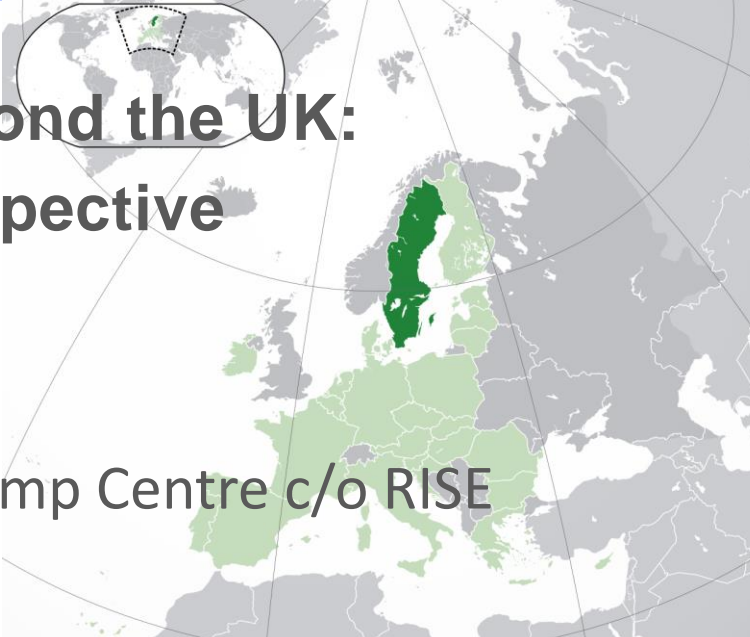


Heat pump experiences from beyond the UK: Sweden, Europe and the IEA perspective

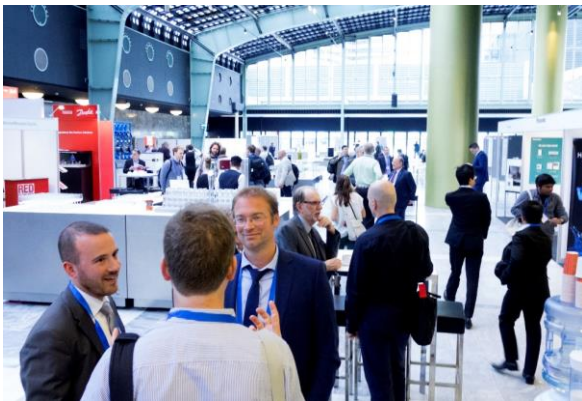


Caroline Haglund Stignor, Heat Pump Centre c/o RISE

The HPT TCP is part of a network of autonomous collaborative partnerships focused on a wide range of energy technologies known as Technology Collaboration Programmes or TCPs. The TCPs are organized under the auspices of the International Energy Agency (IEA), but the TCPs are functionally and legally autonomous. Views, findings, and publications of the HPT TCP do not necessarily represent the views or policies of the IEA Secretariat or its individual member countries.

IEA Technology Collaboration Programme on Heat Pumping Technologies (HPT TCP)

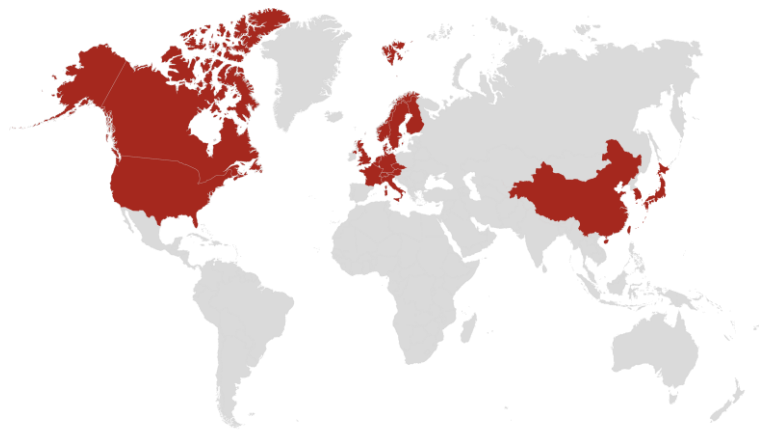
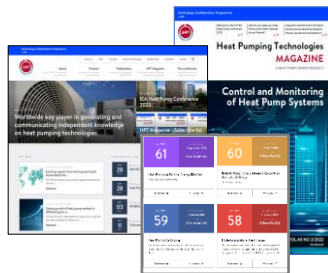
Heat Pump Centre (programme office for HPT TCP)



Research, Development, Demonstration, and Deployment of Heat Pumping Technologies

About Heat Pumping Technologies TCP

- A Technology Collaboration Programme (TCP) within the IEA since **1978**
- An international framework of **cooperation** and **networking** for different HP actors
- A forum to exchange **knowledge** and **experience**
- A contributor to **technology improvements** by RDD&D projects



- | | | |
|----------------|-------------|----------------|
| Austria | France | South Korea |
| Belgium | Germany | Sweden |
| Canada | Italy | Switzerland |
| China | Japan | United Kingdom |
| Czech Republic | Netherlands | United States |
| Denmark | Norway | |
| Finland | | |

Sweden and heat pumps

450 000 km² - 1/5 biggest country in Europe

Mountains, forests 67%,

lakes and rivers 10%

8% arable land

10,5 M inhabitants,

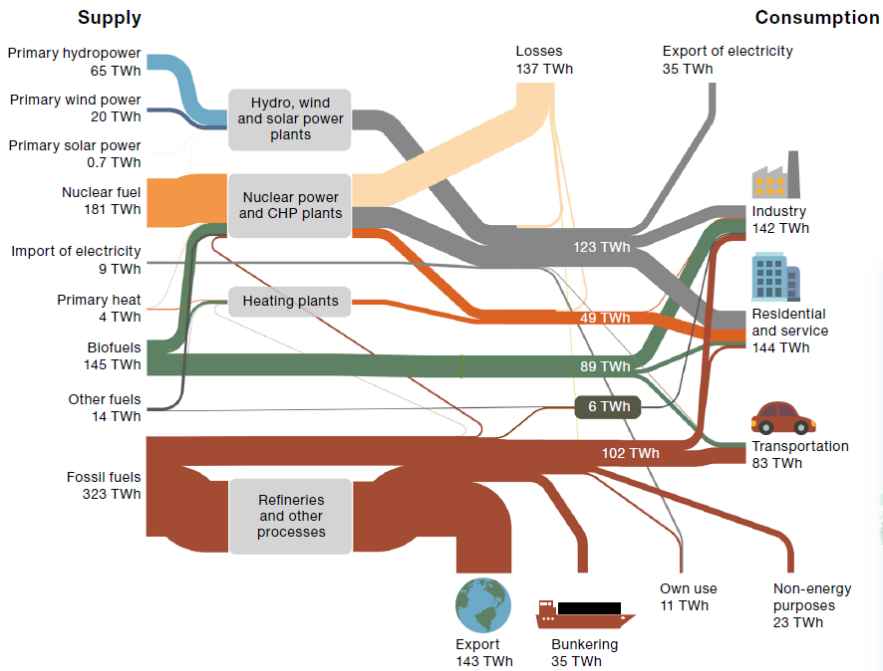
41% urban systems (>50 000)

2,4 M in the greater Stockholm area

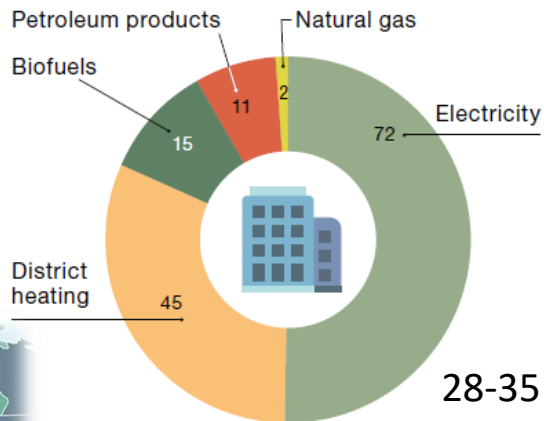
Part of EU and Nordpool



The Swedish Energy System



Final energy use in the residential and service sector 2019, TWh



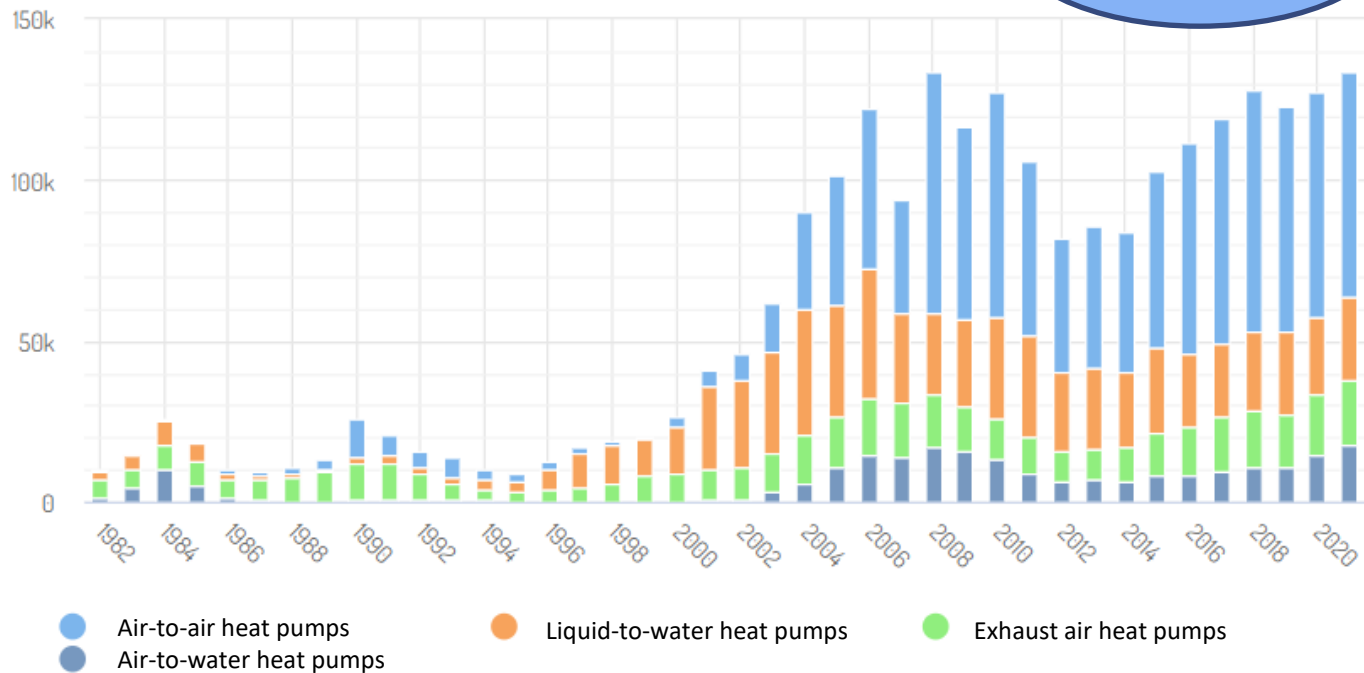
28-35 TWh are used by heat pumps

Electricity import/export

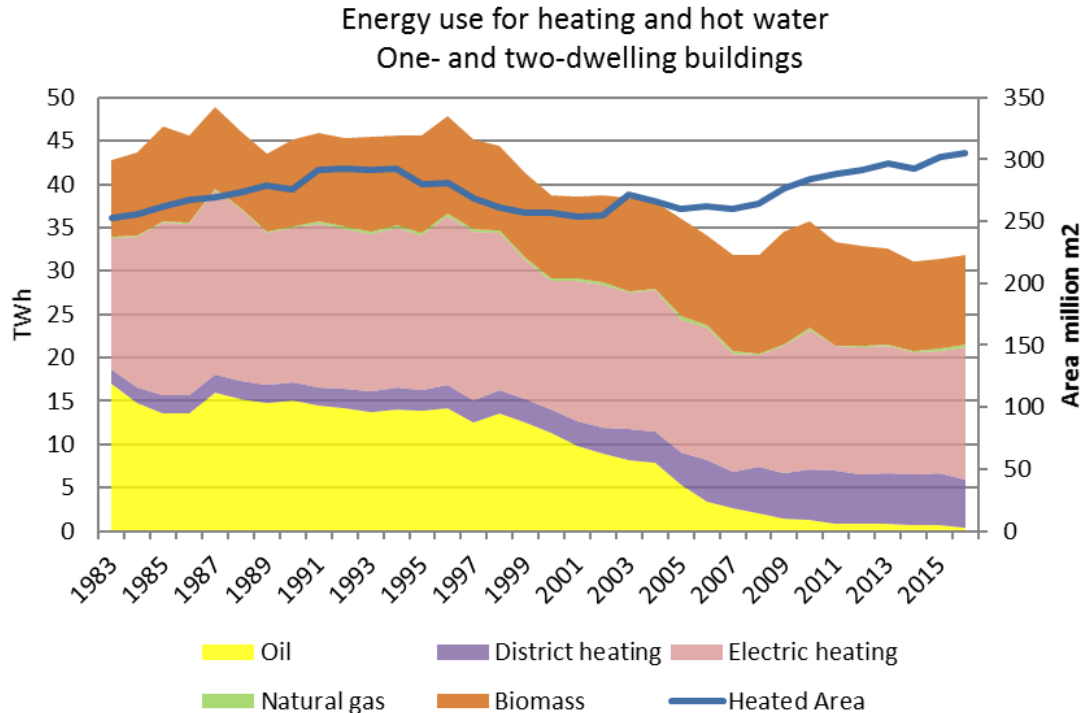


Heat pump sales in Sweden

About 1,5 million heat pumps



Energy use for heating in detached houses



Heating oil almost phased out

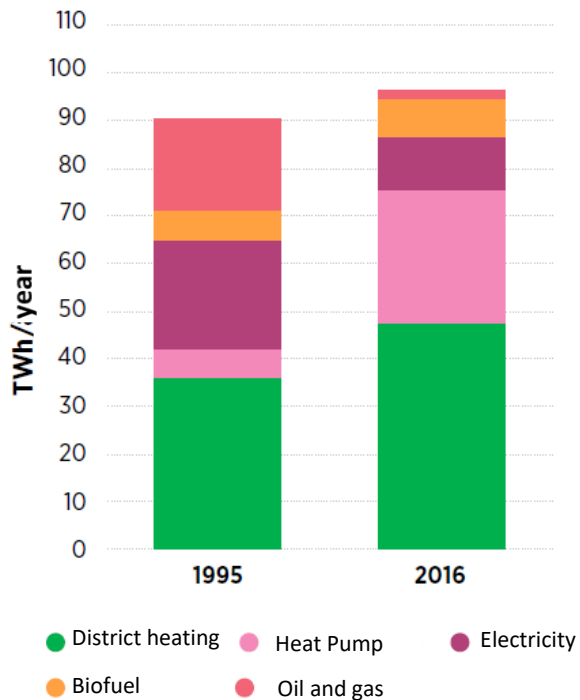
Resistance heating being replaced by heat pumps (incl air-air)

District heating (biomass) increases

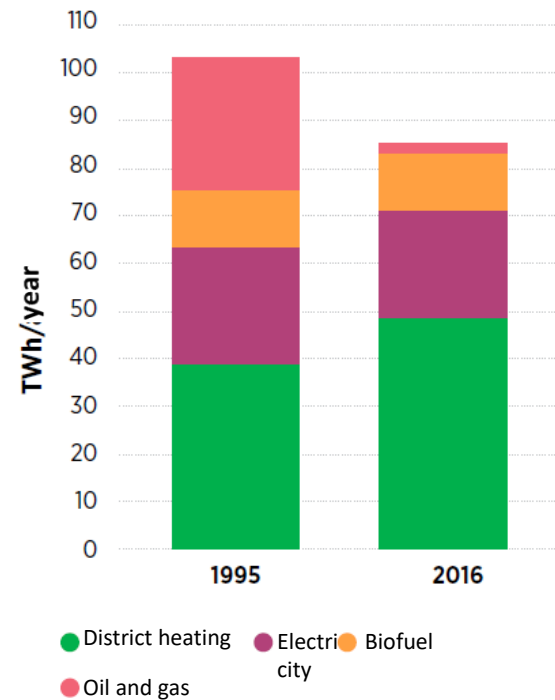
GHG emissions reduced 91% since 1990

Heating in Sweden

- 29-30% of the heating demand in buildings are covered by heat pumps
- 60-65% of single family housed are heated by heat pumps

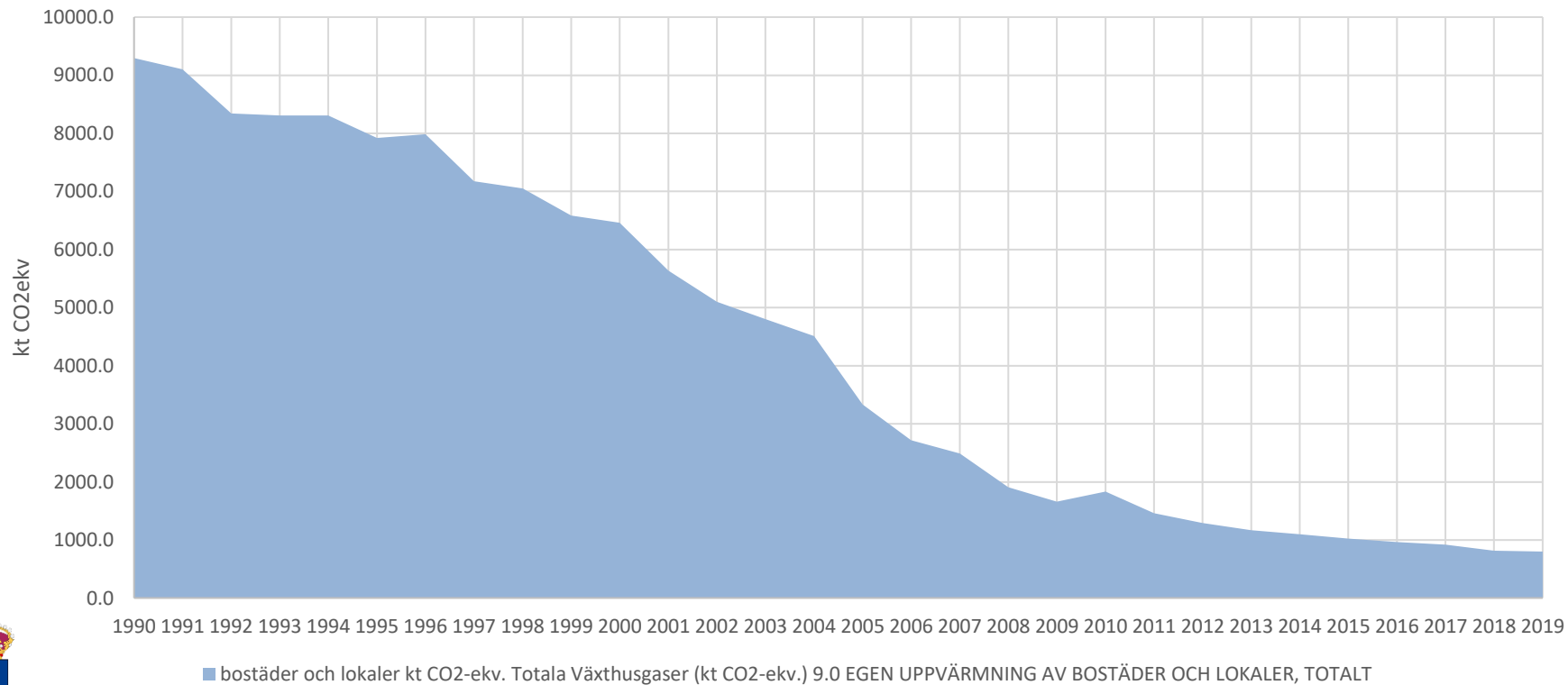


Used energy for heating
by fuel ("heating needs")



Bought energy for heating
by fuel

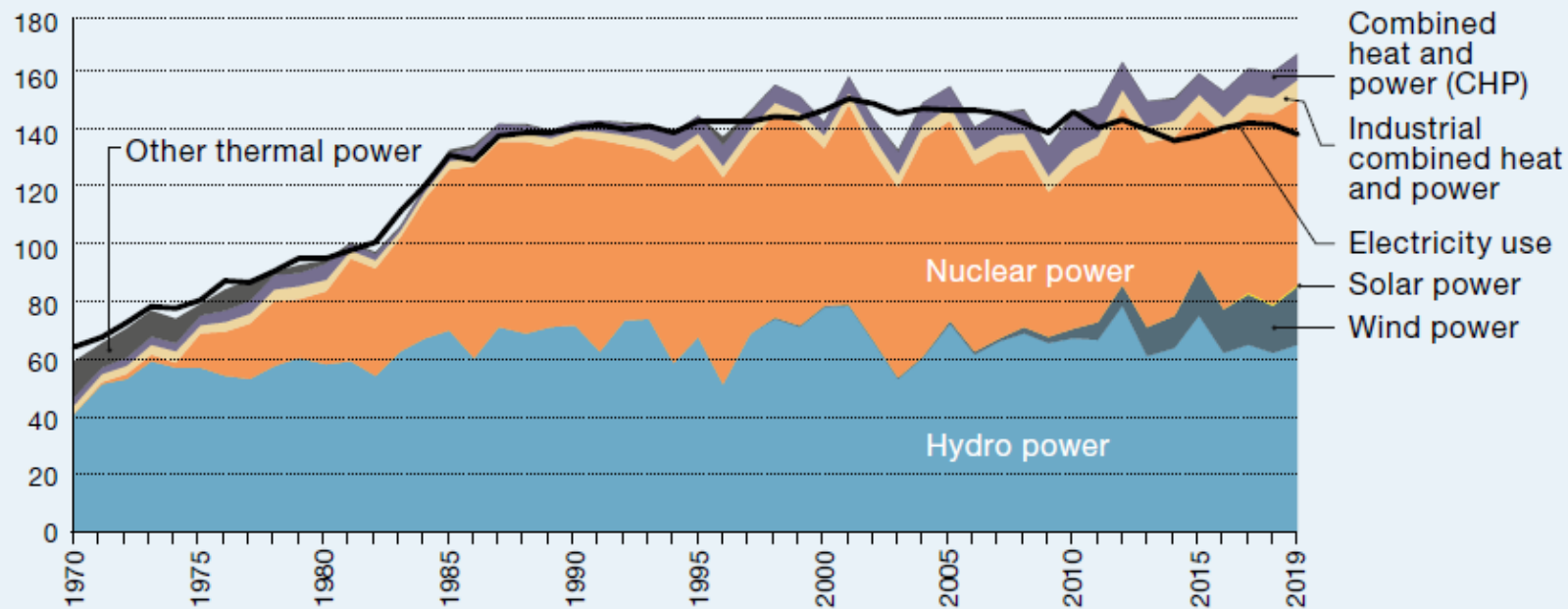
Emissions from heating and electricity generation for houses and premises



■ bostäder och lokaler kt CO2-ekv. Totala Växthusgaser (kt CO2-ekv.) 9.0 EGEN UPPVÄRMNING AV BOSTÄDER OCH LOKALER, TOTALT



Electricity use and electricity generation per type of power 1970–2019, TWh



Sources: The Swedish Energy Agency and SCB (Statistics Sweden).

Remark: Electricity generation for own use is not included.

Stimulating factors behind the transformation of the heating sector

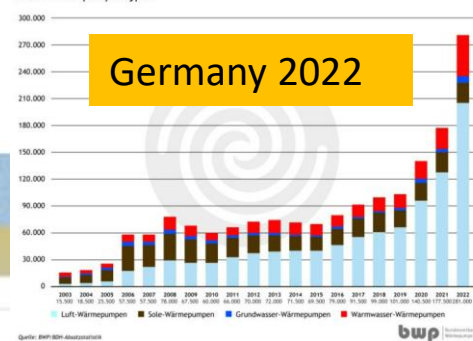
- Continuous public funded **RDD&D programmes** for the technology since the 70's
- Suitable **energy infrastructure** and (relatively) **low electricity prices**
- **Tax on CO₂-emissions** resulting on high tax on heating oil (since 1991)
- **Tax reduction** for **installation** of heat pumps (however relatively limited and not hp directed)
- **Technology procurement competition** to create awareness and kick-start innovation
- Public financing of **product testing, information and advice**, which were essential to create consumer **acceptance and trust** for a new technology
- **Collaboration** and the **competition** between manufacturers (e.g. handling of consumer disputes)
- **Training of installers** by manufacturers and trade organizations
- **Collaboration** between authorities and the industry at the introduction of MEPS (Ecodesign, EL)

Energy Infrastructure and low electricity prices	Continuous R&D&D programmes	Qualified installers	Product testing Information, advice, Creating Trust	Taxes & Incentives	MEPS & Labels
<ul style="list-style-type: none">• Government• Market	<ul style="list-style-type: none">• Government funded• Manufacturers• Research institutes and Universities	<ul style="list-style-type: none">• Industry• Government	<ul style="list-style-type: none">• Government• Industry• Test institutes	<ul style="list-style-type: none">• Government	<ul style="list-style-type: none">• European Union• Government

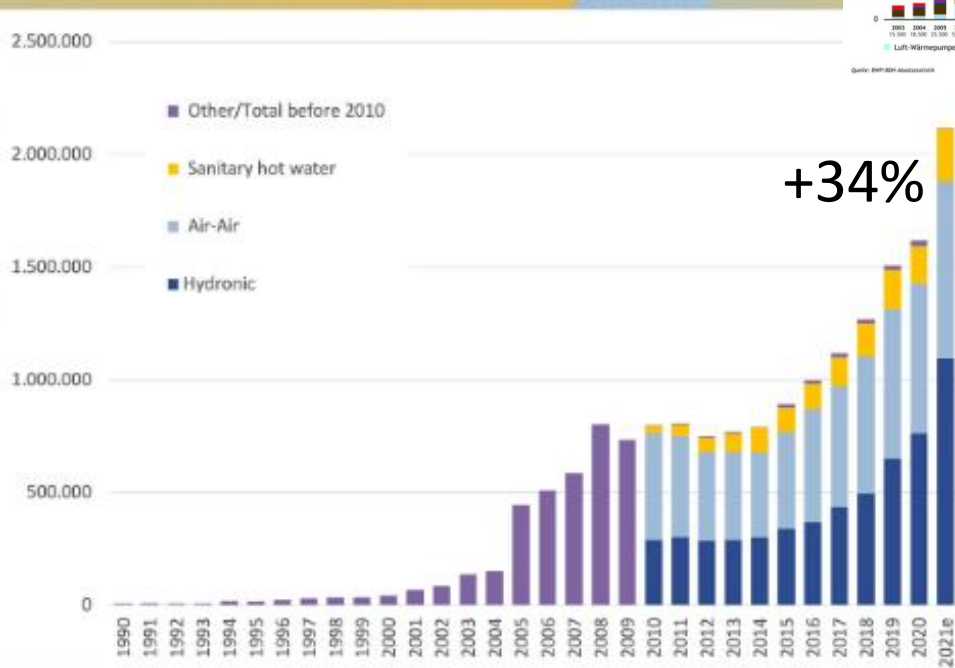
Heat Pump Sales in Europe

Market growth of 50%,
to 200 000 hp reported
for Finland in 2022

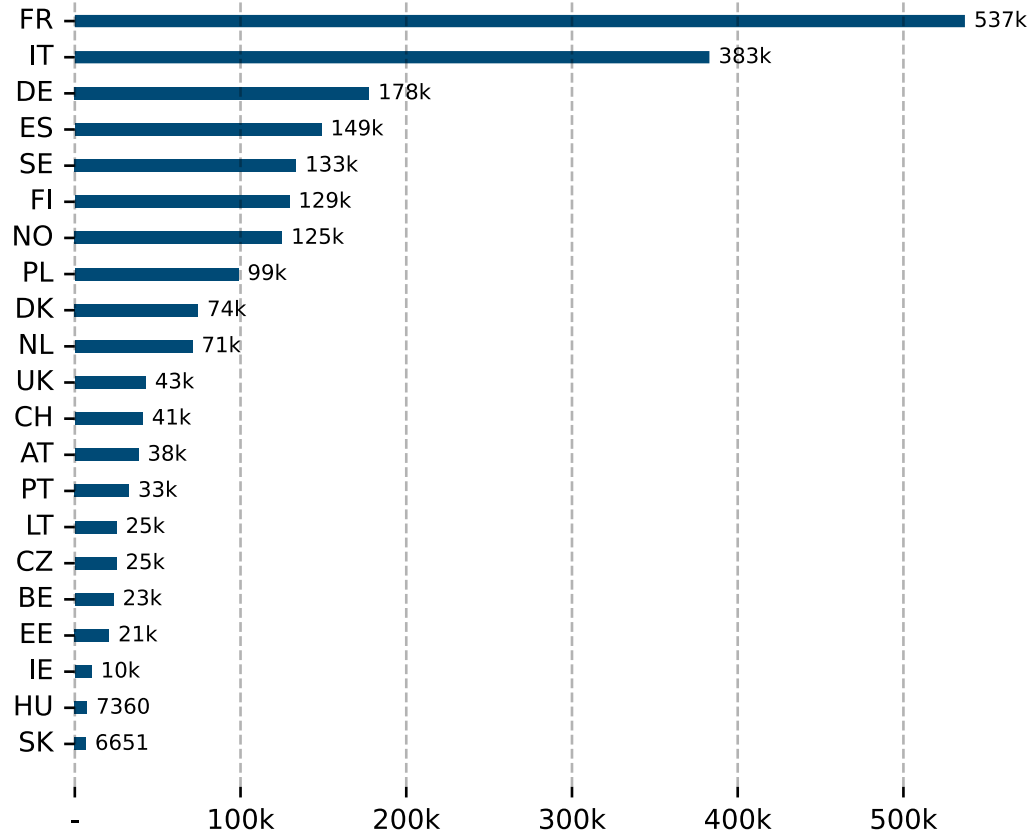
Absatzentwicklung Wärmepumpen in Deutschland 2003-2022
Nach Wärmepumpentypen



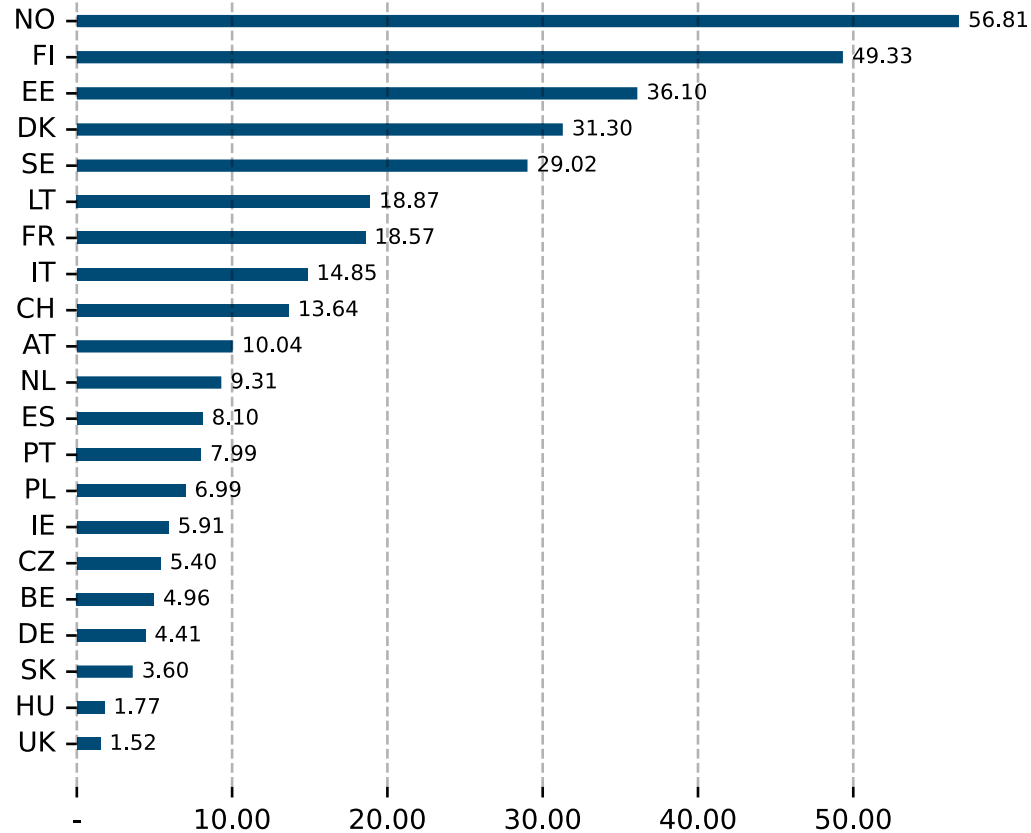
Heat pump sales in 21 European markets



Sales of heat pumps in 2021 | by country



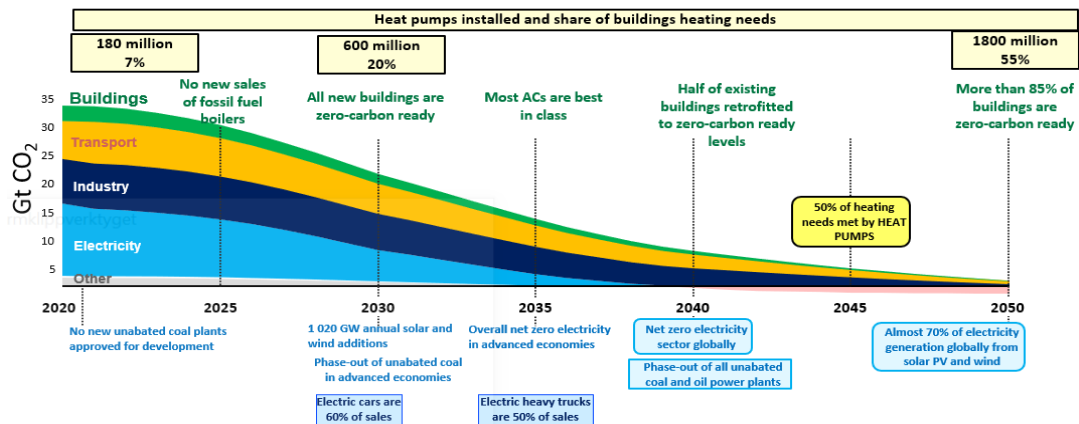
Heat pump sales 2021 per 1 000 households



IEA – the global perspective of heat pumps

Heat pumping technologies have been identified by IEA as the **main heating solution** to reach the ambitions in their **Net Zero by 2050 Roadmap** (2021) - 55% of the heating needs in buildings should be met by heat pumps by 2050 - an **increase by a factor of 3-4** in 2030 and a **tenfold increase to 2050**.

Policy makers around the world **follow the advice** by IEA and **HPT TCP** and have **revised policies** in order to stimulate the **deployment** of the heat pumps, e.g. REPowerEU, Inflation Reduction Act and the Defence Production Act in US

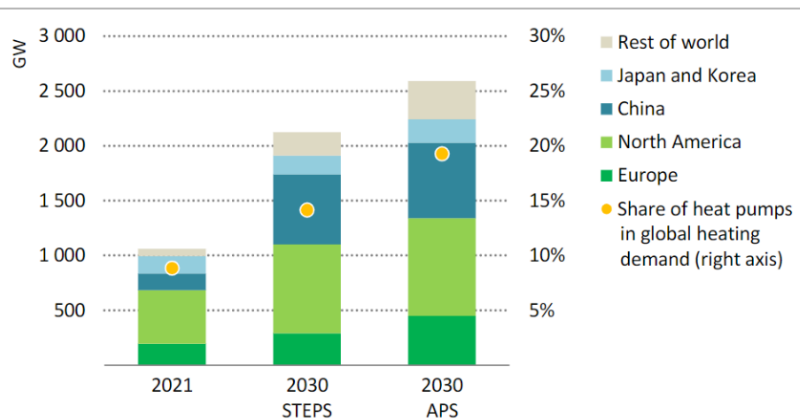


Source: ABERGEL T. et. al., (2021), Net Zero by 2050, IEA, Paris
<https://www.iea.org/reports/net-zero-by-2050>. All rights reserved.



IEA – the global perspective of heat pumps

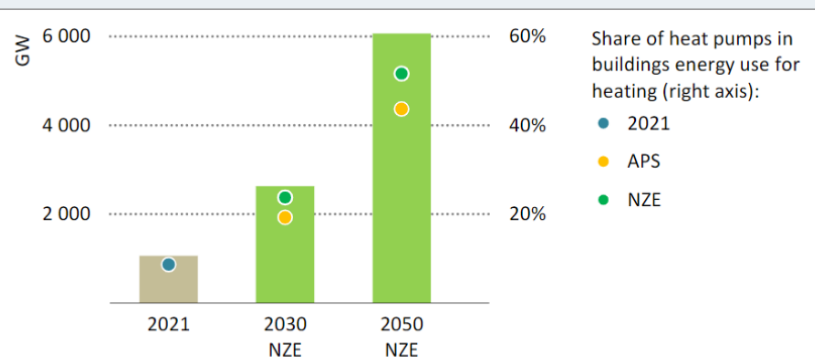
Figure 1.7 ▶ Heat pump capacity in buildings by country/region and scenario, 2021 and 2030



IEA. CC BY 4.0.

Around 20% of heating needs are met by heat pumps in 2030 in the APS, with China, North America and Europe remaining the leading markets

Figure 1.12 ▶ Global heat pump capacity and coverage of heating needs in the APS and NZE Scenario, 2021-2050



IEA. CC BY 4.0.

Global heat pump capacity nearly triples by 2030 in the NZE Scenario and then doubles again by 2050, with stronger policies than those already planned needed beyond 2030

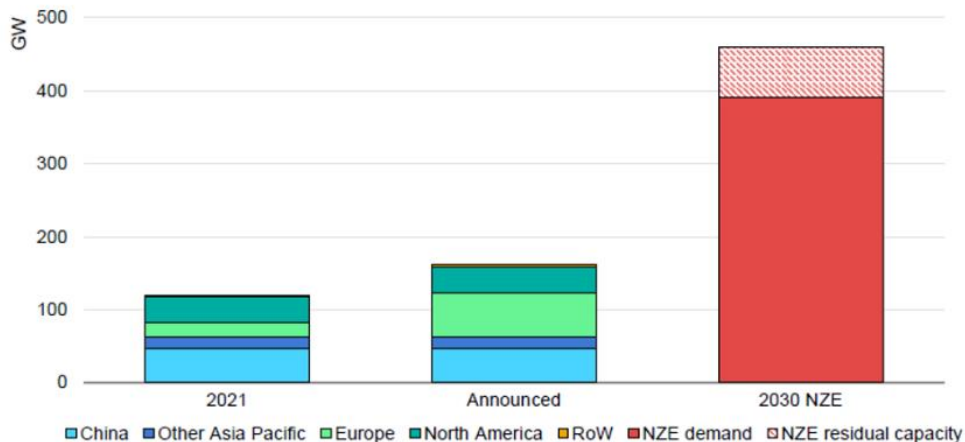
STEP: States Policies Scenario, APS: Announced Pledges Scenario, NZE: Net Zero Emissions by 2050



IEA – the global perspective of heat pumps

- Heat pumps have **strong support from policy** in many countries – however **more is needed**
- Massive **market growth** seen in many countries
- Challenges with **high upfront cost** and lack of **skilled workers**
- Many announcements of **investments** in increased production capacity – **still a gap!**

Figure 4.10 Heat pump manufacturing capacity by country/region according to announced projects and in the NZE Scenario



IEA. CC BY 4.0.

Notes: RoW = rest of world; NZE = Net Zero Emissions by 2050 Scenario. Announced capacity includes existing capacity. The manufacturing capacity needed to meet projected demand in the NZE Scenario (NZE demand) is estimated assuming a utilisation rate of 85%. NZE residual capacity, thus, represents the manufacturing capacity that would remain unused, on average, which provides some flexibility to accommodate demand fluctuations. Heat pump capacity (in GW) is expressed as thermal output capacity. By and large, Europe is the main region to have concrete public expansion plans from manufacturers in place.

Announced heat pump manufacturing capacity covers only one-third of NZE Scenario requirements for 2030, but short lead times mean that capacity could expand quickly.

A 10-Point Plan to Reduce the European Union's Reliance on Russian Natural Gas

Measures implemented this year could **bring down gas imports from Russia by over one-third**, with additional temporary options to deepen these cuts to **well over half while still lowering emissions**.

Action 1



No new gas supply contracts with Russia

Impact: Taking advantage of expiring long-term contracts with Russia will reduce the contractual minimum take-or-pay levels for Russian imports and enable greater diversity of supply.

Action 2



Replace Russian supplies with gas from alternative sources

Impact: Around 30 bcm in additional gas supply from non-Russian sources.

Action 3



Introduce minimum gas storage obligations to enhance market resilience

Impact: Enhances the resilience of the gas system, although higher injection requirements to refill storage in 2022 will add to gas demand and prop up gas prices.

Action 4



Accelerate the deployment of new wind and solar projects

Impact: An additional 35 TWh of generation from new renewable projects over the next year, over and above the already anticipated growth from these sources, bringing down gas use by 6 bcm.

Action 5



Maximise generation from existing dispatchable low-emissions sources: bioenergy and nuclear

Impact: An additional 70 TWh of power generation from existing dispatchable low emissions sources, reducing gas use for electricity by 13 bcm.

Action 6



Enact short-term measures to shelter vulnerable electricity consumers from high prices

Impact: Brings down energy bills for consumers even when natural gas prices remain high, making available up to EUR 200 billion to cushion impacts on vulnerable groups.

Action 7



Speed up the replacement of gas boilers with heat pumps

Impact: Reduces gas use for heating by an additional 2 bcm in one year.

Action 8



Accelerate energy efficiency improvements in buildings and industry

Impact: Reduces gas consumption for heat by close to an additional 2 bcm within a year, lowering energy bills, enhancing comfort and boosting industrial competitiveness.

Action 9



Encourage a temporary thermostat adjustment by consumers

Impact: Turning down the thermostat for buildings' heating by 1°C would reduce gas demand by some 10 bcm a year.

Action 10



Step up efforts to diversify and decarbonise sources of power system flexibility

Impact: A major near-term push on innovation can, over time, loosen the strong links between natural gas supply and Europe's electricity security. Real-time electricity price signals can unlock more flexible demand, in turn reducing expensive and gas-intensive peak supply needs.

REPOWER EU

- *“REPowerEU will diversify our gas supplies, speed up the renewable roll-out, improve energy efficiency and replace gas in **heating** and power. It can reduce our demand for Russian gas by 2/3 before the end of the year” [Ursula Van der Leyen, EC President]*
- **RePowerEU** coincides well with the **10-point plan** presented by IEA (one week earlier).
- The plan proposes to **double the planned yearly pace of deployment of heat pumps** in the coming years
 - Interest for heat pumps is “sky-rocketing” right now
- **Policies in several countries are introduced to stimulate roll-out of heat pumps (Germany, Netherlands, Poland, etc)**
- **REPowerEU** will also boost several other renewable technologies – solar energy, geothermal, district heating, hydrogen, biogas, etc....

RePowerEU
and cut our
dependence on
Russian gas



European
Commission



#EUGreenDeal

Conclusions

To stimulate decarbonisation of heating and cost efficiency by roll-out of heat pumps

- Strengthen fossil free electricity **production** and the energy **infrastructure**
 - **Renovate**/insulate (worst performing) buildings
 - **Adjust levels** of taxes and other energy/emission related fees
 - Support **research and innovation** of solutions adapted for the national market
 - **Support training** of installers and workers in the value chain
 - Introduce measures to deal with **high upfront costs** – subsidies, tax rebates, alternative business models
 - **Information** and trial campaigns to build **consumer trust** and **acceptance** of the technology
- **Strong policy support** for heat pumps in many countries!



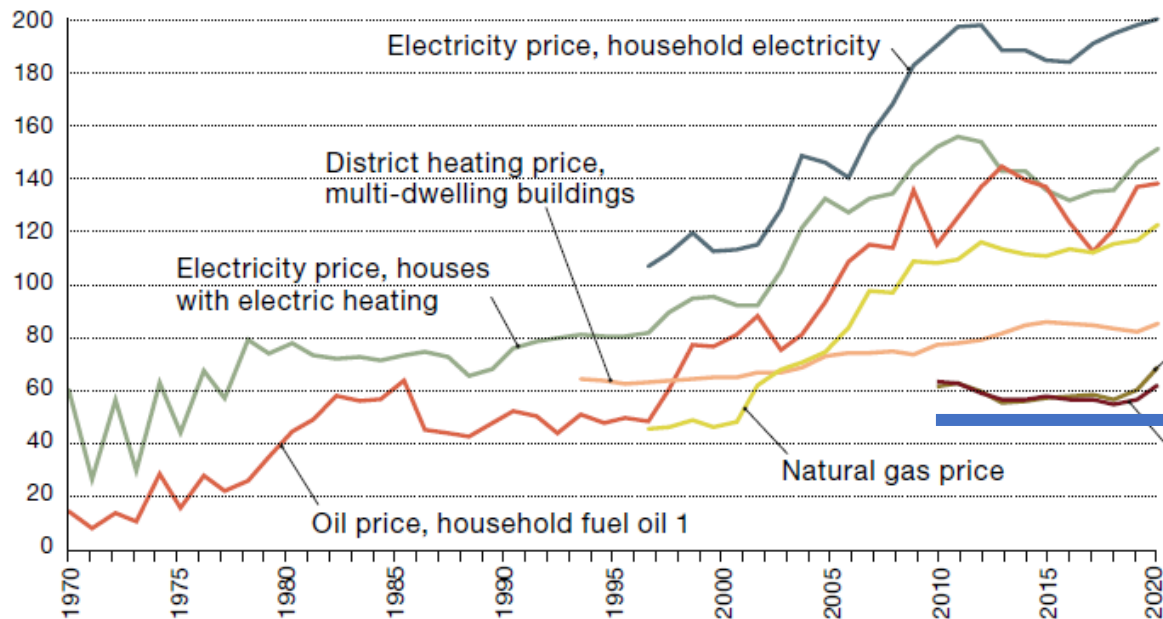
Thanks for your attention!

Caroline.haglundstignor@ri.se

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Energy prices for households from 1970, including taxes and VAT, in 2019 price levels, öre/kWh



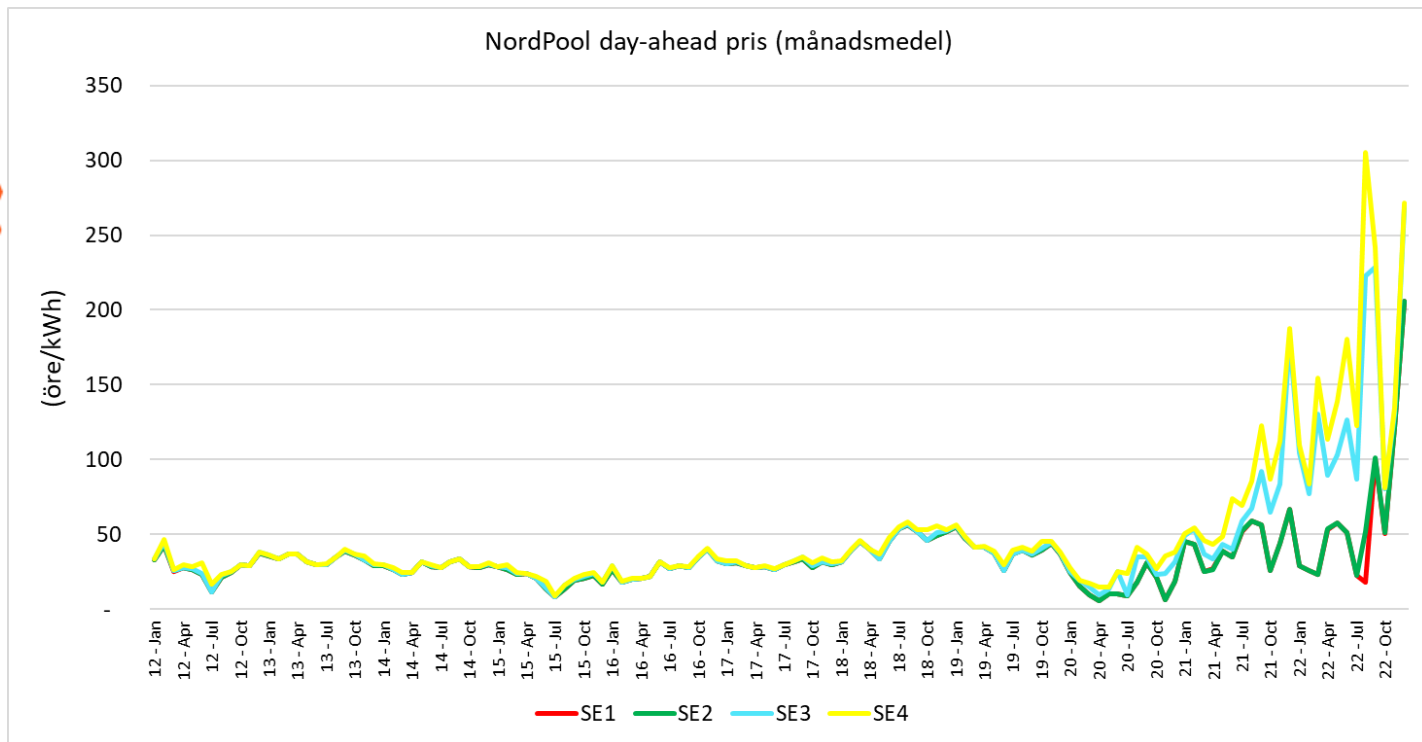
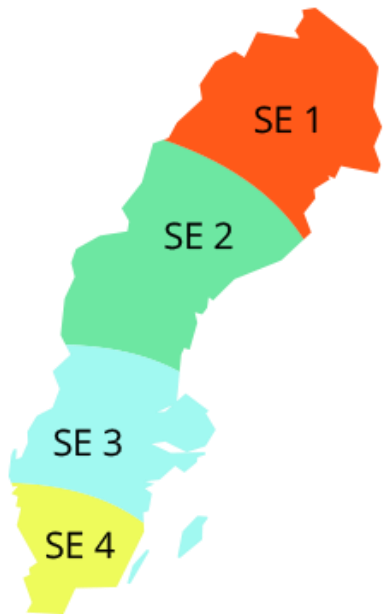
Öre = cent

100 öre ≈ 0,1 Euro / USD



OPEX HP 0,05 Euro/
kWh heat

Sources: The Swedish Energy Agency, Statistics Sweden (SCB), Swedish Petroleum and Biofuels Institute (SPBI). Remark: Prices are presented in 2019 price levels; consumer price index is used for recalculating of prices.



1 öre = 0.1 Euro cent