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
Sweden

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
Average January
1961-1990

Difference 1991-2020
2019

Share from heat pumps?

We estimate 28 – 35 TWh
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.
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, forestry, fishing and construction.
Energy prices for households from 1970, including taxes and VAT, in 2019 price levels, öre/kWh

Sources: The Swedish Energy Agency, Statistics Sweden (Sve), 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
Climate impact

Heating and cooling
Nationella energipolitiska mål till 2020, 2030 och 2040

De energipolitiska målen till 2020 beslutades av riksdagen 2009.  

- Andelen förnybar energi ska 2020 utgöra minst 50 procent av den totala energianvändningen.
- Andelen förnybar energi i transportsektorn ska 2020 vara minst 10 procent.

- Sverige ska år 2030 ha 50 procent effektivare energianvändning jämfört med 2005.

- Målet är 2040 är 100 procent förnybar elproduktion. Detta är ett mål, inte ett stoppdatum som förbjuder kärnkraft.

Sveriges energipolitiska mål till 2020, 2030 och 2040
Målen för 2020 överstegs

Källa: Energimyndigheten och Eurostat
Heating and Cooling is an important piece of the puzzle in energysystem transition.
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

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 CO₂
Adding emissions from electricity generation and district heating

- **Electricity and District Heating (kt CO2-ekv.):** 3.0
- **Own Heating of Apartments and Premises (kt CO2-ekv.):** 9.0

Total Greenhouse Gases (kt CO2-ekv.):

- **Electricity and District Heating:** 20000.0
- **Own Heating of Apartments and Premises:** 10000.0

Yearly emissions from 1990 to 2019.
Adding bio emissions from electricity generation and central heating

- El och fjärrvärme: Biogen koldioxid (CO2) från bränslen (kt) 3.0
- Egen uppvärmning av bostäder och lokaler: Totala Växthusgaser (kt CO2-ekv.) 9.0

Graph shows the trend from 1990 to 2019.
Market

Some statistics
HP market in Sweden
Heat pump sale 1982 - 2020

1.5 million heat pumps
Ground source HP

- 2 M single family houses
- ~400 000 GSHP
- The typical domestic GSHP is a 5-10 kW
Which heating system did the installation replace

- Older HP
- Direct electricity
- Electricity water
- Wood
- Pellets
- New prod.
- Oil
- District heating
- Gas

Year: 2010 - 2022
Sales of heat pumps in 2021 | by country

- FR: 537k
- IT: 383k
- DE: 178k
- ES: 149k
- SE: 133k
- FI: 129k
- NO: 125k
- PL: 99k
- DK: 74k
- NL: 71k
- UK: 43k
- CH: 41k
- AT: 38k
- PT: 33k
- LT: 25k
- CZ: 25k
- BE: 23k
- EE: 21k
- IE: 10k
- HU: 7360
- SK: 6651
Heat pump sales 2021 per 1,000 households

<table>
<thead>
<tr>
<th>Country</th>
<th>Sales per 1,000 households</th>
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<tbody>
<tr>
<td>NO</td>
<td>56.81</td>
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<tr>
<td>FI</td>
<td>49.33</td>
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<td>HU</td>
<td>1.77</td>
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<tr>
<td>UK</td>
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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 - 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
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
Heating and Cooling Strategy → TERMO

- SETPLAN- Deep Geothermal, Cross-cutting heating and cooling technologies for buildings,
- IEA Heat Pump Technologies (HPT)
- IEA District Heating and Cooling (DH)
- IEA Energy Storage (ES)
- IEA Solar Heating and Cooling (SHC)
- IEA Energy in Buildings and Communities (EBC)*
- Mission Innovation: Innovation Community on Affordable Heating and Cooling of Buildings
- Bilateral samarbete med UK, Frankrike, USA, Kina- SHCS
- HE: Clean Energy Transition Partnership CET
- Europeiska Joint Call Eranet Geothermica &Smart Energy System
- IIR- International Institute of Refrigeration

*Funding by E2B2 Program
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<td>UK, IT</td>
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Thank you!

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