European Technology and Innovation Platform on Renewable Heating and Cooling

Nordic and Baltic perspectives on achieving renewable heating and cooling – A roundtable

25th September, 2025
10:00-12:00

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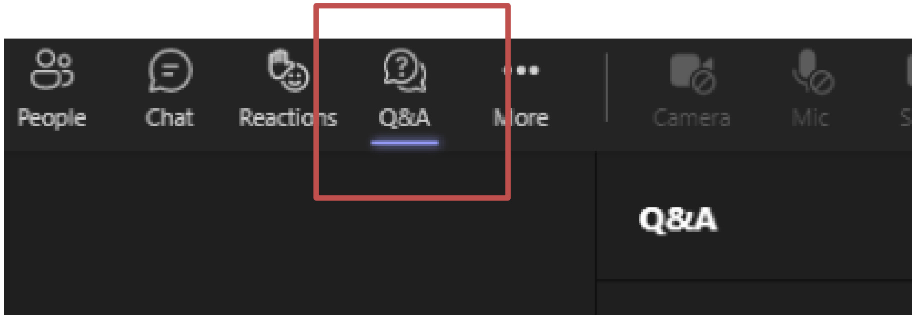
Leonie Kuhlmann,
Policy Officer at EGEC

Moderator

Agenda

- Welcome
- *Presentation of RHC and information on funding opportunities* – Andrej Misech (EUREC/RHC-ETIP)
- *Nordic Power Market Outlook and heat electrification* – Alexander Esser (Aurora Energy Research)
- Technology Expert Presentations:
    - Solar Thermal: *PVT-panels: 6 times more energy from the rooftops and maximum self-consumption & energy classification* – Marcus Kanewoff (DualSun Nordic)
    - Geothermal: *Estonian medium-deep geothermal energy pilot projects* – Helena Gailan (Geological Survey of Estonia)
    - Heat Pumps – Rolf Iver Mytting Hagemoen (Norwegian Heat Pump Association)
    - District Heating in Denmark – Birger Lauersen (Danish District Heating Association)
- Q&A

Teams Webinar Platform Interactions



Andrej Misch,

Project Manager at EUREC

Presentation of RHC and information on funding opportunities

What is the RHC-ETIP Platform?

- Founded in 2008 and **recognised as an ETIP by the European Commission** in 2016
- Stakeholders from the **biomass, geothermal, solar thermal, district heating** and **heat pump** sectors
- Common **strategy** for increasing the use of renewable energy technologies for heating and cooling
- Renewable energy technologies for heating and cooling are **safe**, **clean**, **efficient** and **increasingly cost-competitive**
- **Societal benefit** from the increasing contribution of renewable heating and cooling to the EU
- **Combining** improved and new technologies, innovation and development as well as policy, funding and pilot projects

SCAN ME!

RHC-ETIP overview

Representing research and industry of heating & cooling technologies in Europe:

- Solar thermal
- Biomass
- Geothermal
- Heat pumps
- District Heating & Cooling, Thermal storage

RHC-ETIP's work is structured in solutions-oriented horizontal working groups:

- 100% RE Cities
- 100% RE Districts
- 100% RE Buildings
- 100% RE Industries
- SSH-HWG

What are the Goals?

- Develop working **relationships** with other relevant national and regional platforms
- Establish and update **Strategic Research and Innovation Agendas** per technology area, from basic research to market uptake, identifying priorities in the short, medium and long term
- Identify **priorities** of cross-cutting nature: e.g., education & training, socio-economics aspects, international cooperation
- Identify **innovation barriers**, notably those related to regulation and financing
- Report on **the implementation of R&I activities** at European, national and industrial levels

The RHC Projects Database

- *Objective*: Track past and ongoing projects in the area of renewable heating and cooling
- Focus on those which are funded at EU level
- Whenever possible, the projects's results will also be presented

SCAN THE RHC PROJECTS DATABASE!

The RHC Accelerator Platform

- Bridging the gap between research projects and market-ready solutions
- Database of research projects seeking expert assistance and a directory of investors and experts who want to support project developers

- **If you are an expert of one of our renewable heating and cooling solution or an investment company, please have a look:**

SCAN ME!

Repository of funding schemes

- Direct access to:
  - EU funding schemes catalogue
  - National funding schemes dataset

- Horizon Europe
- LIFE Programme (LIFE Clean Energy Transition)
- Innovation Fund
- The European Investment Bank
- Just Transition Fund (JTF)
- European Energy Efficiency Fund (EEEF)
- Interreg Programme
- Eureka Network
- URBACT Programme
- Urban Innovative Actions (UIA)
- European Spatial Planning Observation Network (EPSON)
- EIT InnoEnergy
- Smart Energy Systems ERA-Net (SES ERA-Net)
- Connecting Europe Facility (CEF)
- InvestEU
- Modernisation Fund
- Recovery and Resilience Facility

National portals for eight EU funds

The national portals are websites set up by Member States to inform citizens about the implementation of Union funds in their countries during the 2021-2027 funding period. Each country has its own national website portal, which covers implementation of

- European Regional Development Fund (ERDF)
- European Social Fund Plus (ESF+)
- Cohesion Fund (CF)
- Just Transition Fund (JTF)
- European Maritime, Fisheries and Aquaculture Fund (EMFAF)
- Asylum, Migration and Integration Fund (AMIF)
- Internal Security Fund (ISF)
- Instrument for Financial Support for Border Management and Visa Policy (BMVI)

- INVENTORY OF FUNDING INSTRUMENTS
- EU FUNDING OVERVIEW
- UP2EUROPE
- NATIONAL SINGLE PORTALS

Repository of funding schemes

- Direct access to:
  - EU funding schemes catalogue
  - National funding schemes dataset

EU-27 Financing Schemes for Decarbonising Buildings, Heating, and Cooling.

→ The comprehensive dataset, "EU-27 Country Mapping of Financing Schemes to Decarbonise Buildings, Heating, and Cooling," provides a detailed, multi-level overview of public and private financing schemes across the EU-27, aimed at supporting building decarbonisation efforts at the European, national, and local levels.

→ The mapping includes financing schemes across key sectors: building envelope, heating and cooling efficiency, renewable energy for heating and cooling, space cooling, district heating and cooling (DHC), and geothermal district heating and cooling (geoDHC).

→ For each scheme, you'll find the original title (with English translation), sector-specific details, descriptions, and direct application links.

[Reference: Conforto Giulia, Marcus Hummel e al., 2024, "EU-27 Country Mapping of Financing schemes to decarbonize Buildings, Heating and Cooling": https://zenodo.org/records/13332217.]

ID	Country	Level	Region	City	Scheme Name (EN)	Scheme Name (local)	Building Eff	H&C Eff	H&C RES	DHC	Geo DHC	Cooling	Residential	Non-Residential	Scheme Type	Main Link	Other Links	Start-End Year	Description
129	Finland	National			Building Renovations Tax Deduction for Households	Kotitalousvähennys	Y	Y	Y	(Y)	(Y)	Y	Y		Tax Incentives	https://www.vero.fi/henkilo		2022-2027	Funding is offered through building renovation tax providing up to €2,250 per year for maintenance an that enhance energy efficiency. Households can re oil-heating systems.
130	Finland	National			Building Renovations Tax Deduction for housing corporations	Asuintalovaraus asunto-osakeyhtiön tuloverotuksessa	Y	Y	Y			Y	Y	Y	Tax Incentives	https://www.vero.fi/yritykse		2019-ongoing	Funding is offered through building renovation tax corporations, with some limitations applying to res
131	Finland	National			Business development aid	Yrityksen kehittämisavustus	Y	Y	Y	Y	Y	Y		Y	Grant/Subsidy	https://rakennerahastot.fi/e		2014-ongoing	Funding is offered by the Centres for Economic Dev Environment as business development aid for com investment projects. This aid is sourced from the E Fund (ERDF) under the Innovation and Skills in Finl Structural Policy Programme. Eligible projects must programme's special objectives and meet specific development aid, with further details available reg
132	Finland	National			Energy aid	Energiatuki	Y	Y	Y	Y	Y	Y	Y	Y	Grant/Subsidy	https://tem.fi/	https://www	2022-ongoing	Funding is offered through the energy aid program projects, studies, and audits on renewable energy Finland. The programme supports projects aimed a 2035 carbon neutrality targets, focusing on reducin associated with new technologies. Aid is granted f implemented without it and covers renewable ene efficient energy use, waste heat recovery, and ene

Repository of funding schemes

Further funding-related information:

- Database of investors relevant for RHC technologies
- Database of (business) experts in RHC technologies
- Insight into RHC-related EU legislation
- National Contact Points Directory
- Database of RHC projects
- Success stories

The accelerator is being established and more information will be gradually added

RHC Accelerator

Thank you!

Project partners

EUREC The Association of European Renewable Energy Research Centres

EGEC GEOTHERMAL

Solar Heat Europe ESTIF

Euroheat & Power

ehpa european heat pump association

WIP RENEWABLE ENERGIES

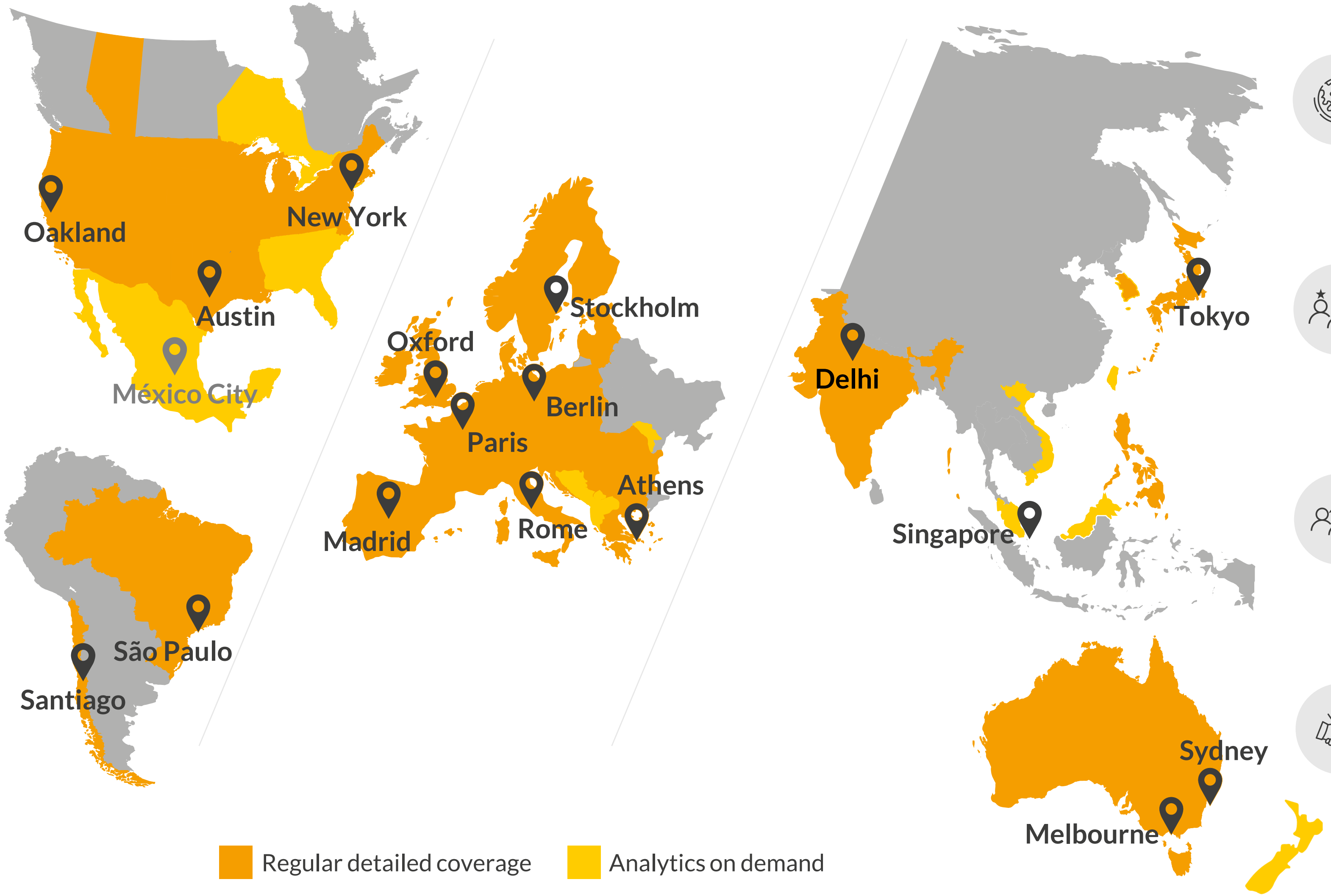
AURORA
ENERGY RESEARCH

Nordic Power Market Outlook

Alexander Esser
Head of Nordics & Baltics
25 September 2025

Aurora provides market leading forecasts & data-driven intelligence for the global energy transition

- Power markets
- Renewables & PPAs
- Storage
- Grid & Congestion
- Electric vehicles
- Hydrogen (H_2)
- Carbon (CO_2)
- Natural gas



17 offices

900+ market experts

950+ subscribing companies

150+ transactions supported in 2024

Source: Aurora Energy Research

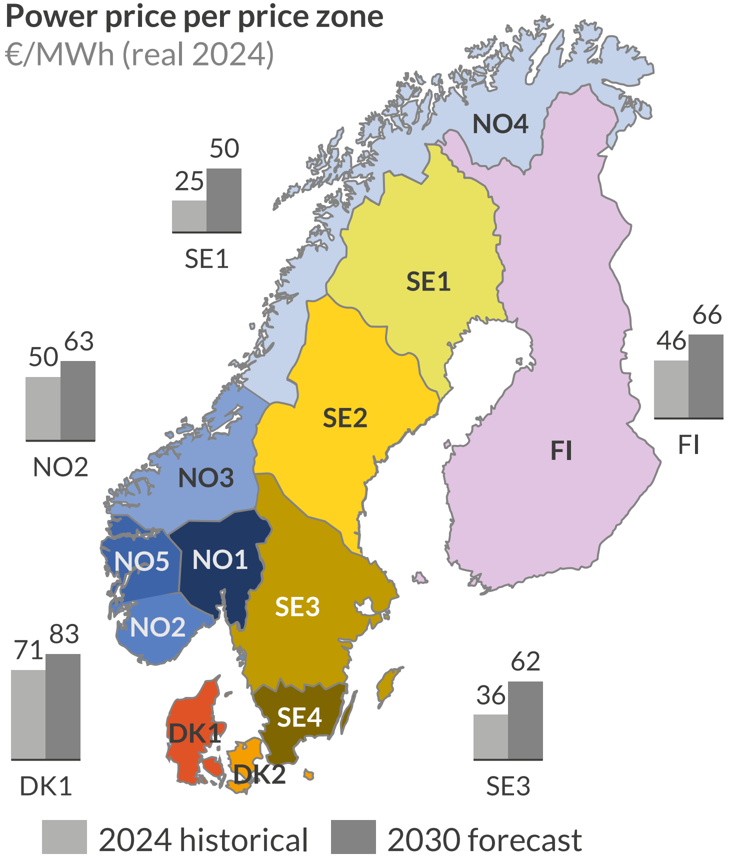
Nordics power market at a glance

Market overview

The Nordic power market consists of twelve price zones with price differences due to transmission constraints.

We expect a convergence by 2030.

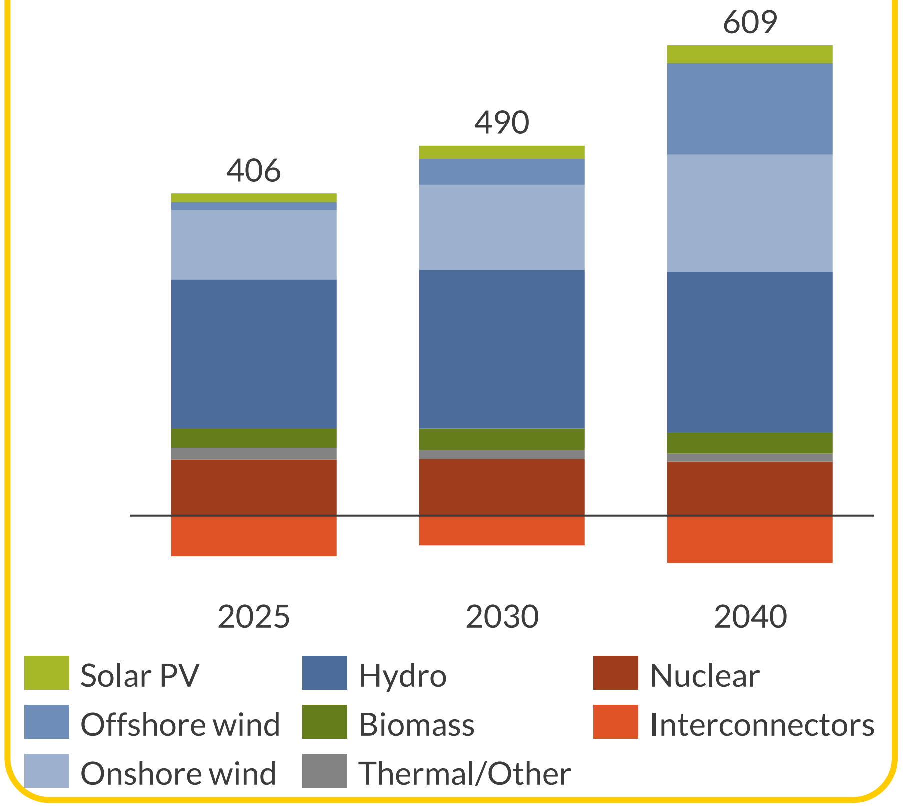
Power price per price zone
€/MWh (real 2024)



System overview

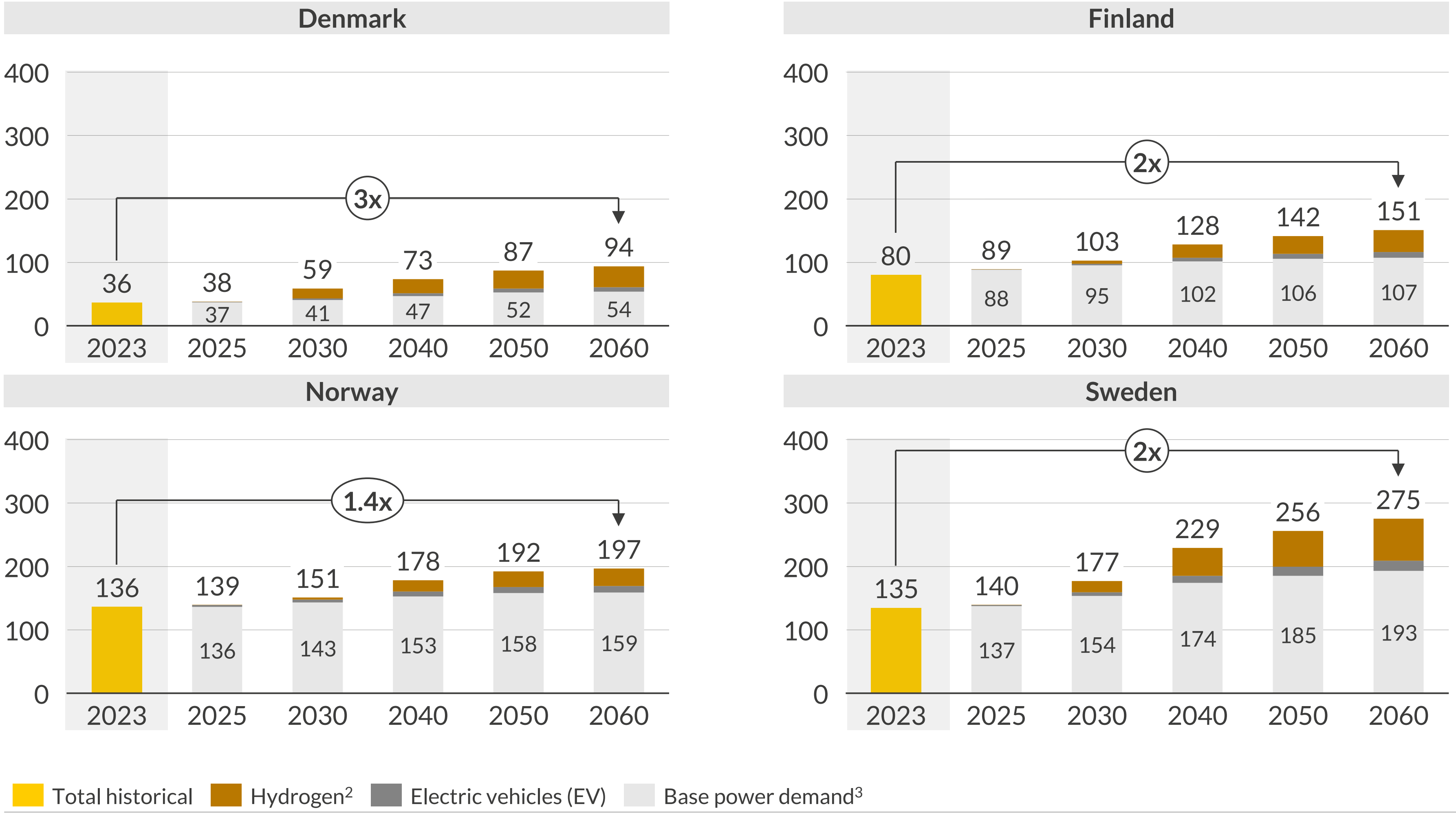
The Nordic power system combines abundant hydropower with fast-growing wind and solar, where hydropower and interconnectors help to shift the generation of intermittent renewables.

Nordic electricity production and net imports
TWh



Sweden and Norway represent 70% of Nordic demand in 2023; Denmark sees a strong demand growth, almost tripling towards 2060

Net Nordic annual power demand by type and country[1]
TWh



1) Includes sectoral demand as well as transmission losses but excludes power plant self-consumption and demand from efficiency losses of storage; 2) Demand for hydrogen production from electrolysis; 3) Underlying base demand from industry, households, commerce and transport excluding electric vehicles, and electrolysis.
Sources: Aurora Energy Research; Statistic Denmark; Statistic Finland; Statistic Norway; Statistic Sweden

AURORA

Denmark
- Denmark undergoes the strongest growth towards 2060, driven by both base and electrolysis demand.

Finland
- In the late 2020s, base demand increase rapidly as many electric boilers come into the market.
- Large industrial projects drive a sharp increase in electrolysis demand after 2030.

Norway
- As battery factories expand and industry electrifies, base demand grows by 10TWh in the 2030s.

Sweden
- Base demand increases in the long run, driven by industry electrification.
- Large industrial projects are planned in northern Sweden, leading to electrolysis demand growth in the late 2020s.

Electric boilers will supply most of Finland’s district heating demand by 2030, rapidly scaling flexible demand

AURORA

Context and drivers

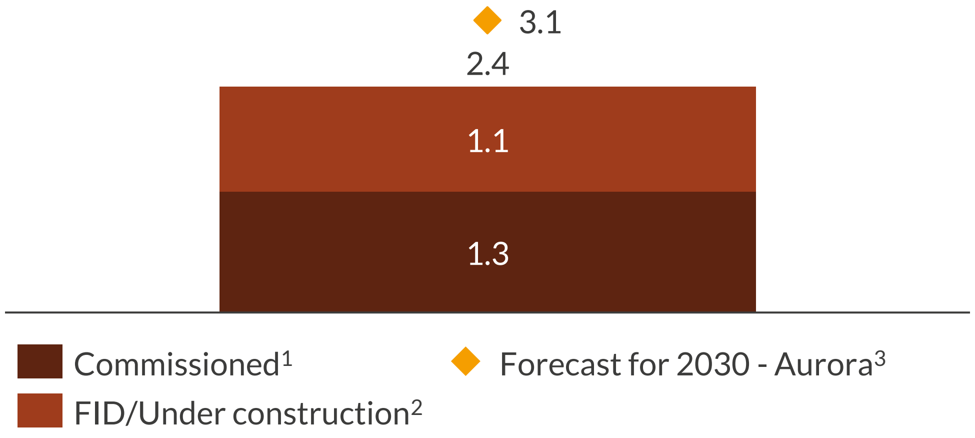
- E-boilers are one of the fastest-growing sources of new flexible demand in Finland, with about 1.3 GW already commissioned and several more GW in the pipeline.
- Growth is driven by:
  - Decarbonisation of district heating
  - Policy incentives and extremely low electricity tax for district heating electric boilers
  - High gas prices and security of supply concerns
  - Import ban on Russian biomass, which is used for heat or co-generation plants
  - Frequent negative or low prices, making electric boilers attractive
- They enable a rapid electrification of district heating through short connection lead times, typically 1-2 years.
- Electric boilers provide operational flexibility - they can ramp up or down quickly, providing valuable DSR.
- Most capacity is concentrated in southern Finland and major urban centres.

Impact

- Capacity is scaling rapidly in district heating, with strong short-term growth expected.
- Electric boilers reduce CHP fuel use and shift heat load to hours of low or negative prices.
- This mitigates negative price events, supporting PPA price floors and reducing curtailment risk for wind assets.

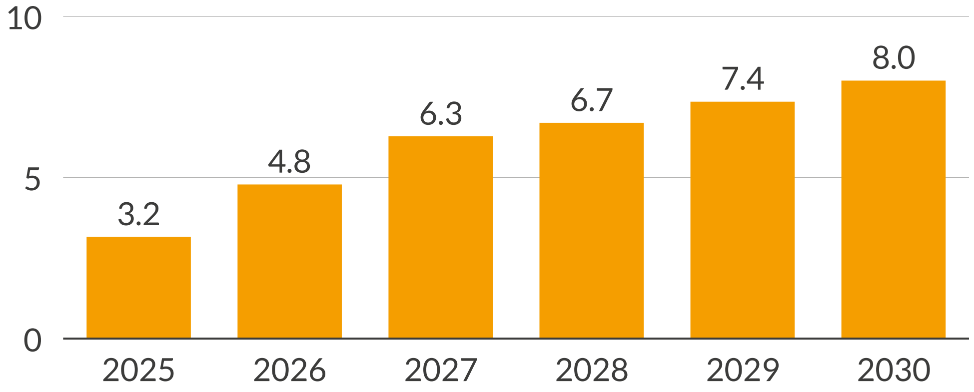
Electric boiler pipeline in Finland until 2030

GW



Projected consumption from electric boilers in Finland

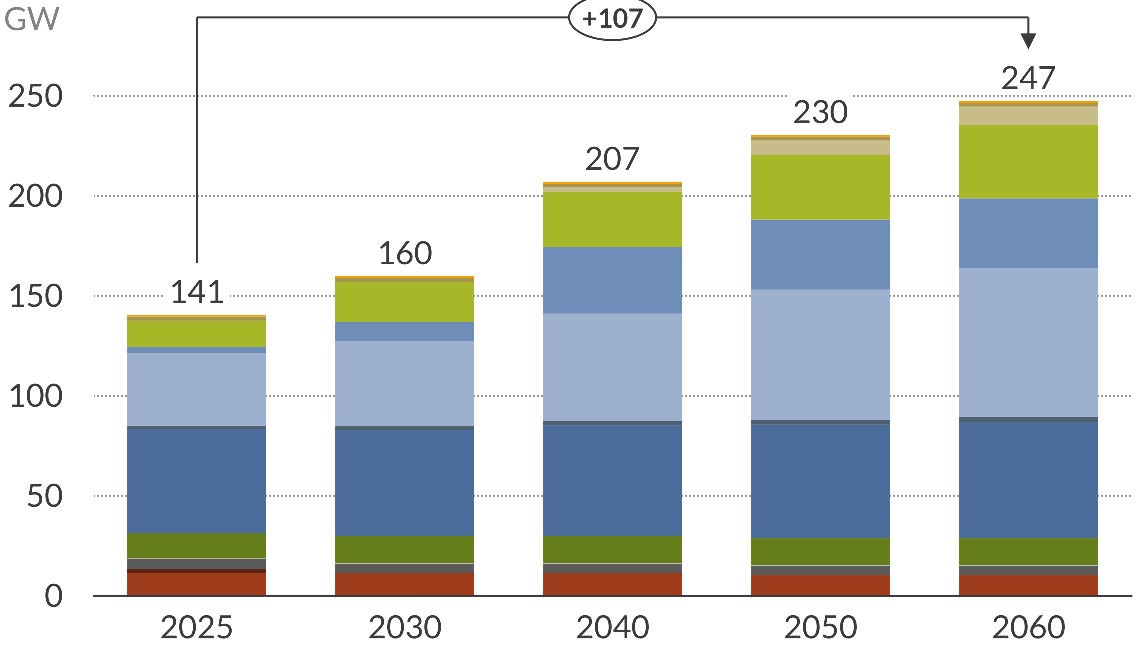
TWh

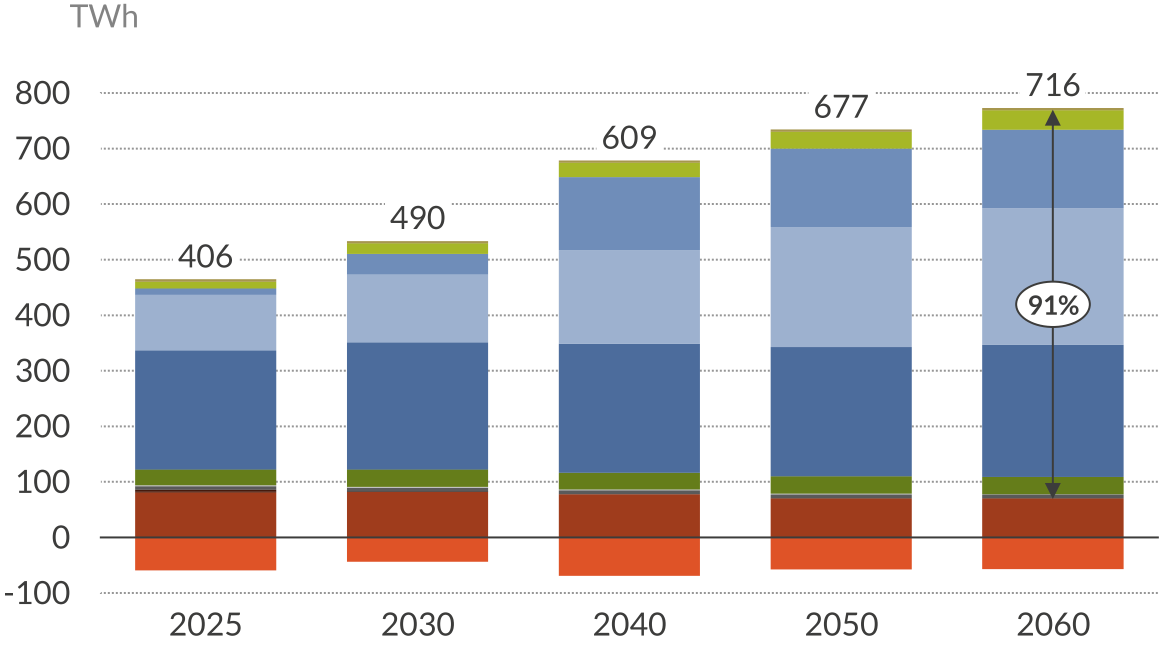


1) Until 2028; 2) YTD values as of 2025-09-17; 3) Aurora’s forecast for 2030 aligns with Fingrid’s, which predicts the total number of electric boilers used in district heating industry for heat and steam production is set to grow to over 3 GW in the coming years (Fingrid, Development Prospects for electricity production and consumption, p.3).

Sources: Aurora Energy Research, Fingrid, Vero

Wind and solar are driving the Nordic capacity expansion; over 90% of generation comes from renewable energy by 2060





- Installed capacity is set to increase by 107GW, particularly driven by rapid growth in wind, supported by falling technology cost, strong decarbonisation targets, and favourable policies.
- Conventional power sources, such as nuclear, coal, gas CCGT, and biomass/biogas, remain roughly 30GW installed capacity throughout the forecast.

- Generation from wind, solar, hydropower, waste and biomass almost doubles between 2025 and 2060, rising from a roughly 80% share of total electricity production in 2025 to 90% in 2060.
- Conversely, conventional thermal technologies such as coal and peat will be phased out by 2030, while nuclear will continue to claim a significant share in the generation mix.

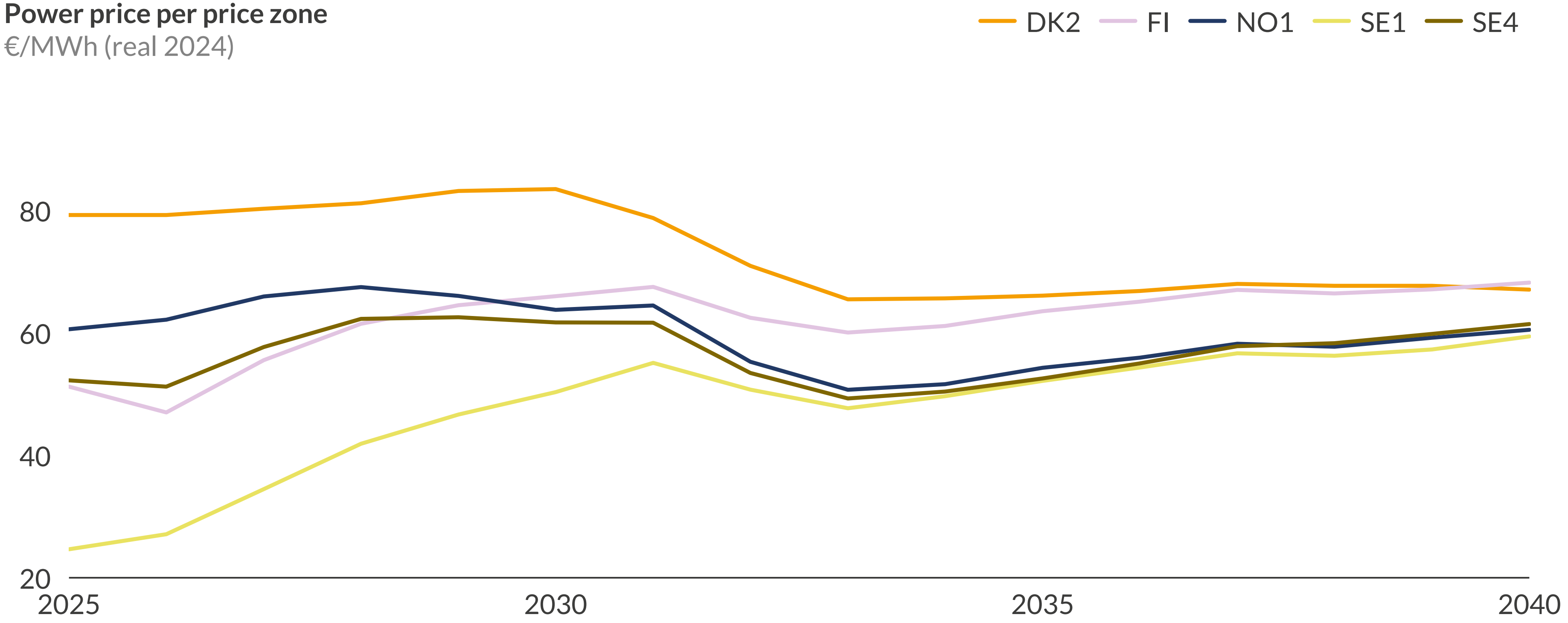
DSR | Gas/oil peaker | Hydrogen peaker | Solar PV | Offshore wind | Onshore wind | Pumped storage | Hydro | Biomass | Other thermal[1] | Gas CCGT | Coal | Peat | Nuclear | Interconnectors

1) Other thermal includes waste plants and on-site industrial thermal power plants; 2) The total figures represent net production, defined as total production minus export volumes.

Sources: Aurora Energy Research

Power prices between the north and the south converge in the 2020s, and decline in the early 2030s as offshore capacity comes online

Power price per price zone
€/MWh (real 2024)



Remaining 2020s

- Prices in Sweden and Finland increase in the 2020s due to rising demand from industry electrification and rising carbon prices.
- Grid buildout and demand growth in the north of Sweden leads to price convergence between northern and southern zones.

2030s

- Wind buildout across the Nordics drives prices down from 2031 to 2033, after which rising power demand and rising cost for flexible assets increase power prices in most areas, except for DK1, where they decrease due to further offshore wind buildout.
- In the 2030s, total interconnection with the continent grows by 2.7GW to 15.8GW, exerting upward pressure on power prices.

Beyond 2040

- Large renewable deployment counterbalances price increases

Sources: Aurora Energy Research

AURORA

ENERGY RESEARCH

Dualsun

Nordic and Baltic perspectives on achieving renewable heating and cooling

PVT-panels: 6 times more energy from the rooftops and maximum self-consumption & energy classification

Speaker: Marcus Kanewoff, CEO Dualsun Nordic

Dualsun

Dualsun introduction

2 sites in France, 1 in Sweden

Head office in Marseille
SPRING manufacturing plant in the Ain region of France

Sales €60M & 186 MWp

of panels delivered
+50% in 2023, +100% in 2022

€19M

invested in R&D since 2010

EUPD RESEARCH TOP BRAND PV MODULES FRANCE 2023

LA FRENCH TECH 2030

La FRENCH TECH GREEN20

Vitrine INDUSTRIE DU FUTUR

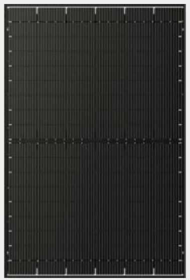
The Solar Keymark
CEN Keymark Scheme

EPD®
THE INTERNATIONAL EPD SYSTEM

EUPD RESEARCH TOP BRAND PV MODULES SWEDEN 2024

Solar energy technologies and their efficiency

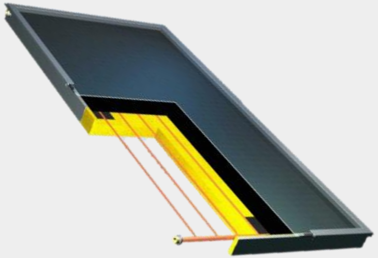
Solar panels (PV)



Solar PV panels generate electricity with approx. **22%** efficiency

Max temperature 65°C

Thermal collectors (T)



Solar thermal panels generate heat and hot water with approx. **60%** efficiency

Max temperature 200°C

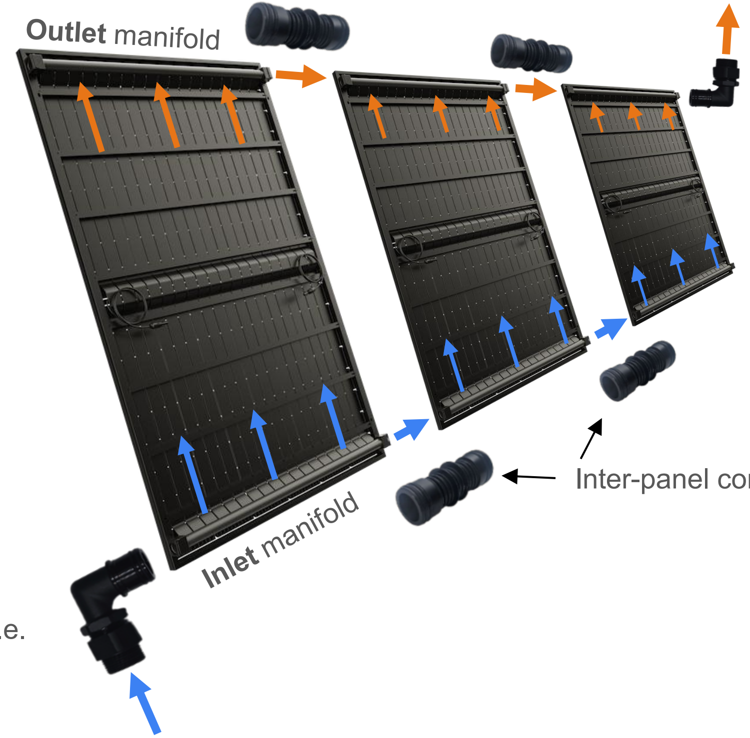
Solar hybrid panels (PVT)

Solar hybrid panels generate both electricity and heat in the same panel with approx. **35-180%** (including yield from the air)

Max temperature 65°C

How does the heat exchanger of a solar hybrid panel look like, and how are the panels connected together?

Cross-section of the heat exchangers

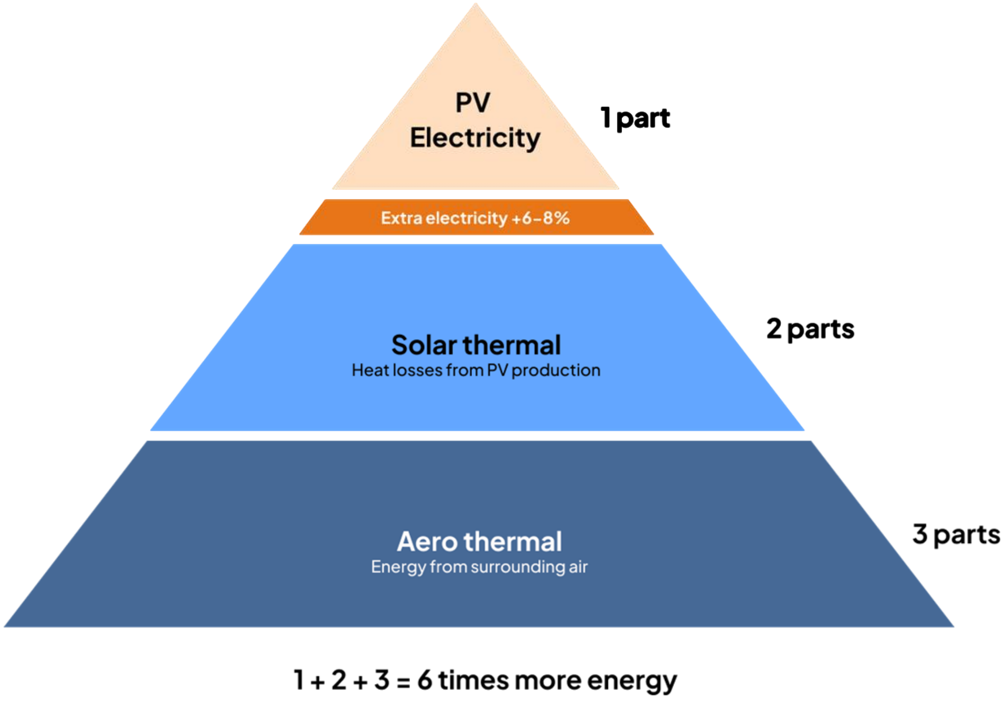


Maximum 7 panels in each group, which are installed by the solar panel installer.

Then a plumber connects the different groups and the pipes down to the energy central.

How is it possible to extract 6 times more energy from the roof tops?

A solar hybrid panel (PVT) brings together 3 different technologies/sources in one panel:



Hybrid panels do not only address electricity, but also the major energy consumers = **heating and hot water**

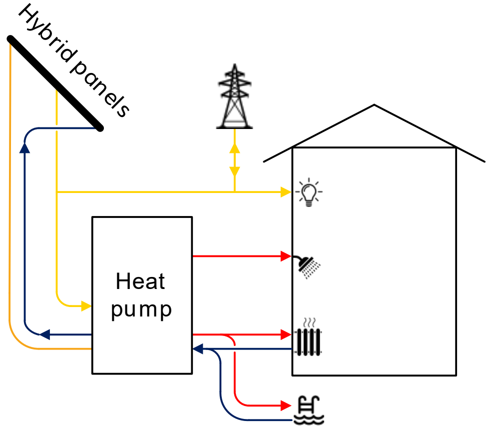
3 main applications for PVT in the Nordics, enabling new energy solutions!

1) PVT source heat pump

Annual yield: 800-1600 kWh/m²

- Heat pump with PVT panels as thermal source instead of boreholes
- Quiet and more efficient alternative to air/water heat pumps or dry cooler
- Minimize consumption of district heating, gas or biomass

Payback: 5-10 years



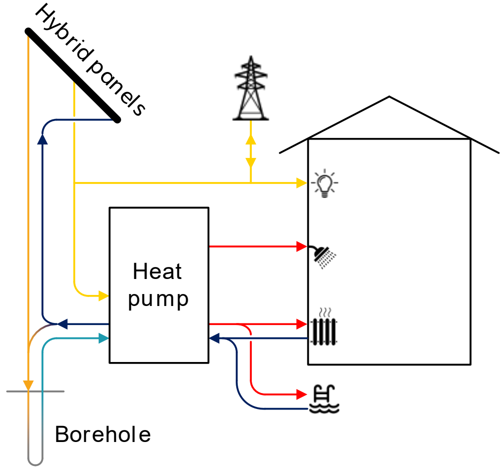
Possibility to upgrade with geothermal storage at a later stage

2) Cold boreholes or COP optimization

Annual yield: 1100-1800 kWh/m²

- Avoid additional drilling
- Recharge for improved efficiency but also power & energy coverage for geothermal heat pumps
- Reduce need of peak power & energy

Payback: 0-12 years

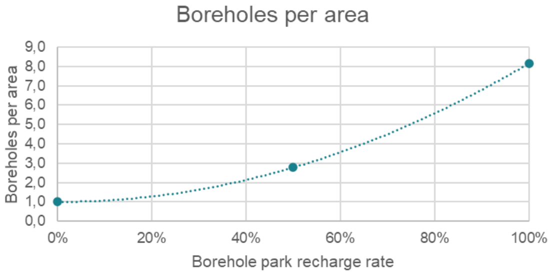


3) Optimized geoenergy storage

Annual yield: 1000-1500 kWh/m²

- Reduce borehole storage cost (number or depth)
- Limited space for borehole storage
- Passively or actively charge seasonal thermal energy storage
- Basically about cutting CAPEX and improve OPEX

Payback: 0-10 years



Retrofit of apartment building with PVT

12 apartments with a 30 kW heat pump in Stockholm

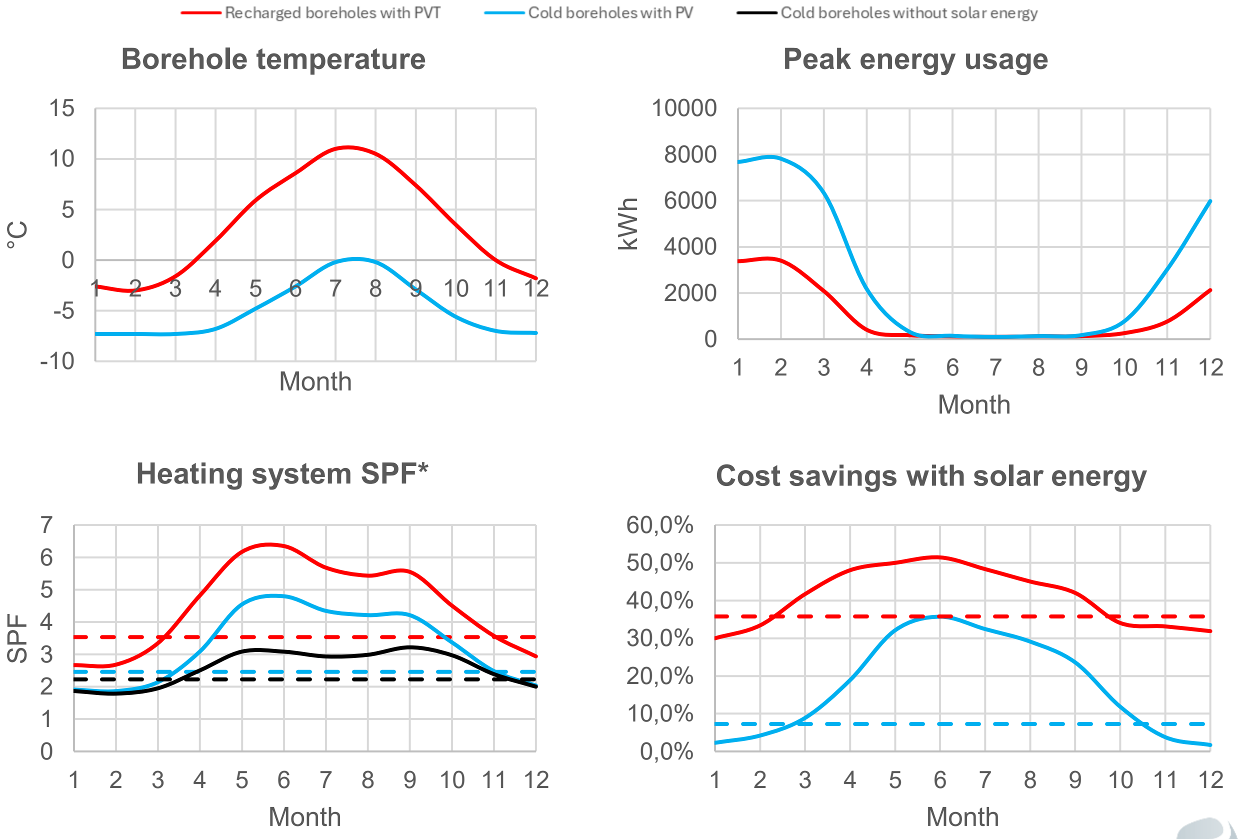
Project details:

Urban area with small plot
- 20 m x 20 m plot
- 12 apartments
- 30 kW heat pump
- 3 cold boreholes of 150 m

Potential actions:
- Do nothing!
- Install 30 PV panels
- Install 30 PVT panels

Heating system SPF* includes:
- Peak energy
- Self-consumed PV electricity

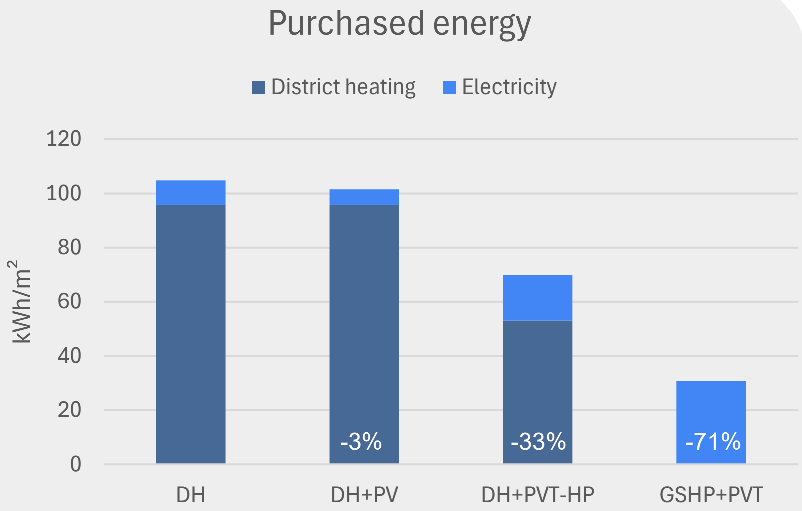
* Seasonal performance factor



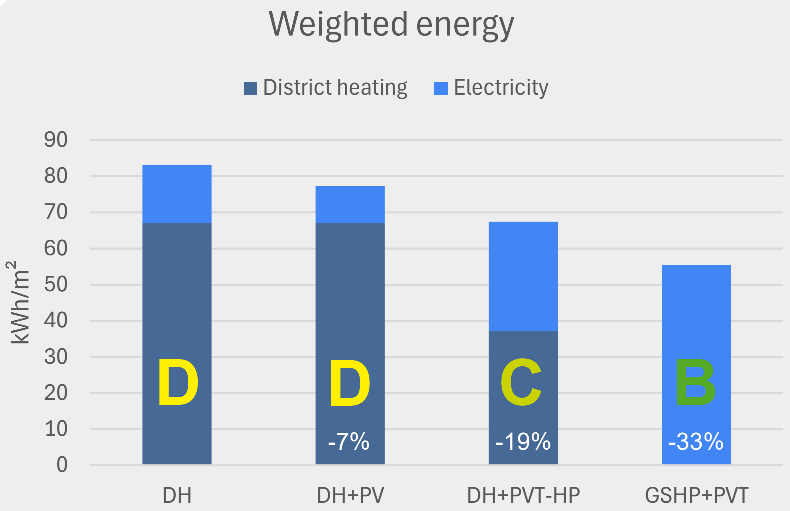
PVT-panels impact on OPEX and Energy labelling

Customer case in Stockholm: The building from 1940 is placed on a small plot, which traditionally has been too small for boreholes to a ground source heat pump. However, with recharge from PVT-panels the distance could be reduced from 20m to 13m between boreholes.

Improvement of **operation cost** with solar hybrid panels



Improvement of **energy labeling** with solar hybrid panels



Swedish weighting factors:

- District heating: 0.7
- Electricity: 1.8

Two new building apartment projects, with PVT & GSHP

More references on LinkedIn

Net-zero energy building in Karlskrona, Sweden

- Liquid-water heat pump combined with boreholes and PVT
- 100% power and energy coverage for electricity, heating and hot water
- 84 PVT panels
- 130 PV panels

Plus-energy building in Trondheim, Norway

- Liquid-water heat combined with boreholes and PVT
- The building block is a net-producer of 2 kWh/m²/year to the grid
- 472 PVT panels

Two new building projects, with PVT-source heat pump

More references on LinkedIn

AdO Arena, swimming hall in Bergen, Norway reduced district heating consumption with 30%

- Liquid-water CO_2 heat pump with PVT = REPower EU- solution!
- No boreholes at all
- Reduced district heating consumption with 30%
- 228 PVT panels

Apartment building in Lund, Sweden improved energy class from C to A

- Liquid-water heat pump with PVT = REPower EU- solution!
- No boreholes at all
- 50% energy coverage, and 50% through district heating
- 168 PVT panels
- 112 PV panels

Dualsun

We will assist you with your projects!

Jakob Jamot, CTO

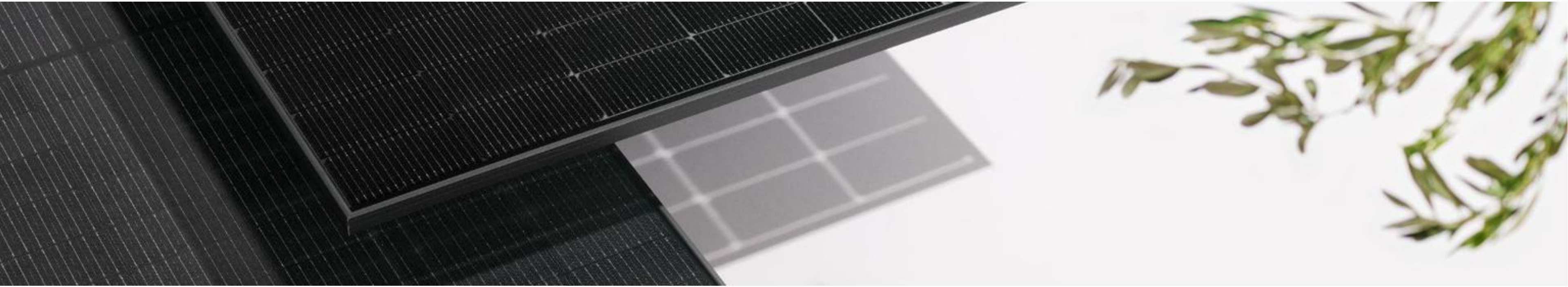
Jakob.jamot@dualsun.com

+46 73 573 64 88

Marcus Kanewoff, CEO

marcus.kanewoff@dualsun.com

+46 70 593 02 93



Dualsun

Additional material, sent out after the presentation

Customer case: Hönö projektet (SE-speaker) (EN-speaker)
LinkedIn

From energy class G till B

SPRING4 (PVT) and **FLASH** (PV) 425W TOPcon

SPRING4 Non-insulated

Designed for heat pump application with boreholes

Datasheet

SPRING4 Finned

Designed for heat pump application without boreholes

Datasheet

SPRING4 Insulated

Designed for hot water and pool applications

Datasheet

FLASH matching panel

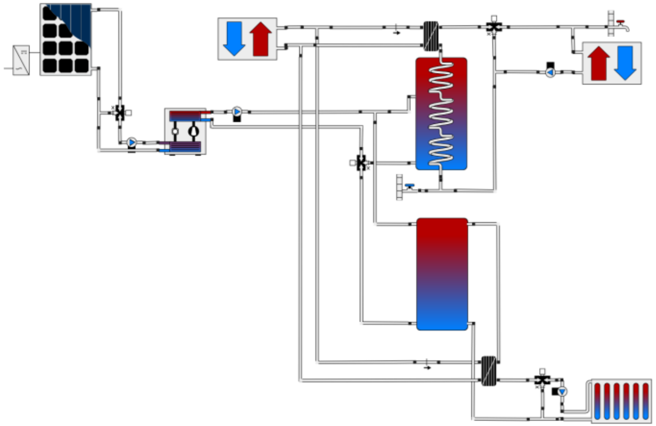
Efficient bifacial PV panel, the perfect complement to **SPRING4** for a seamless design

Datasheet

Two step process with PVT

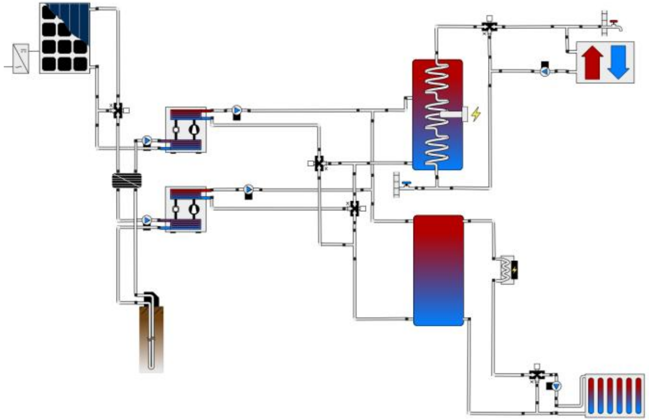
Step 1:
Reduce bought energy from district heating, gas or biomass:

- Install brine-water heat pump that would cover 20-30% of power in a full ground source heat pump installation
- Install 1.2-1.5 PVT panels per kW of heat pump
- Cover 40-60% of energy demand



Step 2:
Get free from district heating, gas or biomass dependance:

- Increase installed brine-water heat pump capacity to achieve desired power coverage
- Complement with boreholes
- The number of PVT panels already installed in step 1 then match the calculated amount in step 2 when boreholes are added (approx. 0.4 PVT panels per kW heat pump)



REPUBLIC OF ESTONIA
GEOLOGICAL SURVEY

Estonian medium-deep geothermal energy pilot projects

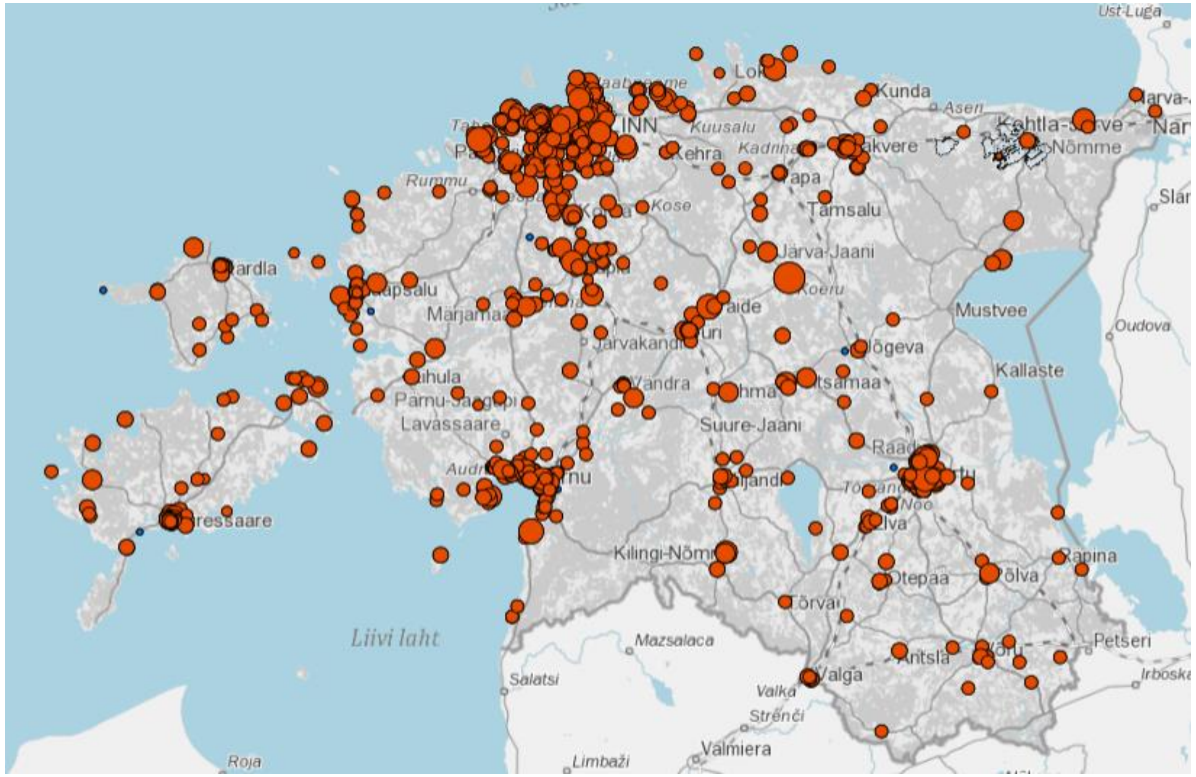
Helena Gailan
Head of the Department of Geothermal Energy
PhD, Power Engineering and Geotechnology

Regional roundtable for the Nordics and Baltics on Renewable Heating and Cooling

RHC

25th September 2025

Ground source boreholes for heating in Estonia



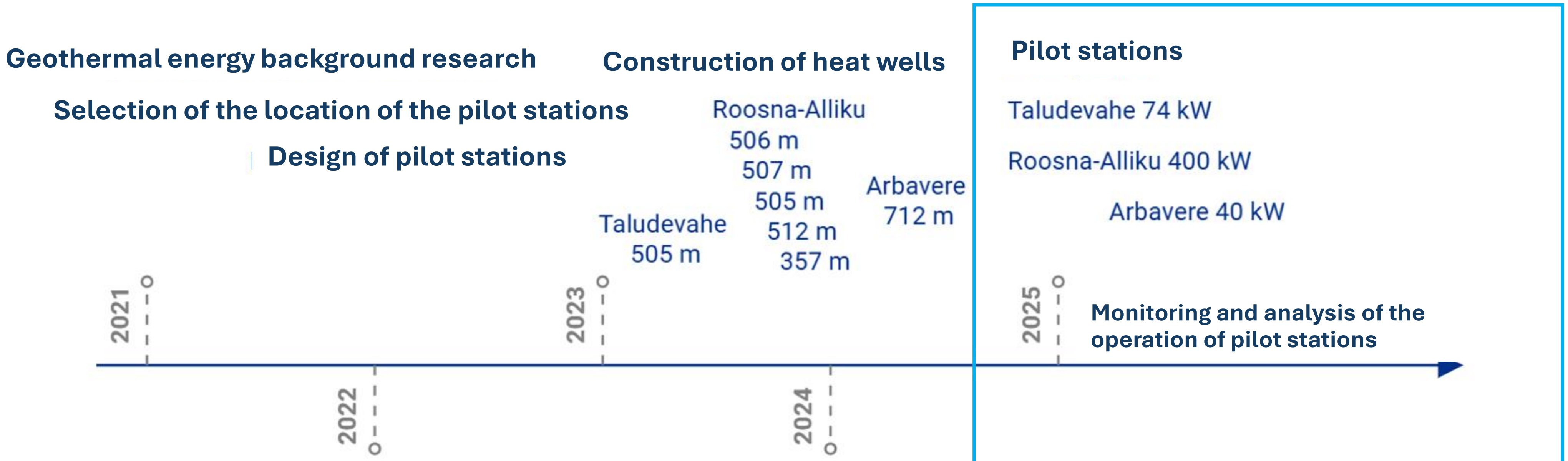
gis.egt.ee

- 6000 closed loop system heat wells
- 100 open loop system boreholes
- *ca* 1300 boreholes added in 2024-2025
- Mostly 50-200 m deep
- Low temperatures10-15 degrees
- Sales of ground source heat pumps increasing, 2 x compared to 2016: +2400 GSHP in 2023

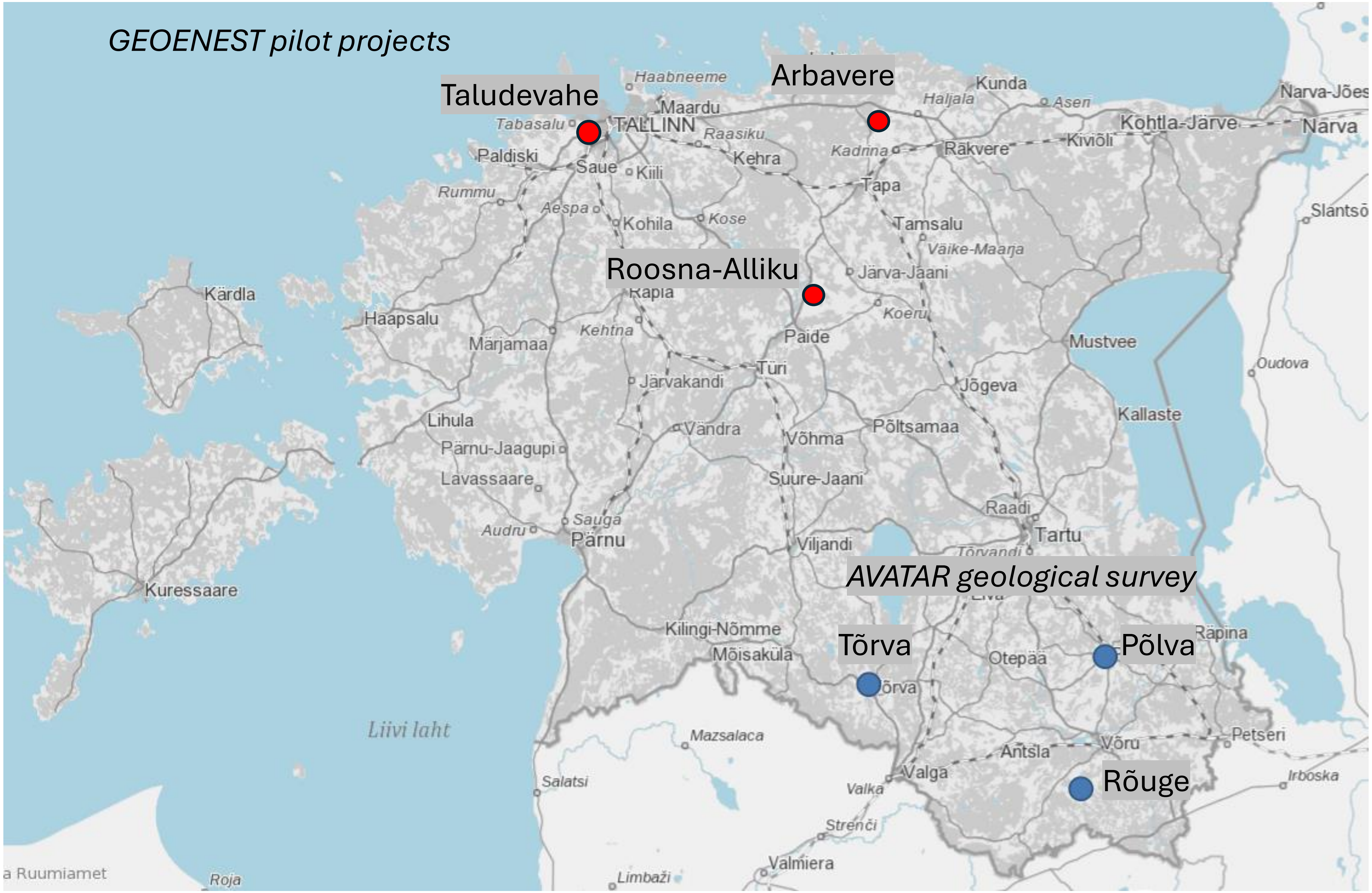
Densely populated areas:
available land and existing landscaping

GEOENEST 2021-2025

- Initiated by the Ministry of Economic Affairs and Communications, today the Ministry of Climate
- Budget: 3.8 million euros, sales revenue from GHG emissions trading
- The aim is to support the objectives of Estonia's energy and climate policy by analyzing and piloting the potential for introducing geothermal heating

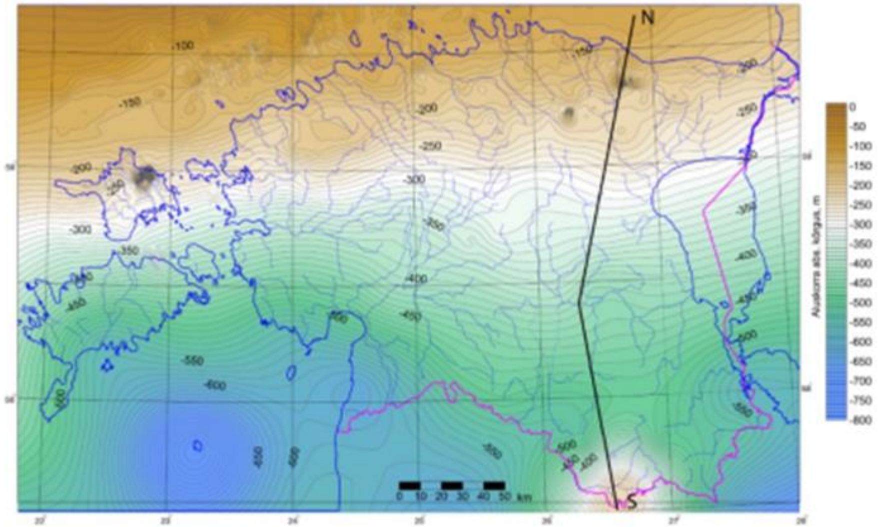


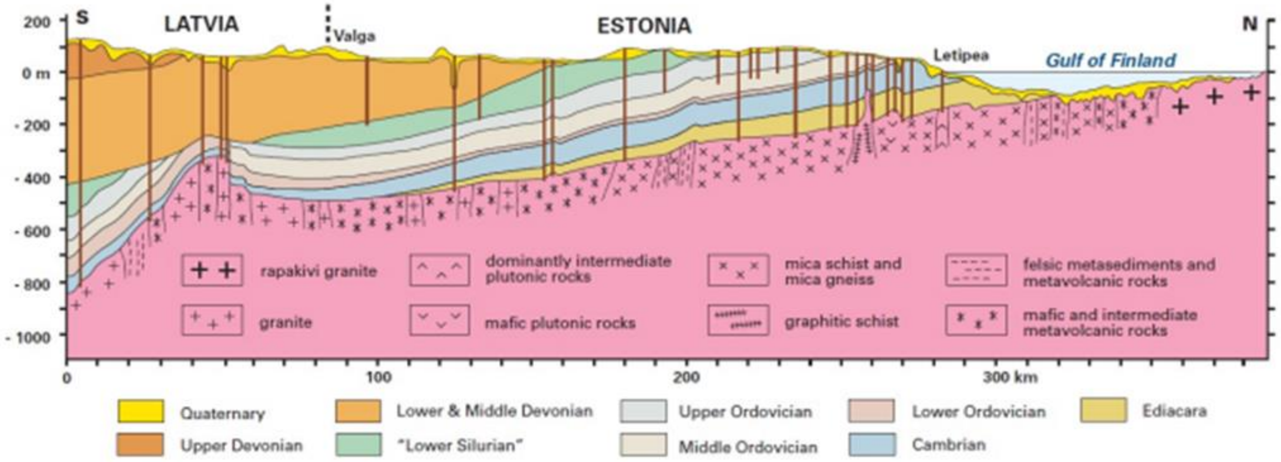
https://www.egt.ee/uuringud-ja-projektid/maapoueressursid/geoenest



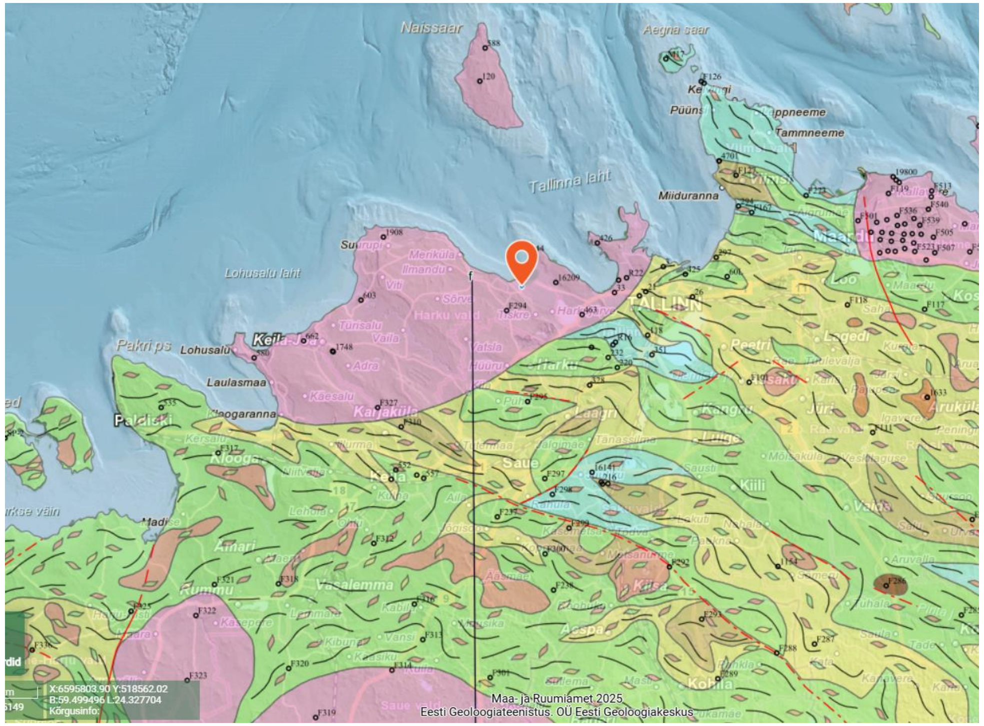
Geological Survey of Estonia

Geology





Puura & Vaher 1997



- Crystalline basement, part of the Fennoscandian shield
- Similar with the rocks in Southern Finland
- North-Estonia Rabakivi-Granite, Naissaare pluton

Geological Survey of Estonia

Tallinn pilot station

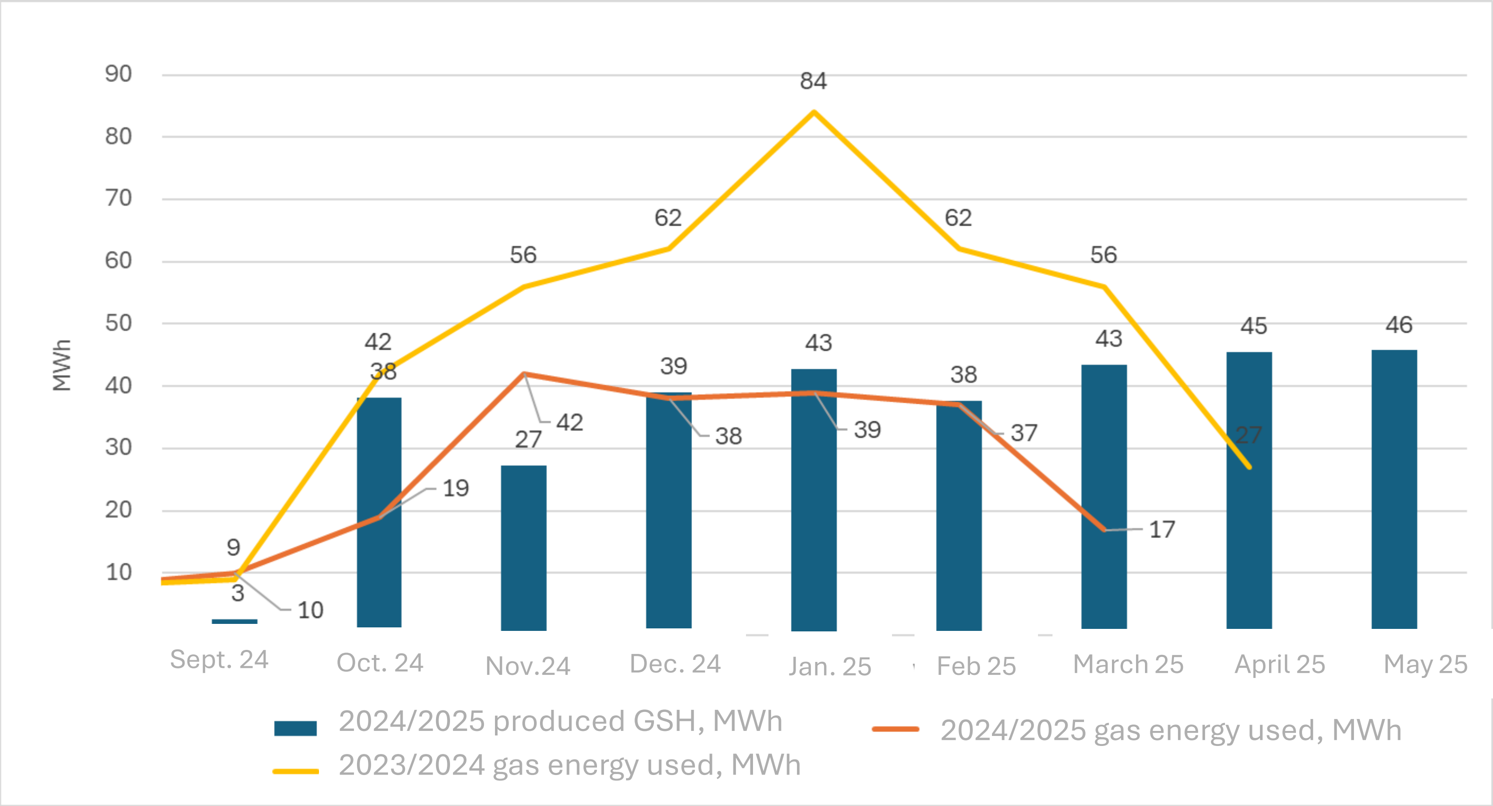
Opening of the pilot station on 03.05.2024

- Taludevahe 116, Tallinn
- 46 apartments, 4360 m2
- Energy consumption: 420 MWh per year, 85 MWh/month
- Gas boiler: radiator heating and domestic hot water

- Geothermal well 505 m: the first deepest
- 350 m rabakivi granite
- Double U-tube, total length 2000 m
- Ground Source Heat pump Oilon RE76

- In cooperation with Balrock OÜ, Inseneribüroo Steiger OÜ, TJ Hooldus OÜ in the construction of the pilot station

Tallinn pilot station: first heating period using GSHP



45-50 kW average heat load of the borehole
90-100 W/m for the 505m borehole

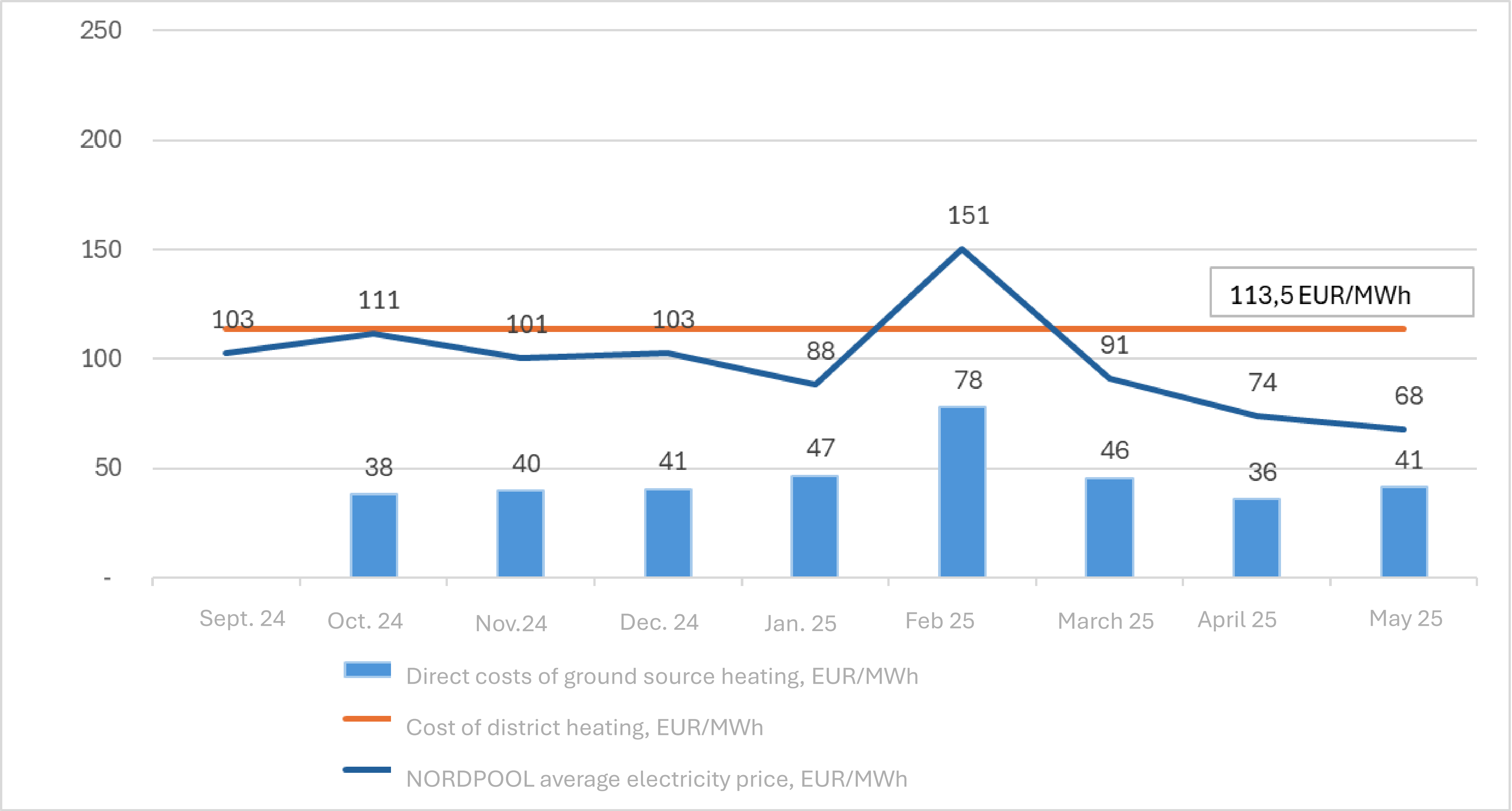
GSHP provided 340 MWh of thermal energy, i.e. about 77% of the total heat energy demand

COP 3,3...4,1

On average, 28 MWh/month less gas has been consumed while the production of geothermal energy started

Geological Survey of Estonia

Tallinn pilot station: direct costs 46 EUR/MWh, 60% cheaper than the price of district heating (gas energy) 113,5 EUR/MWh



Geological Survey of Estonia

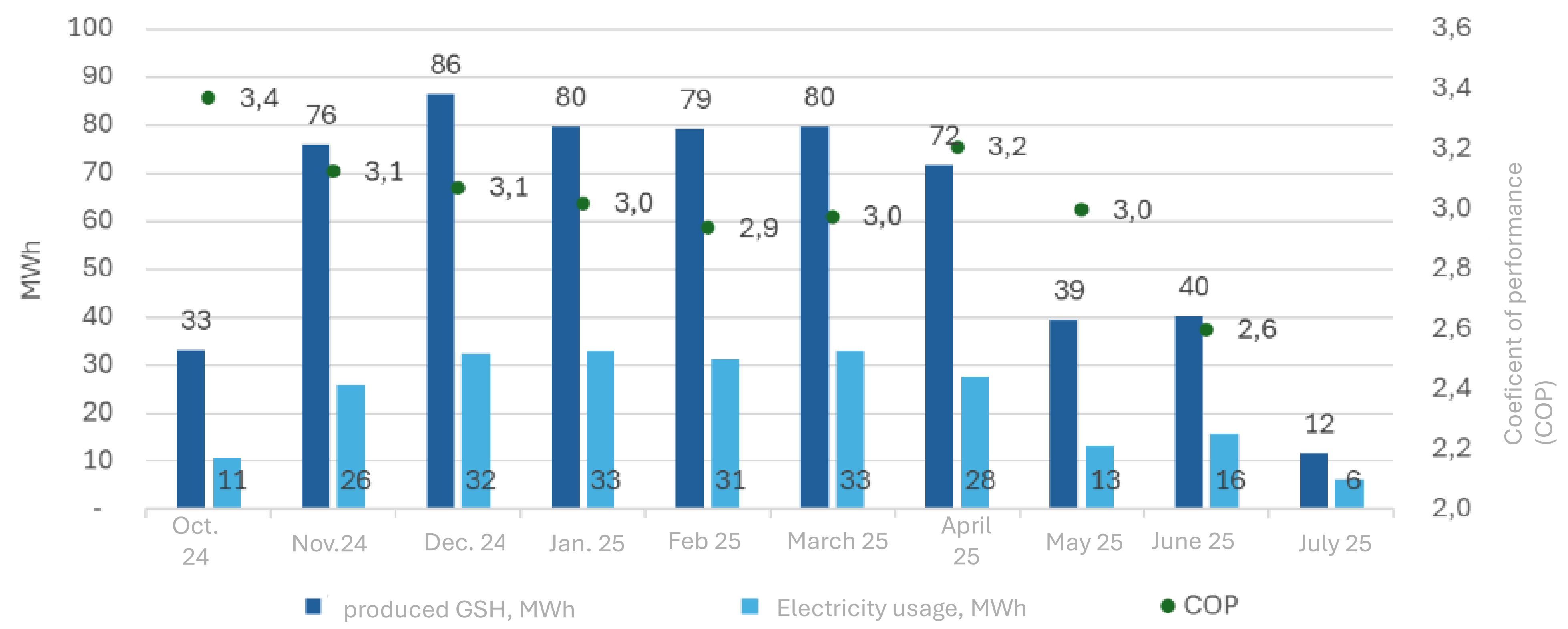
Roosna-Alliku (Järva county) pilot station: district heating

The pilot station was launched in mid-October 2024, opening on 12.11.2024

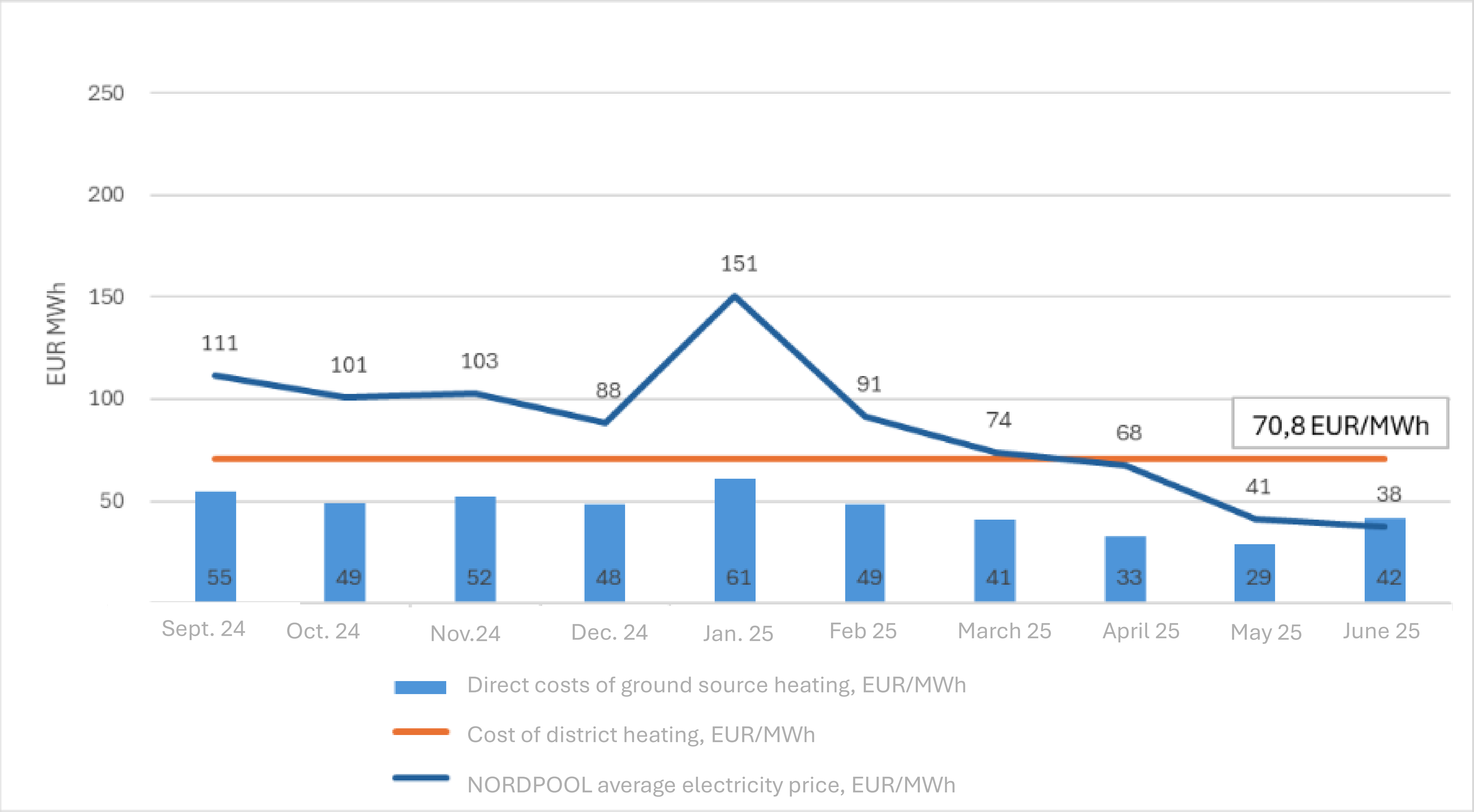
- District heating network: kindergarten, apartment building, municipality service building: 6581 m2 of heated area
- Radiator heatingOil shale oil boiler 500 kW
- Ground source heat: 5 boreholes
  - 506 m
  - 507 m
  - 505 m
  - 512 m
  - 357 m*
- Nominal power of the Oilon heat pump 400 kW
- 120 m bedrock gneiss, casing 395 m for isolating sedimentary rocks and aquifers
- Partners were Balrock OÜ, Inseneribüroo Steiger OÜ, TJ Hooldus OÜ

Roosna-Alliku: first heating period: 479 MWh thermal energy by GSHP

74 MWh per month,
110 kW average heat power
COP 3,2



Roosna- Alliku direct costs 51 EUR/MWh



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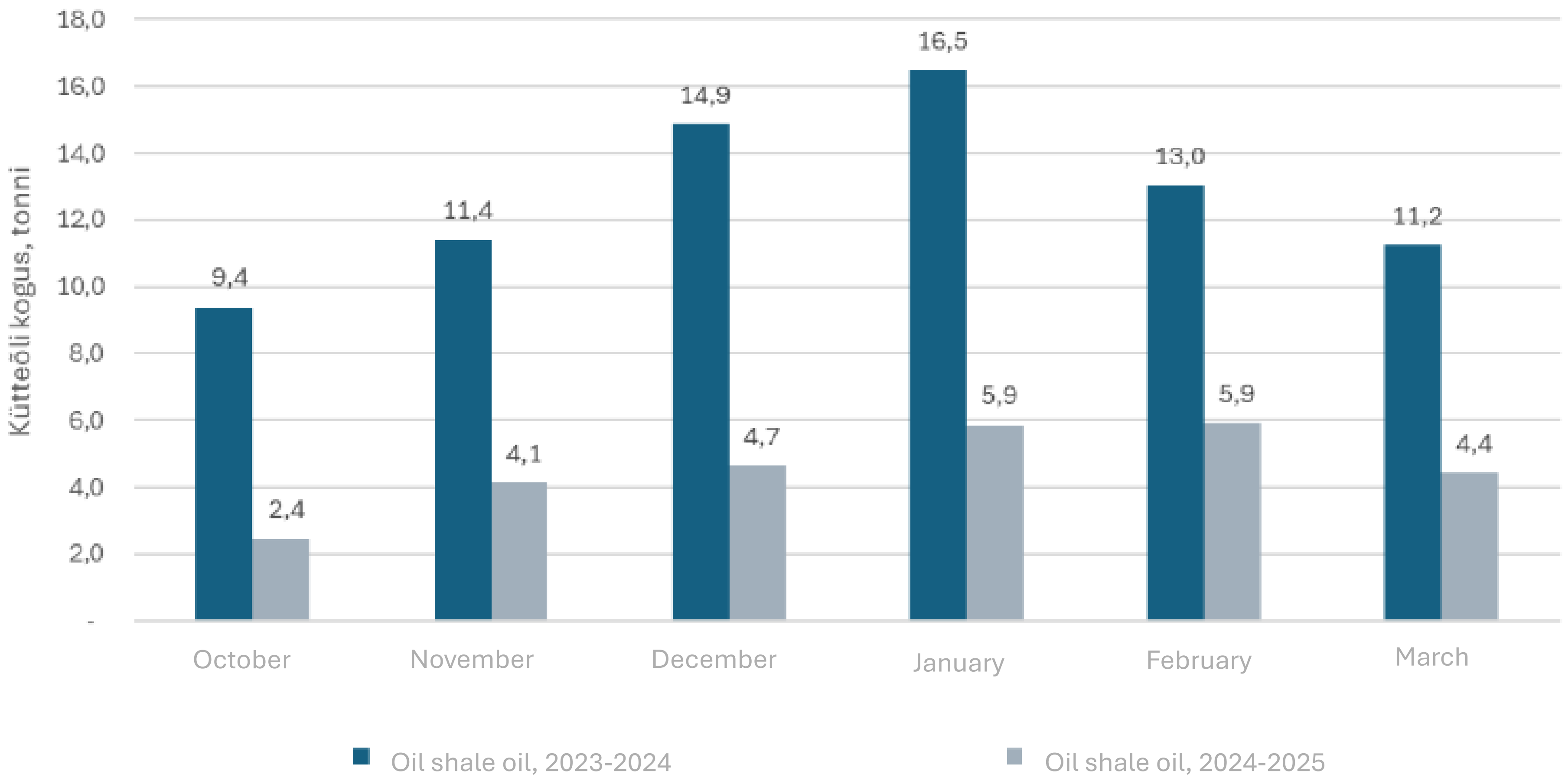
50 tons less oil shale oil (60-70%), i.e. 150… 200 tonnes of CO2
Geothermal energy covered about 60% of the energy demand



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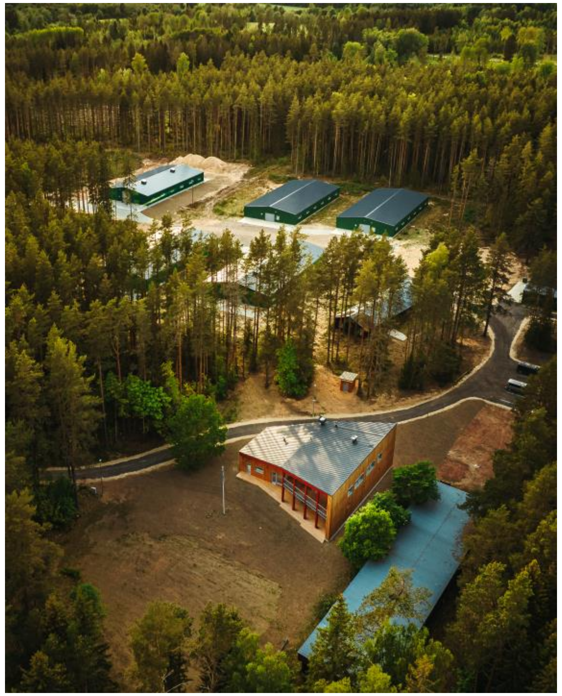
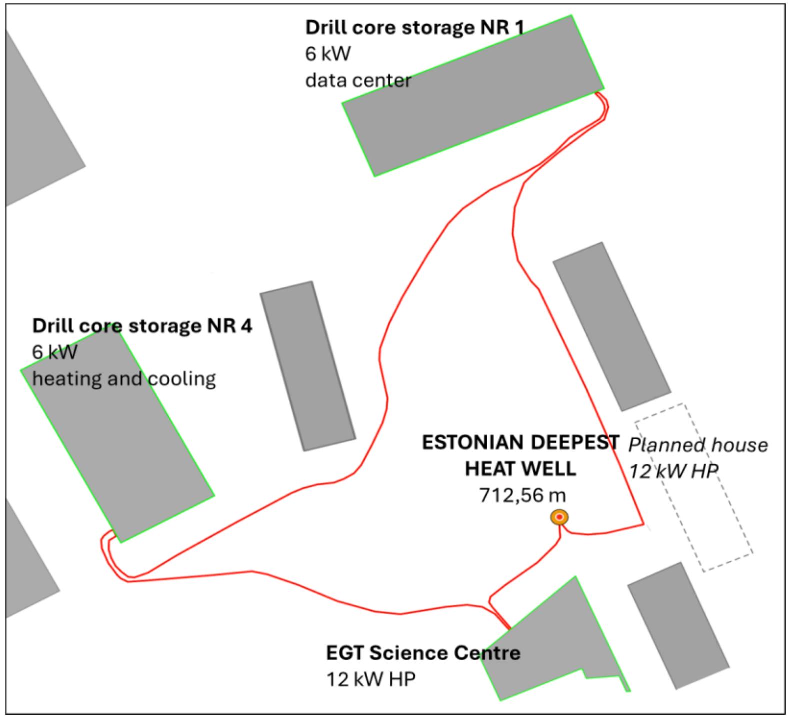
Geological Survey of Estonia Arbavere: Estonia's deepest 712,5m



EGT Arbavere Research Centre
Photo: Peeter Paaver



- Low-temperature district heating network with cooling
- Consumers: research house, drill core repositories 1 and 4, planned building
- 712.5 m heat well, groundwater temperature *ca* 20 degrees
- Heat pumps: 6kW+6 kW+12 kW (+12 kW)
- The goal is to test coaxial tube-based technology: heating and cooling
- 5G heating network
-
- The construction of the pilot station began in the spring of 2024 and completed at the end of July 2025.
- Engineering bureau Steiger OÜ and Coron OÜ
- Heating starts at october 2025

Conclusions

- Improved medium-deep drilling capacity in Estonia enhances the feasibility of geothermal solutions
- Initial heating period results are promising, though long-term performance requires extended observation
- Each project component—from drilling to automation—contributes to overall efficiency and influences the payback period
- Energy prices, including alternative fuels and district heating tariffs, play a significant role in economic viability

- Challenges faced:
  - Integrating challenges between the existing and new heating systems
  - District heating network require higher temperatures
  - Automation related issues
  - System complexity
    - Building energy demand
    - Heating system compatibility
    - Electrical and automation integration
    - Geological and geotechnical conditions
    - Drilling and subsurface considerations
  - Limited time and insufficient knowledge at the planning stage
  - Public procurement complexities

Republic of Estonia
Geological Survey

Aitäh!
Thank You!

Helena.Gailan@egt.ee
Head of the Department of Geothermal Energy
Geological Survey of Estonia

GEOENEST https://egt.ee/uuringud-ja-projektid/maapoueressursid/geoenest
AVATAR https://egt.ee/uuringud-ja-projektid/maapoueressursid/avatar

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NORSK VARMEPUMPEFORENING

The heat pump market in Norway

Rolf Iver Mytting Hagemoen
Norwegian Heat Pump Association

RHC-ETIP Regional Roundtable: Nordic and Baltic Perspectives on Achieving Renewable Heating and Cooling

North Atlantic Ocean
15°
30°
Barents Sea
Hammerfest
Tromsø
Halti (Finland)
1,365 m
Inari
Ivalo
Murmansk
Northeast Passage
Narvik
Kiruna
Kebnekaise
2,097 m
70°
© Nations Online Project
Bodø
Kola Peninsula
Arctic Circle
Arctic Circle
Rovaniemi
Haparanda
Tornio
Kemi
Kuusamo
Norwegian Sea
Luleå
Oulu
FINLAND
65°
SWEDEN
Umeå
Kajaani
Kokkola
Östersund
Trondheim
Vaasa
Kuopio
RUSSIAN FEDERATION
Sundsvall
NORWAY
Jyväskylä
Savonlinna
Galdhøpiggen
2,469 m
Gulf of Bothnia
Pori
Mikkeli
Tampere
Lappeenranta
Lillehammer
Gävle
Lahti
Turku
Helsinki
Kouvola
Bergen
Oslo
St Petersburg
Uppsala
60°
Drammen
Västerås
Gulf of Finland
Haugesund
Karlstad
Tallinn
Fredrikstad
Örebro
Stockholm
ESTONIA
Stavanger
SCANDINAVIA
National capital
Major city
International borders
Linköping
Kristiansand
Gothenburg
North Sea
Skagerrak
Kattegat
Jönköping
LATVIA
Riga
N
DENMARK
Baltic Sea
LITHUANIA
Copenhagen
Malmö
Vilnius
55°
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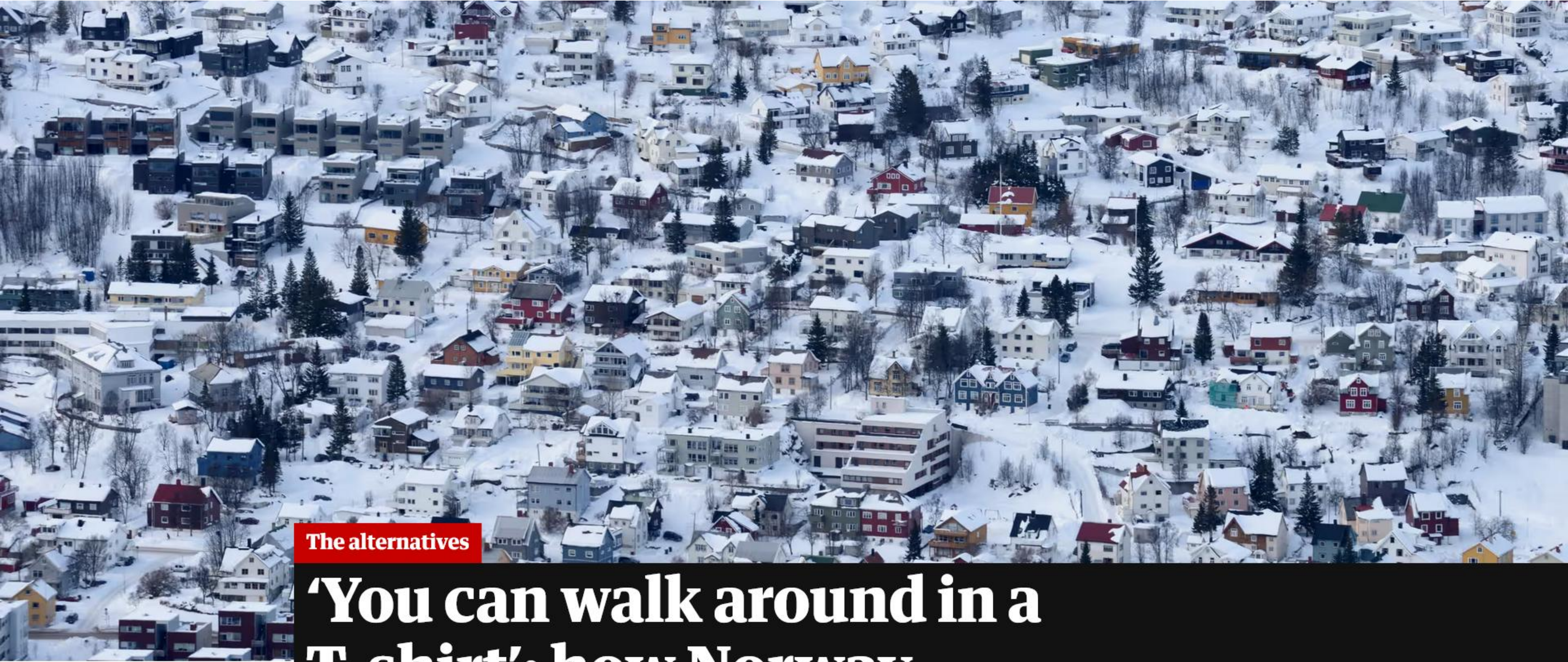
0
200
400 km
0
100
200
300 mi



The alternatives

'You can walk around in a T-shirt': how Norway brought heat pumps in from the cold

The Tromsø sorting office of the Norwegian postal service Posten Bring is heated by heat pumps. The city is located more than 200 miles north of the Arctic Circle.

The Guardian

Distribution of heat pumps in Norway

- In the period 1987 - 2024, over 1.9 million heat pumps have been sold in Norway
- Air-to-air: almost 1.76 million
- Air-to-water: over 63,000
- Brine-to-water: over 71,000
- Exhaust heat pumps: over 28,000

- Over 1.5 million heat pumps are in operation, which amounts to over 12 TWh of ambient heat.

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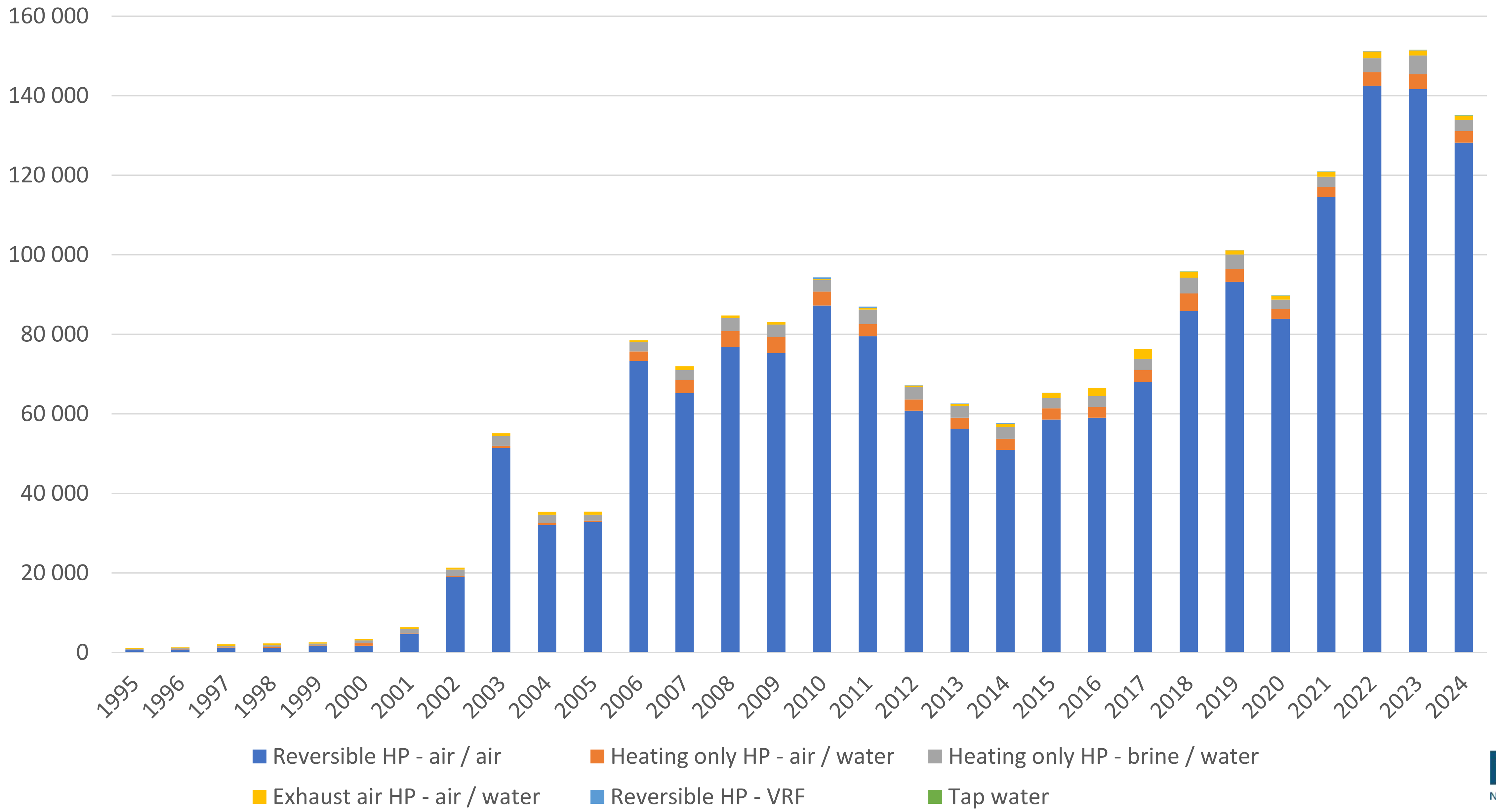
NORSK VARMEPUMPEFORENING

Total market heat pumps 1995 – 2024



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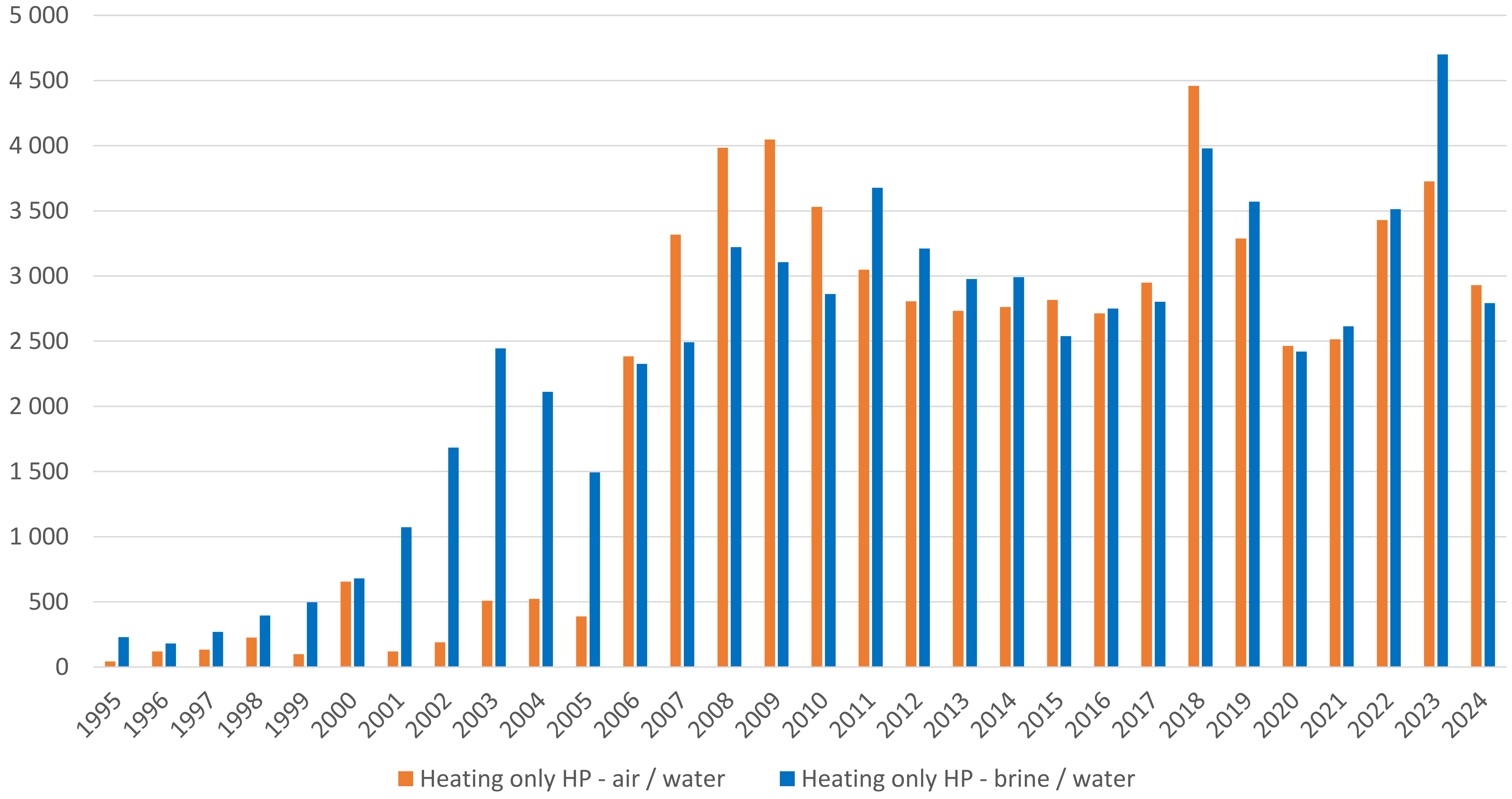
Air-to-water and brine-to-water heat pumps 1995 – 2024



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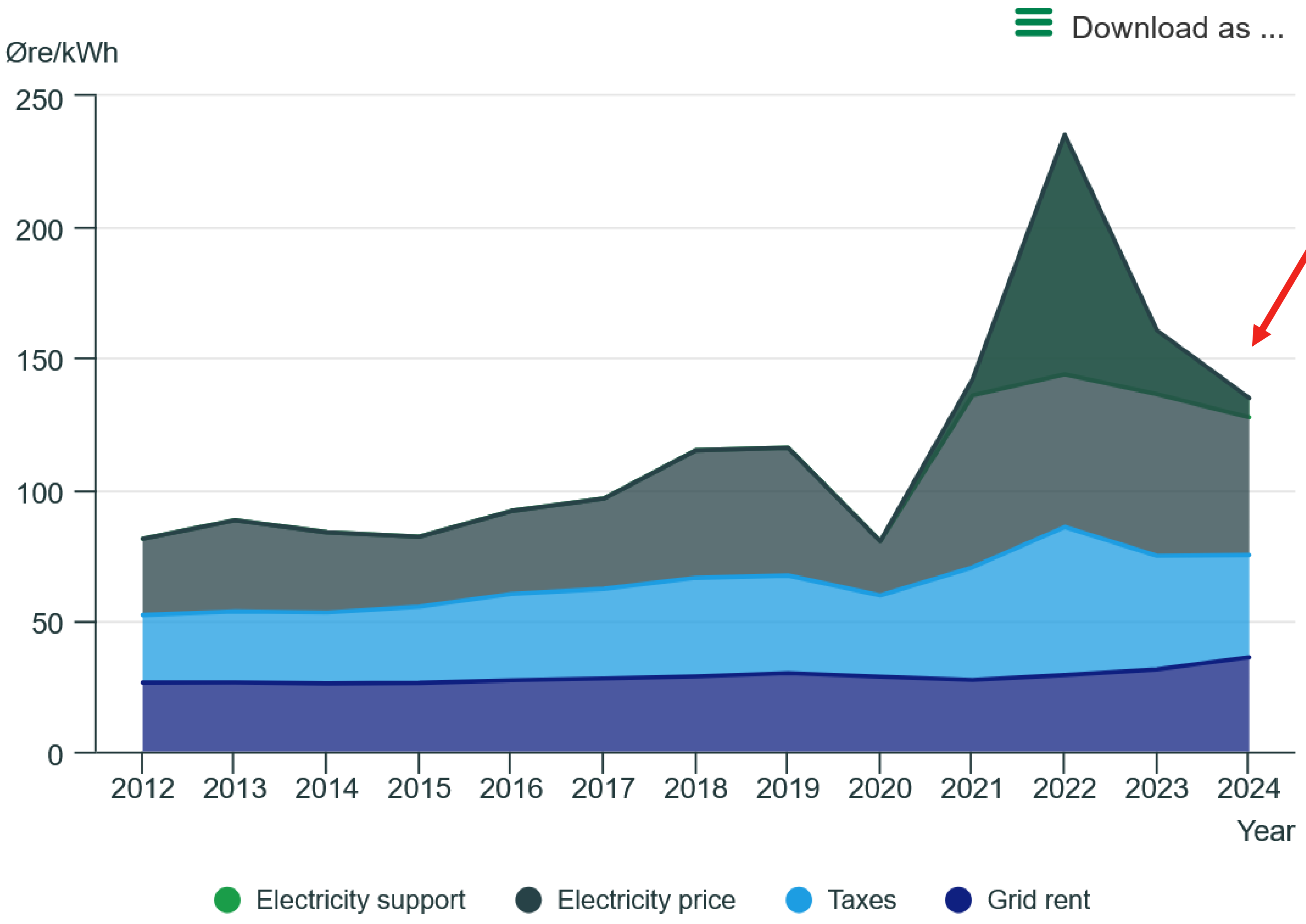
NORSK VARMEPUMPEFORENING

Electricity price, grid rent and taxes for households



100 øre = 1 NOK =
= 0,085 Euro

Average price 2024

Electricity price = 0,599
= 0,051 Euro

Electricity support = -7,4
=0,0059 Euro

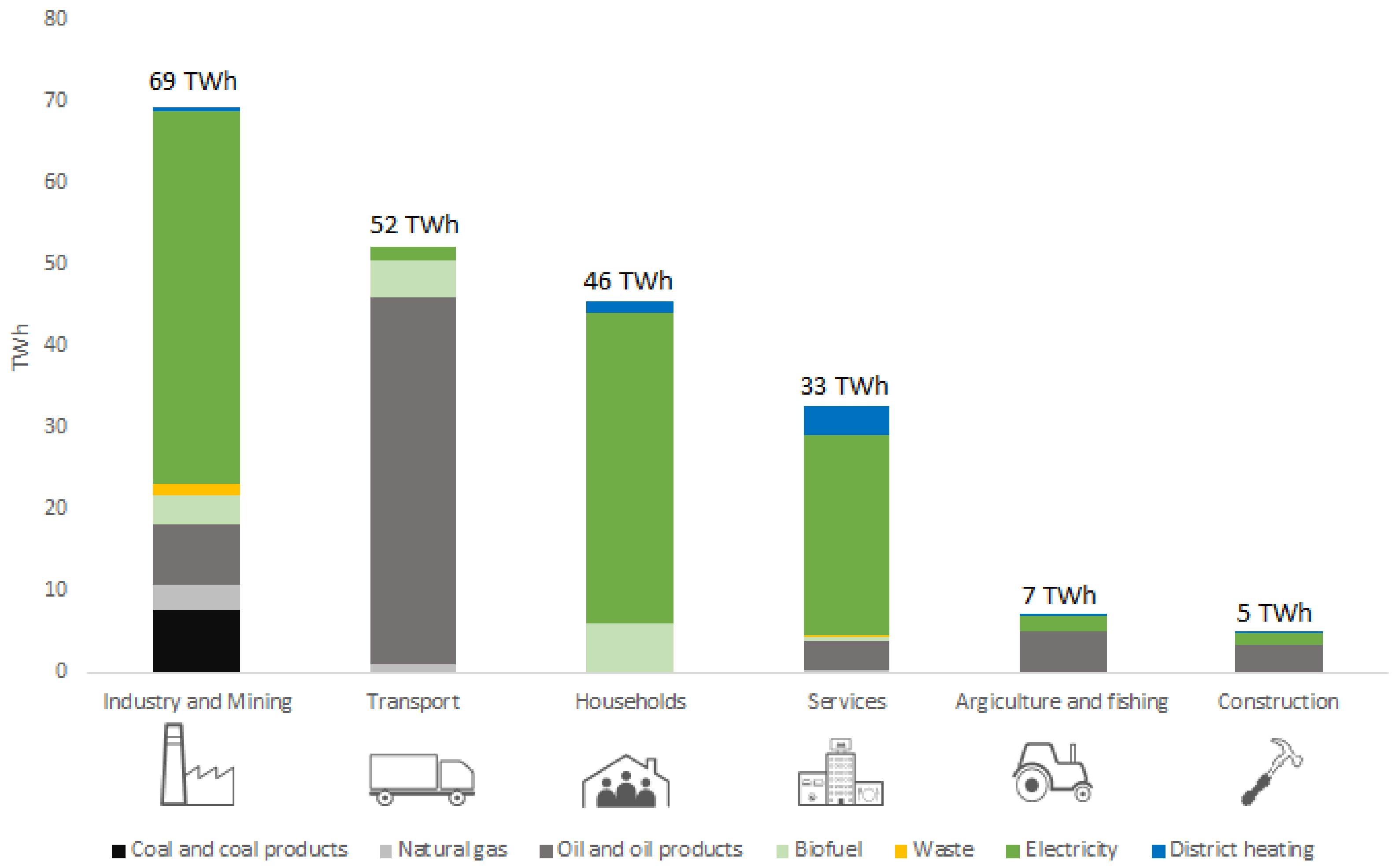
Taxes = 0,39
= 0,033 Euro

Grid rent = 0,36
= 0,031 Euro

Source: Electricity prices, Statistics Norway

NOVAP NORSK VARMEPUMPEFORENING

Final energy consumption in Norway



Total in 2020: 211 TWh. Source: Statistics Norway

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NORSK VARMEPUMPEFORENING

Use of fossil energy in Norway

Fossil oil heating is prohibited for most buildings since 2020

Fossil energy is prohibited in new buildings since 2015

Gas heating is only available in a few places

Fossil energy is still used in industry, but this will be phased out

CO_2-tax: 120 Euro per ton of CO_2 (NOK 1405) (142 US Dollar)

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NORSK VARMEPUMPEFORENING

Electricity production and consumption

Electricity production in 2024:	157,2 TWh
Electricity consumption 2024:	138,5 TWh
Energy inland consumption 2024	215 TWh
Net export of electricity:	18,4 TWh

1791 **hydropower plants 88 %**
of Norwegian production capacity

65 **wind farms 11 %**
of Norwegian production capacity

The total renewable share in Norway is 55.4 %, compared with 46.7 % in 2010

Electric heating is common in Norway

65% of Norway's population has a fireplace in use, either in their home or at their cabin.

Norwegian EV market

2025 : 94,5 percent of all new cars sold were fully electric.

More than 60 % of all households have a heat pump

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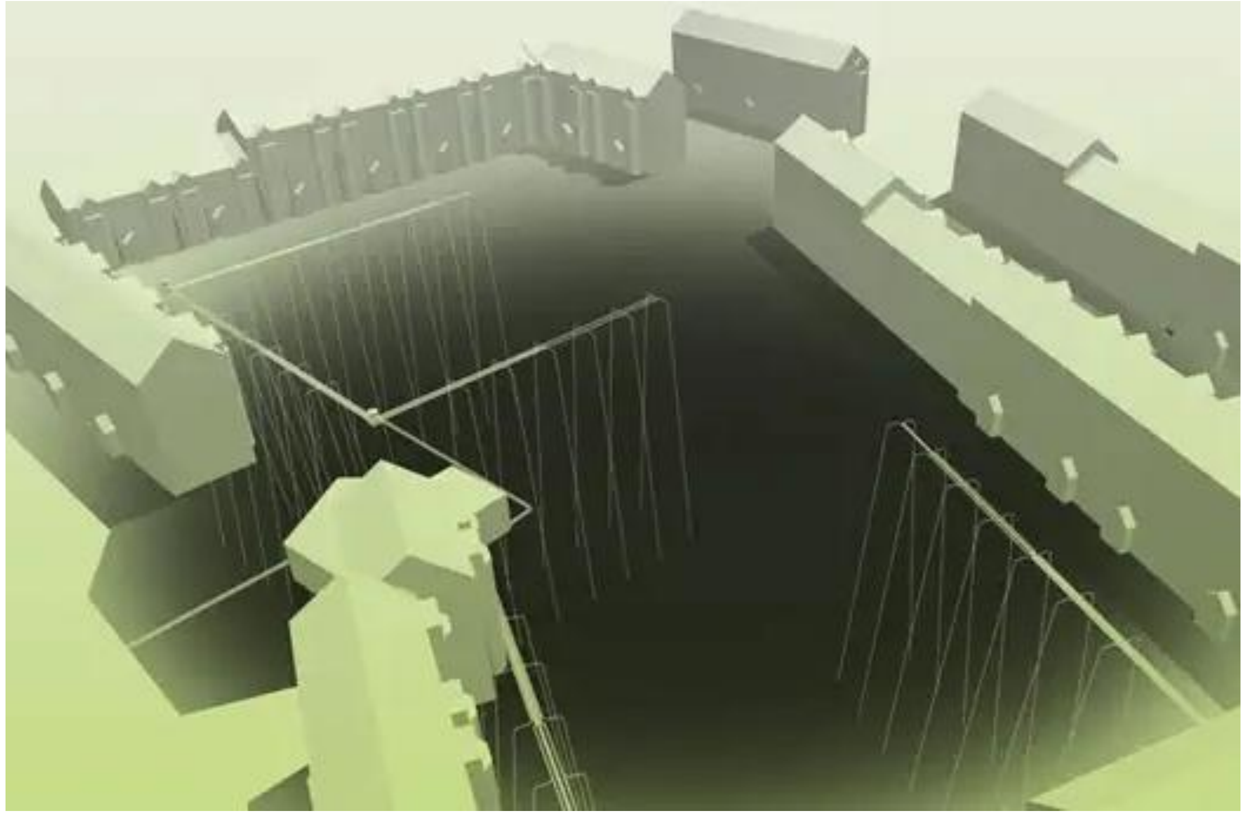
NORSK VARMEPUMPEFORENING

Air-to-water heat pumps in both old and new buildings

Geothermal heat pumps with energy wells



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NORSK VARMEPUMPEFORENING


Propane heat pumps
Demand for the use of natural
refrigerants is growing rapidly

Industry -

Ammonia high temp heat pumps

Felleskjøpet ANEO

In 2024, 6.8 TWh of district heating was delivered to end users. The share of heat pumps in district heating is growing.

Some success factors and challenges for heat pumps in Norway

+ Electrification of society - strong electricity grid
+ Price of electricity vs gas - heat pumps are the most profitable heating solution
+ Taxes on electricity vs CO_2 - bans of fossil fuels for heating in Norway
+ High quality heat pumps for cold climate
+ Large network of skilled installers throughout the countries

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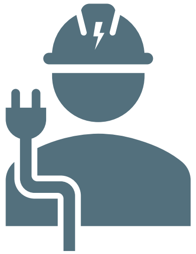
NORSK VARMEPUMPEFORENING

Challenges for heat pumps

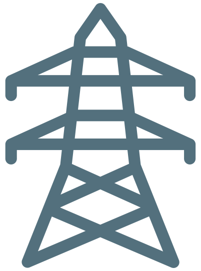
High investment cost a barrier

Does not normally apply to air-to-air heat pumps in detached houses.



Building technical regulations encourage electric heating

Since 2015, no incentive to choose heat pumps. Most buildings does not have hydronic heating.



Low electricity prices

Electricity prices affect demand for heat pumps since the most important driver for acquiring heat pumps is saving on electricity costs.

What have NOVAP done to increase the market?

SKILLS

- We are the largest training provider to increase the competence of installers and Energy/HVAC consultants

POLICY

- We collaborate with environmental and industry organizations to strengthen the framework conditions for energy efficiency and heat pumps

KNOWLEDGE, REPUTATION AND TRUST

- We work a lot with consumer and political communication

Danish District Heating

RCH-Roundtable 25. September 2025

Birger Lauersen, Manager International Affairs

DANISH DISTRICT HEATING ASSOCIATION

Danish district heating's history

1950's
- Regulation municipal utilities

1960's
- Growth on private and municipal initiative

1970's
- Energy crisis
- Heating Commission
- Shift to surplus heat (CHP)

1980's
- Heat law
- Heat planning
- Continued shift to CHP and other surplus heat sources
- Expansion of networks
- No more oil

1990's
- Localised CHP
- Natural gas/biomass

2000's
- Consolidation
- Looking for sustainable heat

2010's
- Expansion
- Renewables
- Integration

2020's – Today
- Energy crisis
- Climate crisis
- New focus on DH
- Independence from imported fuels
- High demand for transition to renewable energy

DANISH DISTRICT HEATING ASSOCIATION

Heat Supply Act - Objective

Please note: Revised Google translation!

First Heat Supply Act in 1979

Paragraph 1:

"(1)….to promote the most socio-economic and environmentally friendly utilization of energy for heating buildings, supplying them with hot water and reduce the dependency of the energy system on oil.

(2) …in agreement with the objectives mentioned in subsection (1), the supply of heat shall be organised with a view to promoting the highest possible degree of cogeneration of heat and power.

(3) *…also to promote the use of energy from renewable energy sources in heat production for use in companies' production and services."*

DANISH DISTRICT HEATING ASSOCIATION

Municipal role in Danish heating sector (very condensed!)

Before 2019: Planning with intent

Zoning based on lowest socio-economic cost (not consumer cost!)

- Zones suitable for ”collective supply”
  - Heat density (urban & suburban areas)
  - Availability of heat source or gas
  - District heating or natural gas
  - Request construction by utility
  - Permitting (grid and production)
  - Optionally impose obligation to connect/remain connected
  - Issue loan-guarantee (grid and production)
- Zones for individual solutions (countryside)

After 2019: ~~Planning with intent~~ Analyzing feasibility

Zoning based on lowest socio-economic cost/~~not~~ consumer cost/technical feasibility/sustainability……~~!~~

- Zones suitable for ”collective supply (DH)”
  - Heat density (urban & suburban areas)
  - Availability of heat source ~~or gas~~
  - District heating ~~or natural gas~~
  - ~~Request construction by utility~~
  - Permitting/Easing of permitting (grid and production)
  - ~~Optionally impose compulsory connection/remain connected~~
  - Issue loan-guarantee (grid and production)
  - No support for individual heat pumps (for one year)

Consumer protection through national legislation!

DANISH DISTRICT HEATING ASSOCIATION

How do we heat Danish homes (and other buildings)?

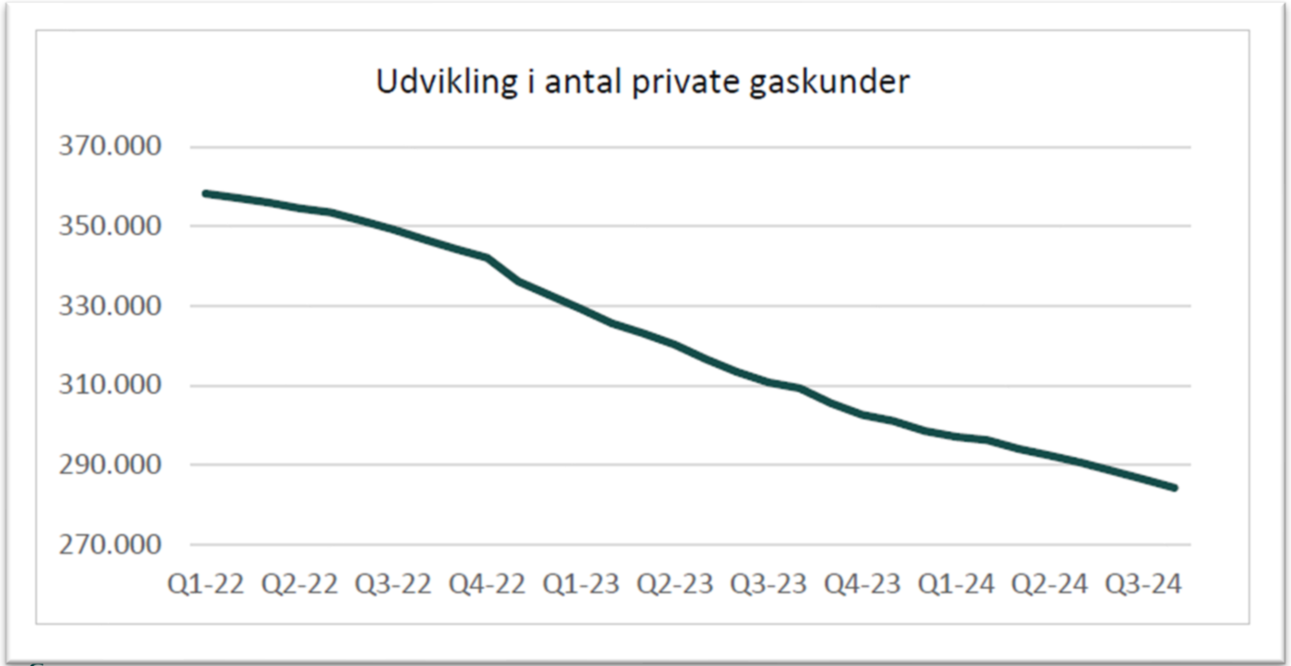
Heating solution in all Danish occupied homes by number, 2025 Source: Statistics Denmark, 2025*	Detached houses	Terraced, linked or semi-detached houses	Multi-unit buildings	All homes	Industrial, public, tertiary, service etc. buildings
District heating	46,8%	71,1%	94,5%	69,5%	60,1%
Central heating/with oil	7,3%	1,0%	0,7%	3,5%	8,9%
Central heating/with N-gas	18,1%	18,0%	3,4%	12,4%	21,0%
Central heating/without oil or N-gas	7,1%	0,4%	0,1%	3,1%	2,4%
Heat pump	14,6%	4,8%	0,5%	7,3%	3,4%
Direct electric heating	5,3%	4,4%	0,6%	3,6%	2,3%
Stoves, other	0,7%	0,1%	0,2%	0,4%	0,7%
Unknown	0,1%	0,2%	0,0%	0,1%	1,2%
	100,0%	100,0%	100,0%	100,0%	100,0%

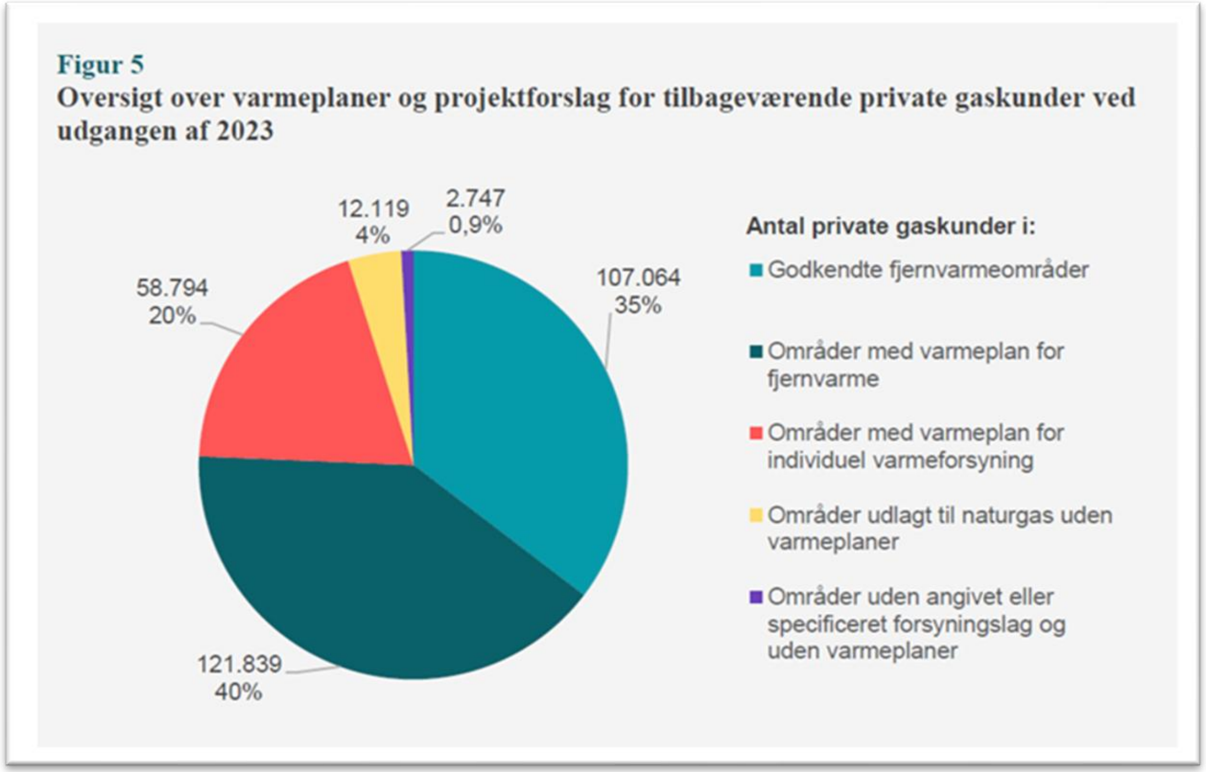
*As reported by building owners to national building register. Both past changes and current trends in heating conversions may thus be underreported.

DANISH DISTRICT HEATING ASSOCIATION

Conversions from gas

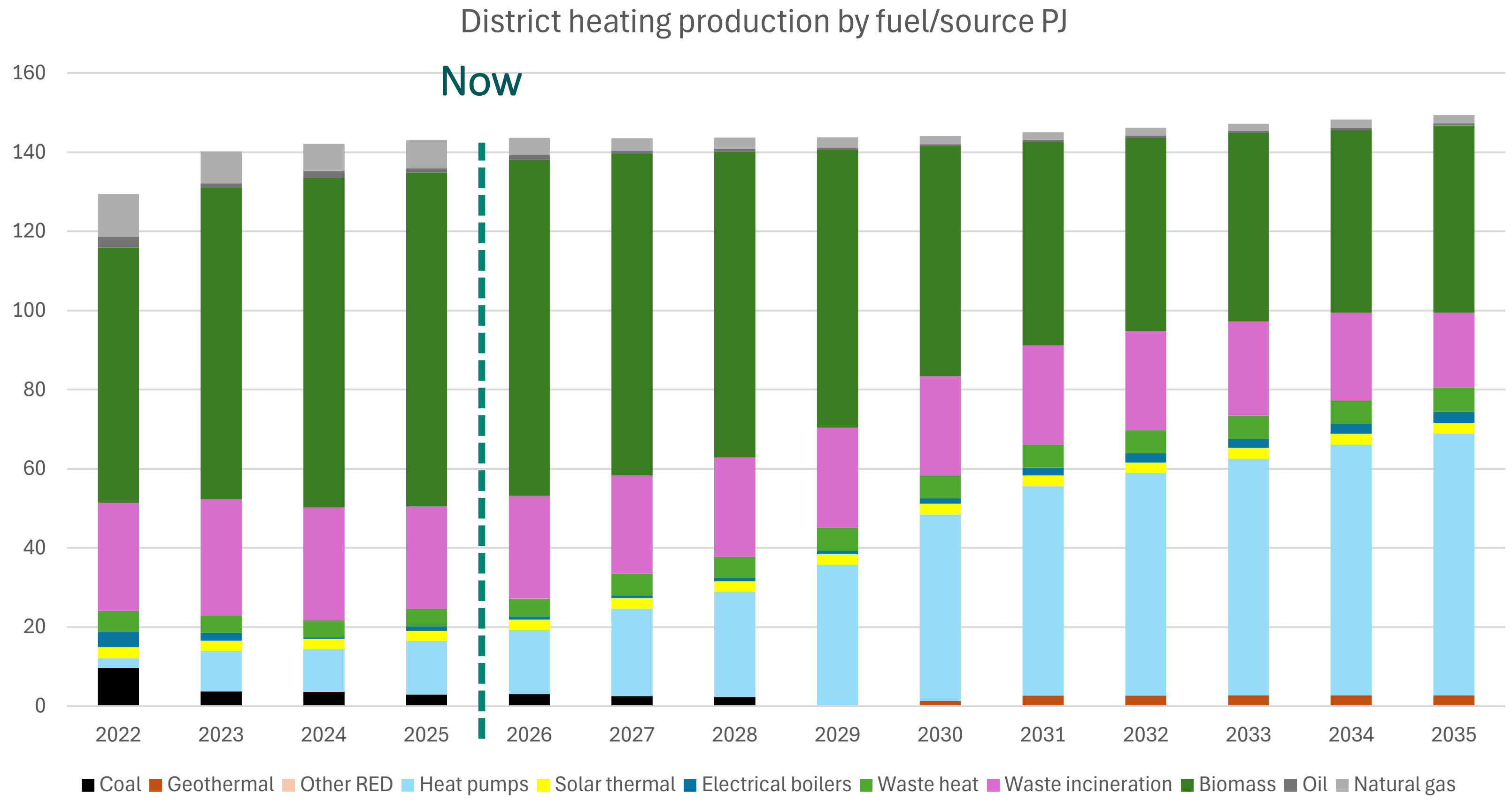
Reduced political focus, lower gas prices, and thus consumer concern, combined with higher construction costs have slowed expansion of district heating and sale of heat pumps





DANISH DISTRICT HEATING ASSOCIATION

Type of energy and renewables share in Danish district heating (2017-2035)



- The share of renewable energy in the district heating supply has increased from around 60% in 2017 to 78% in 2023.
- Political aim to have fully carbon neutral heating and electricity sector by early 2030'ties

Data source: Danish Ministry of Climate, Energy and Utilities: Denmark's Energy and Climate Outlook 2024.

DANISH DISTRICT HEATING ASSOCIATION

Phasing in new technologies in Danish district heating

Large scale heat pumps – largest 3 x 44 MW

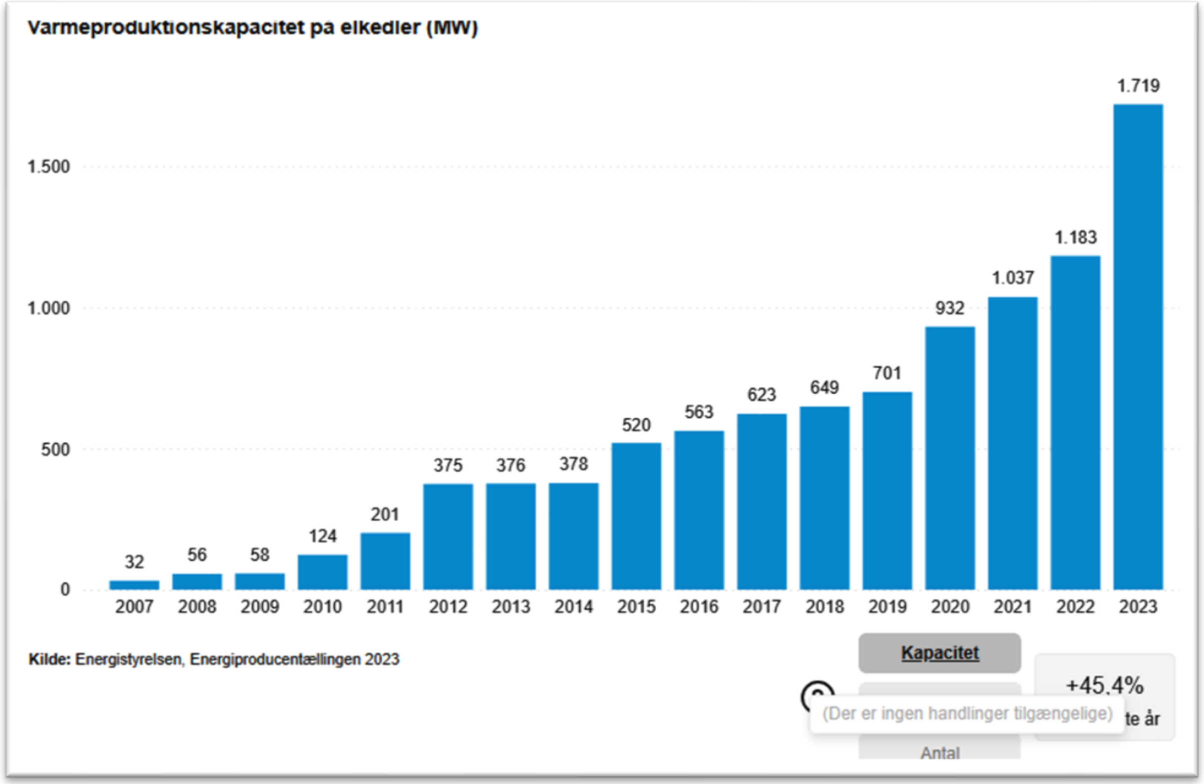
- **Sea/sewage water**
- **Waste heat**
- **Ambient heat**
- **Geothermal**

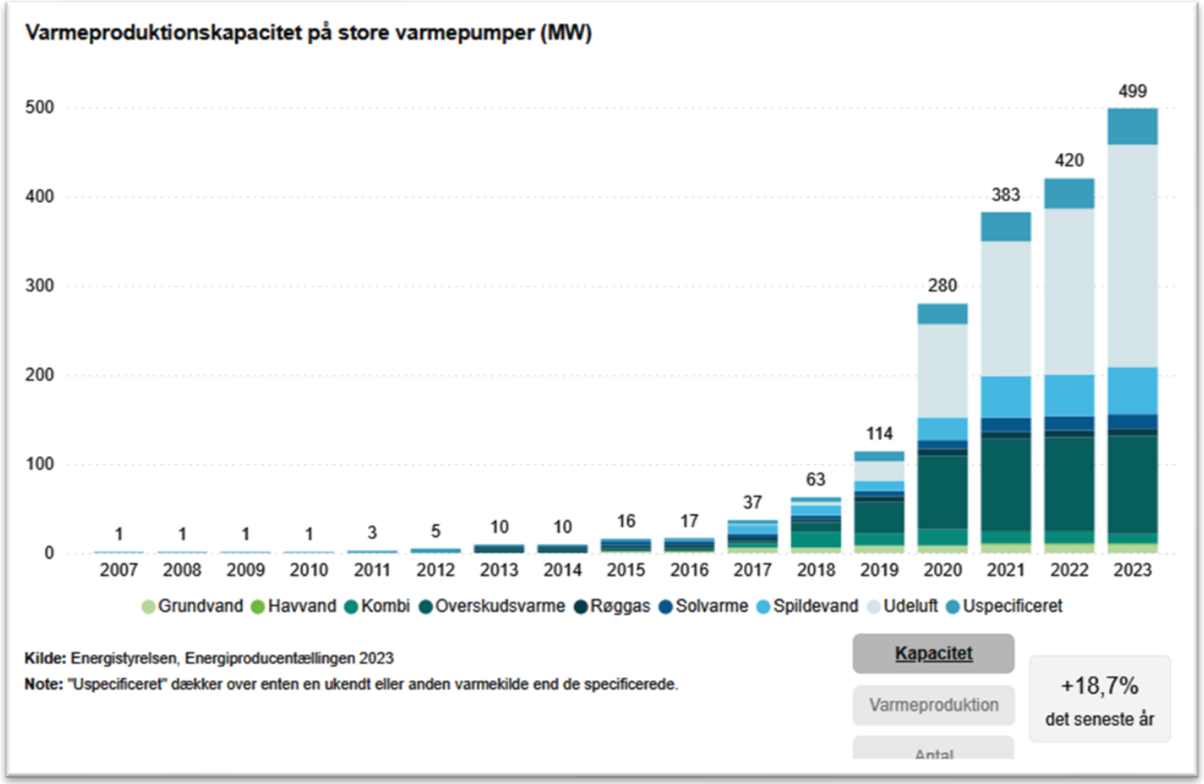
Electrical boilers – largest 80 MW

Geothermal – largest 110 MW

DANISH DISTRICT HEATING ASSOCIATION

Electrification of district heating





DANISH DISTRICT HEATING ASSOCIATION