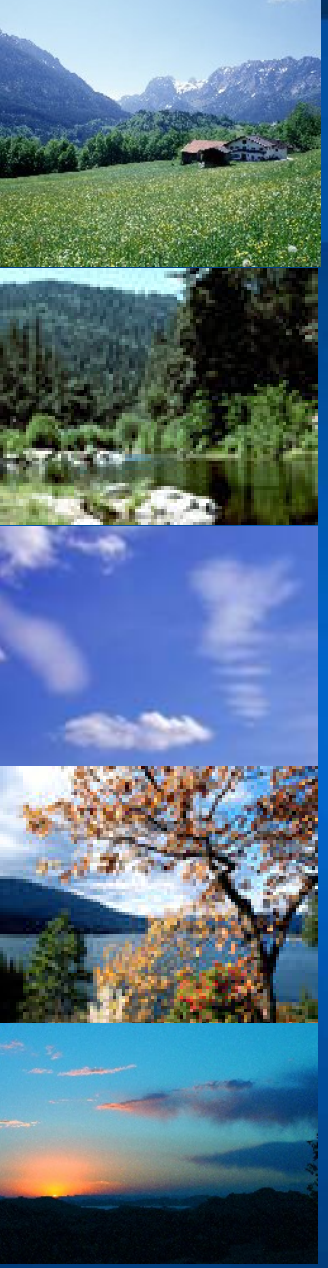


Three important E:s in Heat Pump Technology

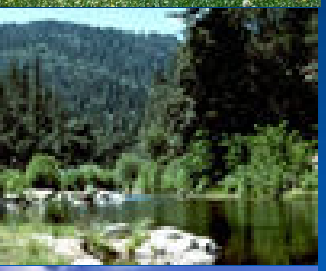
Energy

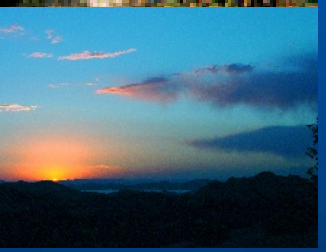
Environment

Economy

Martin Forsén
Swedish Heat Pump Association
European Heat Pump Association

Typical Ground source heat pump (5.5 kW_{th})

General working principal

Radiators

Under floor heating

Fan-coils

Heat sink

Compressor

Heat source

Ground rock

Ground Source

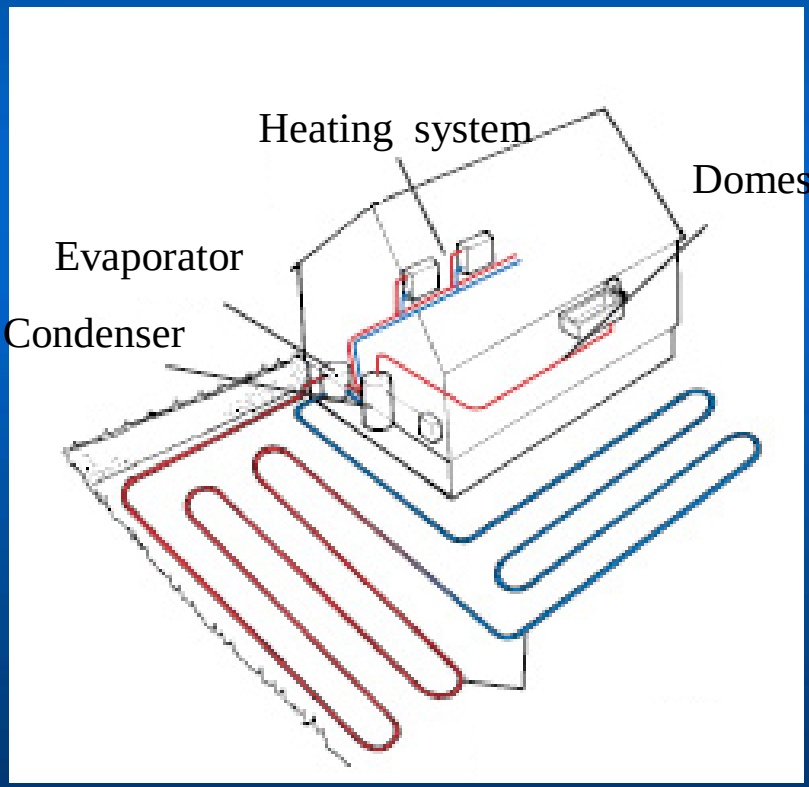
Ground soil

Ambient air

Coefficient of performance (COP) =

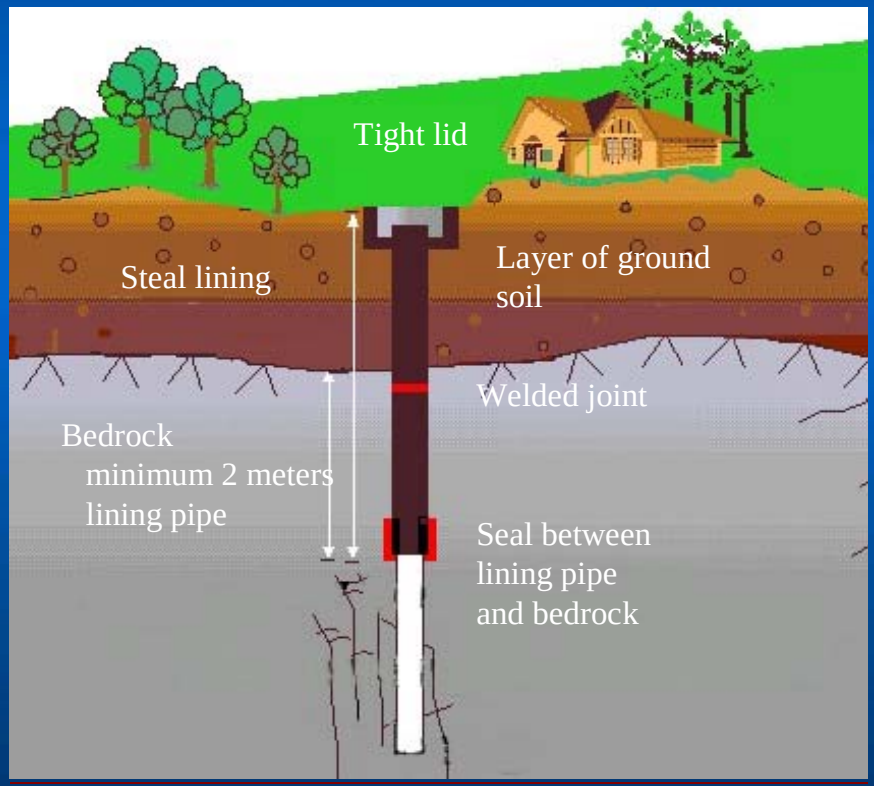
Ground source heat pumps

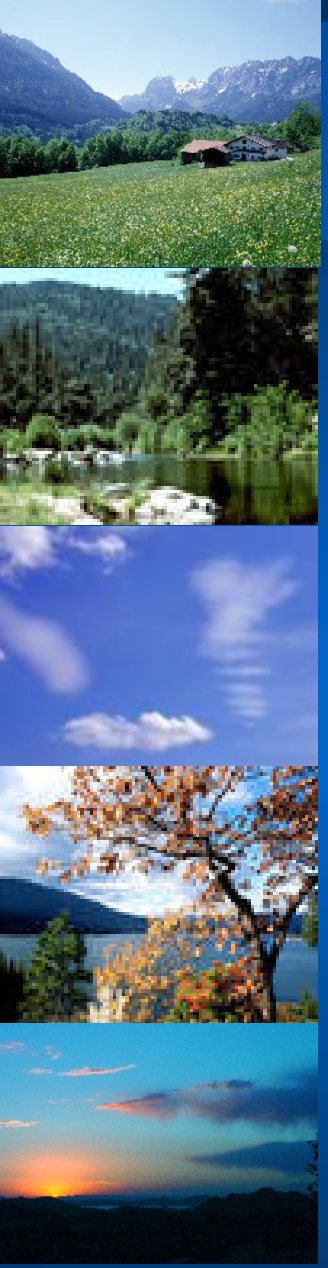
- **Horisontal ground soil system**
- *Vertical ground soil/rock system*



Ground source heat pumps

- *Horisontal ground soil system*
- **Vertical ground soil/rock system**





One family house – Ternitz (Austria)

- 240m² living space
- 11 kW Geothermal heat pump
- 280 m² Flat collector
- Controlled ventilation

One family house – Ternitz (Austria)

- Seasonal performance factor 5,3
- Energy costs EUR 390,-
- Energy savings
  - Oil 1923 Liters
  - CO_2 4,1 Tonnes

Multi-family house, Norrtälje, Sweden

Number of flats: 90

Heated area: 7.800 m²

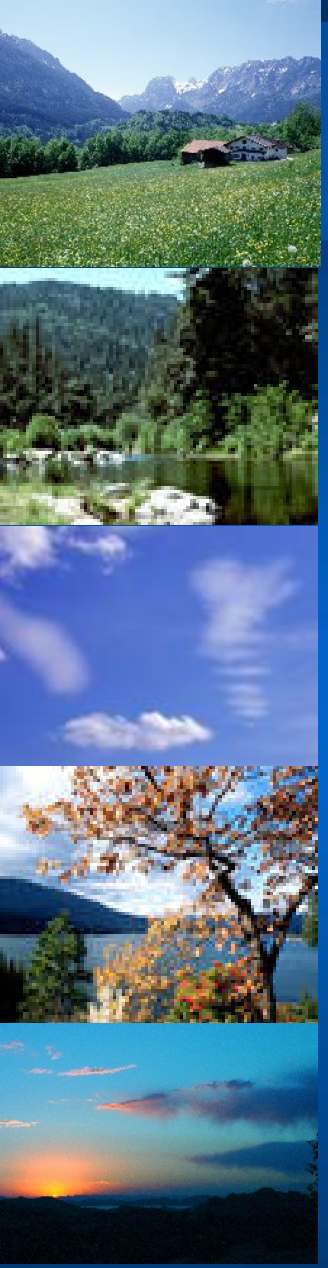
Previous heating system: Oil boilers

New system
4 x GSHP 40 kW + oil boiler (back-up)

Heat source:
19 boreholes x 173m

Annual savings: 40.000 euro

Pay back time: 4 years



Multi-family house, Norrtälje, Sweden

Commercial building, Les Mureaux, Paris, France

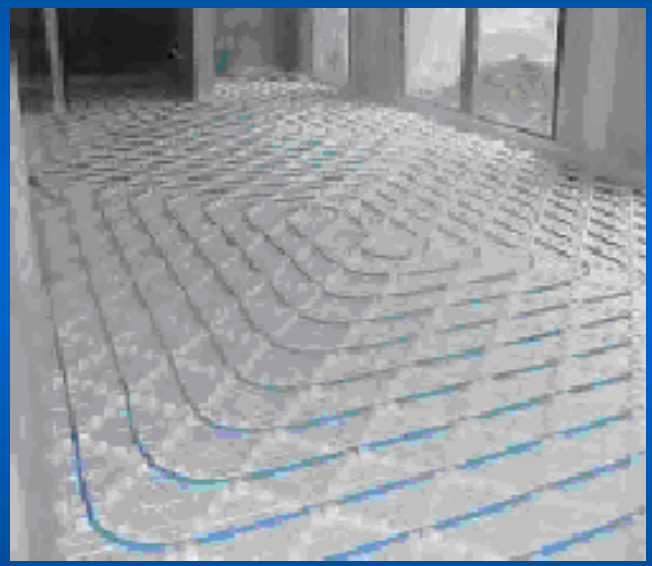
Office building

Conditioned area: 4.400 m²

1 Ground water heat pump (290 kW_{th})

Utilasation heating + free cooling

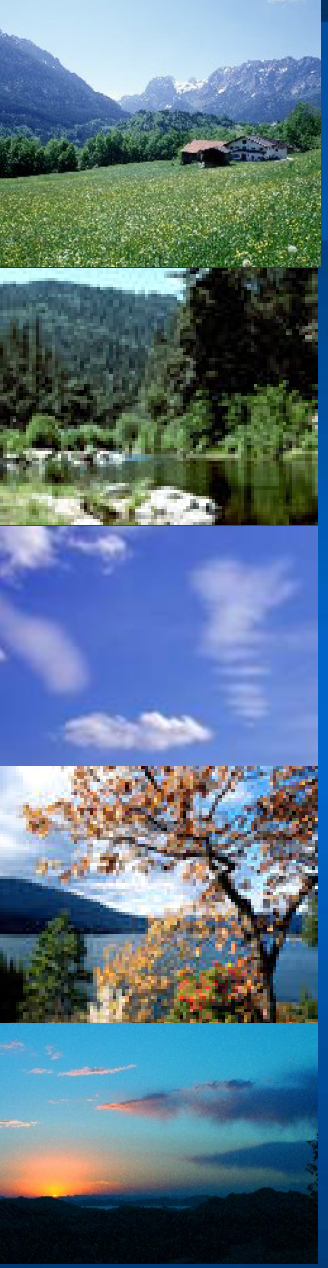
Commercial building, Les Mureaux, Paris, France



Under floor heating and cooling system

Seasonal performance factor heating: 4.1

Seasonal performance factor cooling: 8.2



Demands on heating systems

Consumer perspective

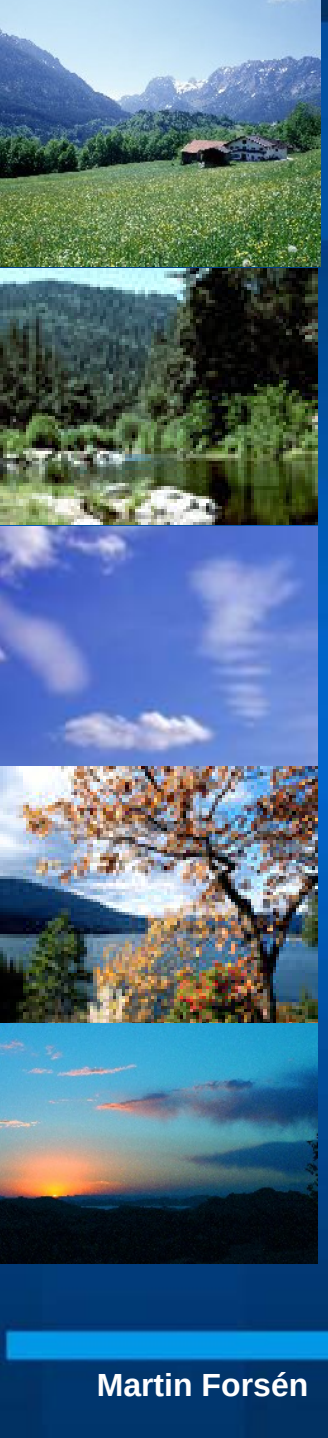
Functionality
- Heating
- Cooling

Reliability
- Operational reliability
- lock-in effects (depency on one supplier)

Convinience
- Operation and maintenance
- Space requirements
- Simplicity in installation

Economy
- Investment costs
- Operating costs

Environmental impact
- Green house gas emissions
- Particles
- Acidification
- Eutrophication



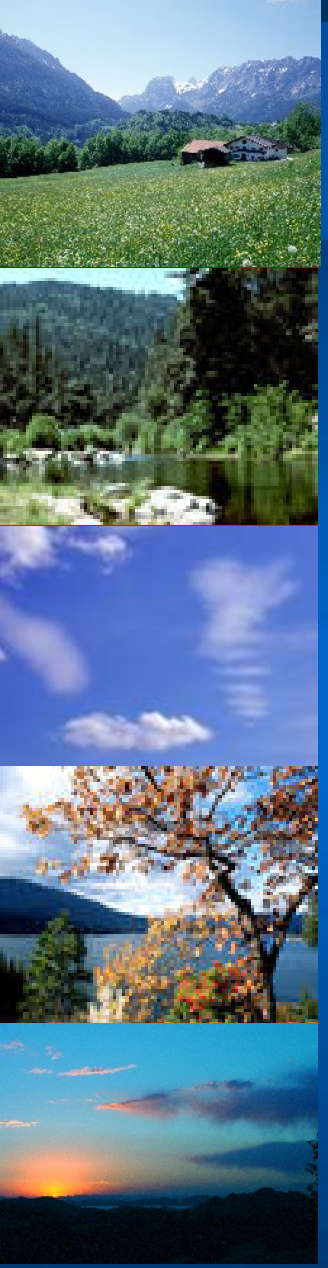
National perspective

Energy efficiency
- Primary energy efficiency

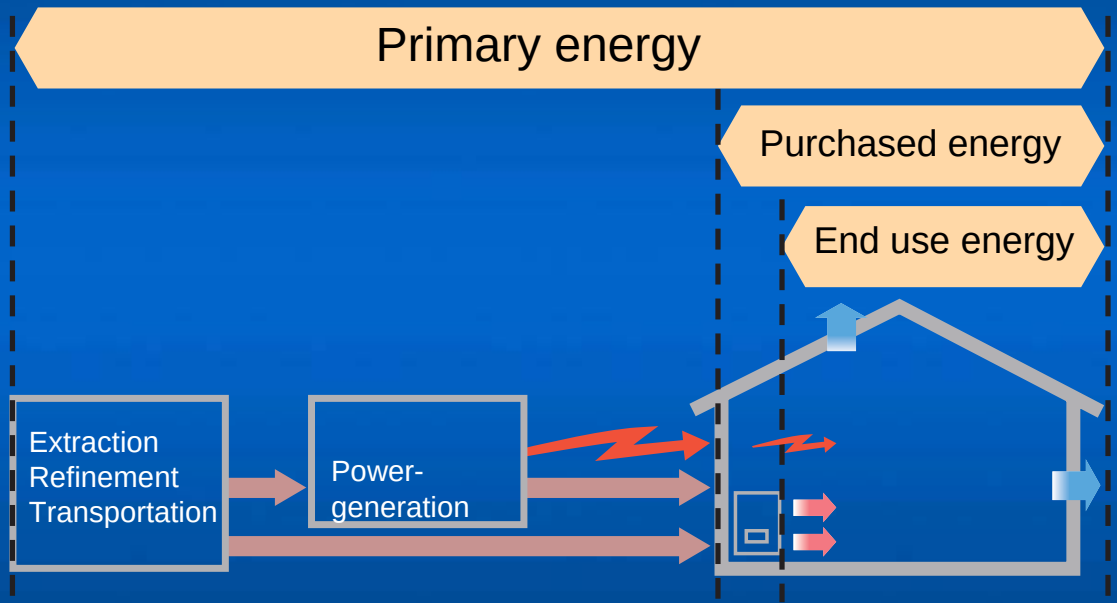
Environmental impact
- Green house gas emissions
- Particles
- Acidification
- Eutrophication

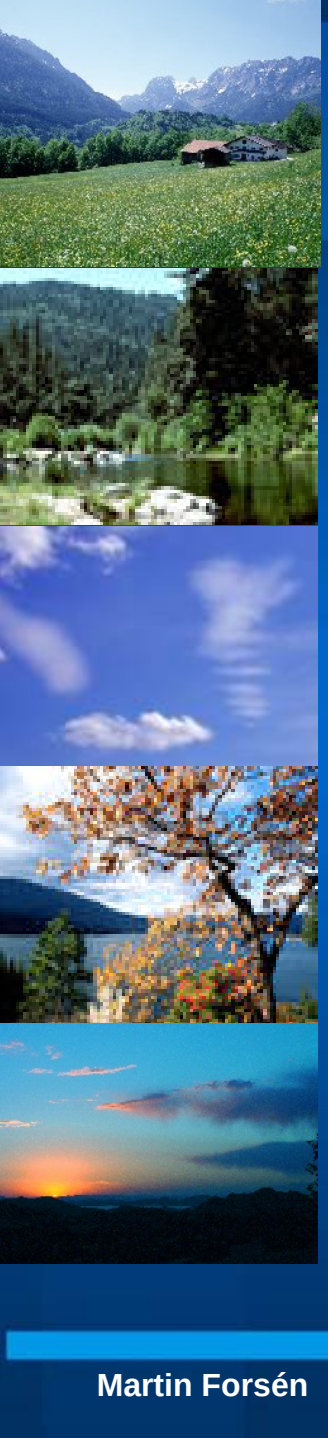
Renewable energy sources
- *20% by 2020*

The proposal for a renewable energy directive was published yesterday!

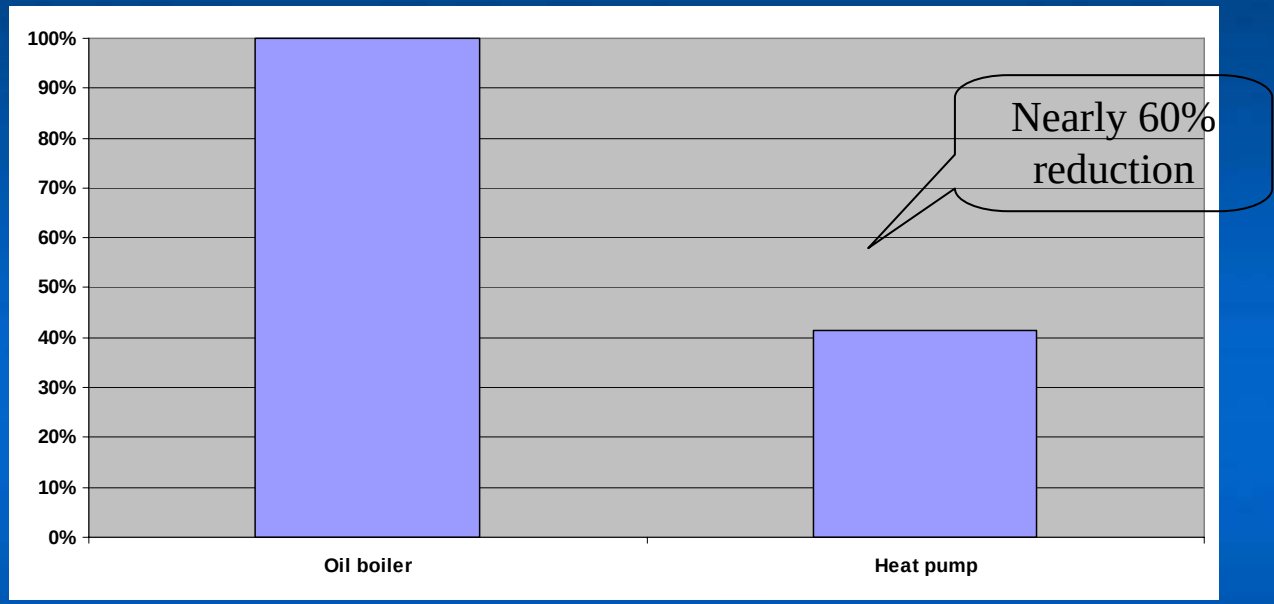


System boundaries





Reduction of green house gas emissions

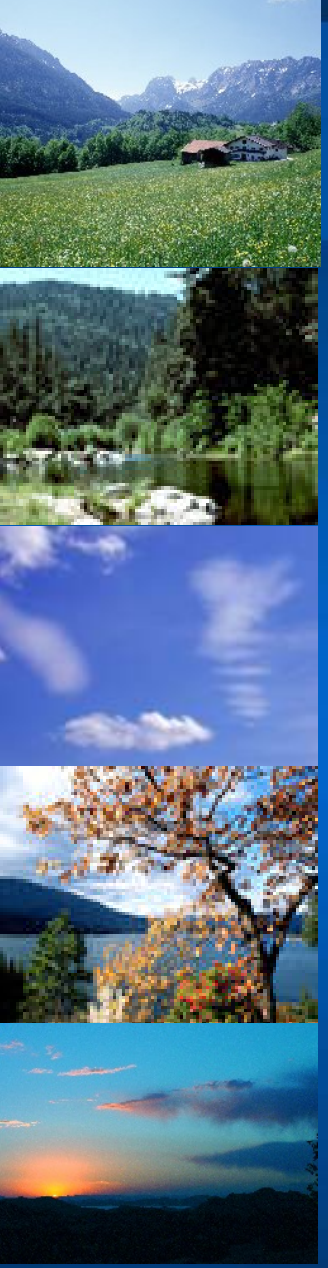


Reduction of $CO_{2equvivalents}$ when heat pumps are replacing oil boilers

Efficiency oil boiler 90%

Seasonal performance factor heat pump 4

Electricity based on EU-25 mix



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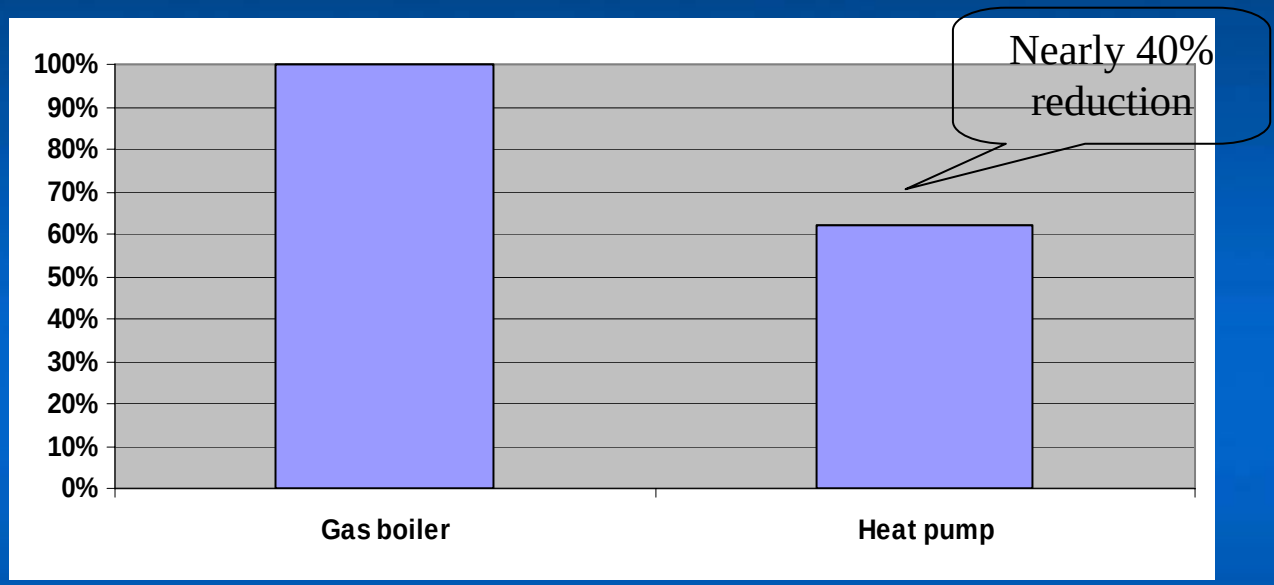

Reduction of $CO_{2equvivalents}$ when heat pumps are replacing gas boilers

Efficiency gas boiler 95%

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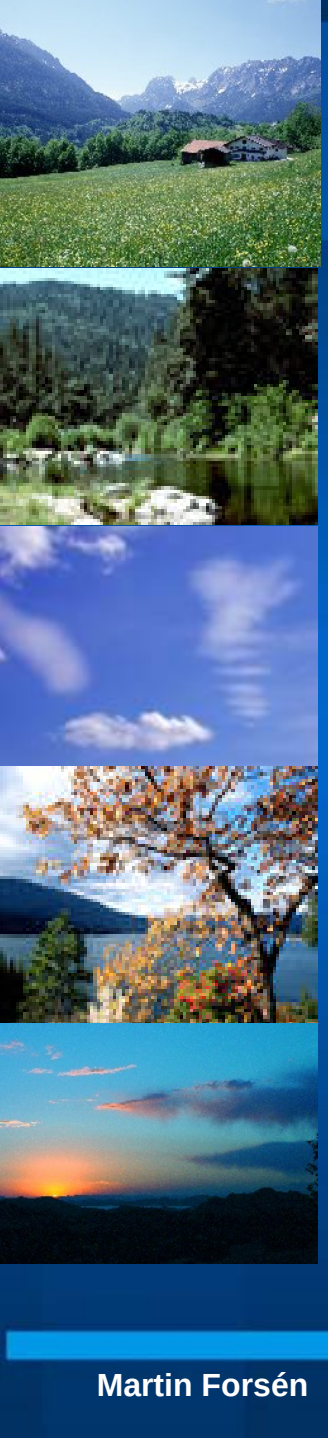
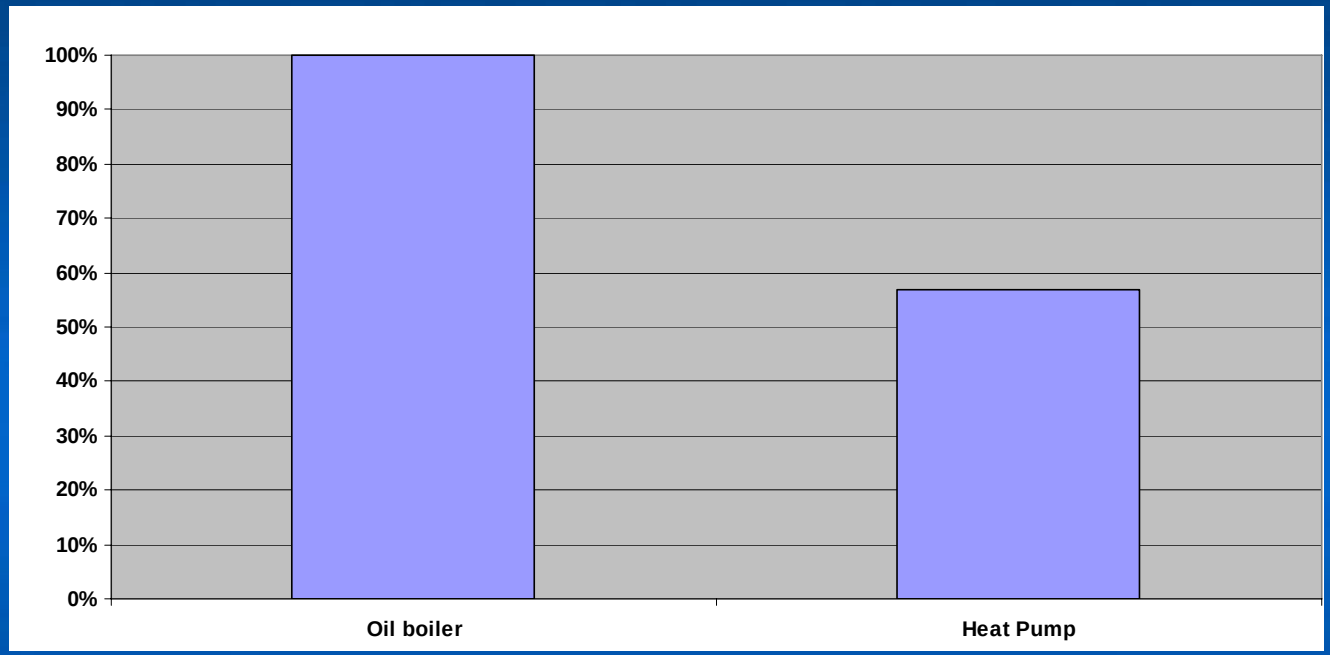


Primary energy savings



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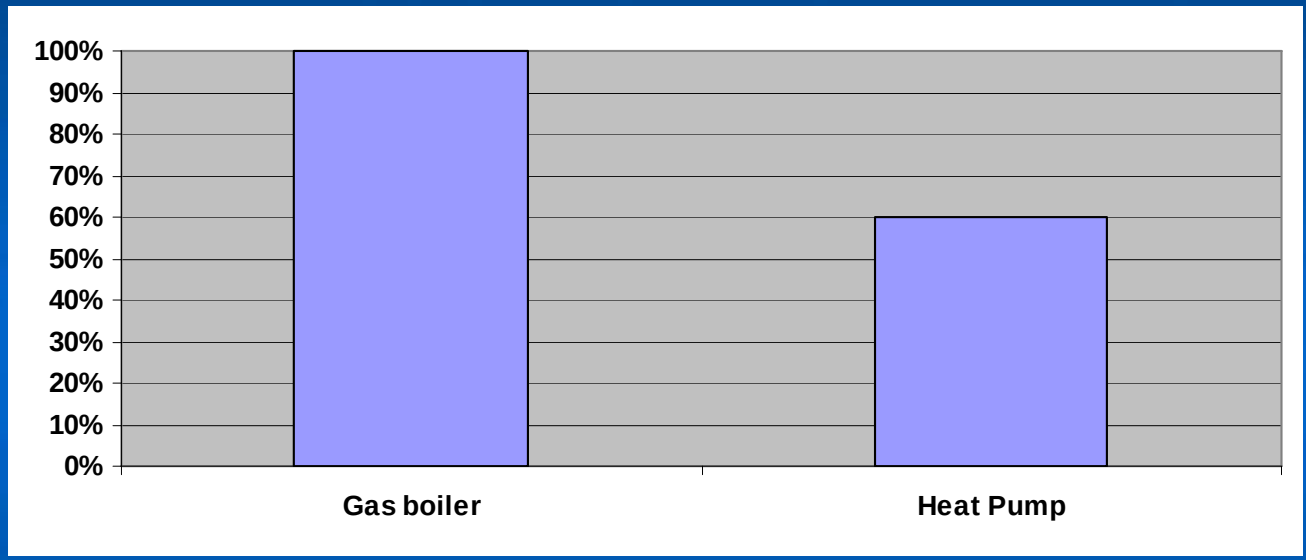

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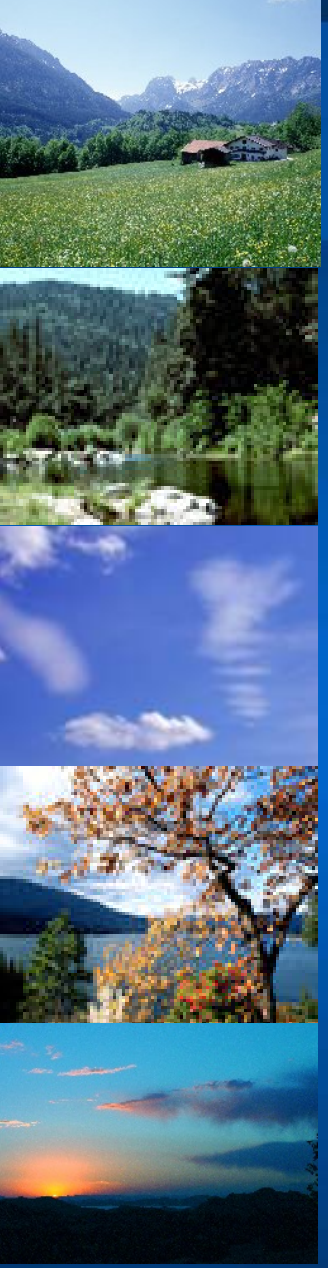
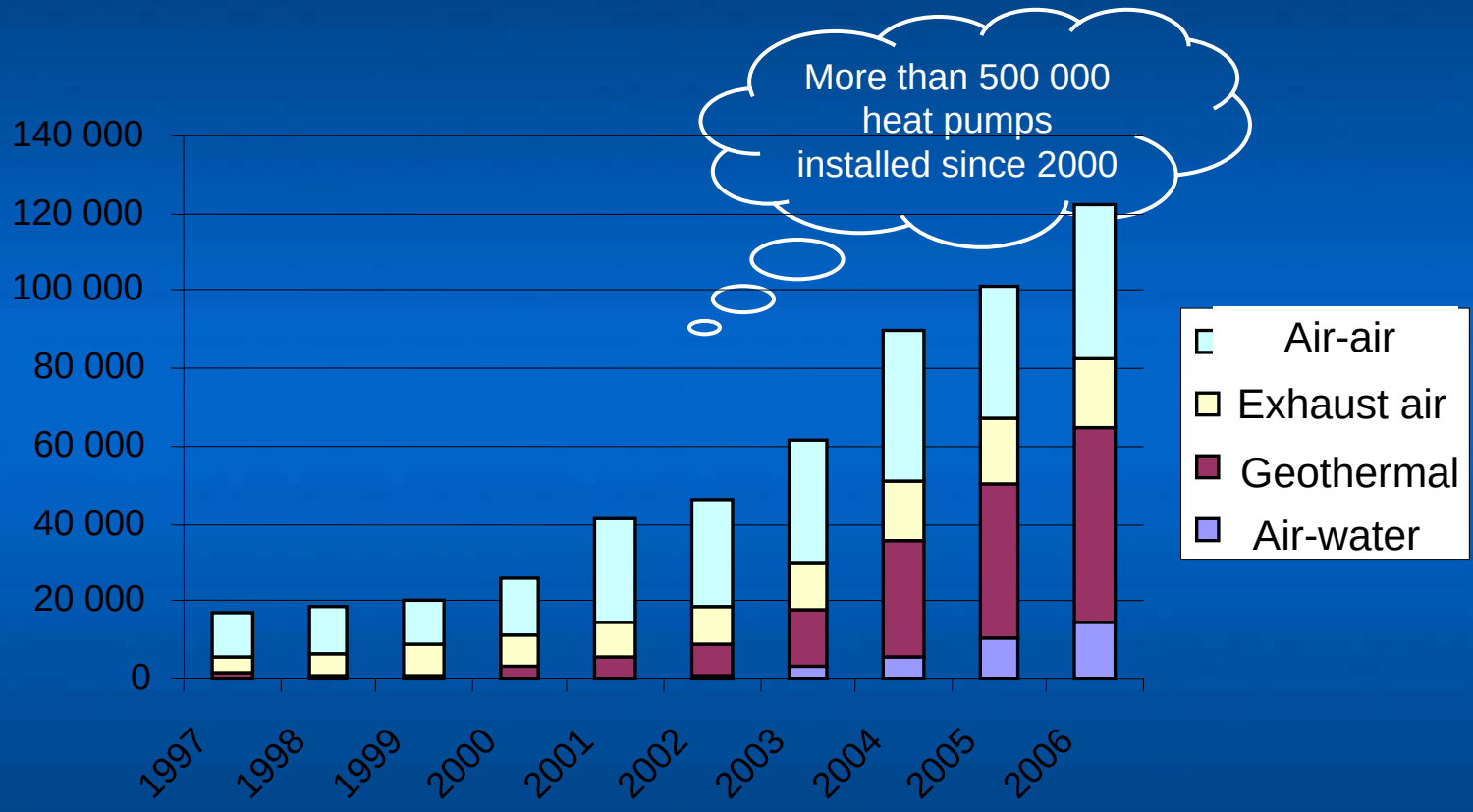
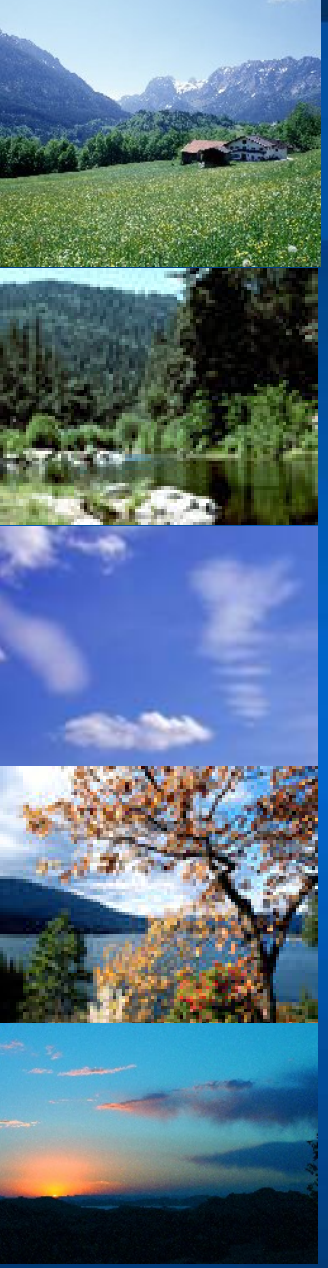
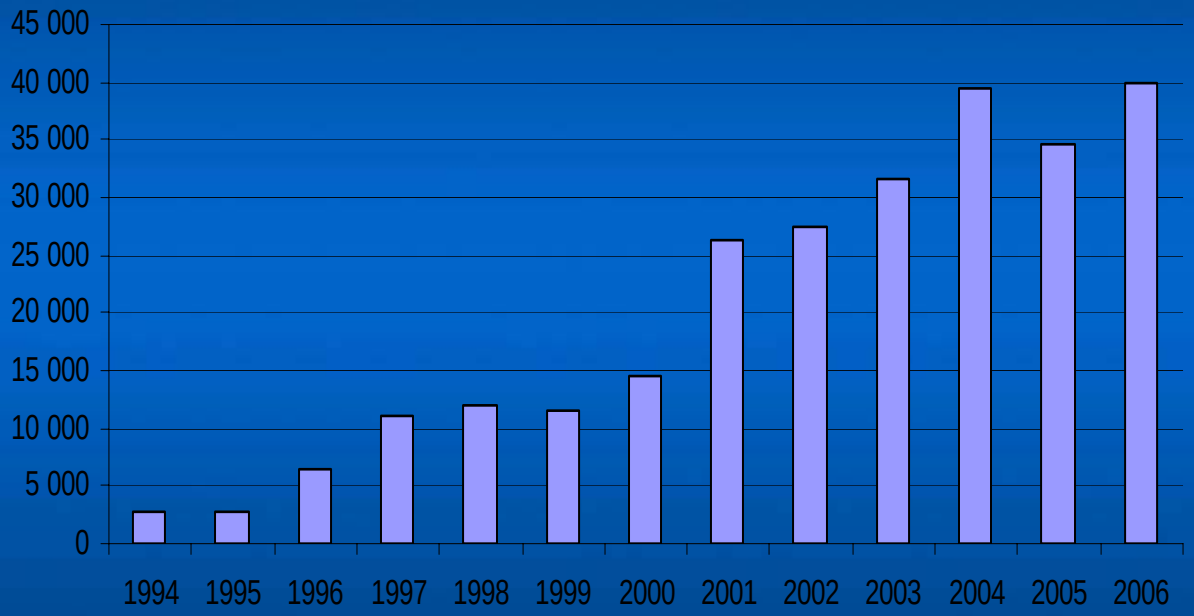


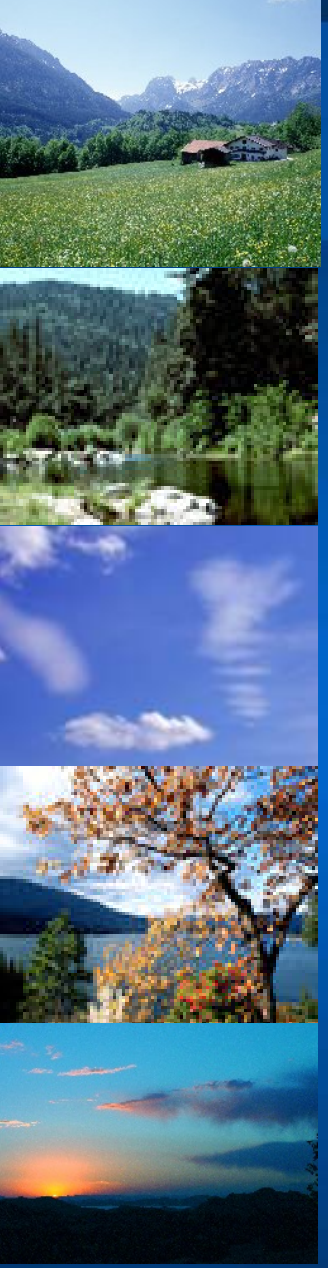
The Swedish success story



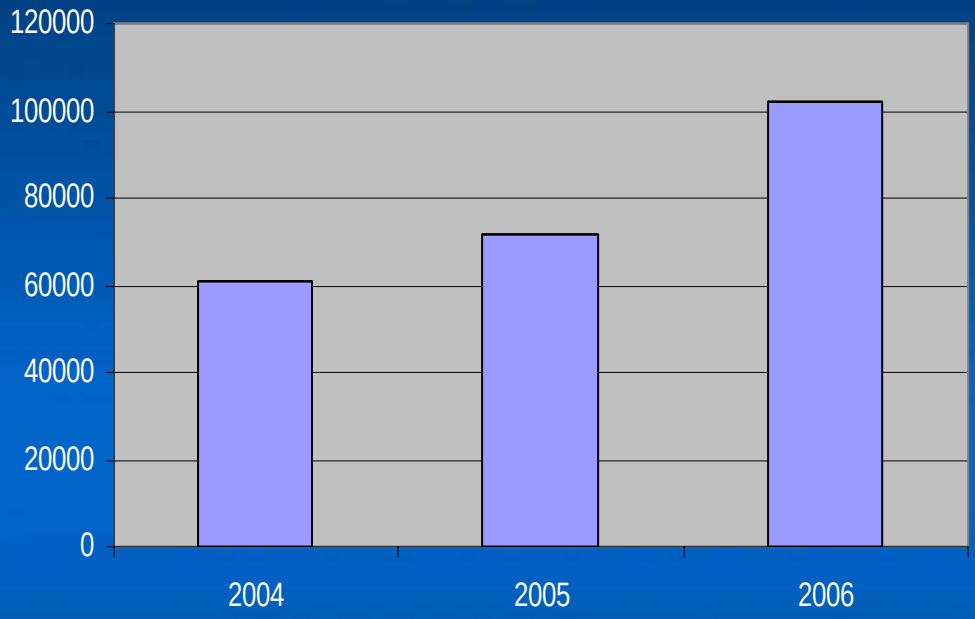


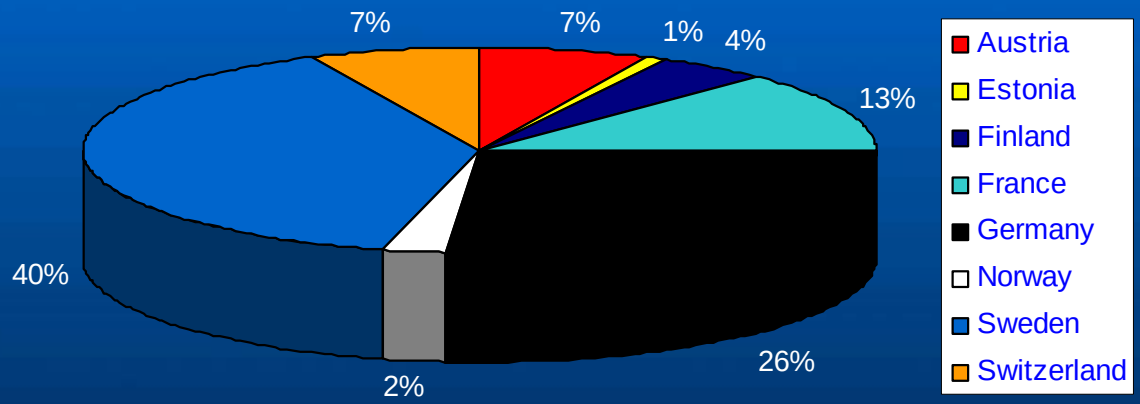
Ground source heat pumps in Sweden

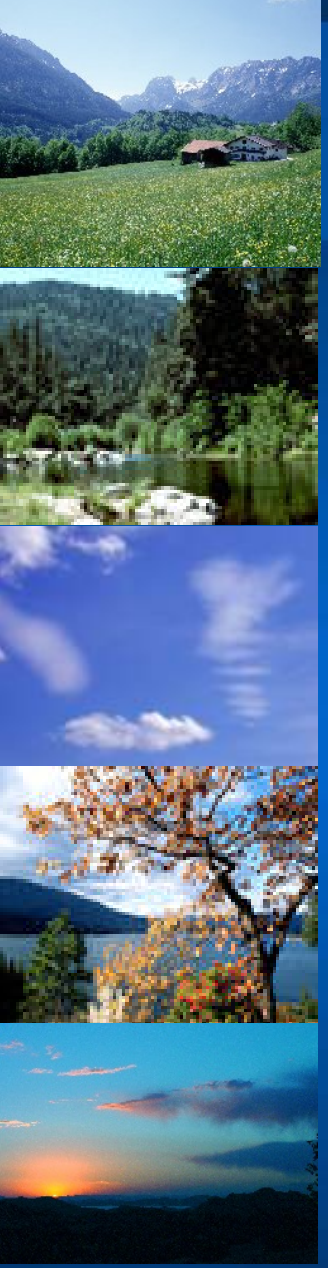




Ground source heat pumps in Europe



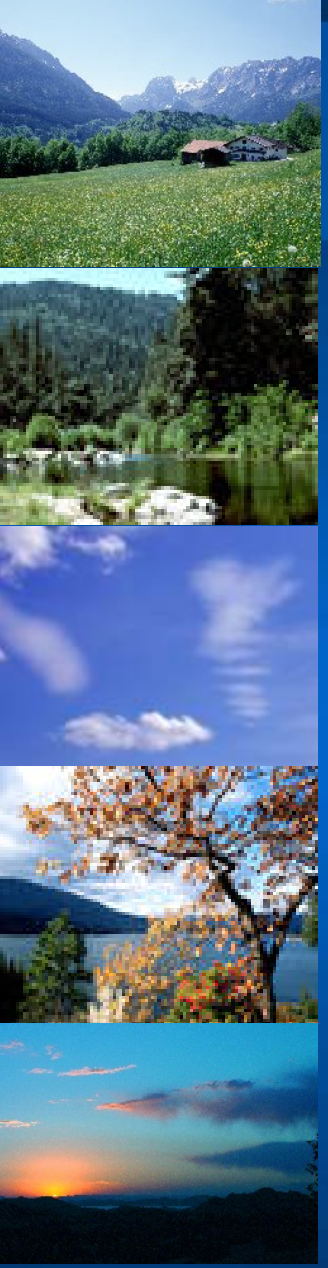




Enormous potential

Our vision!

1 million ground source heat pumps/year by 2015



Thank you for your
Kind attention