THE ROLE OF HEAT PUMPS TO GAIN EU RES GOALS OF 2020 IN FINLAND

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Abstract: One of the key issues in energy discussions in Finland is the share of renewable energy and resources in the final consumption. Finland has European Unions binding target of increasing this share by about 10 percentage points (from 28.5 % to 38 %). This corresponds to an increase of RES approximately 38 TWh per year. Today by means of over 300 000 heat pumps a total of 2-3 TWh/a of renewable energy is produced for heating houses. Naturally the amounts, types and sizes of installed Heat Pumps effect on the final intake of RES with HPs. But RES amount will be strongly dependent on the exact SPF calculation method in the EU Renewable Energy Directive.

Taking into account the rapid growth of the Finnish heat pump market, good climate conditions, advanced house technology and expected environment policy trends the one million heat pumps that are forecasted for 2020 will provide 20-30 % of the renewable energy goal for Finland.

It is clear that Finland has a strong heat pump market, with large potential. Different market segments are the place for the different type of Heat Pumps. Passive and low energy building has its own challenges for heat pumps solutions in Finnish cold climate conditions. One million exit existing houses has electricity or oil heating and replacement market for those will be big potential for ground coupled, air to water, exhaust and air to air heat pumps.

The subsidy policy and punishing tax policy for CO2 releasing fuels of the Finnish state will also have a huge role and contribution within heat pumps to gain the challenging goals of 2020 of RES in Finland.

Key Words: heat pumps, Finland, Renewable Energy, RES goal, heat pump market

1 INTRODUCTION

In 2020, there will have to be an increase of 38 TWh/a in the energy generated from renewable energy sources out of the total amount of energy that is used in Finland. In other words, ten years from now an amount that is the equivalent of 10 Loviisa nuclear power plant units. We might be pushed for time. The directives have been signed. Neither political nor public communication has seemed to grasp the heart of the matter. Nor has major actions been taken.

It is important to understand the reason for the creation of this EU RES Directive. Our globe is warming because, since the oil era started in the 19th century, a few generations of people are now burning up the huge reserves of fossil fuels that took tens of millions of years to accumulate. There is so much carbon dioxide being released into the atmosphere that it is, already now in the 21st century, threatening to radically change the conditions on earth and only just over a hundred years after the oil era began. There must be a reduction in energy use; the use of fossil fuels must be stopped as soon as possible and replaced with renewable ones, and in most societies also with CO2-free nuclear power. The RES Directive

states the country-specific goals for renewable energy use for 2020. For Finland, the Directive stipulates an increase from 28,5% of RES to 38%, i.e. 38TWh.
There are some interesting observations to be made, as well as some surprises, in the initial RES discussions in Finland. The understanding that CO2 tax-exempt natural gas is, in fact, a fossil fuel has begun to cause a lot of pain for, e.g., district-heating companies. Their ecological deed when faced with this taxation prospect is to make threats to start using more coal. But we have to be rid of both energy forms. There is no use crying over spilt milk, it will not change facts.

2 FINLAND, COUNTRY IN FACTS



Figure 1: Finland, the extreme North East Country of the European Union

Finland country facts:

Population:	5,3 million
Area:	338 000 km^2
Capital:	Helsinki
Number of single/two-family houses and free-time houses:	1 600 000 pcs
Average heat demand single family house:	20-25 MWh/year
Number of all buildings:	1 400 000 pcs
Share of energy from renewable sources in final consumption of energy 2005:	28,5%
Binding target for the use of renewable sources by 2020:	38%
Rate of new construction single family houses 2010:	10 000 pcs

Generation of electricity 2010:

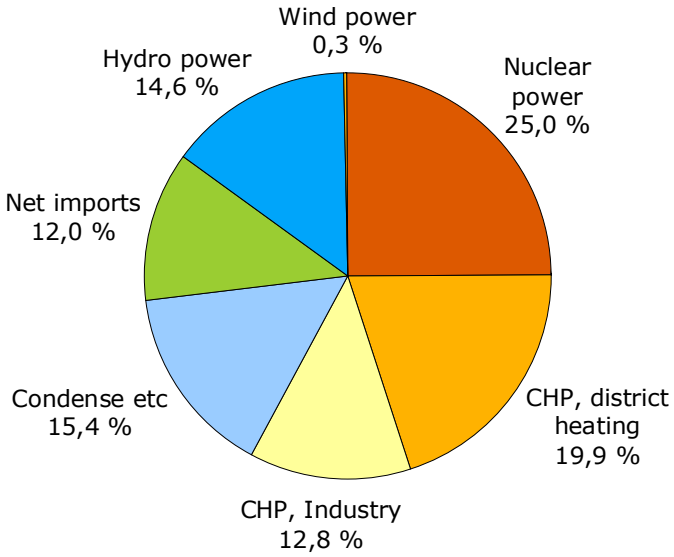


Figure 2: Net Supplies of Electricity 2010 in Finland
87.5 TWh

National emission factor (g CO_2/$kWh_{electricity}$) was 168in Finland in 2008. The emissions from power generation from coal, natural gas and peat were 16.9 million tons of carbon dioxide in 2010, one-third more than the previous year. The growth is due to increased separate and CHP power generation, because the increased demand and reduced electricity imports from the west had to be replaced by particularly coal and other fossil fuels. Nevertheless, electricity generated in Finland last year was still 59 per cent greenhouse gas emissions-free. The share of renewable energy sources was 31 per cent of all power production. The use of domestic wood and other bioenergy increased by one quarter last year.

Energy prices:

Average end consumer prices including distribution and taxes 1/2011:

Electricity:	12,4 euro cent/kWh
Heating oil:	9,5 euro cent/kWh
Pellets:	5,3 euro cent/kWh
District heating:	7,2 euro cent/kWh

3 RES COMING HEAVY

In 2020, there will have to be an increase of 38 TWh/a in the energy generated from renewable energy sources (RES) out of the total amount of energy that is used in Finland.

Ministry of Employment and the Economy published 2010 the plan how to manage this challenging target

Table 1: Renewable Energy Source (RES) targets 2020 by Ministry of Employment and the Economy in Finland

Renewable	More RES 2020	In practice
Bio	18 TWh/a	A lot of heat and power plants from fossile fuels to wood chips and pellets
Wind	6 TWh/a	1000 windmills 3 MW each
Heat Pumps	6 TWh/a	Heat pumps 300.000 ->1.000.000 pcs (2 TWh/a => 8 TWh/a)
Others	2 TWh/a	Additional hydropower, usage of wood chips and pellets in small houses, solar, bio gas
Traffic	6 TWh/a	Adding ethanol and biodiesel in traffic fuels upto 20%
Total	**38 TWh/a**	RES from 28,5% to 38 %. Corresponds annual energy production of 10 Loviisa nuclear power plant units (470 MW)

3.1. The major part of RES from bio, solar marginal

The major part of RES, 18TWh/a, is planned to be supplied by increasing the use of woodchips in the electricity and heat production of power plants. According to the energy industry, the length of the transitional period depends on the amount and timing of state subsidies. 6 TWh/a will be covered by adding biodiesel and ethanol to transportation fuels. Finland's remaining 2 TWh/a RES burden would be covered by other means, such as the use of biogas, pellets and solar energy. Major challenges each and every one of them.

3.2 Wind power 15 %

Today Finland is a developing country of wind power with its some tens of wind mills. Wind power is afforded a lot of space in the papers. This is good from a RES viewpoint. However, only as long as the basic facts are kept in mind when composing selling headlines. The planned 1000 new wind farms (3000MW) for 2020 will produce approximately 6TWh/a of renewable energy per year, requiring investments of approximately five to eight billion Euros. The majority of that sum will have to come out of either higher electricity costs for the consumers or from taxes. There might be slight rush in organising the rigging of that many windmills before 2020.

4 HEAT PUMPS WILL TAKE A BIGGER ROLE THAN WIND, TRAFFIC OR SOLAR

Much ado about nothing so far. There are little results, let alone action. Something nevertheless: small heating companies have been able to increase the use of woodchips, and quite a lot of district heating is already being produced with RES in Finnish provinces. And not forgetting, suddenly amidst these traditional fuel-focused heating markets we find this oddity, the tiny and magnetic heat-pump industry. And it is not until during the past few years that the political field has woken up to start scoring political points for the achievements of the heat-pump industry.

300,000 heat pumps have made their way into the markets without subsidies or political clamour, on market-based terms. That number already represents 2-3 TWh/a worth of RES.

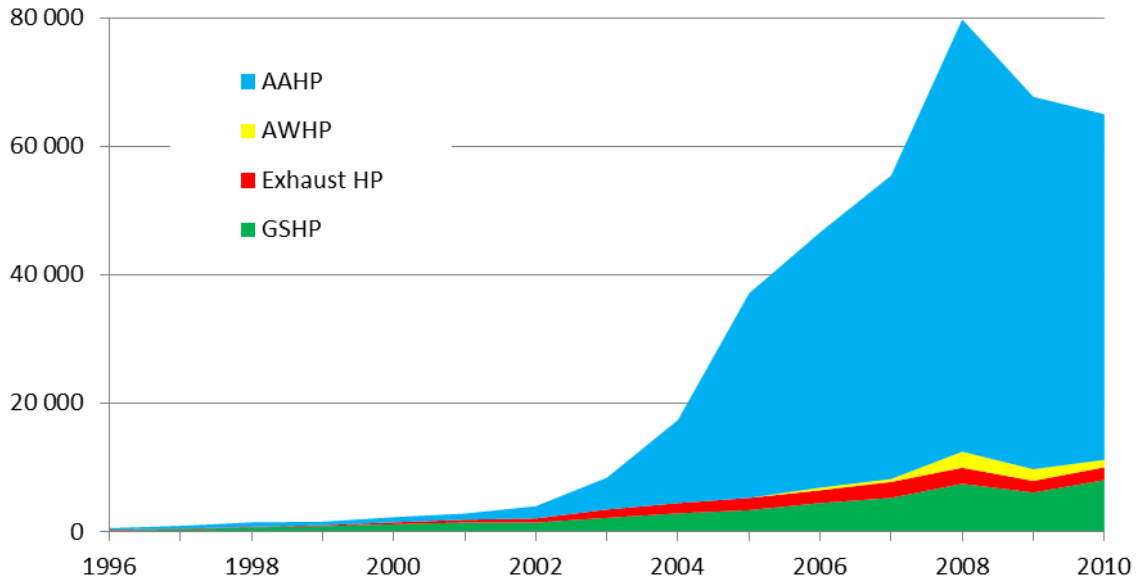


Figure 3: Installed heat pumps in Finland 1996-2009, in pieces

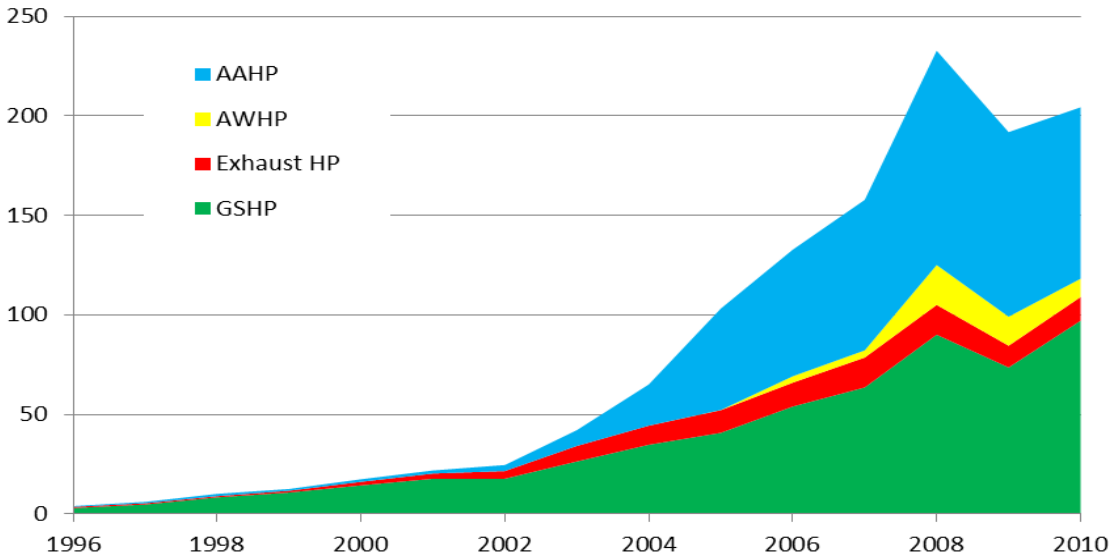


Figure 4: Installed heat pumps in Finland 1996-2009, in Million euros
(with end customer prices as installed including taxes,
GSHP 18.000€, Ex HP 6.000€, A/W HP 11.000€, A/A HP 1.800€)

The estimated added 6TWh/a RES potential for heat pumps in 2020 may even be a cautious estimate. The yet undefined RES calculation formulas for heat pumps will have an impact of numerous terawatts. The prevailing fear in the industry as well as the stop-go and irrational subsidy policies may cause the growth factor for heat pumps to even fall. The actual potential of heat pumps is, however, much greater than envisioned. The implementation of the rest of this renewable energy package will, in after all, raise the price of energy more than anyone is willing to believe. The competitiveness of heat pumps will furthermore improve.

5 CAN SOMETHING BE CHEAP AND GOOD?

There is really something that can be simultaneously cheap and good. Heat pumps as a renewable energy source are good for RES goals and affordable for both the state as well as the customer.

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