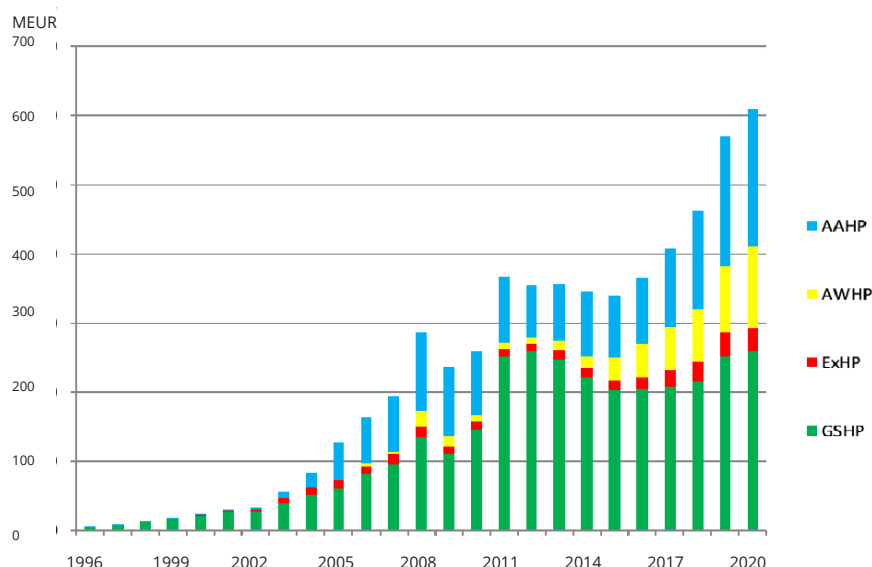


Figure 3 Heat pumps installed in Finland, in euros, 2005-2020 [1]

(Megawatt-size district heating/cooling, shopping center, service building, industrial HPs as well as planning, service, etc. are missing from figures in graph.)

but also saving district heating by heat pumps installed locally in individual houses.

The main reason behind the success is clear, yet this reason also stands out on a European scale. In Finland, heat pump systems are a highly profitable investment. The return on capital invested is often 10-15%/a. The Finnish government does offer only very limited subsidies to heat pump projects apart from the household tax deduction that can be claimed for the installation work of a heat pump.

Heat pumps are easy to use, hassle-free, require little space and have a cooling feature. These are arguments that also speak in favor of choosing a heat pump. Affordable electricity, the lack of a gas network, the high consumption of heating energy caused by Nordic conditions, a suitable bedrock for drilling, and a customer-friendly heat pump system supply all create favorable preconditions for profitable investments.

After fulfilling a 1 million heat pump vision in 2020, the next target of 2 million heat pumps can be set for 2030.

References

- [1] The Finnish Heat Pump Association SULPU ry, 2021, Statistics 2020

- [2] Pesola, A., Karttunen, V., Vanhanen, J., 2015, Lämpöpumppuinvestointien alueellinen ja kansantaloudellinen tarkastelu, Gaia Group report.,
- [3] Rämä, M., Niemi, R., Similä, L., 2015. Poistoilmalämpöpumput kaukolämpöjärjestelmässä, VTT, asiakasraportti p.4.
- [4] Rinne, S., Freda, A., Auvinen, K., Ruggiero, S., Temmes, A., 2018, Discussion paper: Clean district heating – how can it work? (pdf). Publication of the Smart Energy Transition project funded by the Academy of Finland's Strategic Research Council.
- [5] Finnish Energy, Statistics 2019

JUSSI HIRVONEN
 Executive Director
 Finnish Heat Pump Association SULPU ry
 Finland
jussi.hirvonen@sulpu.fi