Heat pump technology – Sweden

Country Report

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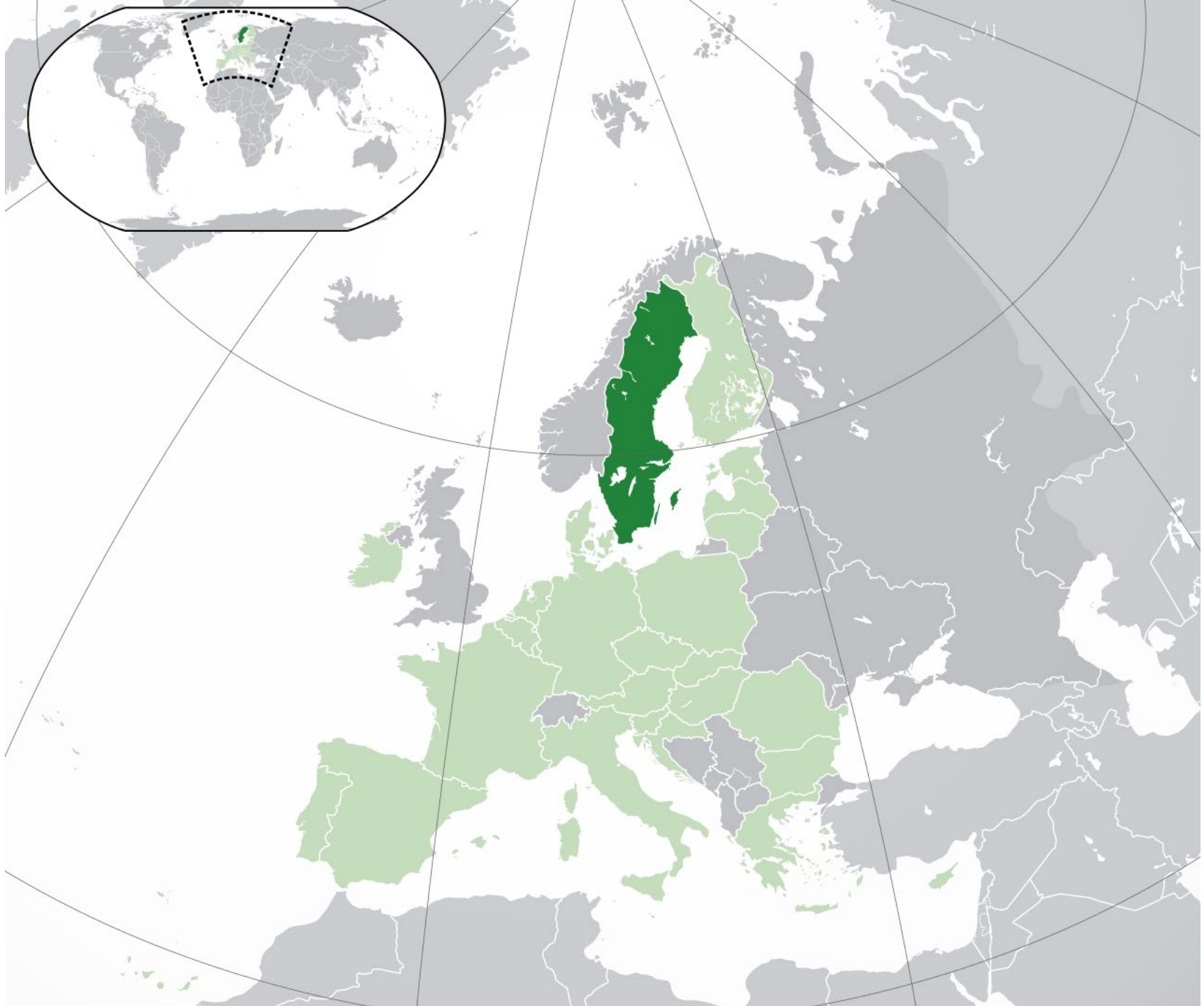
Sweden

Swedish Energy Agency- We are leading society´s transition to a sustainable energy system

Swedish Refrigeration and Heat Pump Association

SVENSKA KYL&VÄRMEPUMP FÖRENINGEN

Swedish Energy Agency



Sweden

450 000 km^2 - 1/5 biggest country in Europe

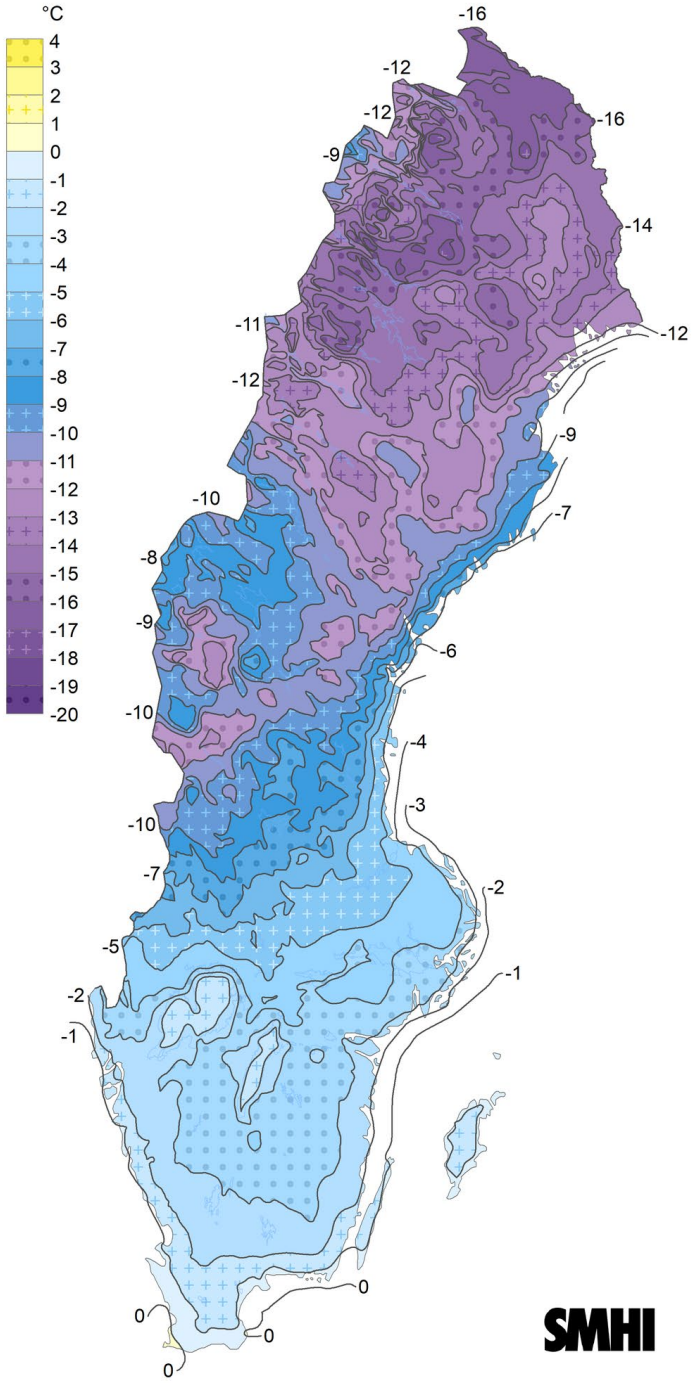
Mountains,
forests 67%,
lakes and rivers 10%
8% arable land

10,5 M inhabitants,
41% urban systems (>50 000)
2,4 M in the greater Stockholm area

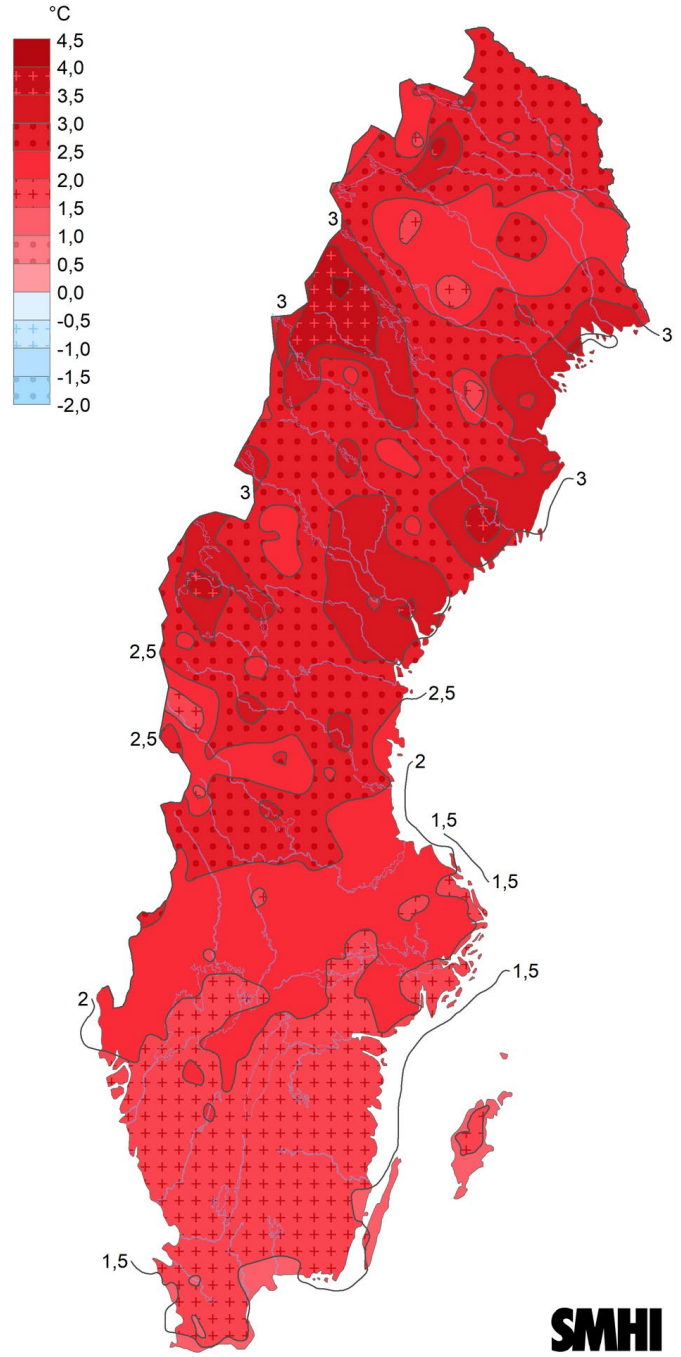
Part of EU and Nordpool

Average January

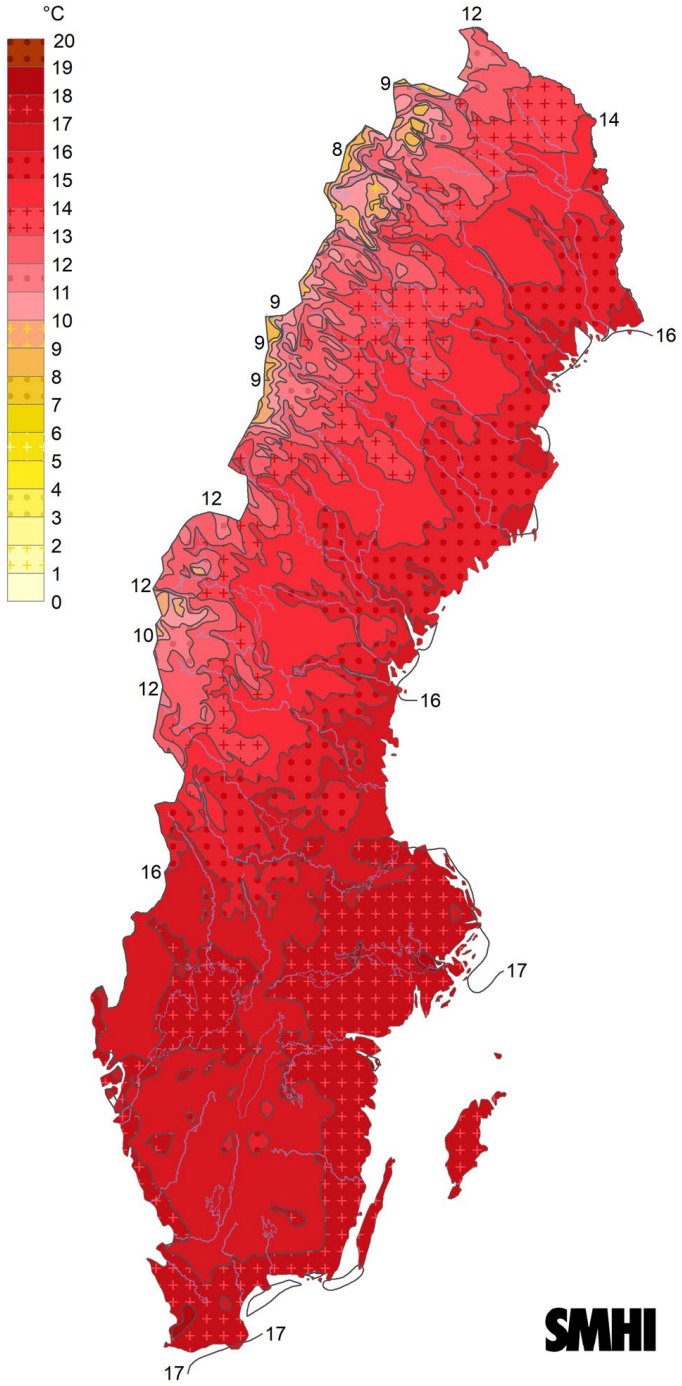
1961- 1990



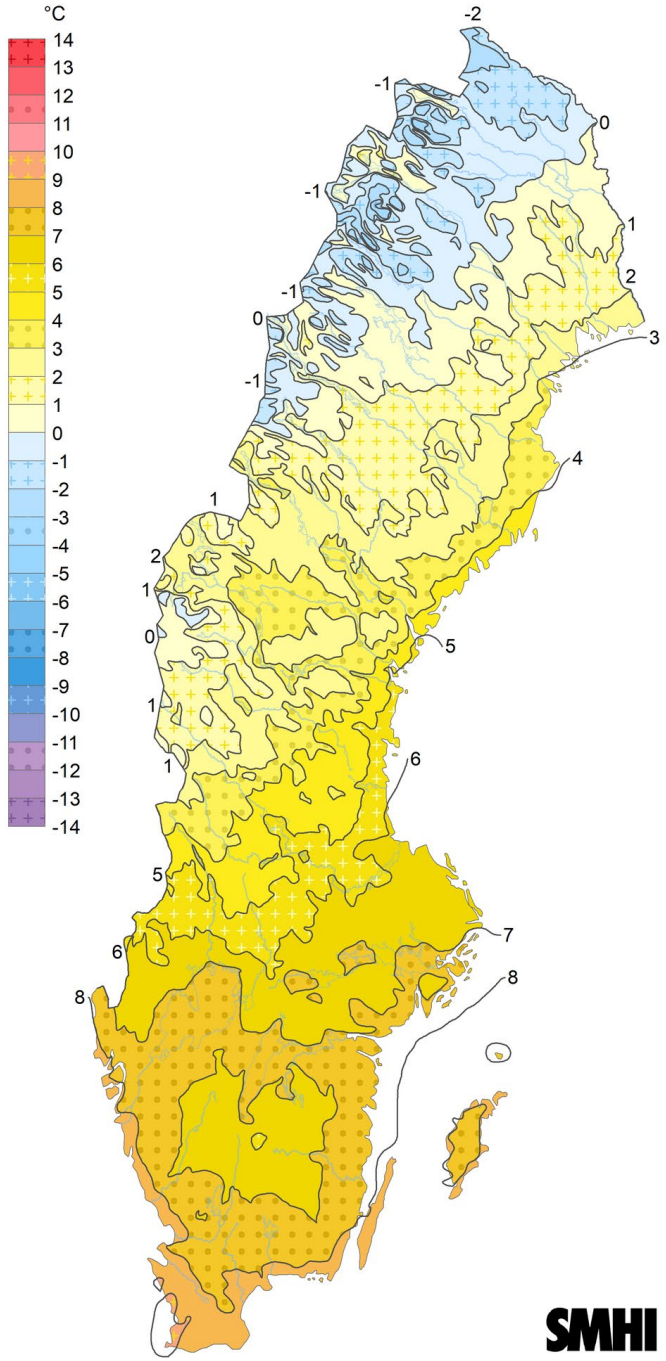
Difference
1991-2020

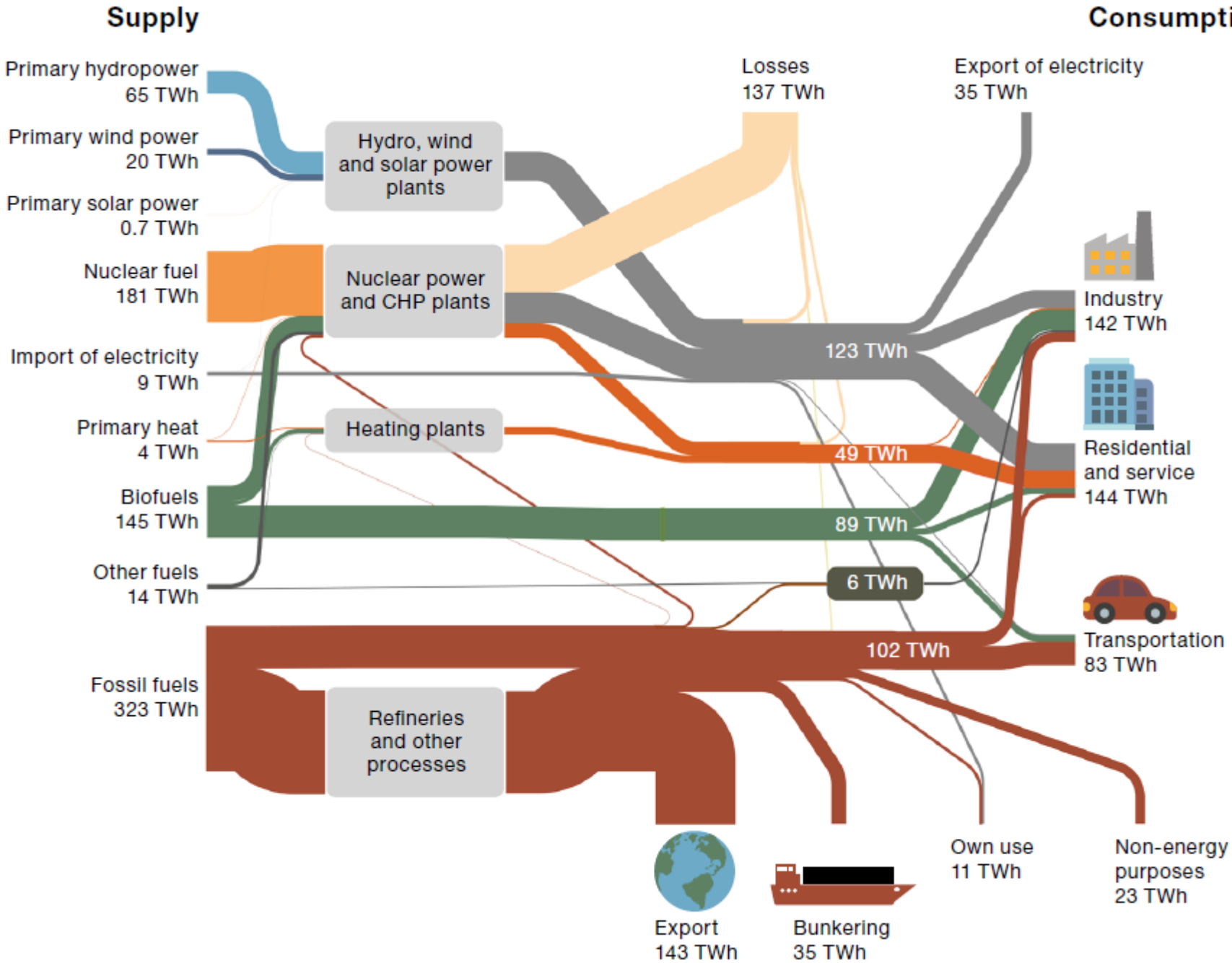


Average July
1991-2020



Yearly average
1991-2020





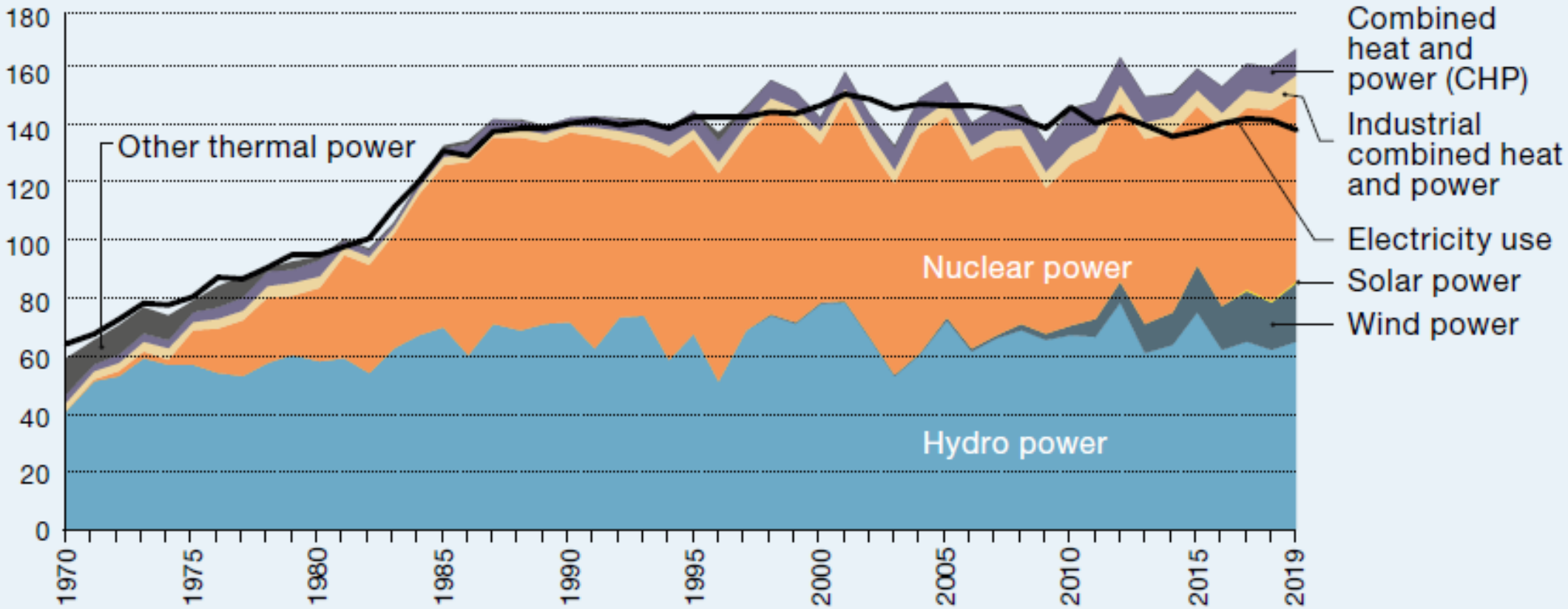
2019

Share from heat pumps?

We estimate 28 – 35 TWh

Swedish Energy Agency

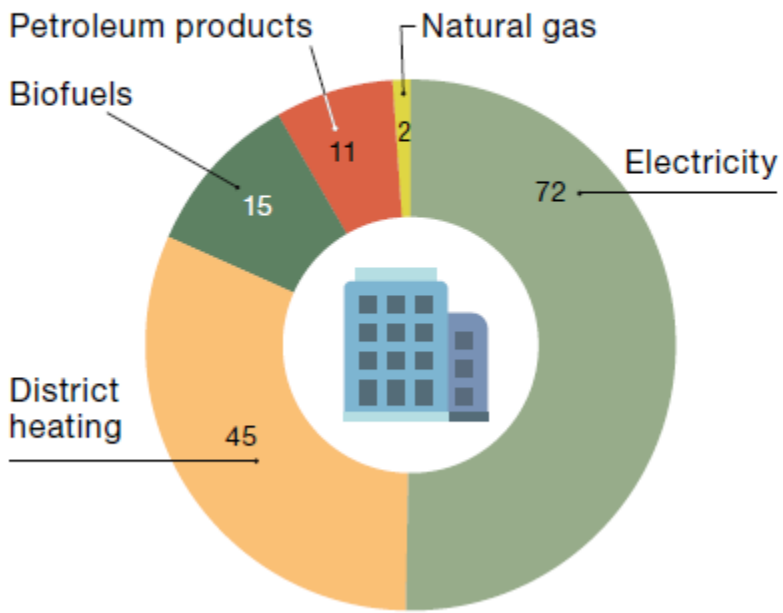
Electricity use and electricity generation per type of power 1970–2019, TWh



Sources: The Swedish Energy Agency and SCB (Statistics Sweden).
Remark: Electricity generation for own use is not included.

Swedish Energy Agency

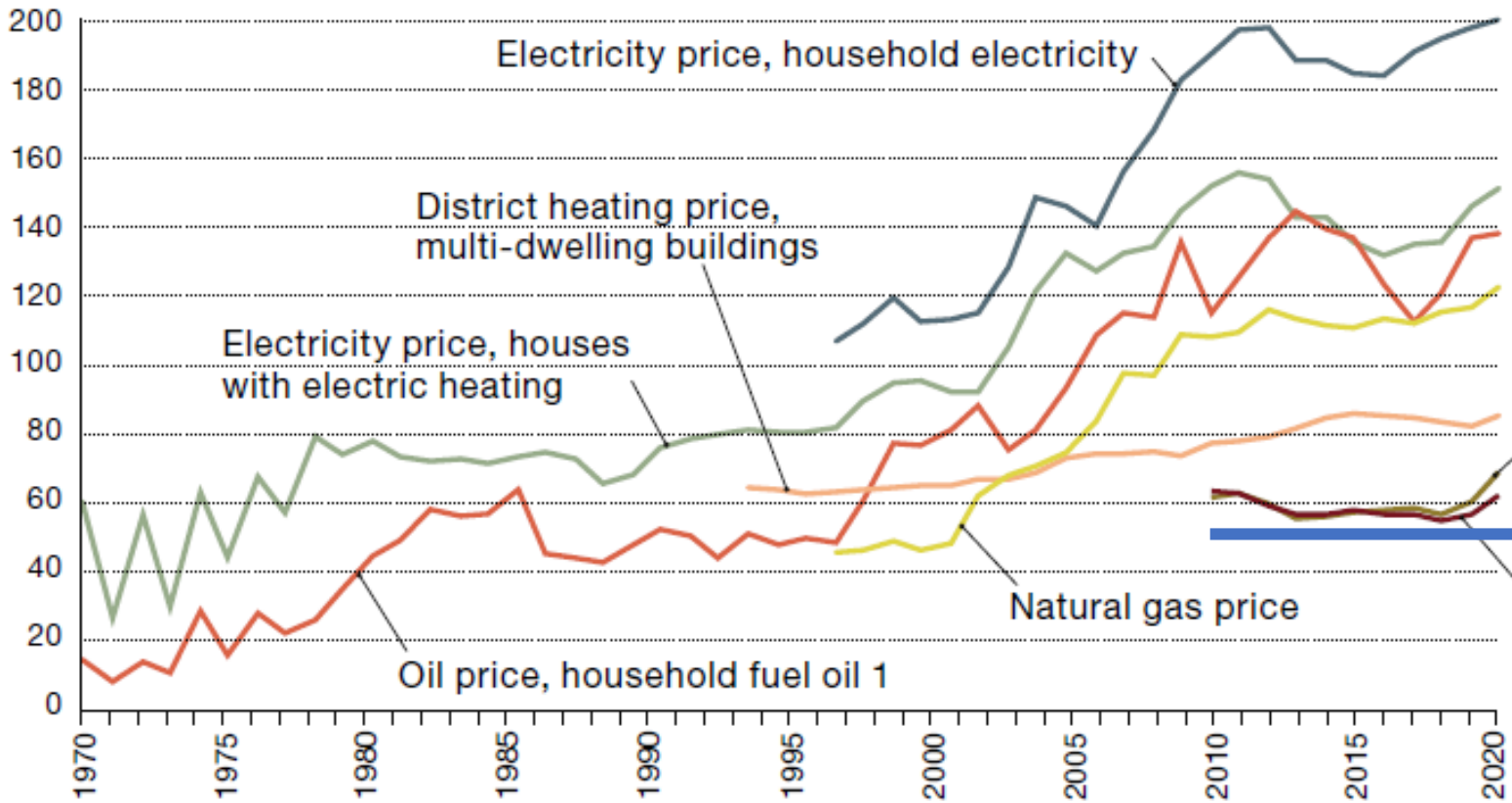
Final energy use in the residential and service sector 2019, TWh



- Electricity and district heating account for more than 80 per cent of the energy used in the residential and service sector.
- Electricity is the most common energy carrier for heating in houses, followed by biofuels and district heating. In multi-dwelling buildings and nonresidential facilities district heating is by far the most common energy carrier.
- Petroleum products can be used for heating but are mainly used for machinery in agriculture, foresting, fishing and construction.

Swedish Energy Agency

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



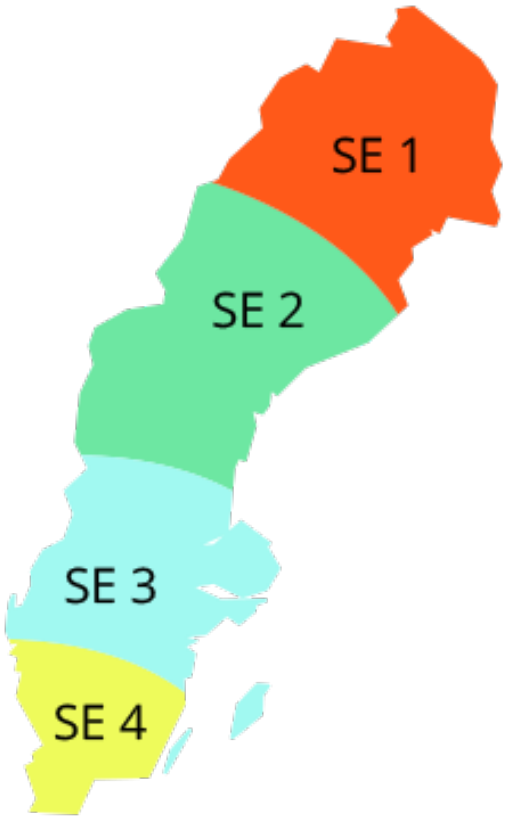
Sources: The Swedish Energy Agency, Statistics Sweden (SCB), Swedish Petroleum and Biofuels Institute (SPBI). Remark: Prices are presented in 2019 price levels; consumer price index is used for recalculating of prices.

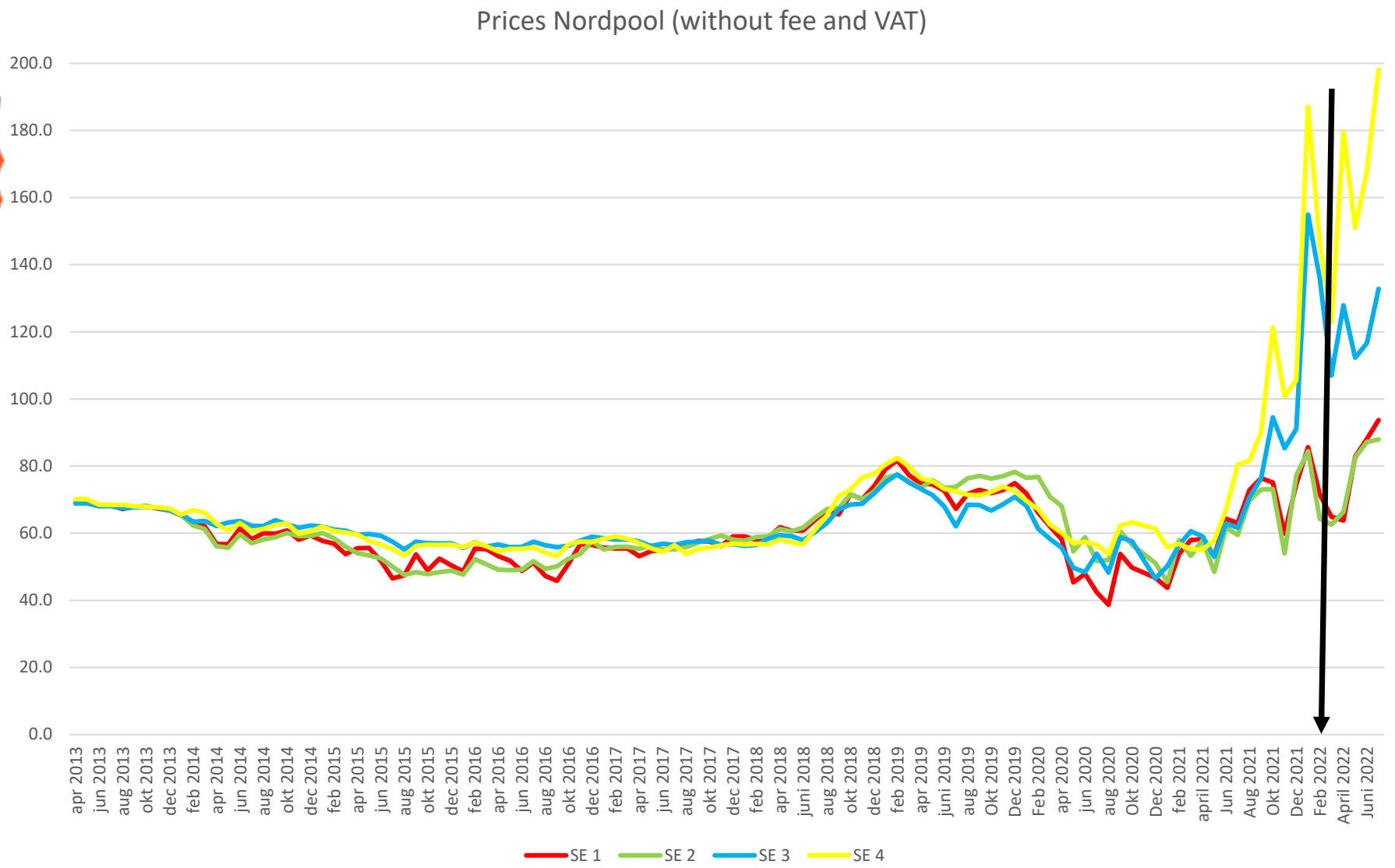
Öre = cent

100 öre ≈ 0,1 Euro / USD

OPEX HP 0,05 Euro/ kWh

Swedish Energy Agency


SE 1
SE 2
SE 3
SE 4


Prices Nordpool (without fee and VAT)
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
apr 2013
jun 2013
aug 2013
okt 2013
dec 2013
feb 2014
apr 2014
jun 2014
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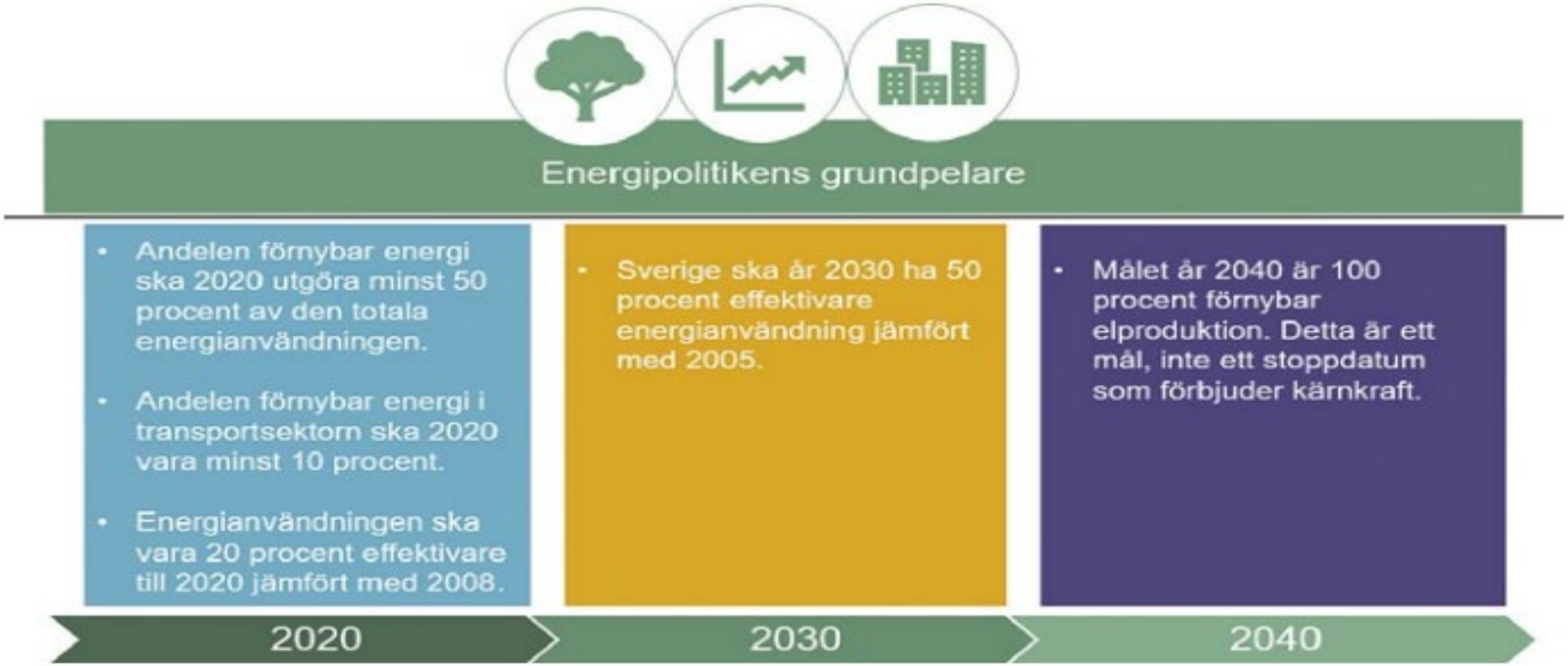
juni 2019
aug 2019
Okt 2019
Dec 2019
Feb 2020
apr 2020
jun 2020
aug 2020
Okt 2020
Dec 2020
feb 2021
april 2021
Jun 2021
Aug 2021
Okt 2021
Dec 2021
Feb 2022
April 2022
Juni 2022
SE 1
SE 2
SE 3
SE 4

Climate impact

Heating and cooling

Nationella energipolitiska mål till 2020, 2030 och 2040

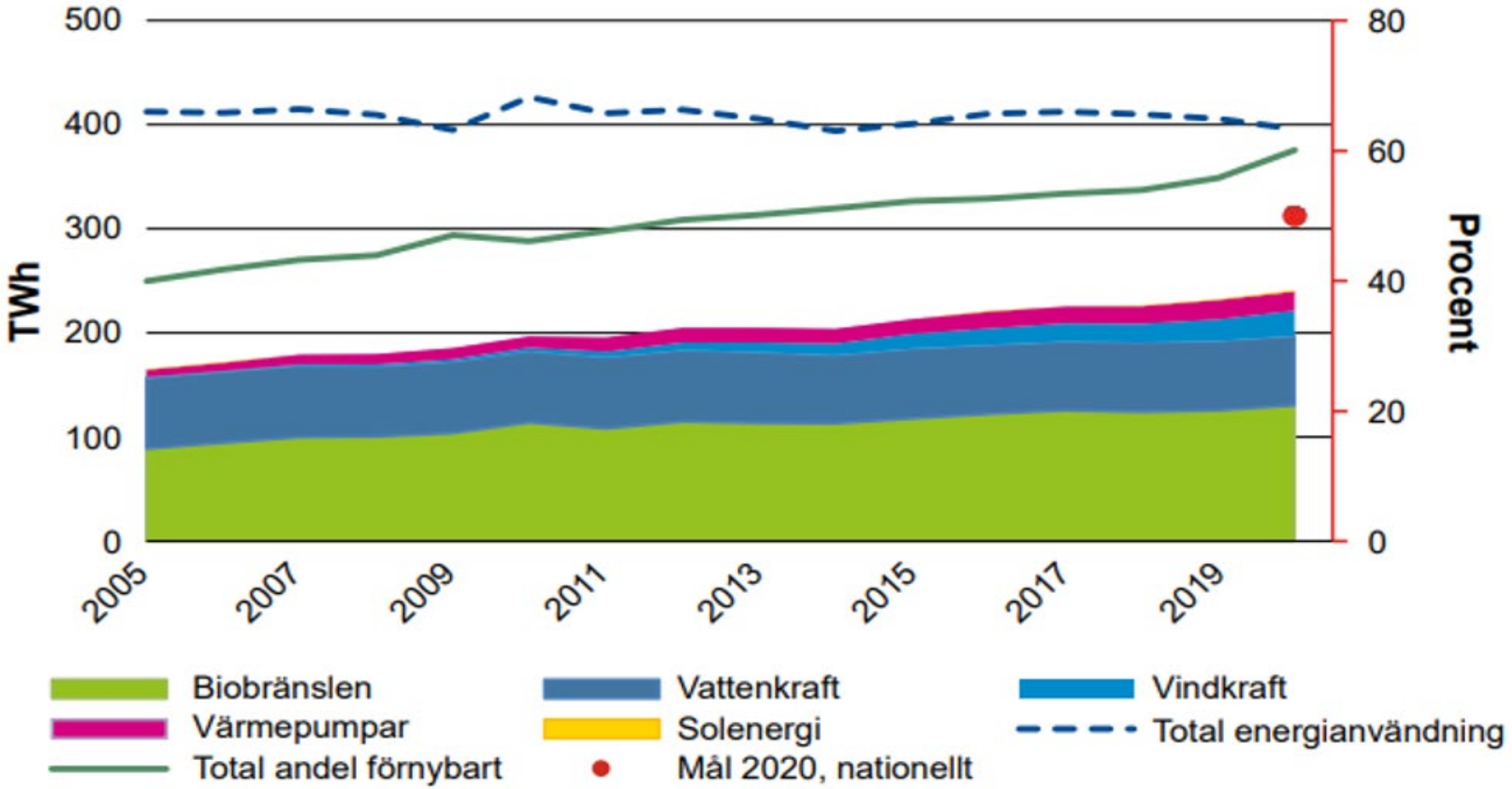
De energipolitiska målen till 2020 beslutades av riksdagen 2009.[7]



Sveriges energipolitiska mål till 2020, 2030 och 2040

Swedish Energy Agency

Målen för 2020 överstegs



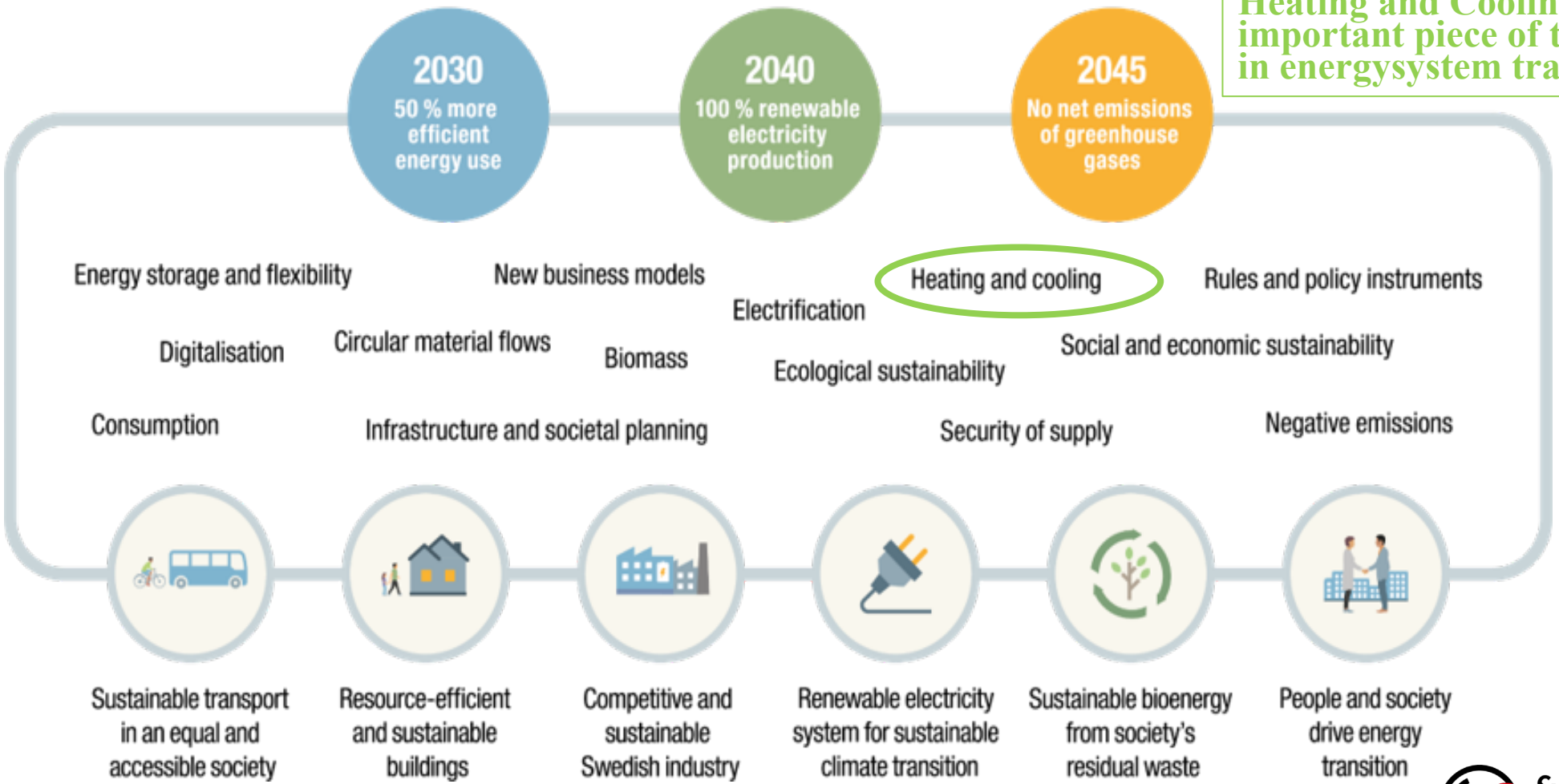
Källa: Energimyndigheten och Eurostat

Swedish Energy Agency

THE GLOBAL GOALS

Sweden shall be the world's first fossil-free welfare state

Heating and Cooling is an important piece of the puzzle in energysystem transition



Swedish Energy Agency

Climate targets

Sweden should have net zero emissions 2045,

and thereafter negative emissions.

Emissions (negative or positive) from land use, change use of land and forestry (LULUCF) not included.

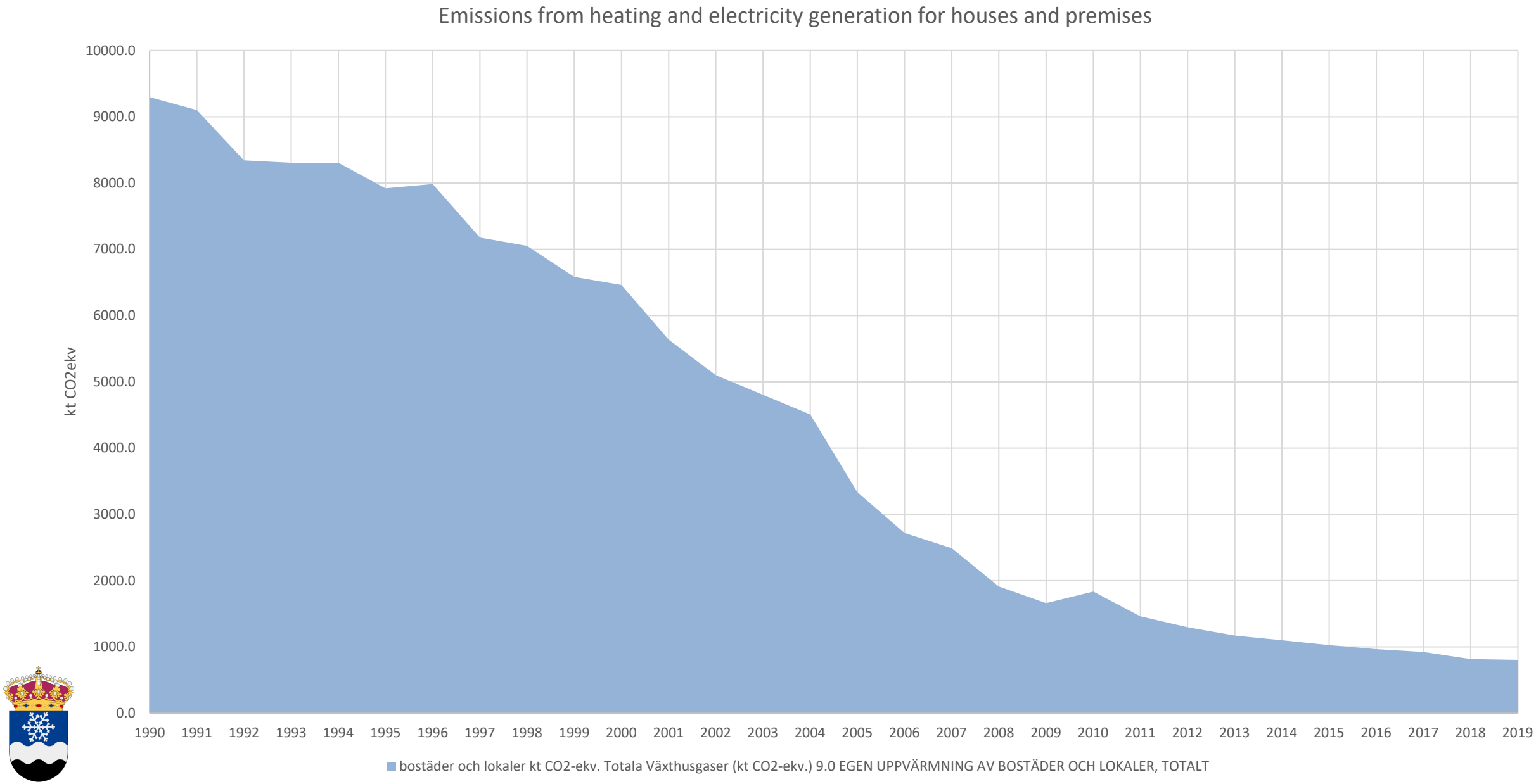
Climate impact – not so easy

Bio fuels CO_2 neutral

- The forest increases it mass
- The threes regrow

Bio fuels worse than fossil fuel in the short term

- More CO_2 is emitted / kWh
- Less CO_2 gets collected the years after deforestation
- The forest (and the soil) will increase it mass more without harvesting
- We don’t have 100+ years according to IPCC


Emissions from heating and electricity generation for houses and premises
kt CO2ekv
10000.0
9000.0
8000.0
7000.0
6000.0
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
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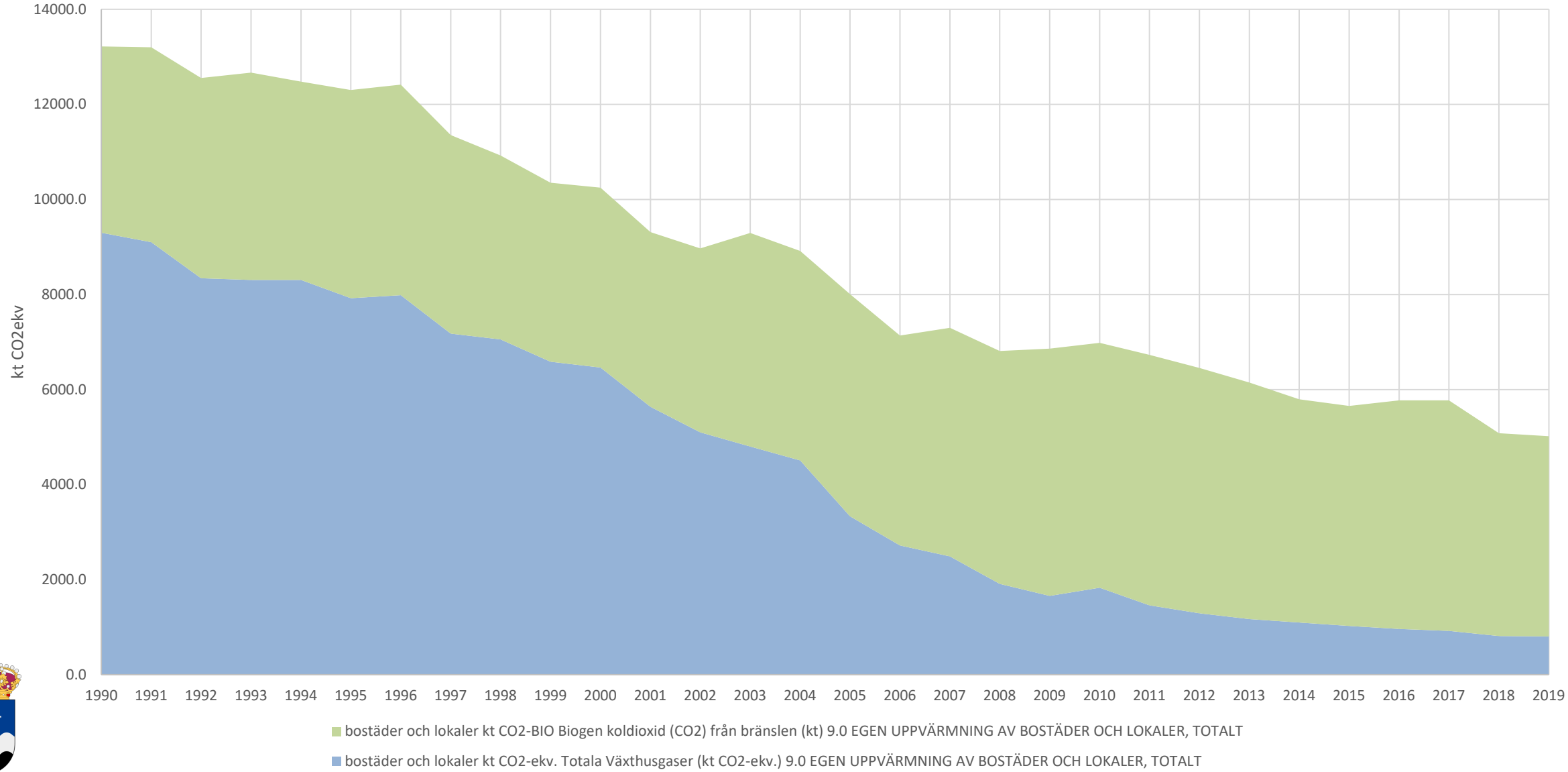
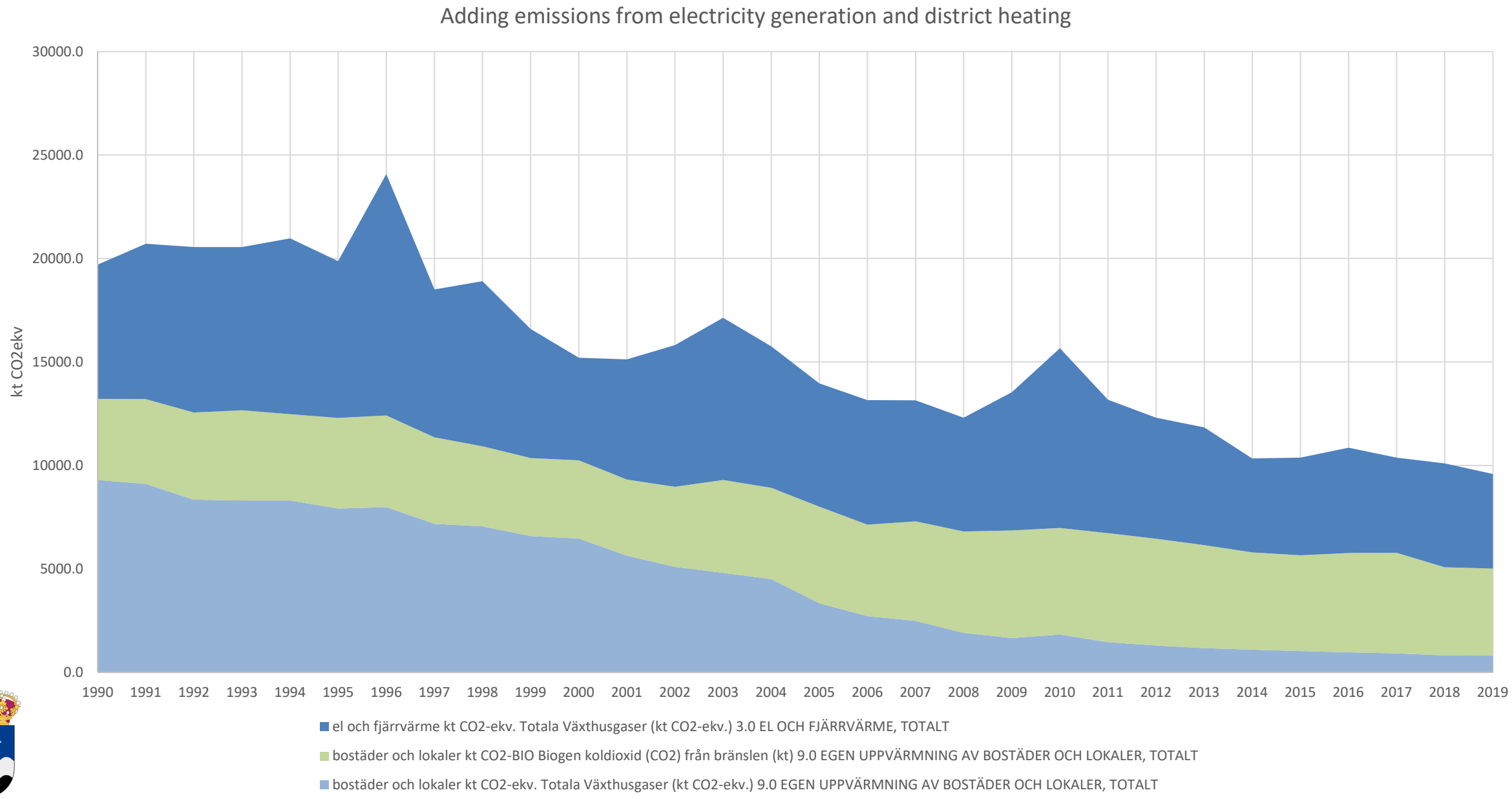
bostäder och lokaler kt CO2-ekv. Totala Växthusgaser (kt CO2-ekv.) 9.0 EGEN UPPVÄRMNING AV BOSTÄDER OCH LOKALER, TOTALT

Emissions from heating and electricity generation for houses and premises with bio CO_2




Adding emissions from electricity generation and district heating
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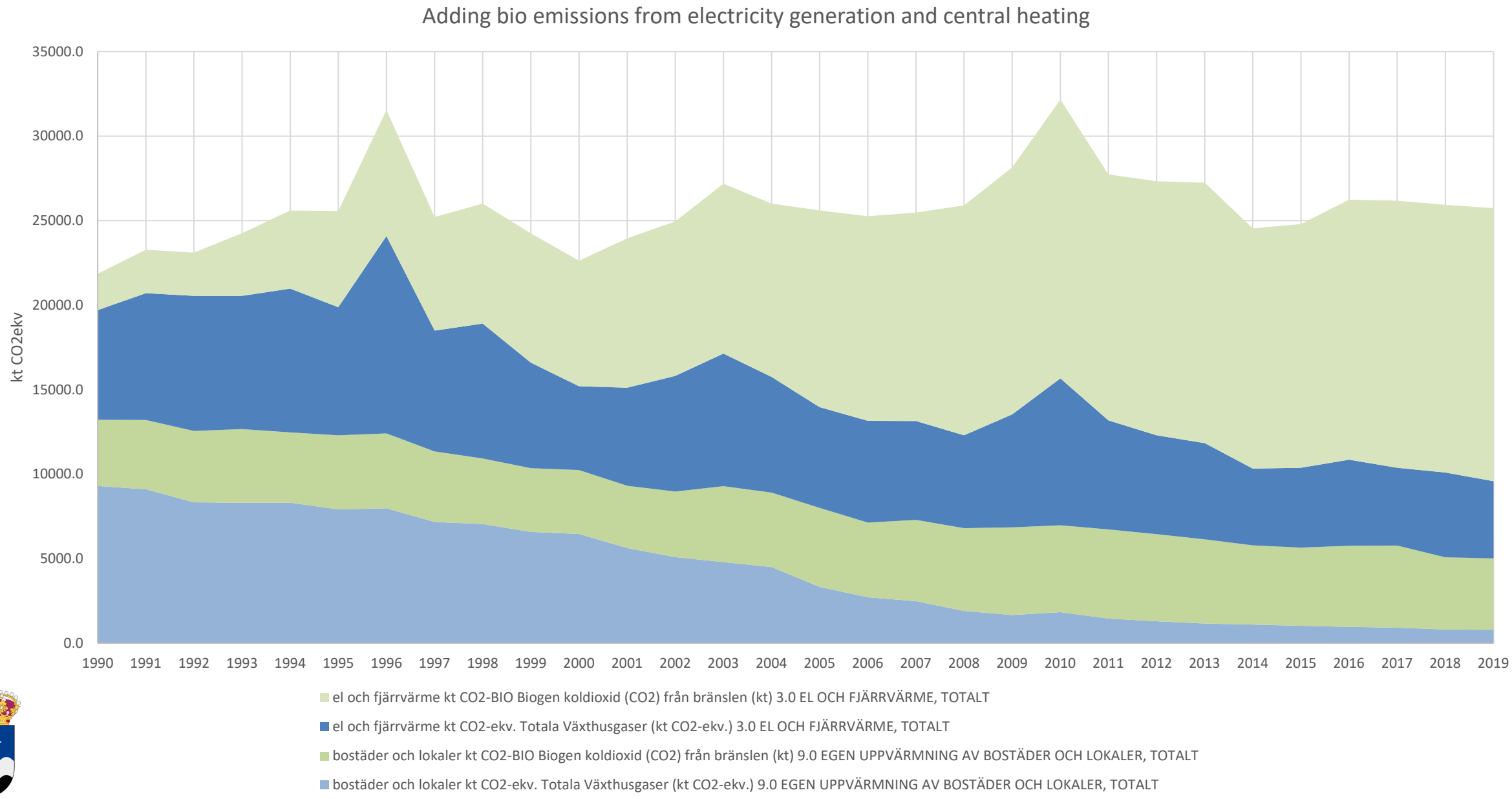
bostäder och lokaler kt CO2-BIO Biogen koldioxid (CO2) från bränslen (kt) 9.0 EGEN UPPVÄRMNING AV BOSTÄDER OCH LOKALER, TOTALT
bostäder och lokaler kt CO2-ekv. Totala Växthusgaser (kt CO2-ekv.) 9.0 EGEN UPPVÄRMNING AV BOSTÄDER OCH LOKALER, TOTALT


Adding bio emissions from electricity generation and central heating
kt CO2ekv
35000.0
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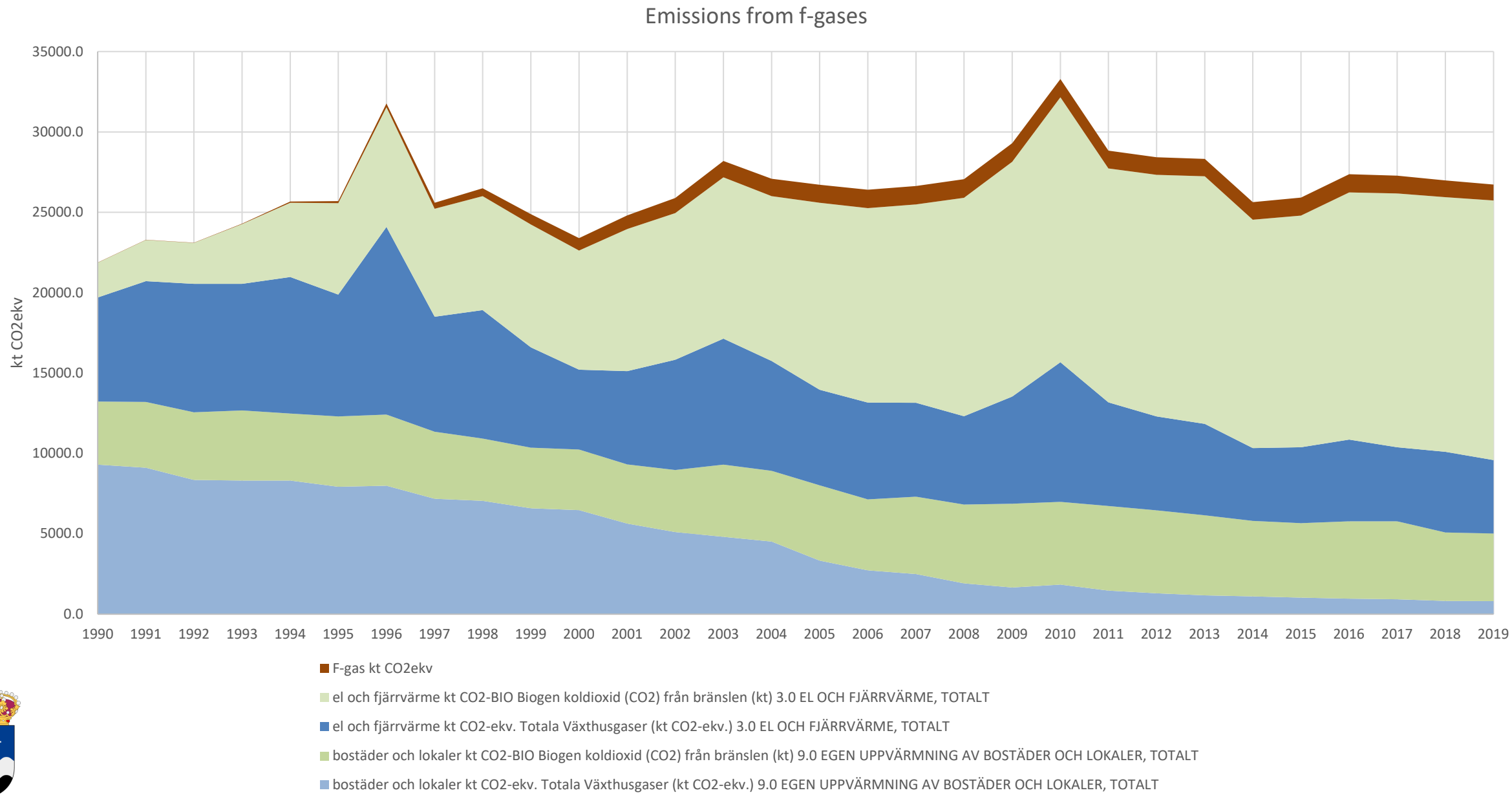
Emissions from f-gases
kt CO2ekv
35000.0
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25000.0
20000.0
15000.0
10000.0
5000.0
0.0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
F-gas kt CO2ekv
el och fjärrvärme kt CO2-BIO Biogen koldioxid (CO2) från bränslen (kt) 3.0 EL OCH FJÄRRVÄRME, TOTALT
el och fjärrvärme kt CO2-ekv. Totala Växthusgaser (kt CO2-ekv.) 3.0 EL OCH FJÄRRVÄRME, TOTALT
bostäder och lokaler kt CO2-BIO Biogen koldioxid (CO2) från bränslen (kt) 9.0 EGEN UPPVÄRMNING AV BOSTÄDER OCH LOKALER, TOTALT
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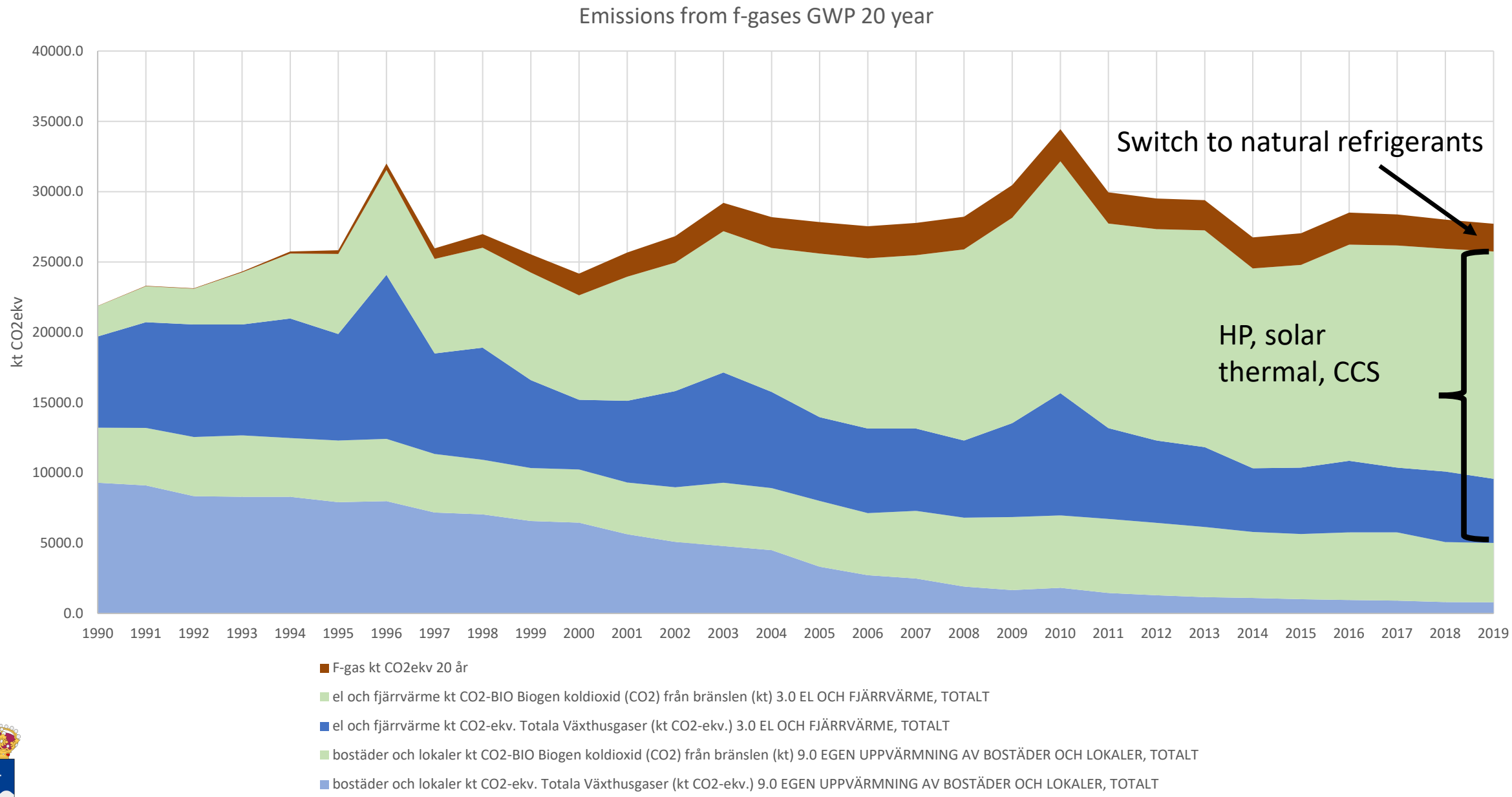
Emissions from f-gases GWP 20 year
kt CO2ekv
40000.0
35000.0
30000.0
25000.0
20000.0
15000.0
10000.0
5000.0
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Switch to natural refrigerants
HP, solar thermal, CCS
F-gas kt CO2ekv 20 år
el och fjärrvärme kt CO2-BIO Biogen koldioxid (CO2) från bränslen (kt) 3.0 EL OCH FJÄRRVÄRME, TOTALT
el och fjärrvärme kt CO2-ekv. Totala Växthusgaser (kt CO2-ekv.) 3.0 EL OCH FJÄRRVÄRME, TOTALT
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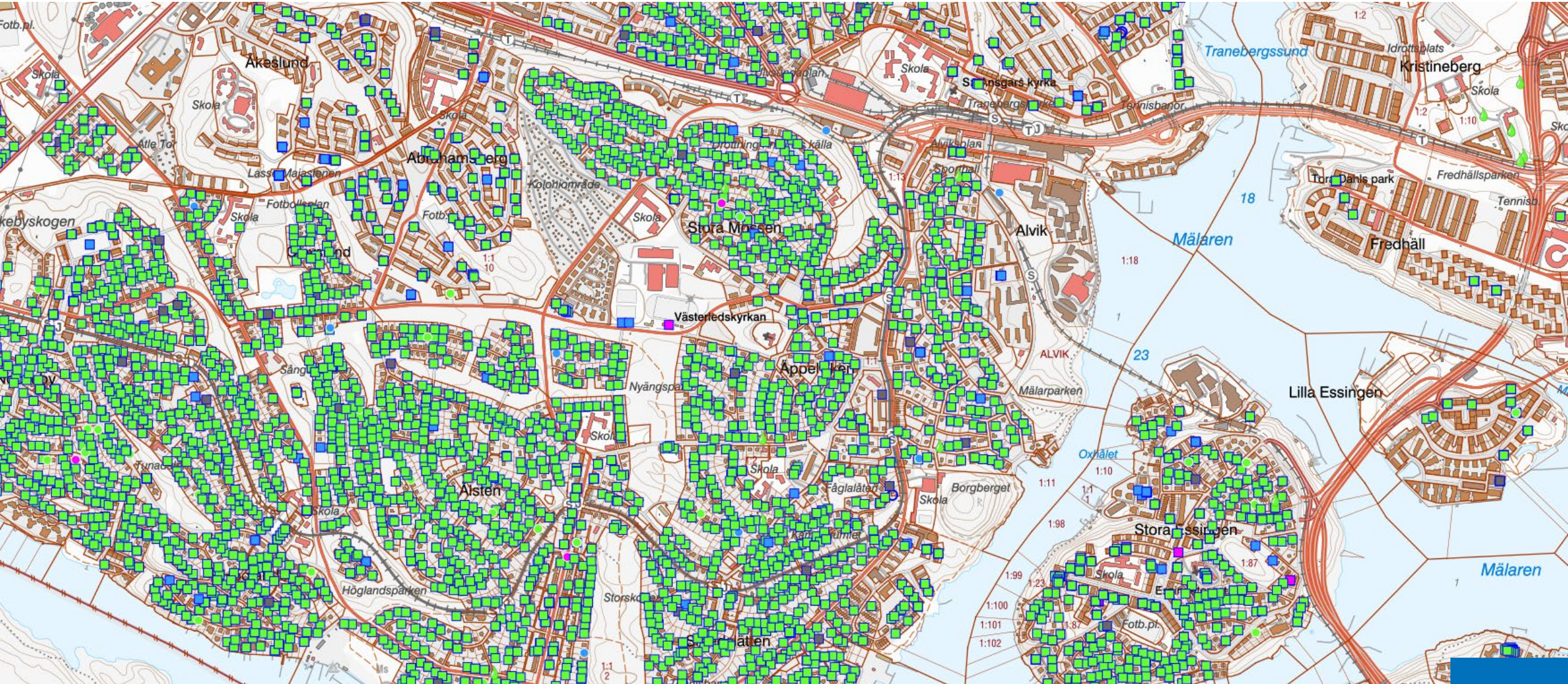
bostäder och lokaler kt CO2-ekv. Totala Växthusgaser (kt CO2-ekv.) 9.0 EGEN UPPVÄRMNING AV BOSTÄDER OCH LOKALER, TOTALT

Market

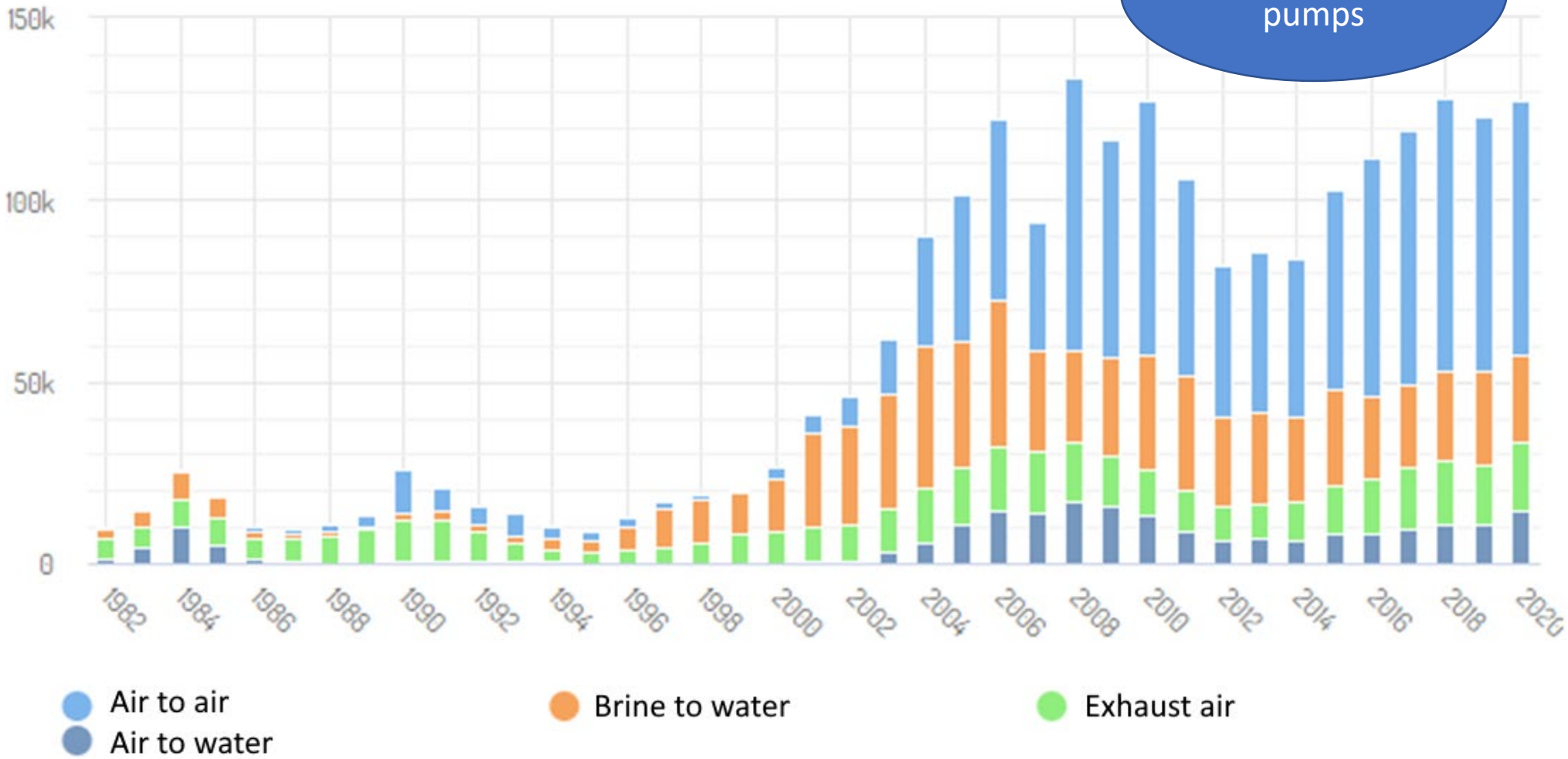
Some statistics

HP market in Sweden



Heat pump sale 1982 - 2020

1,5 million heat pumps



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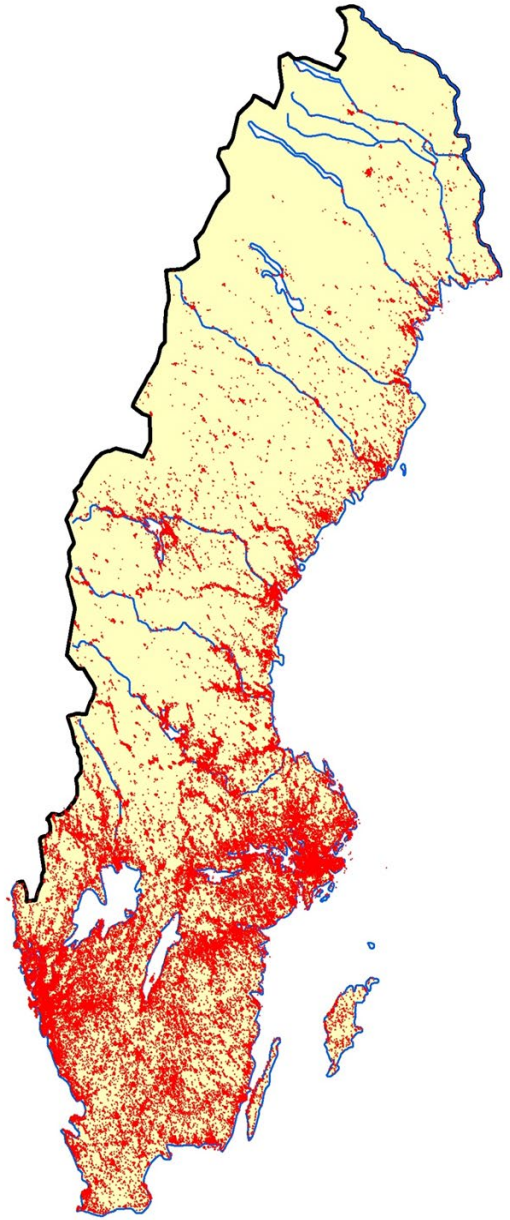
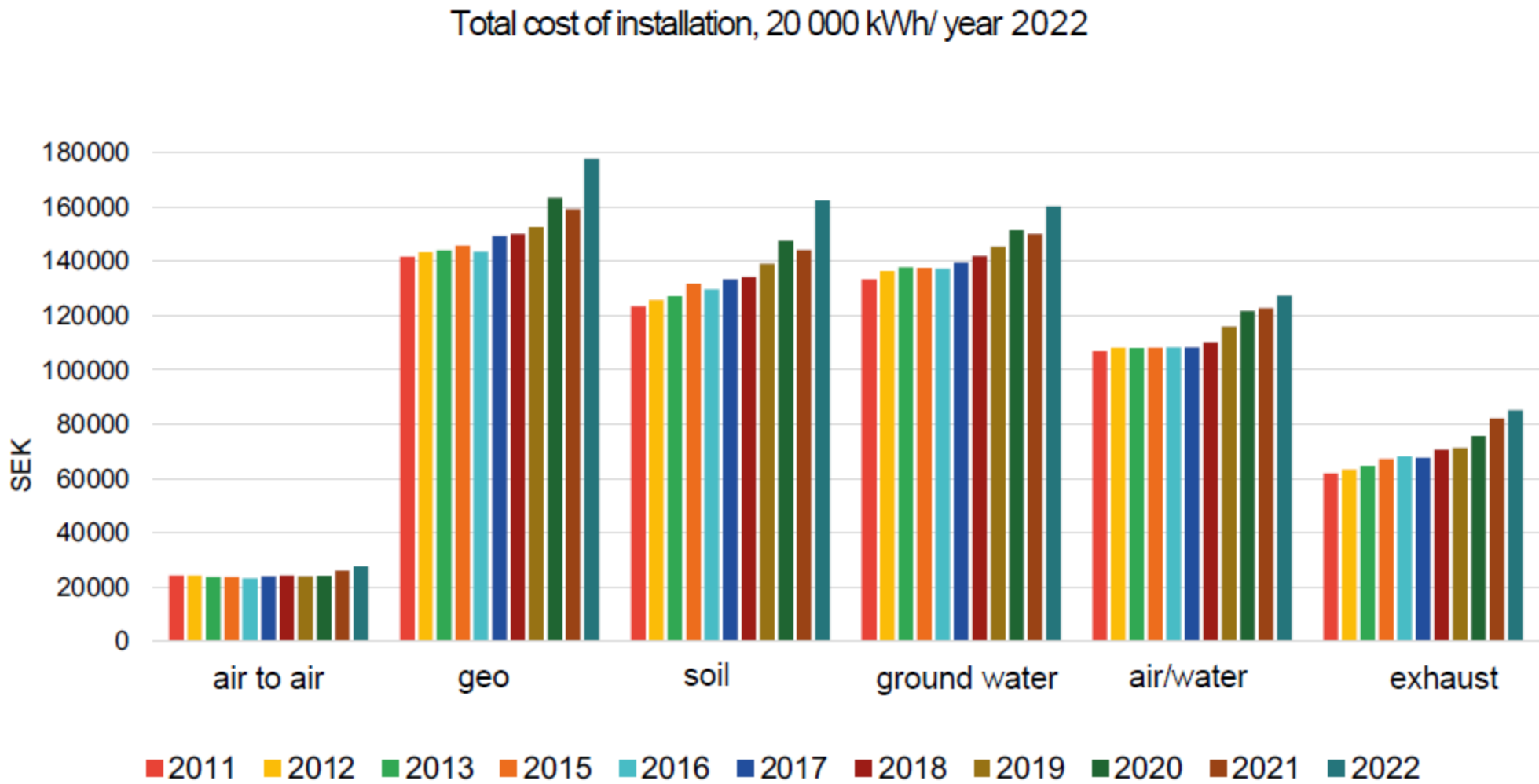
Ground source HP

- 2 M single family houses
- ~400 000 GSHP
- The typical domestic GSHP is a 5-10 kW





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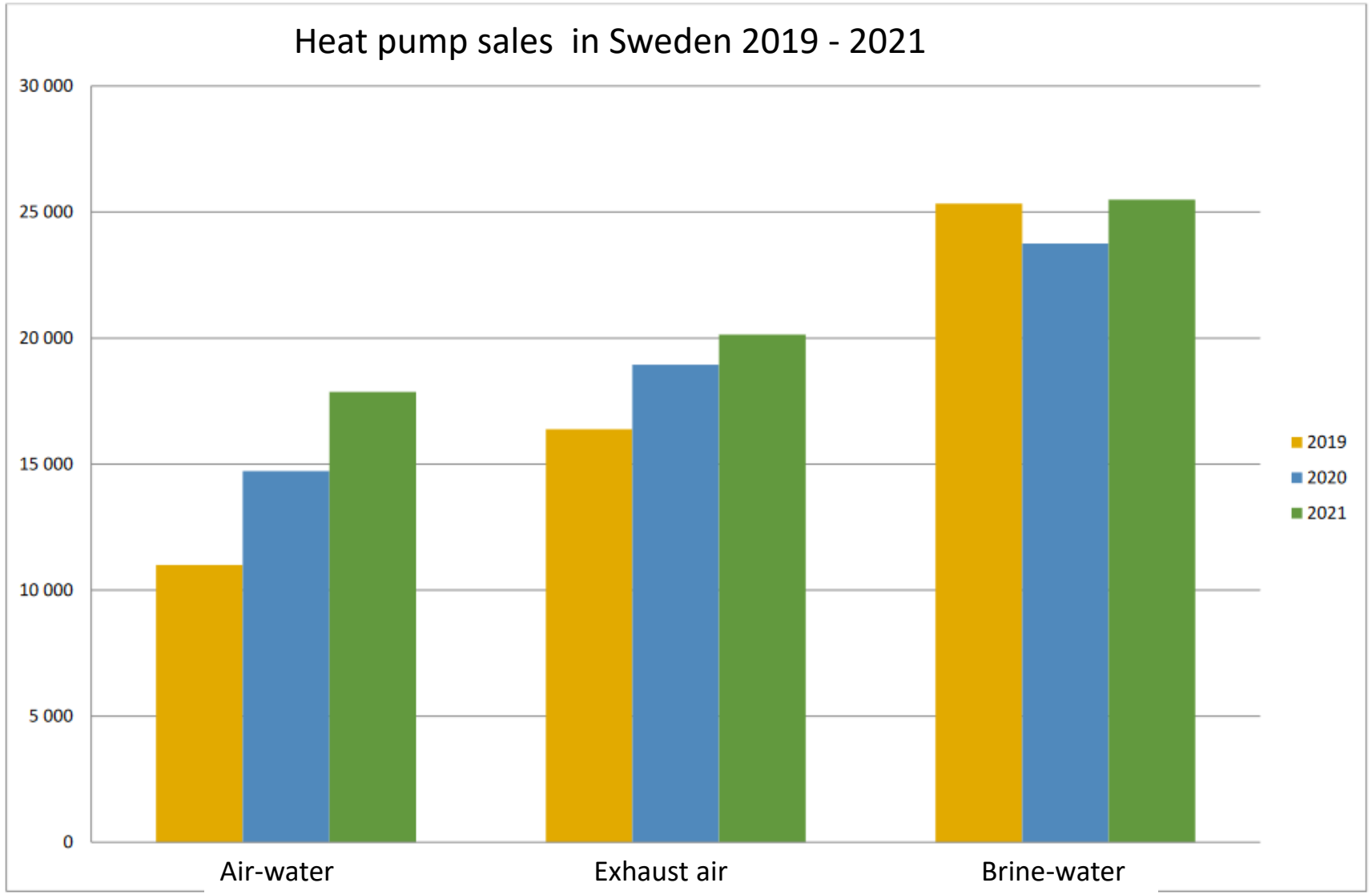
FÖRENINGEN



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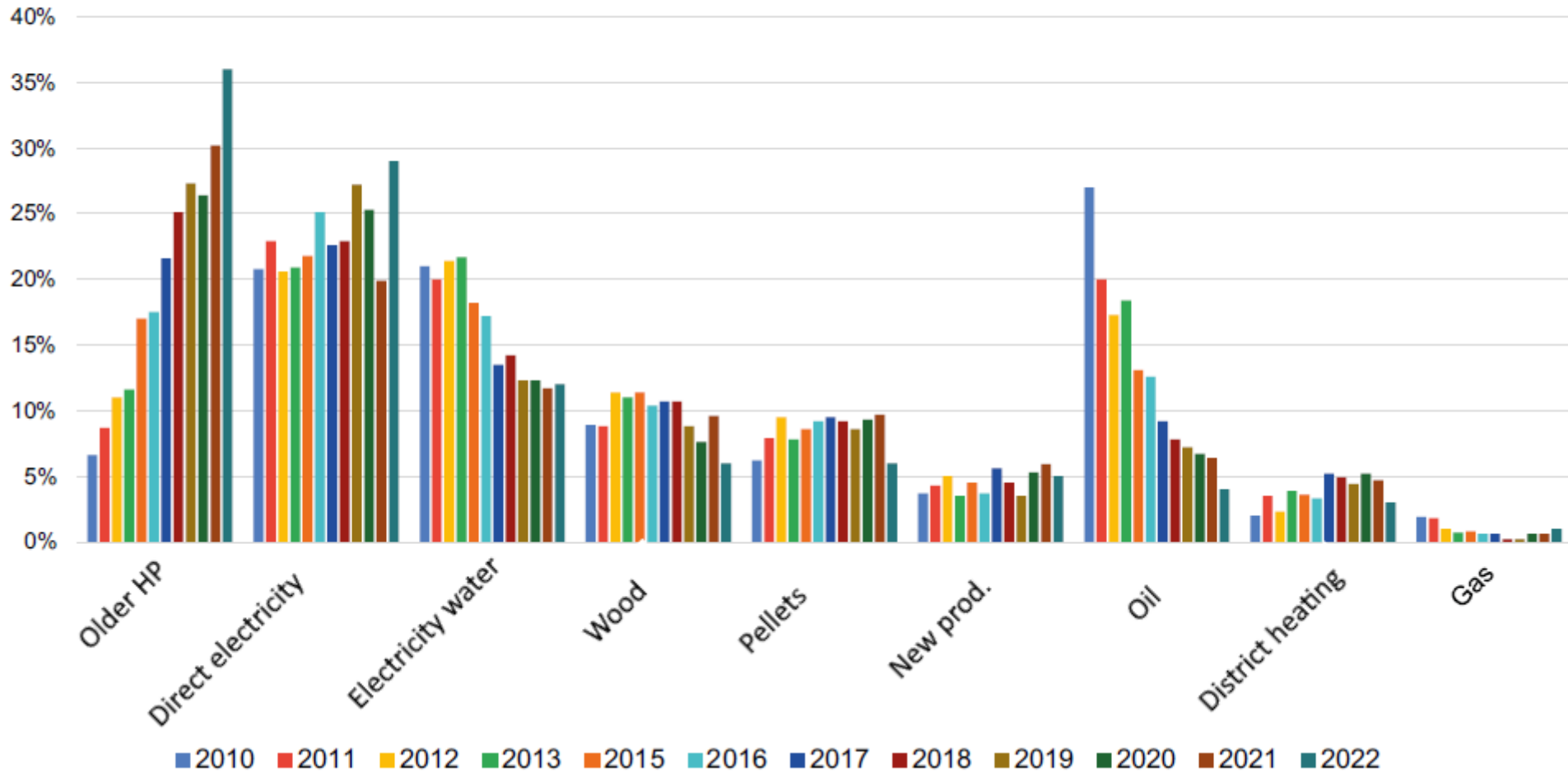
FÖRENINGEN

Which heating system did the installation replace



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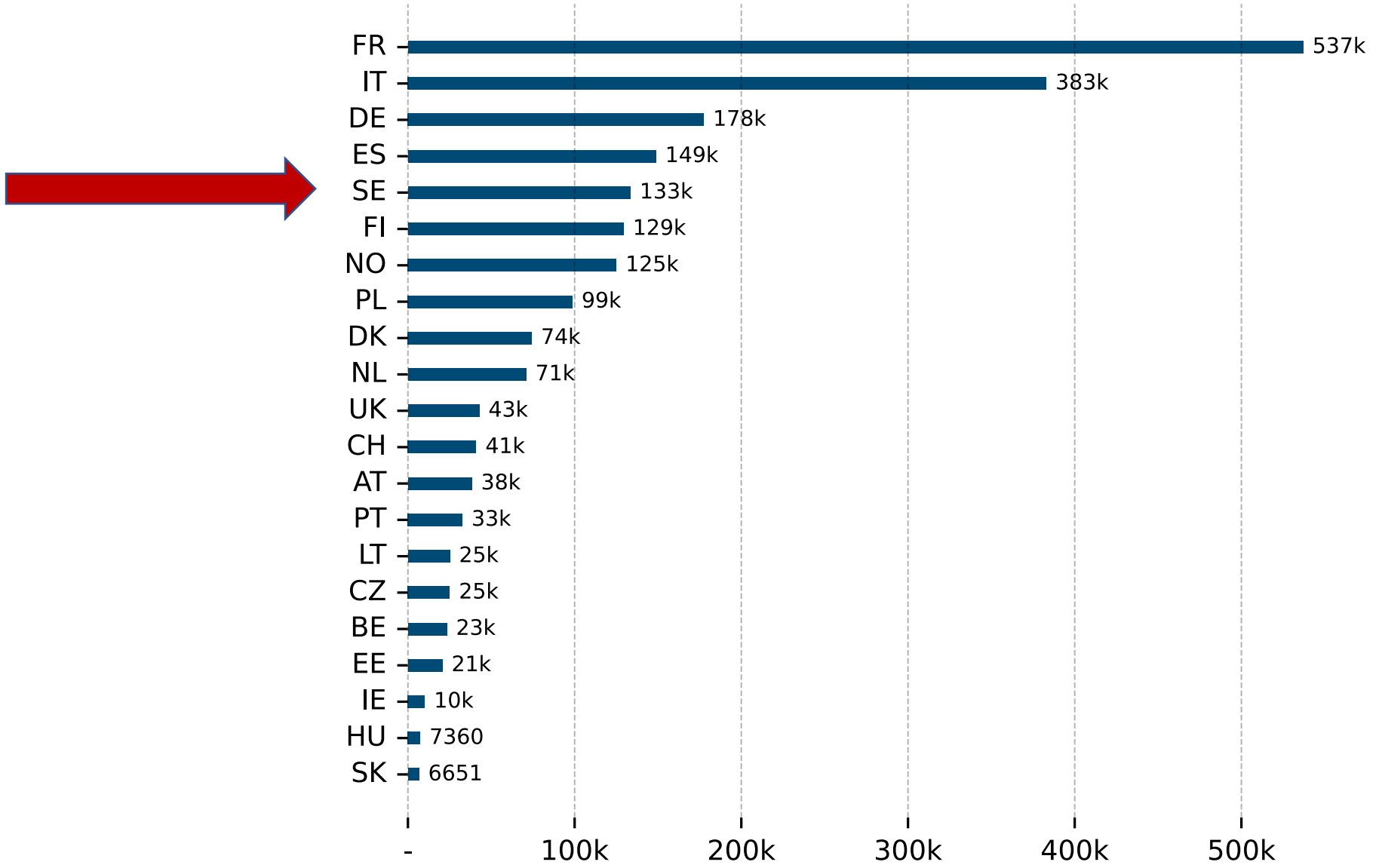
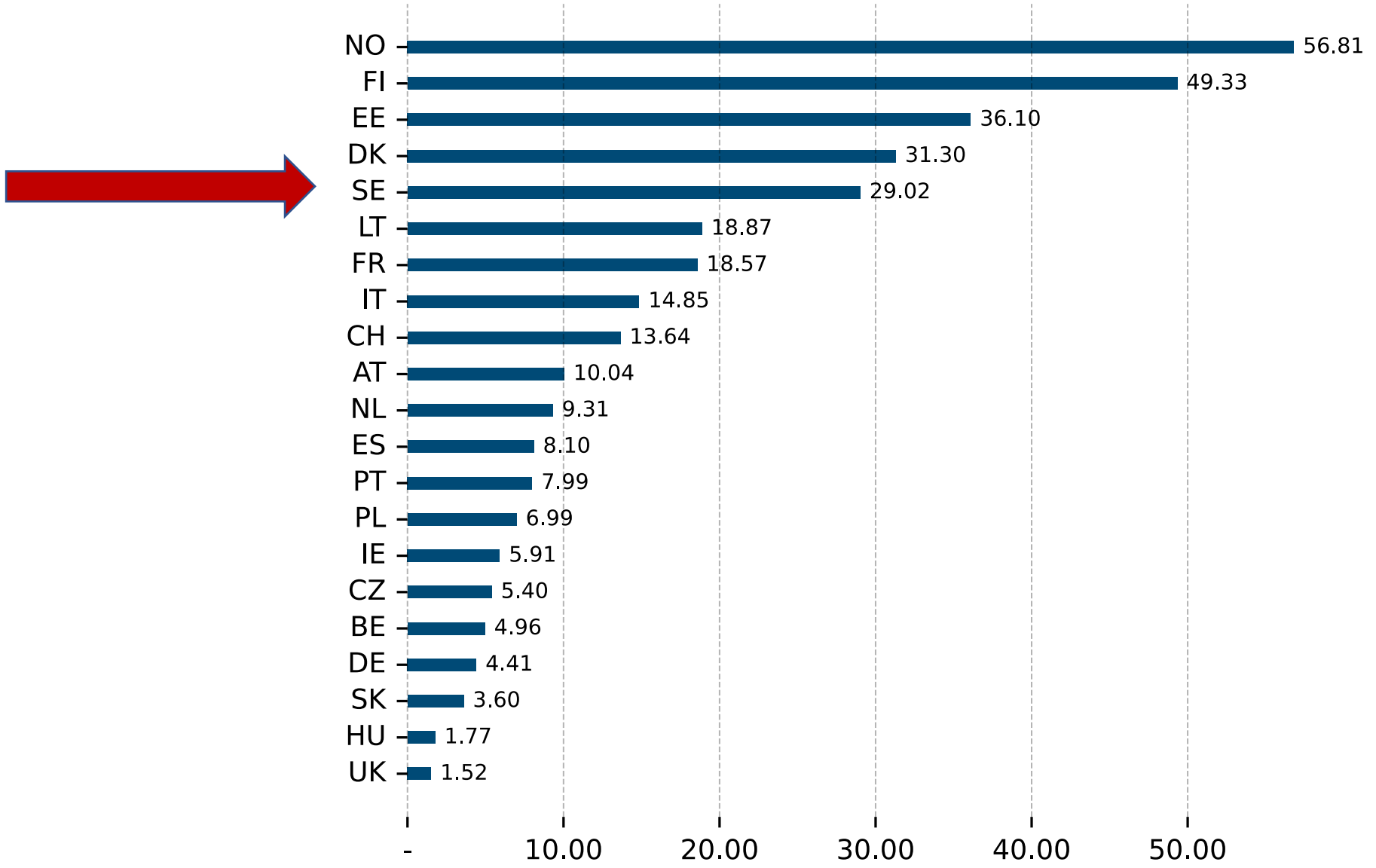
FÖRENINGEN

Sales of heat pumps in 2021 | by country



stats.ehpa

Heat pump sales 2021 per 1 000 households



stats.ehpa

Research & Innovation

With a focus on Refrigeration and Heat pumps

Nutek – alternative refrigerants 1994-96

Driven by the phase out of ozone depleting substances

- Work with flammable refrigerants (Hydro carbons)
- Low charge
- Brazed plate heat exchangers

Swedish Energy Agency

Swedish Energy Agency - Effsys programs 1997 - 2018

- A broadening of focus from components to systems
- Supported academia, the industry and the energy system to be where it is today
- High level of expertise of
  - thermal systems
  - Natural refrigerants
- Funding private and public partnership

Swedish Energy Agency

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Energy agency – Termo 2017

Research and innovation of thermal systems

- Refrigeration, Heat Pumps, Storage, Solar and District heating
- System view of total energy system
- Environmental changes
- termoinnovation.se/

- Innovation cluser “Varmt & Kallt” focal point for RoI
  - refrigeration & heat pumps
  - geothermal system
  - varmtochkallt.se

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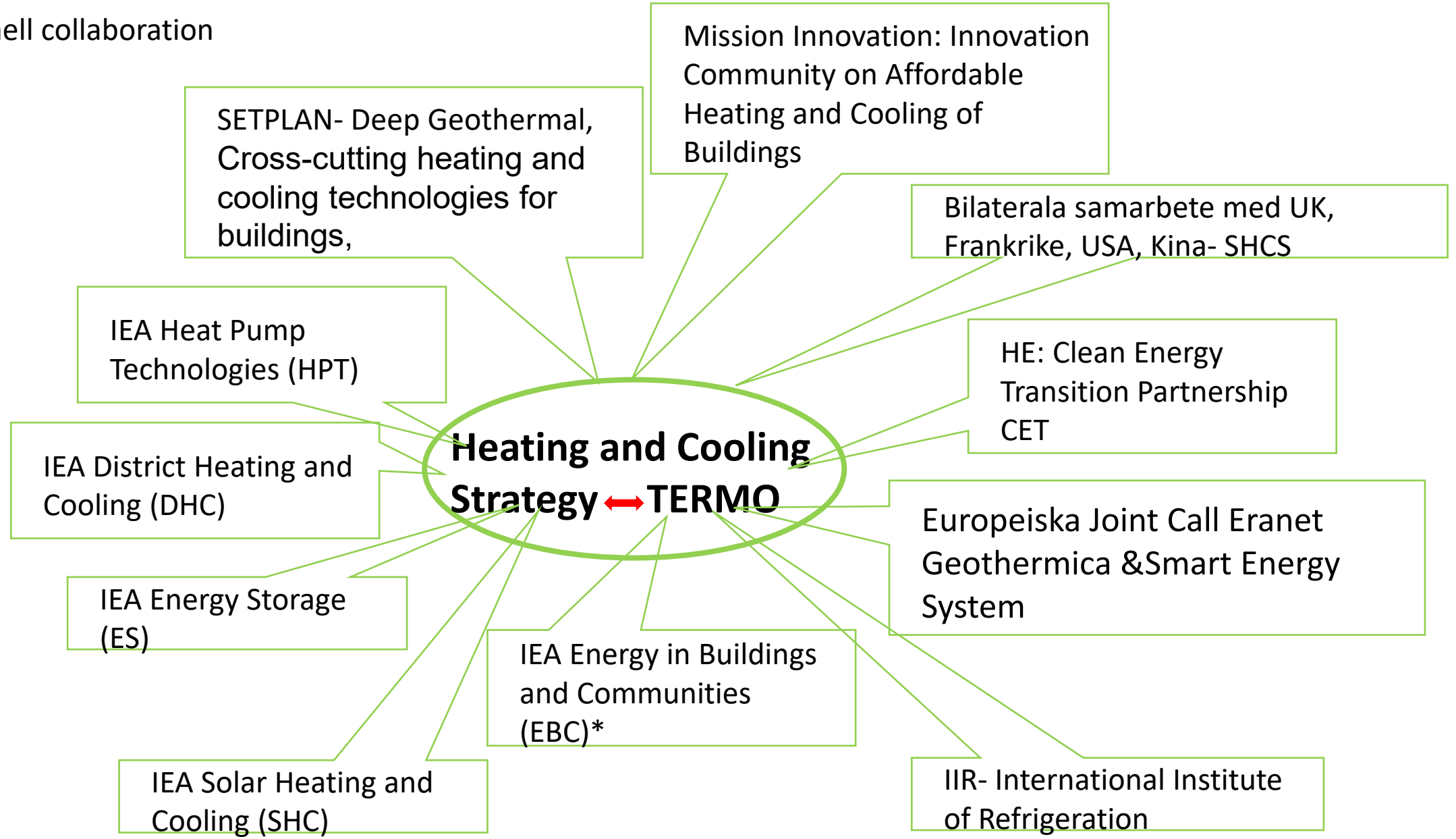
Internationell collaboration



*Funding by E2B2 Program

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Annexes in HPT TCP

ADVANCED COOLING/ REFRIGERATION TECHNOLOGIES DEVELOPMENT	53	CN, DE, IT, KR, US
HEAT PUMP SYSTEMS WITH LOW GWP REFRIGERANTS	54	AT, DE, FR, IT, JP, KR, SE, US
INTERNET OF THINGS FOR HEAT PUMPS	56	AT, CH, DE, DK, FR, NO, SE
FLEXIBILITY BY IMPLEMENTATION OF HEAT PUMPS IN MULTI-VECTOR ENERGY SYSTEMS AND THERMAL NETWORKS	57	AT, DK, DE, FR, NL, SE
HIGH-TEMPERATURE HEAT PUMPS	58	AT, BE, CA, CH, DE, DK, FR, NL, NO, JP
HEAT PUMPS FOR DRYING	59	AT, CN, DK
RETROFIT HEAT PUMP SYSTEMS IN LARGE NON-DOMESTIC BUILDINGS	60	UK, IT
HEAT PUMPS IN POSITIVE ENERGY DISTRICTS	61	CH, DE, JP, US




Thank you !

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