

European GSHP scene

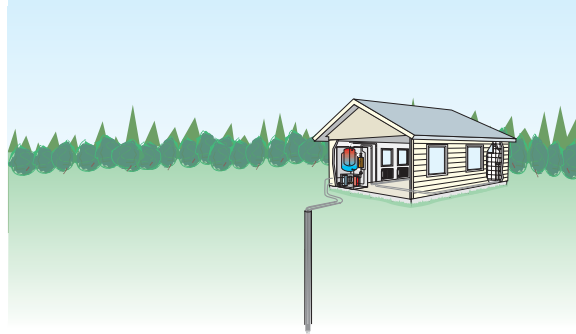
Roger Nordman IEA Heat Pump Centre ,ProHeatPump



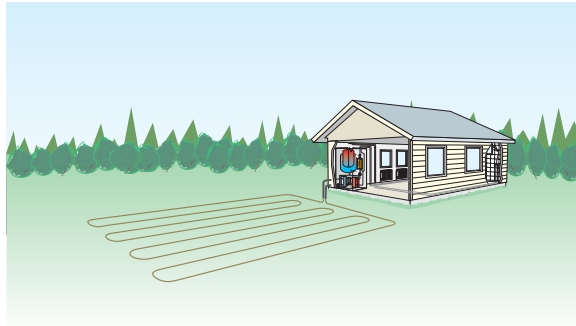
SP Technical Research Institute of Sweden



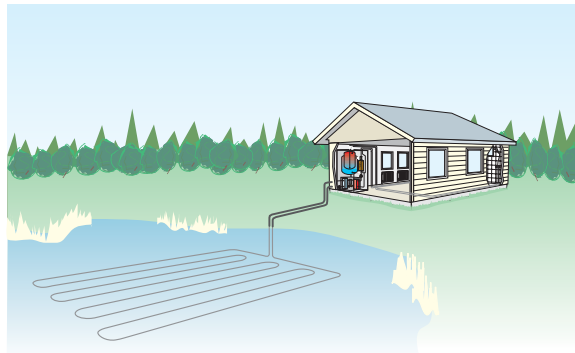
GSHP



Vertical borehole



Horizontal collector



Lake collector

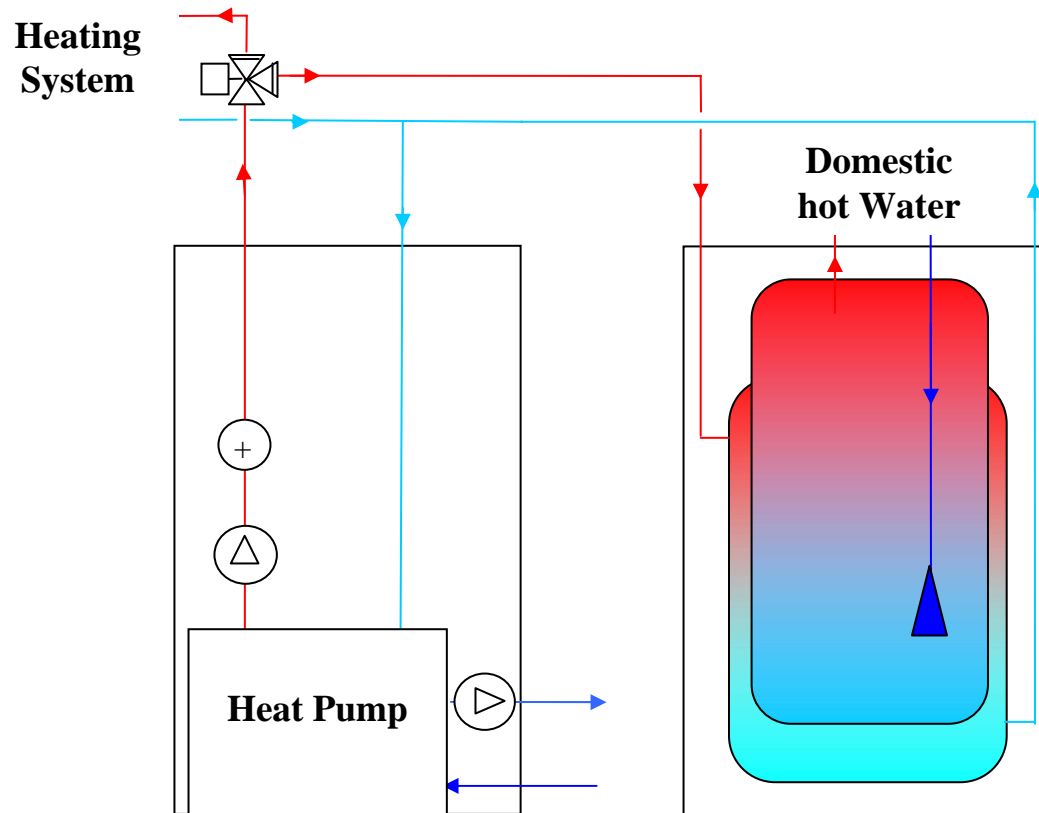


SP Technical Research Institute of Sweden

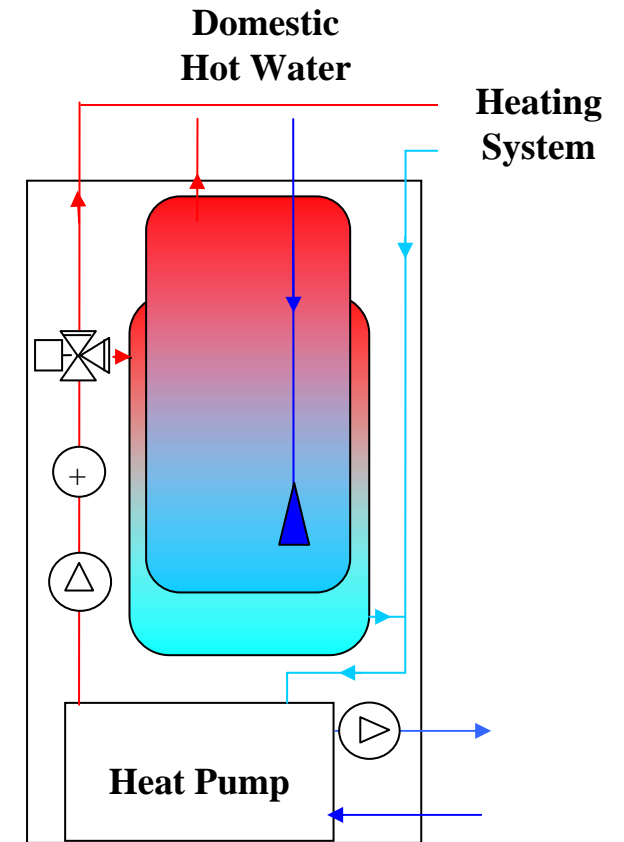


Heat pump designs

Design with separate domestic water heater



“Compact” design most common (SE)



N.B. combined tap water and space heating



SP Technical Research Institute of Sweden



Where's the application

Domestic single family houses
Small units, appr. 2- 15 kW



Multifamily houses
Larger units, appr. 20-100 kW



Commercial buildings
Offices, schools, sport centers, etc.



SP Technical Research Institute of Sweden



Competing technologies

Gas heater:

Cheap, small investment cost → Stress Life Cycle Cost, LCC

Gas price expected to rise more than electricity price due to CO2 charges

Oil boiler:

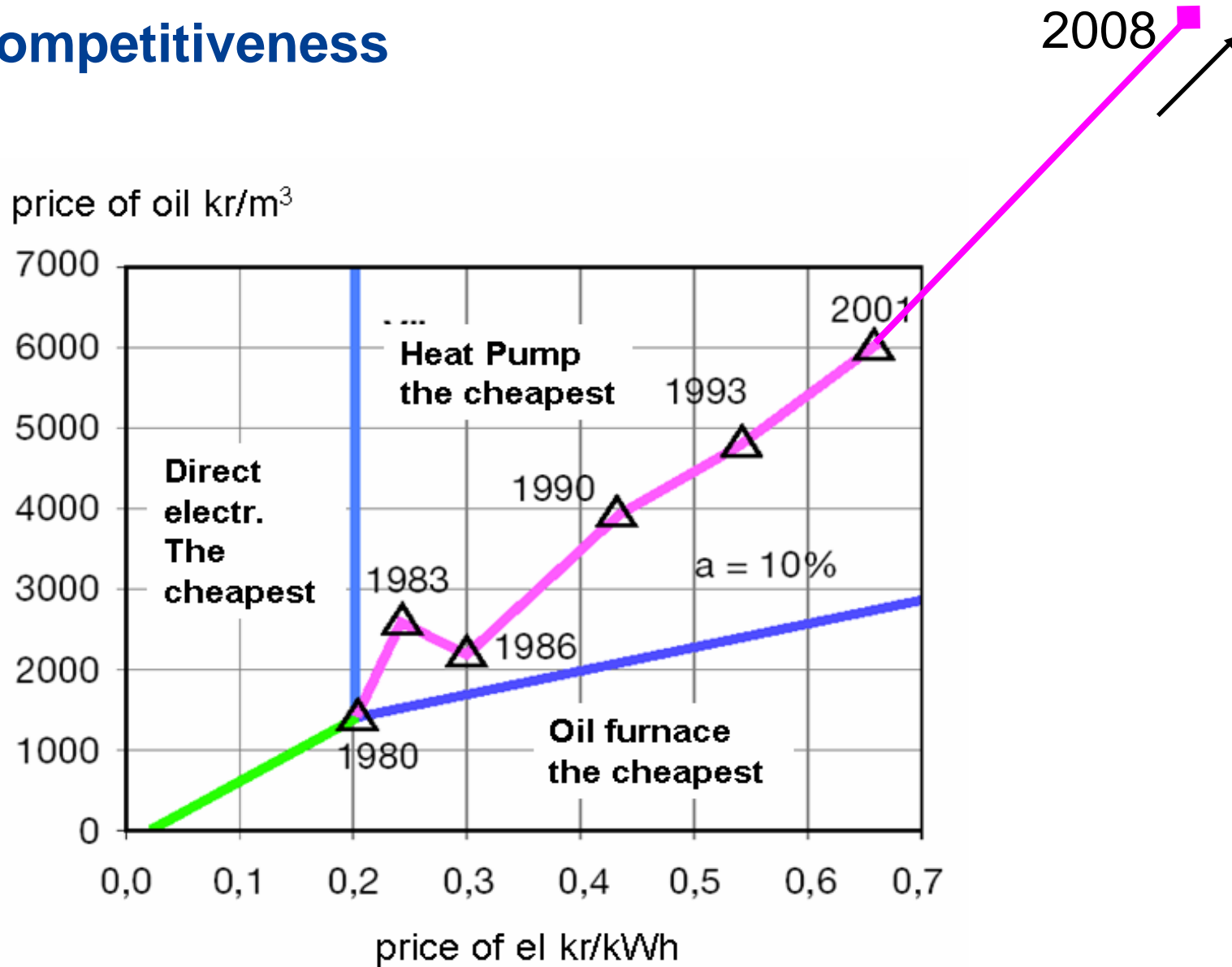
Really no excuse....!



SP Technical Research Institute of Sweden



Competitiveness



SP Technical Research Institute of Sweden



Opportunities

- High energy coverage
- Combined space heating, domestic hot water and cooling possible
- Silent operation
- Suitable for both new (underfloor heating) and retrofit (hydronic radiators) houses
- Reliable
- Reduce carbon footprint
- Reduce primary energy usage



SP Technical Research Institute of Sweden



Experiences of end-users – main motives for installing Ground-Source Heat Pumps in Sweden

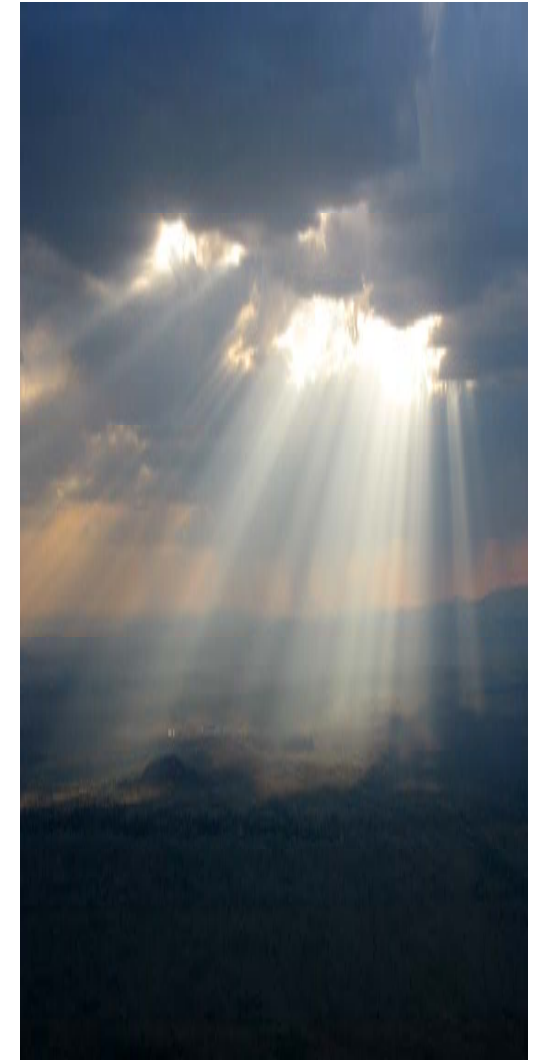
(Results from field measurement study)

Reduce energy cost 75%

Replace old boiler 57 % (98 % retrofits)

Environmental concerns 34%

Increased comfort - "plug-and-play" 20%



SP Technical Research Institute of Sweden



Barriers in the UK (?)

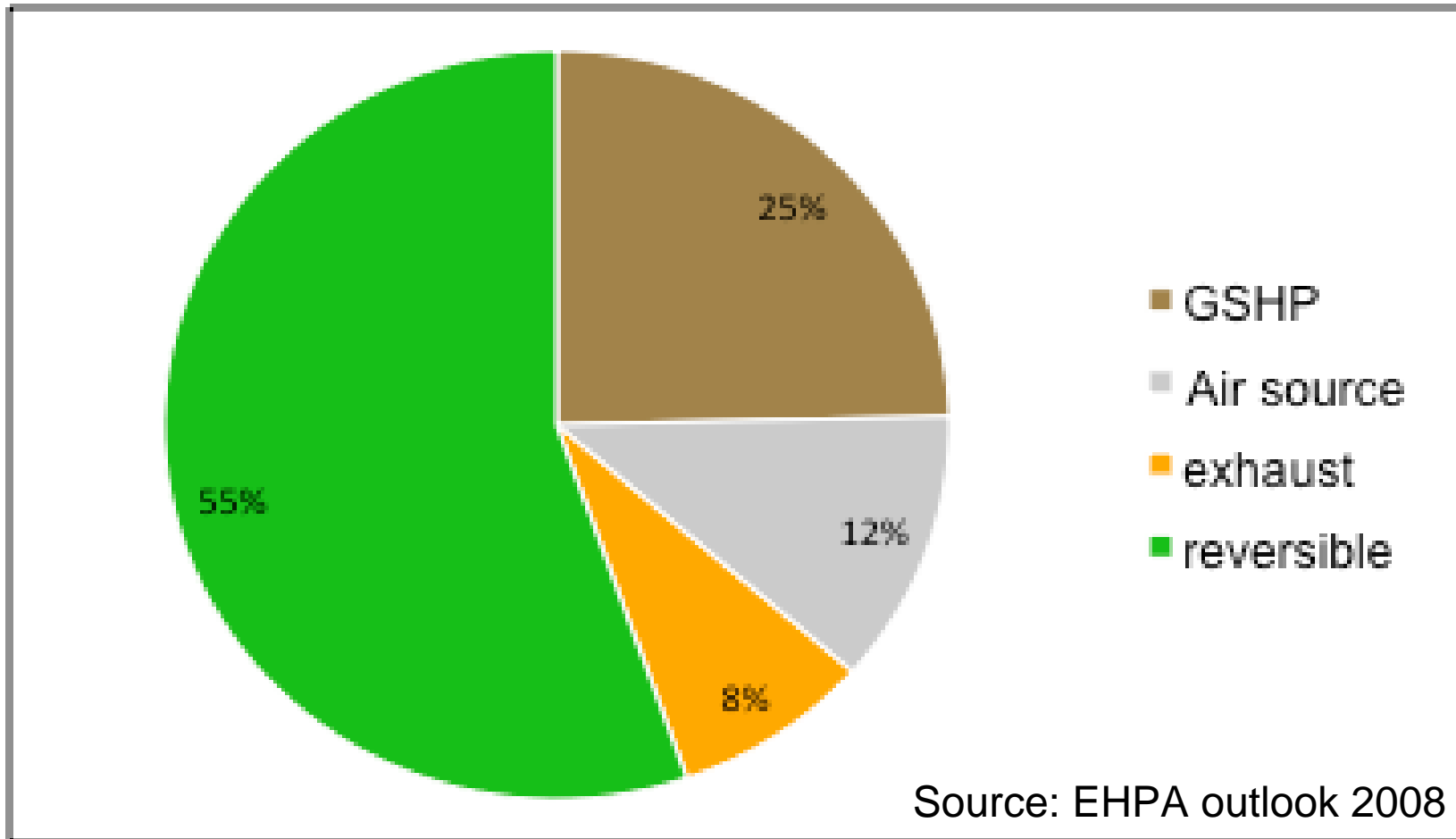
- Electricity grid
- Rock properties → grouting necessary if no crystalline rock (£)
- Hydronic heating system used?
- Gas grid → gas driven heat pump!
- Need for permission/notification to drill? (takes time)



SP Technical Research Institute of Sweden



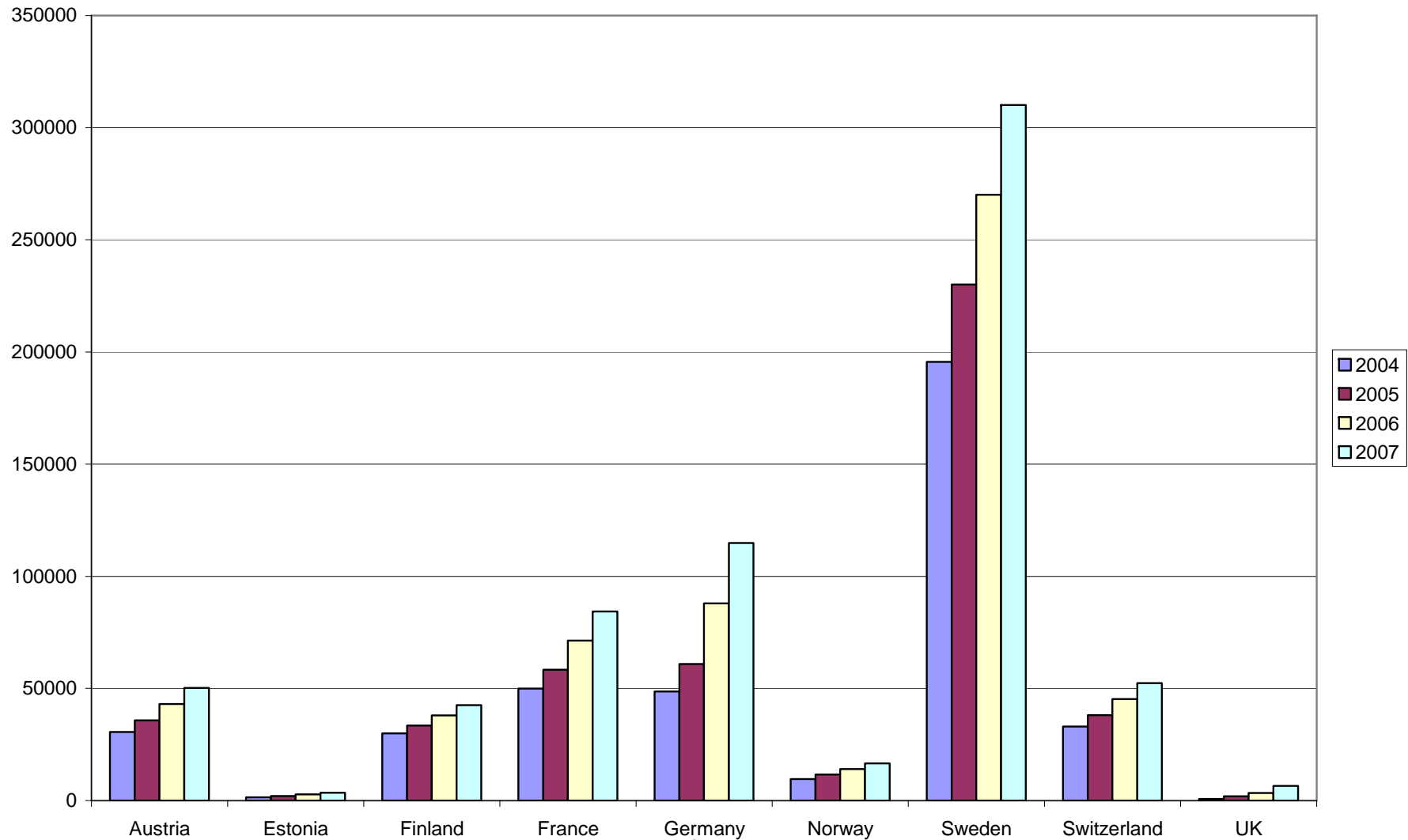
Market share of GSHP



SP Technical Research Institute of Sweden



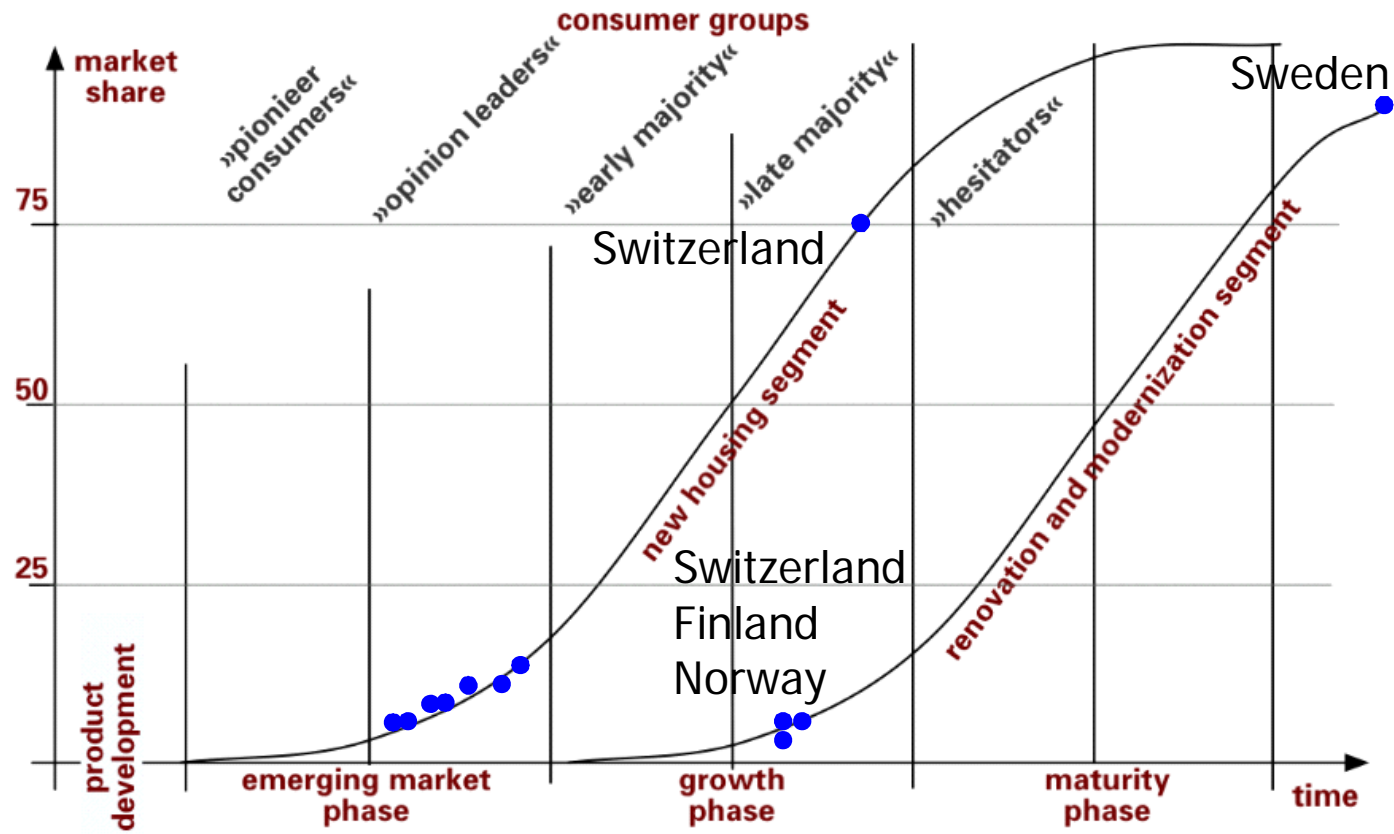
Accumulated number of installed GSHP's



SP Technical Research Institute of Sweden



Market maturity GSHP in Europe



SP Technical Research Institute of Sweden



Potential, domestic

Total annual refurbishment rate of almost 4,9 million units in the EU 25, Norway, Switzerland and Liechtenstein.

The UK is top of the list, with an annual replacement 1.0 million units

The total stock of one/two family houses in the EU 25, Norway, Switzerland and Liechtenstein is almost 98 million.

→ Need for high temperature heat pumps

New built houses generally represent 1-2% of the building stock



SP Technical Research Institute of Sweden



Domestic applications

Replaces oil boiler or gas boiler in **renovation**

Requires additional radiators if not well dimensioned

Generally lower SPF values, so need for good design

Installation in **new built** houses

Underfloor heating systems @ 35C

Generally good SPF

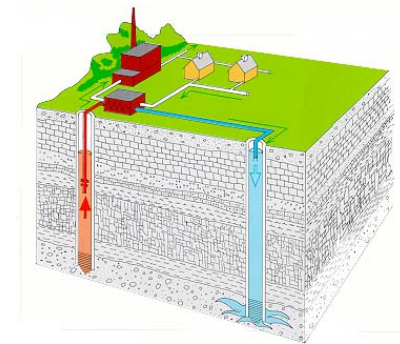


SP Technical Research Institute of Sweden



Commercial buildings

- Thermal storage systems – multiple boreholes
- Supplies both heating, hot water and cooling
- Cooling is passive or free cooling
- Low operational cost



Aquifer Thermal Energy Storage



Borehole Thermal Energy Storage

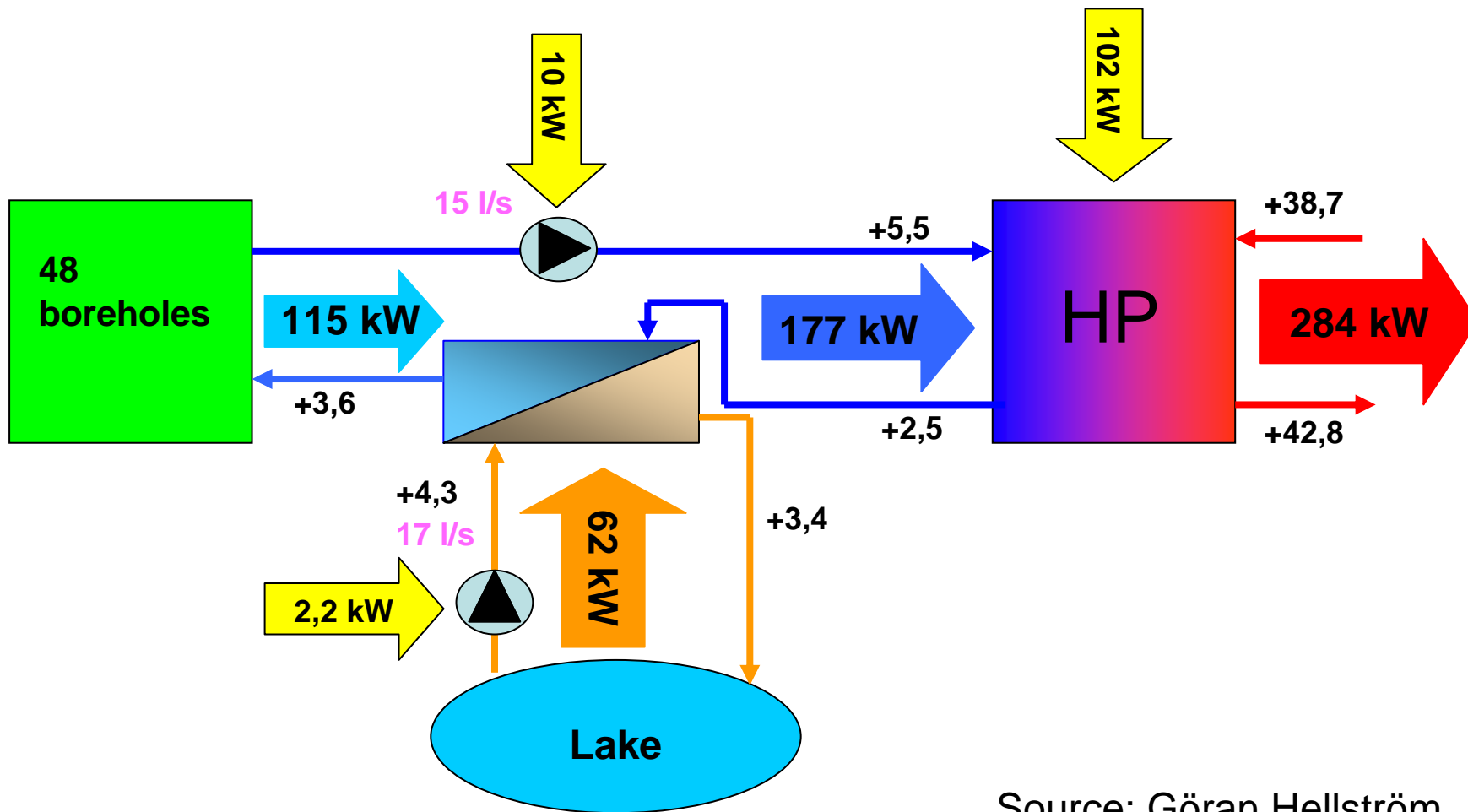


SP Technical Research Institute of Sweden



Näsby parks slott

Ground-coupled heat pump with recharge from lake



Source: Göran Hellström



SP Technical Research Institute of Sweden



Näsby parks slott - Profitability

Estimated based on first seven months of operation

Alternative 1. Oil

Alternative 2. Ground-source heat pump and oil (peak)

Additional investment cost:	750.000 EUR
Reduced operational cost:	180.000 EUR/year
 Straight pay-off time:	 4,2 years

Reduced oil consumption 79 %

Reduced bought energy (oil & electricity) 57 %

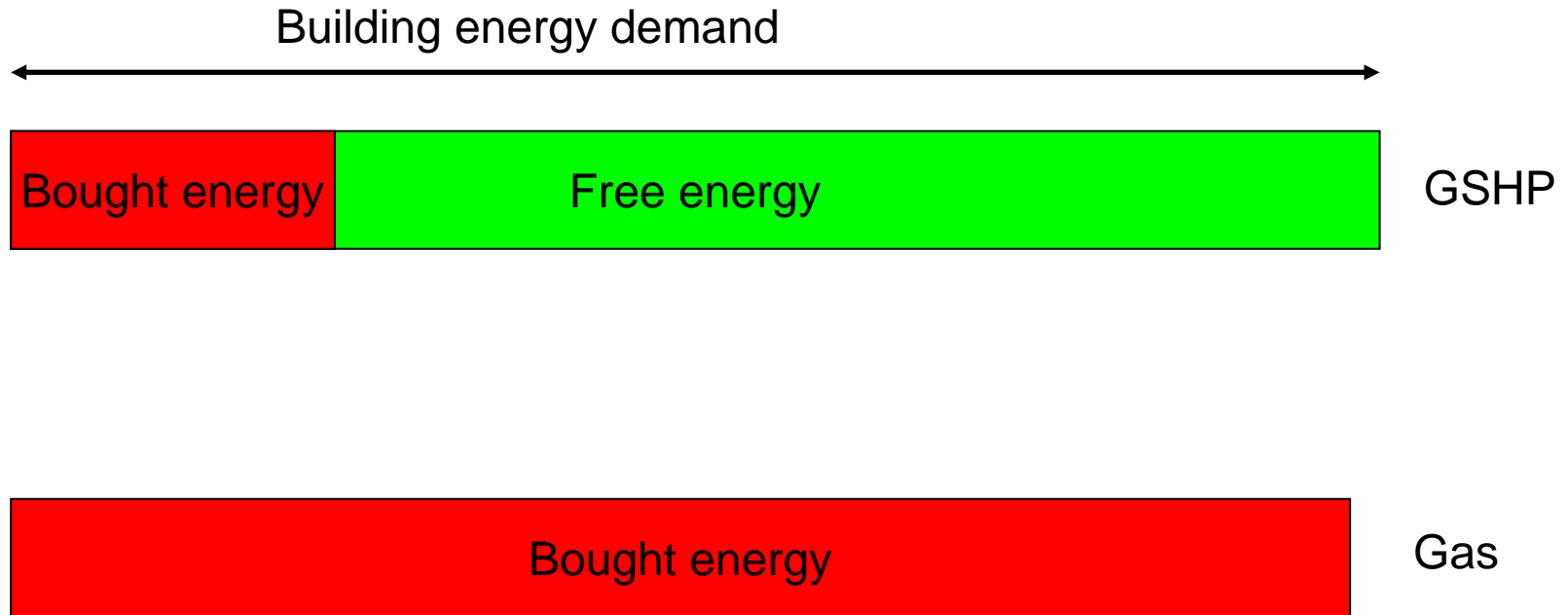
Source: Göran Hellström



SP Technical Research Institute of Sweden



GSHP cut primary energy needs...



SP Technical Research Institute of Sweden



... and CO2 emissions

GSHP with SPF of 3 compared to a Gas boiler

Type	Heat demand (kWh)	efficiency	primary energy use (kWh)	Specific CO2 emissions (kg CO2/kWh)	CO2 emissions (kg)
Oil-fired boiler	15000	0.8	18750	0.274	5138
Gas-fired boiler	15000	0.95	15789	0.202	3189
Electrical boiler, EU ele	15000	0.95	15789	0.4721	7454
Electric heat pump, EU electricity mix 2005, SPF = 3	15000	3	5000	0.4721	2360

Price relation Gas / el = $15789/5000 = 3.3$

Mean EU emissions



SP Technical Research Institute of Sweden



Keys to successful business (SE)

- All-in contractors – taking care of the entire instalment
- Insurance packages
- R&D in close collaboration with industry

- Training of drillers and installers

EU-Cert-HP (EHPA)

- Certified Products



- Good installations → SPF value rather than COP



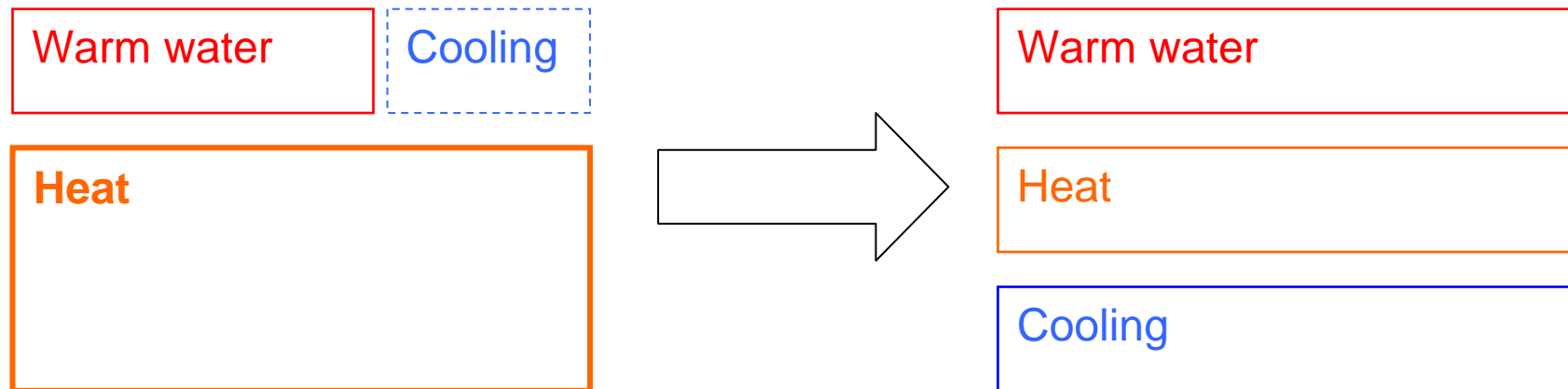
SP Technical Research Institute of Sweden



Trend

Heating and cooling demand in future low energy buildings?

Heating and warm water same magnitude of size!



SP Technical Research Institute of Sweden



Is there a future for GSHP?

Answer: Definite YES!, but...

- Need for increased knowledge in all stages, follow-up
 - Manufacturing, drilling, installation
- Go for robust systems – QA system in place
- Design the heat pump **system** well! (HP + distribution system)



SP Technical Research Institute of Sweden



Conclusions

GSHP's can:

Reduce carbon footprint

Supply a low cost heating solution

Supply heating with a high share of renewable energy

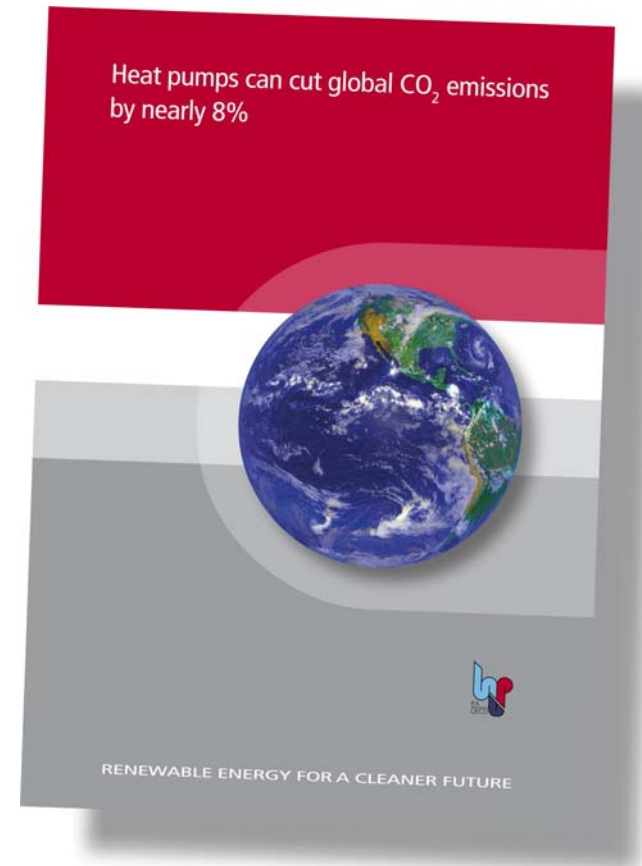


SP Technical Research Institute of Sweden



Thank you for listening!

www.heatpumpcentre.org
www.proheatpump.eu



SP Technical Research Institute of Sweden

