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# About Finnish energy system – trends, roles of bioenergy and heat pumps

EXPRESS Study Tour in Joensuu 27.-28.6.2023

- Background information

**Timo Tahvanainen**

*Regional Council of North Karelia*

*[timo.tahvanainen@pohjois-karjala.fi](mailto:timo.tahvanainen@pohjois-karjala.fi)*

27.06.2023 | EXPRESS Study Tour

## FINLAND: Highly energy and electricity intensive country

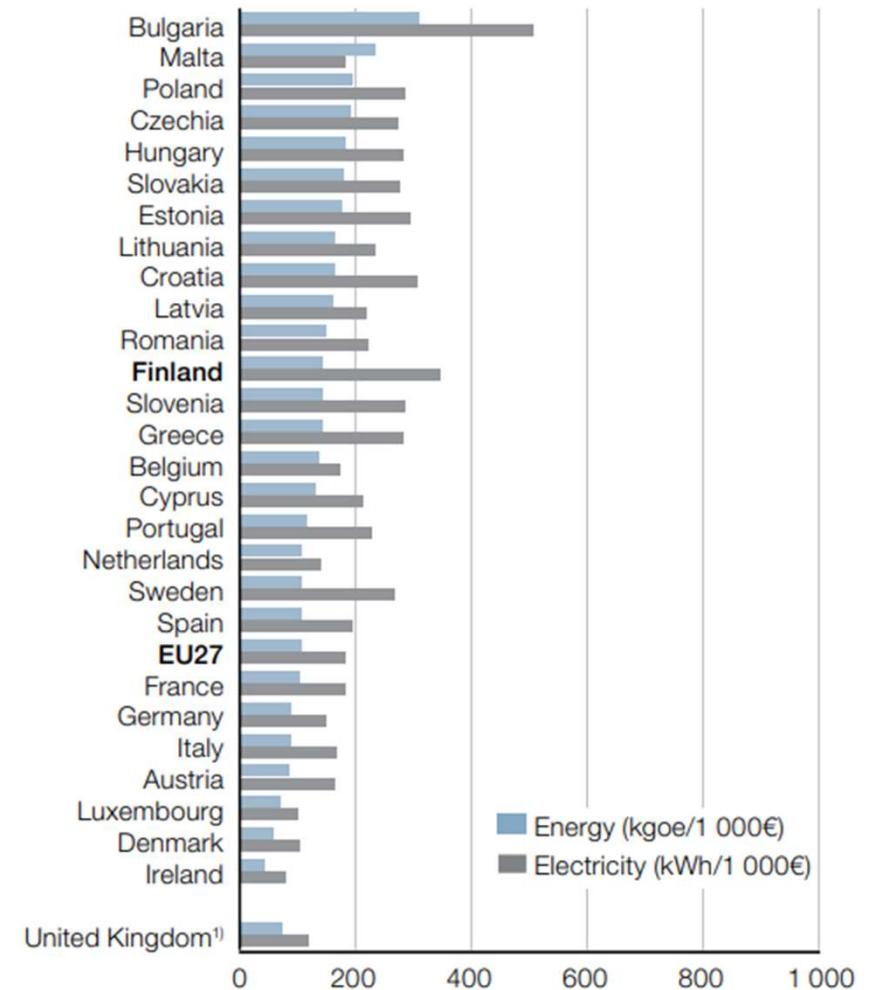
- Energy intensive metal, forest and chemical industries
- Cold climate
- Long distances – sparse population

Total energy consumption (2020): 356 TWh  
Population: 5,5 mill

Statistics 2022:

- Electricity: 82 TWh
  - renewable 54%
  - domestic 57%
  - CO<sub>2</sub>-neutral 89%
- District heating: 36,4 TWh
  - renewables 49%

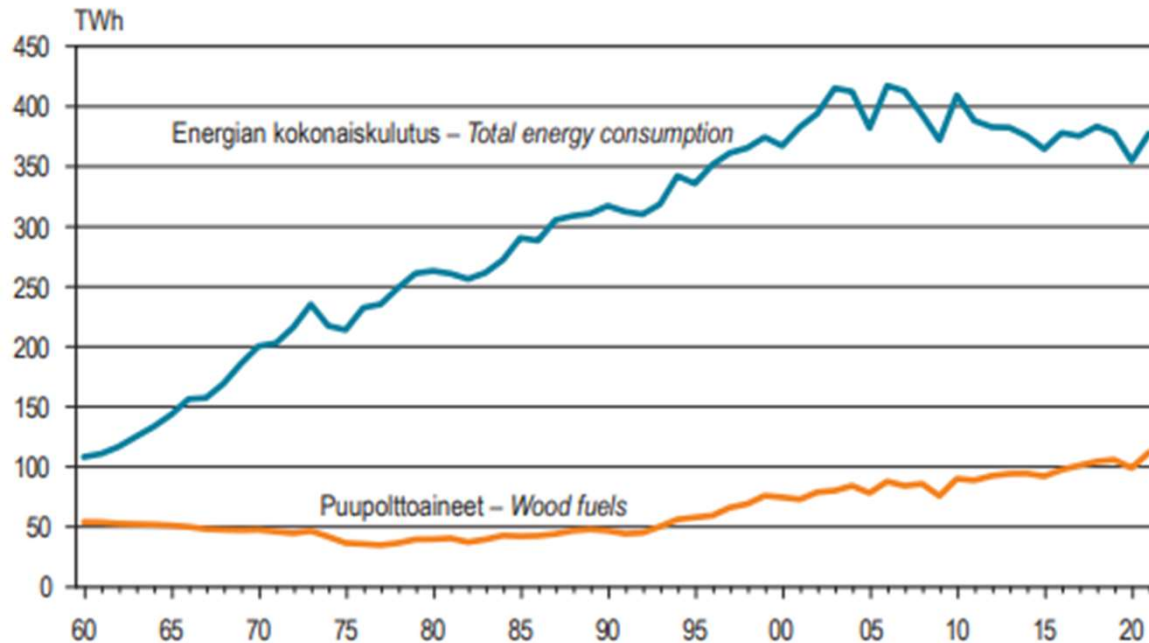
Consumption of energy and electricity per GDP-unit  
in EU countries 2019



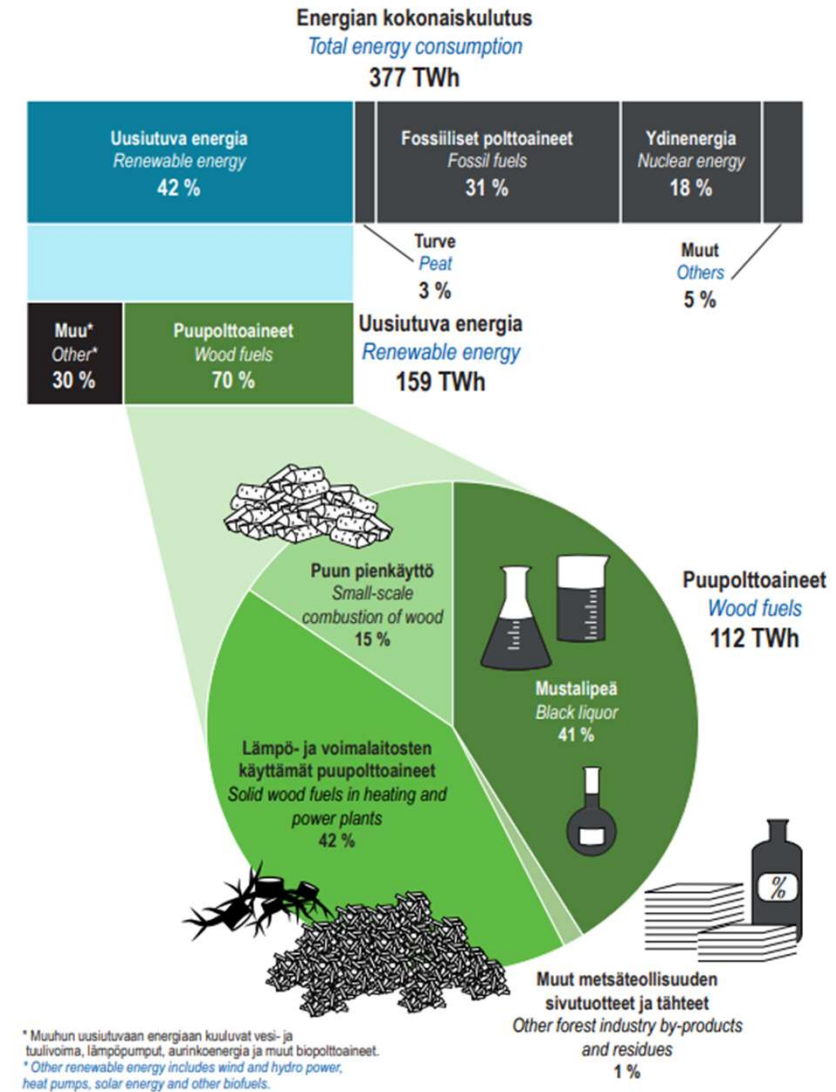
Source: Eurostat

# Share of renewables 42%

- of which 70% is wood-based

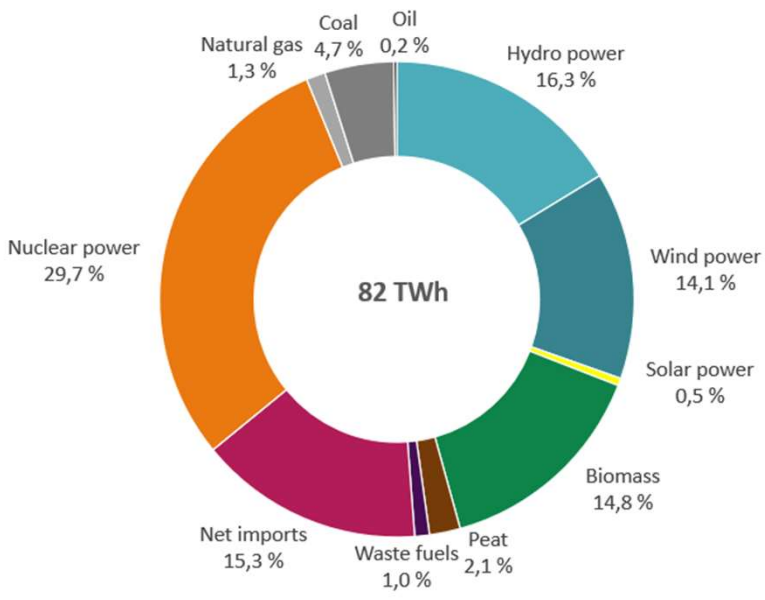


Lähde: SVT: Tilastokeskus – Source: OSF: Statistics Finland



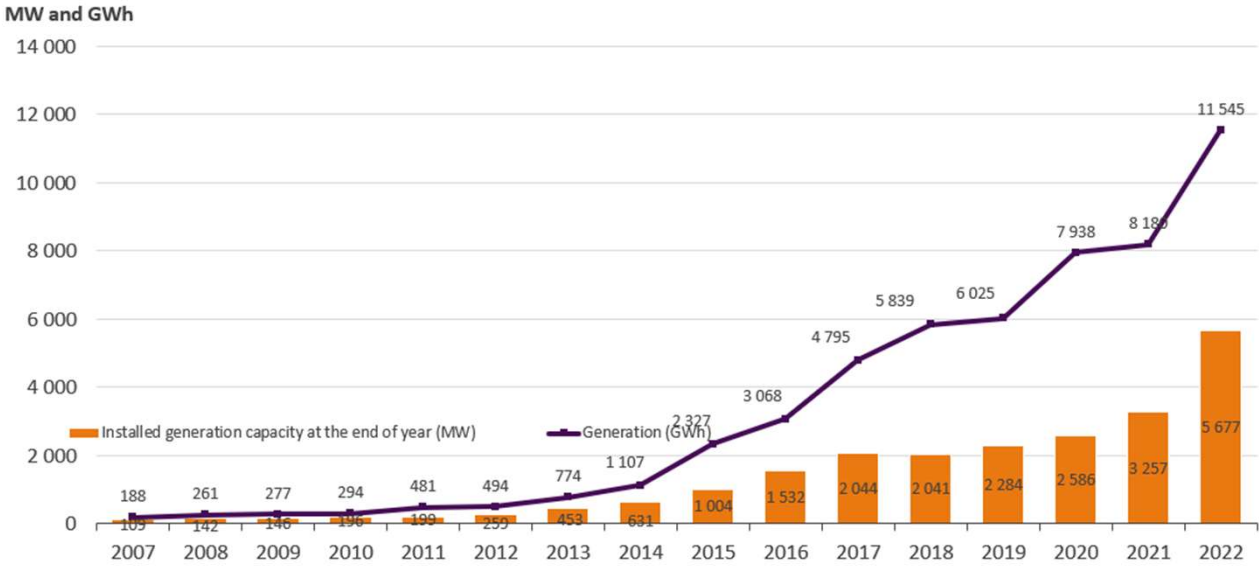
Lähteet: SVT: Tilastokeskus; SVT: Luonnonvarakeskus – Sources: OSF: Statistics Finland; OSF: Natural Resources Institute Finland

# Share of renewables is growing fast - especially wind

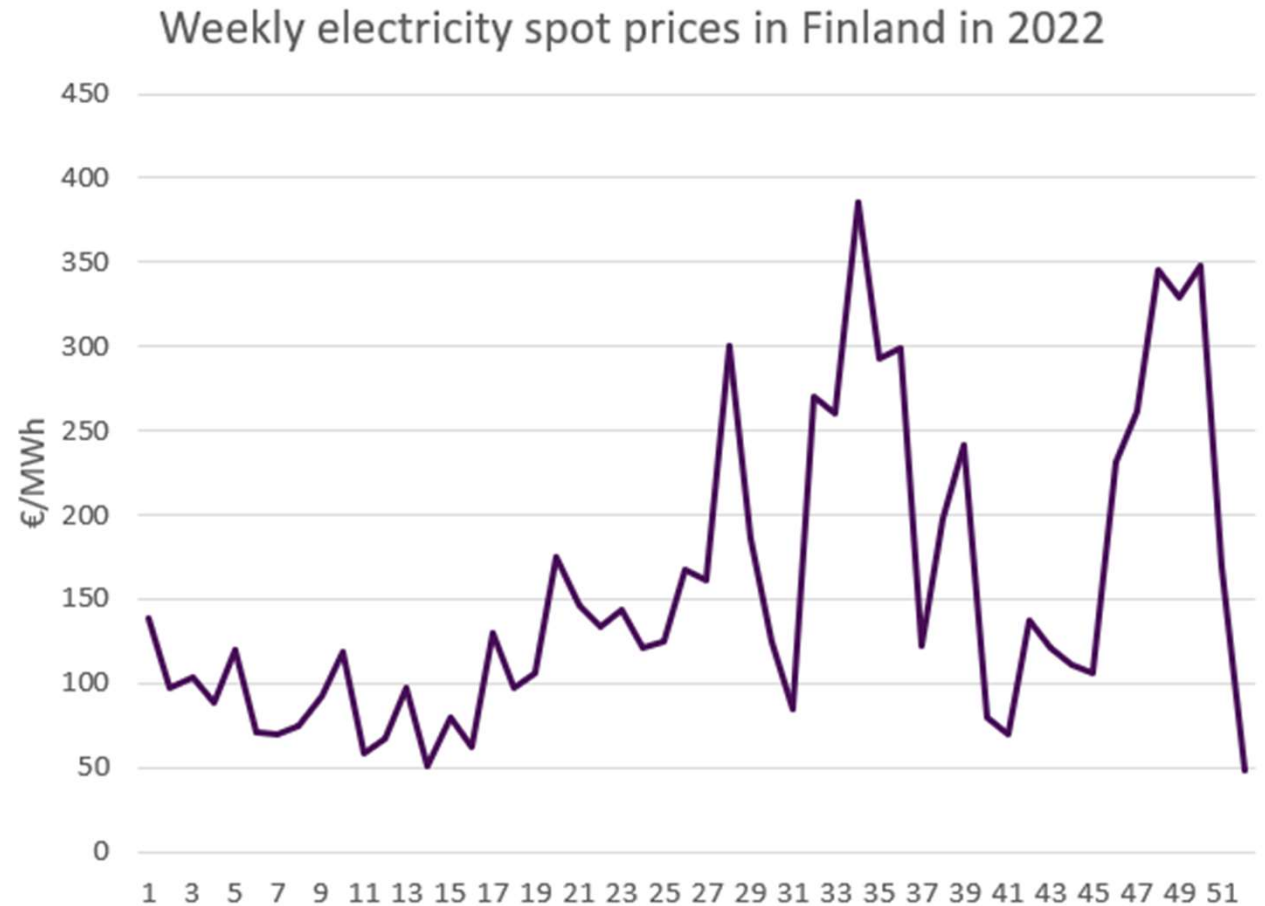


Source: Finnish Energy

## Wind power grows rapidly: Capacity increased 76 percent and production 41 percent



**Balancing supply and demand becomes major challenge in electricity markets - reflects in high peak prices and fierce price fluctuation**



Demand-response significant business opportunity in all scales and spots in the energy system!

# Firewood significant in domestic heating

- Reducing peak electricity demand during cold winter days (electricity demand-response)
- Energy safety
- Self-sufficiency: tool against **energy poverty** \*
- Small-scale domestic wood heat 17 TWh
  - 6,3 mill m<sup>3</sup> / year in wood stoves etc
  - 0,6 mill m<sup>3</sup> / year wood chip heating
  - 4,7 % of total energy consumption !
- Metla latest survey on heating season 2001/2002:
 

About 4/5 of firewood supply was based on users' own work / supply and only 1/5 was purchased from professional suppliers! Share of firewood vendors has slowly increased since that, but is still most likely less than 1/3

8.11 Pientalojen polttopuun käyttö 1992–2017  
Fuelwood consumption in small-scale housing, 1992–2017

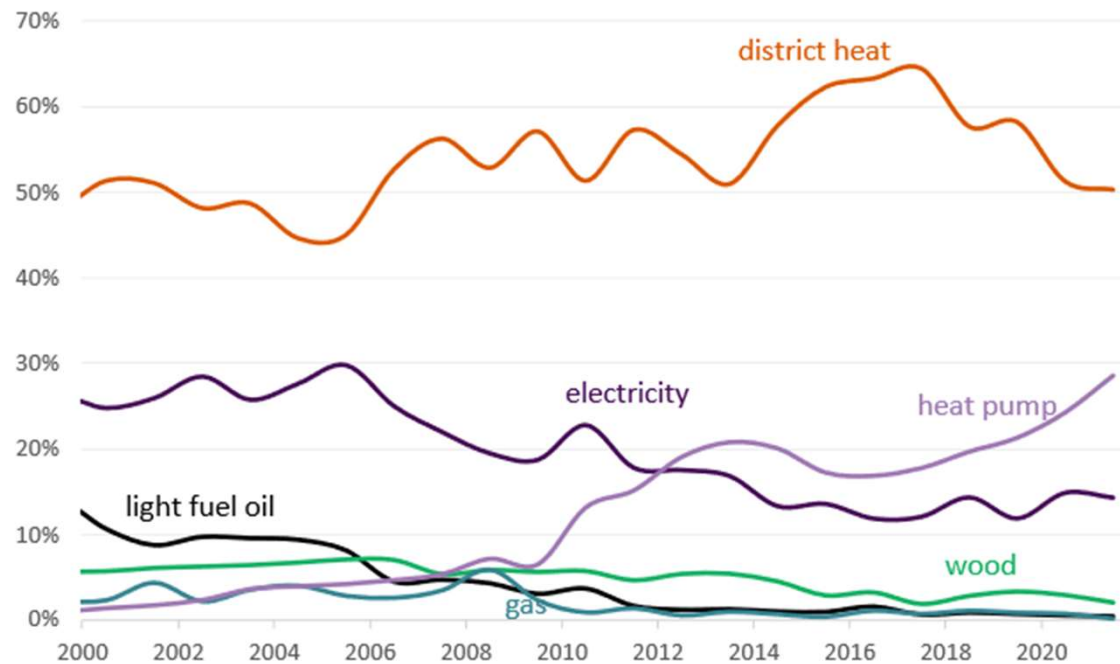
Lämmityskausi ja alue Heating period and region	Runkopuu – Stemwood				Jätepuu Wood residues	Kaikkiaan Grand total
	Halko Log-wood	Klapi Smallwood	Hake Forest chips	Yhteensä Total		
	1 000 m <sup>3</sup>					
1992/1993	..	..	..	4 636	968	5 604
2000/2001	..	..	..	5 151	981	6 133
2007/2008	1 065	3 809	490	5 363	1 333	6 697
2016/2017	<b>1 196</b>	<b>4 667</b>	<b>600</b>	<b>6 464</b>	<b>443</b>	<b>6 907</b>
	<b>Koko maa – Whole country</b>					
	<b>Maakunnittain – By region</b>					
1 Uusimaa	67	493	22	582	45	628
2 Varsinais-Suomi	44	334	34	412	37	449
4 Satakunta	55	286	45	387	17	403
5 Kanta-Häme	25	176	44	246	8	254
6 Pirkanmaa	62	496	105	663	34	697
7 Päijät-Häme	36	167	49	251	29	280
8 Kymenlaakso	21	157	3	181	8	189
9 Etelä-Karjala	56	166	30	252	12	264
10 Etelä-Savo	145	297	12	455	34	489
11 Pohjois-Savo	120	305	44	468	13	481
12 Pohjois-Karjala	87	208	10	304	11	315
13 Keski-Suomi	80	347	23	450	19	469
14 Etelä-Pohjanmaa	29	262	72	363	22	385
15 Pohjanmaa	54	142	33	230	23	252
16 Keski-Pohjanmaa	21	72	12	105	8	113
17 Pohjois-Pohjanmaa	151	372	36	559	96	655
18 Kainuu	61	104	19	183	10	193
19 Lappi	77	245	8	330	17	347
21 Ahvenanmaa	3	39	1	42	0	43

Pientalojen polttopuun käyttö sisältää maatilojen asuin- ja tuotantorakennusten, muiden asuinpientalojen ja vapaa-ajan asuntojen puupolttoaineet. Lämmityskaudella 2016/2017 kaikki halot, klapi ja metsähake on oletettu runkopuuksi.

Fuelwood includes wood fuels consumed on farms in residential and production buildings, in other residential buildings and holiday homes. During the 2016/2017 heating period, all log-wood, smallwood and forest chips are included in statistics as stemwood.

Lähde: Luonnonvarakeskus – Source: Natural Resources Institute Finland

# District heating is the most popular method of heating in new buildings



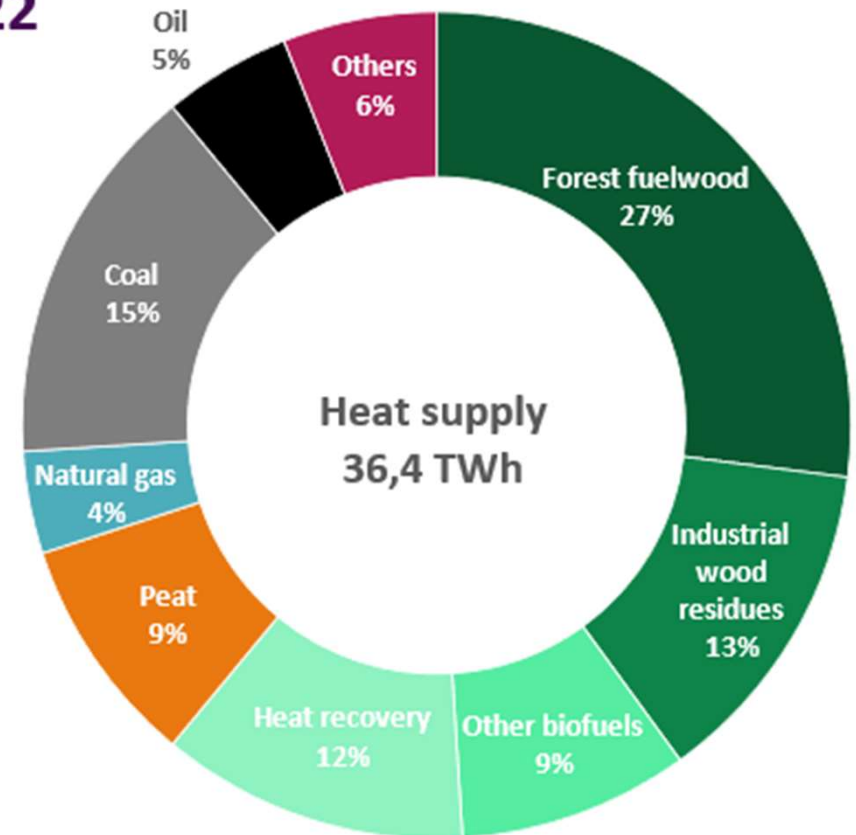
Source: Statistics Finland, Granted building permits (heated cubic volume)

- Market share of district heating in 2021
- All buildings 50 %
- Residential buildings 54 %
  - Blocks of flats 83 %
  - Detached and semi-detached houses 15 %
- Office buildings 84 %
- Public service buildings 69 %
- Commercial buildings 58 %
- Industrial and mining and quarrying buildings 48 %
- Warehouses 38 %

**Heat recovery using heat pumps and heat storing is growing fast in district heat systems.**

**In new detached houses heat pump is the most common heating system**

**2022**

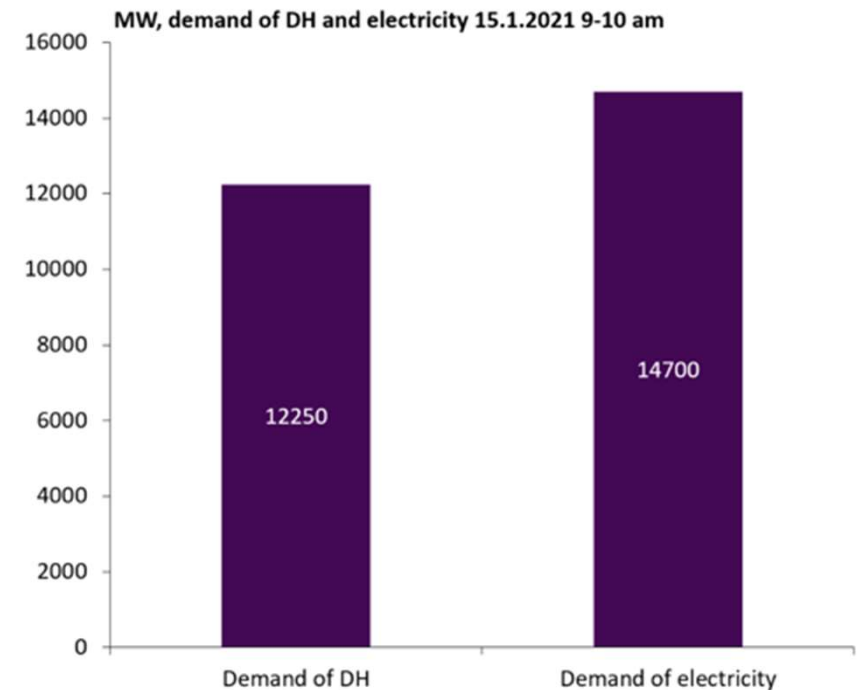
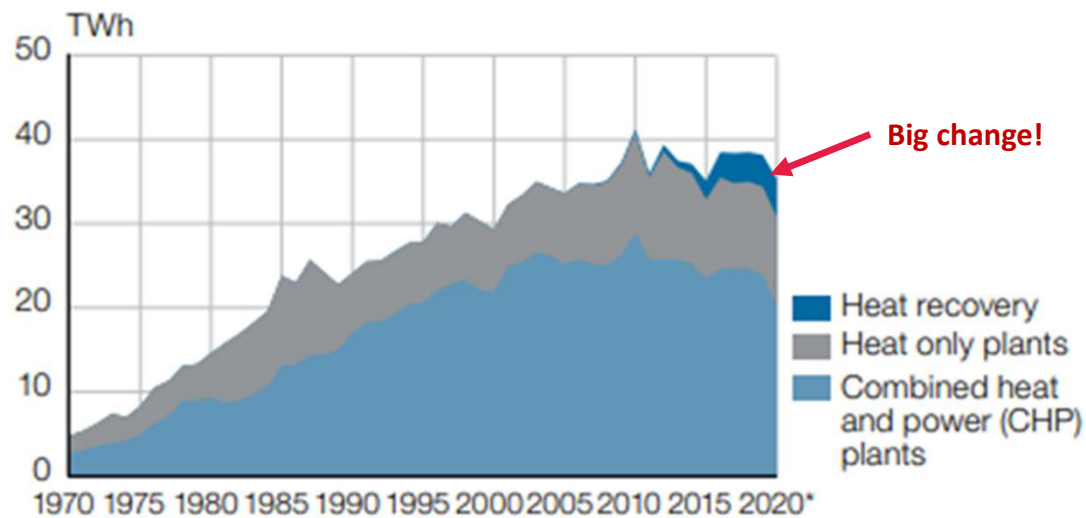


Source: Finnish Energy



# Trend towards distributed energy systems, but the role of district heating remains high especially during high heat energy demand

Production of district heat 1970–2020\*



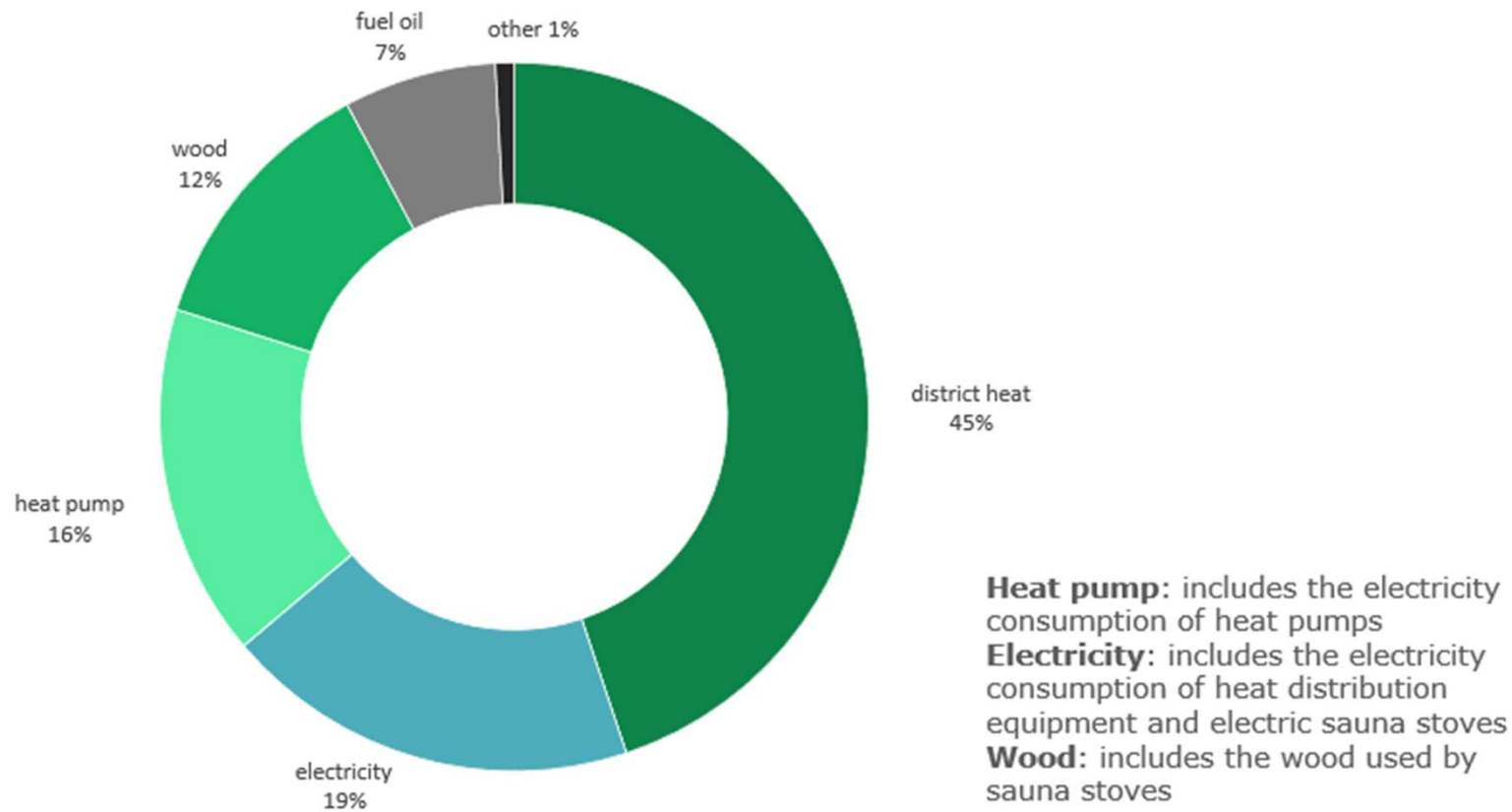
Source: Finnish Energy

# On-going systemic change in energy system

- Getting rid of fossils: oil, gas, coal, peat – even combustion in general
- Green electrification covers all sectors: industry, traffic, heating / households...
- Trend from centralized towards (more flexible) distributed systems & hybrid systems
- Wind & solar most cost-competitive sources for new electricity production: investments growing fast!
- In cities & south cooling beats heating demand, peak electricity consumption is due to need for cooling
- Importance of energy saving, energy storages and demand response in electricity markets are growing
- Traditional district heating has stopped growing
  - Use of waste heats (typically assisted by heat pumps) substitutes fuel consumption / combustion
  - Energy system is becoming more complex – hybrid system, growingly complex to manage and optimize
  - District heat networks increasingly important as heat storages and tools for utilizing waste heats
  - Biomass is very good energy storage and backup source (safety of energy supply)
- Business models in energy sector are evolving fast
- Solar energy and heat pumps have great scalability – mobilizing also consumers' investments

# Market share of space heating 2020

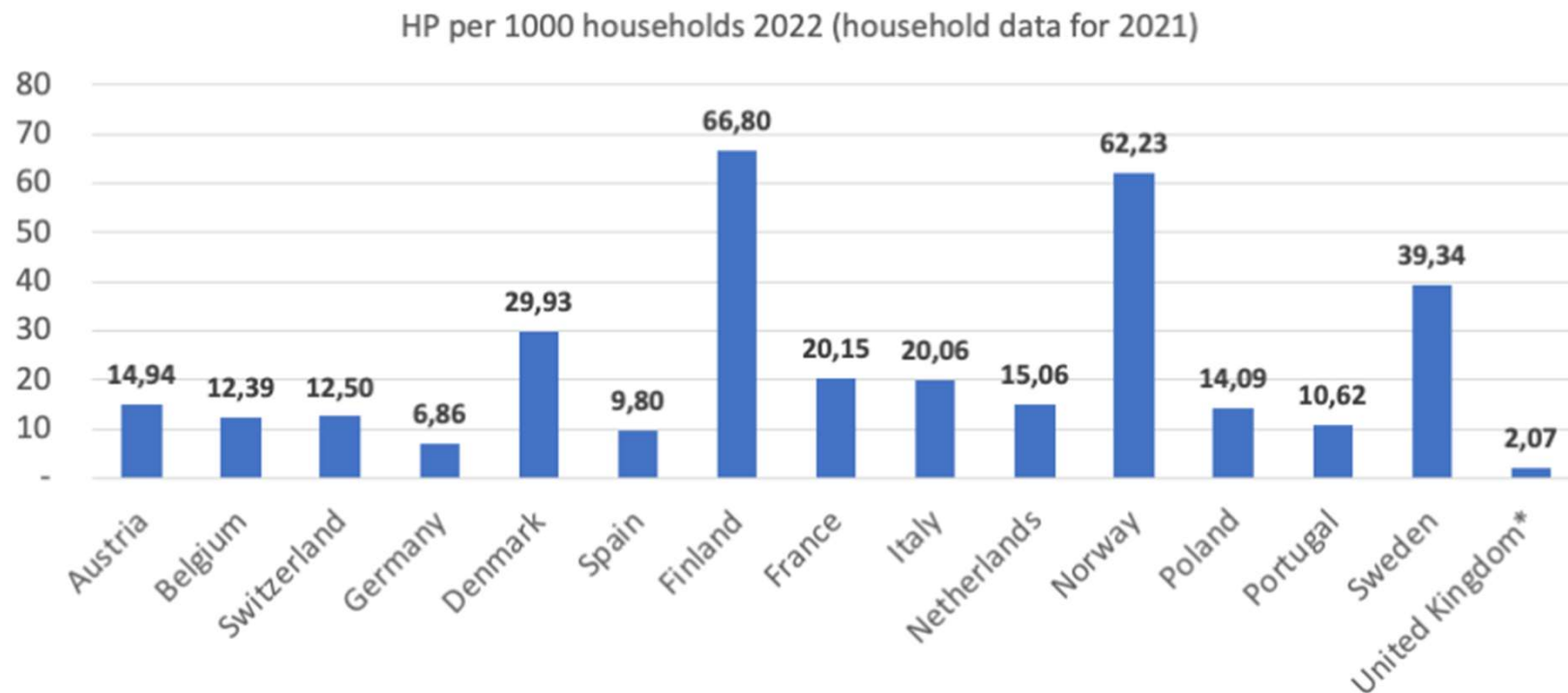
Residential, commercial and public buildings



Source: Statistics Finland

# Finland is the most heat-pumped country in Europe!

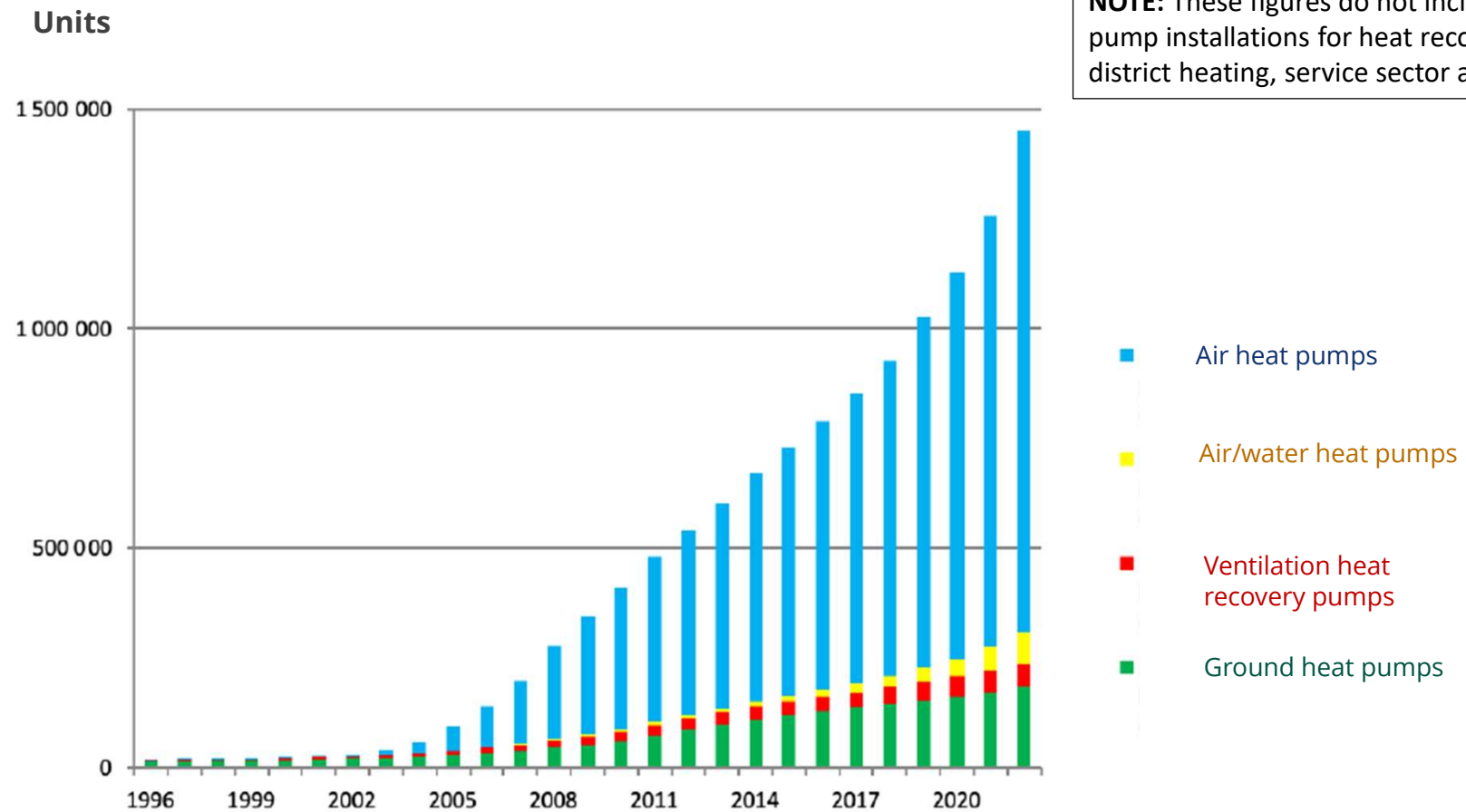
(per number of households)



Source: Finnish Heat Pump Association - SULPU

# Cumulative sales of heat pumps in Finland

1,45 million units

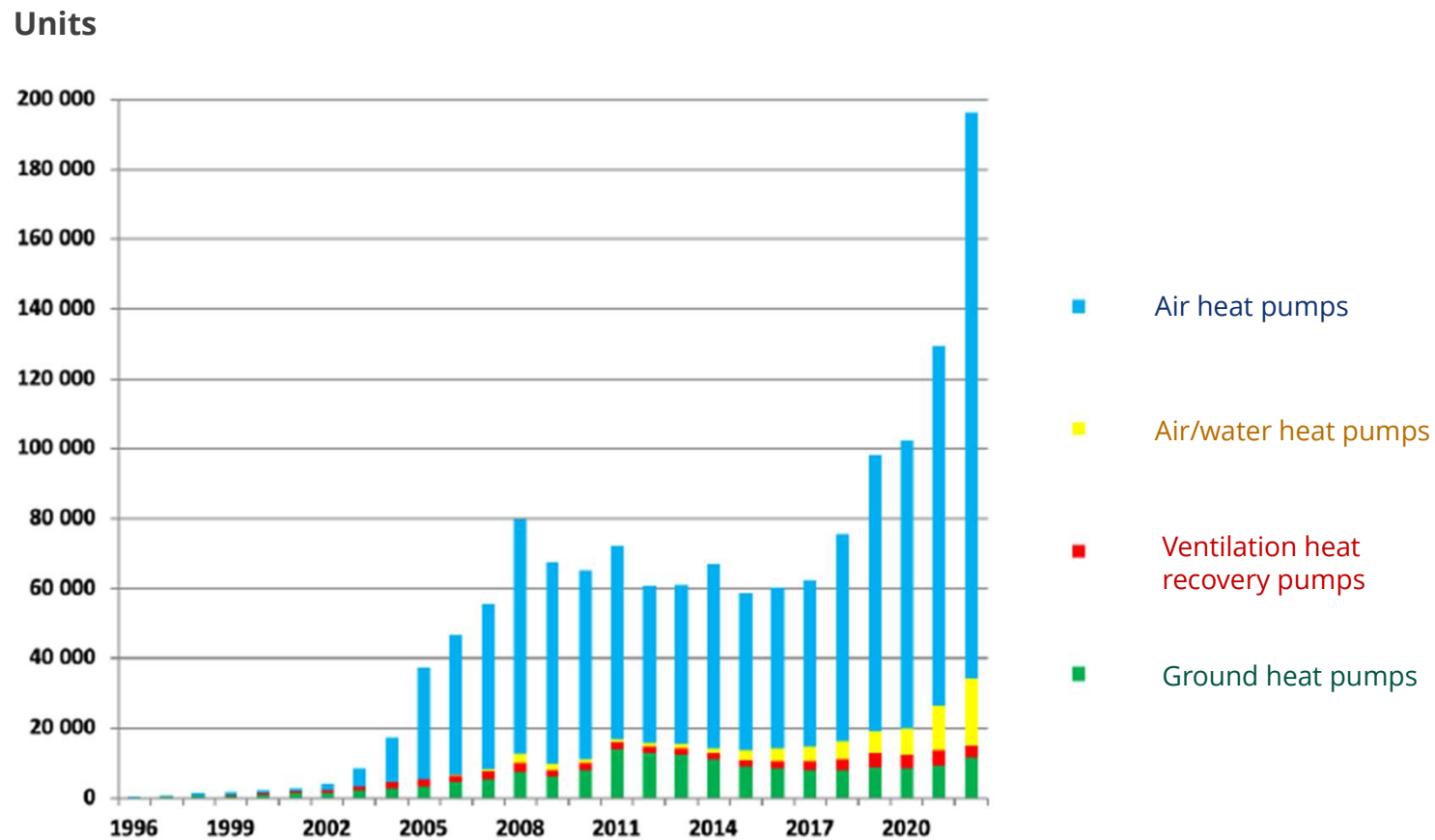


**NOTE:** These figures do not include large scale heat pump installations for heat recovery in industry, district heating, service sector and large buildings!

Source: Finnish Heat Pump Association - SULPU

# Annual sales of heat pumps in Finland

196,000 units in the Year 2022



Source: Finnish Heat Pump Association - SULPU

# Thank you!

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