



Heat Pumps in Europe

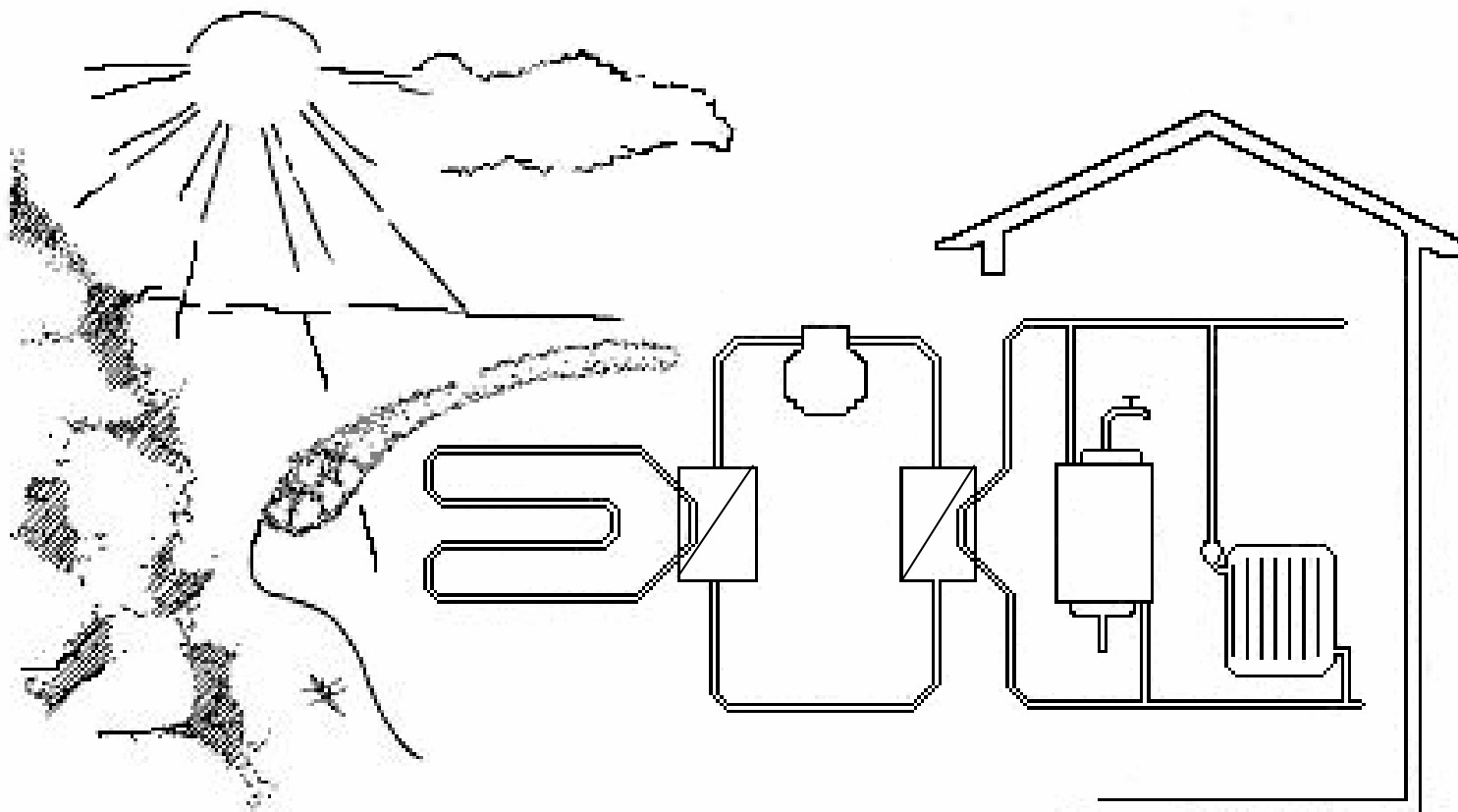


Principle

- heat pumps are a renewable energy source because they convert low grade heat present in the ground, water or air into useable heat
- electricity is only used to concentrate the heat, not to produce the heat itself



Heat Pumps in Europe



Typical ground source heat pump system



Heat Pumps in Europe



Renewable energy source

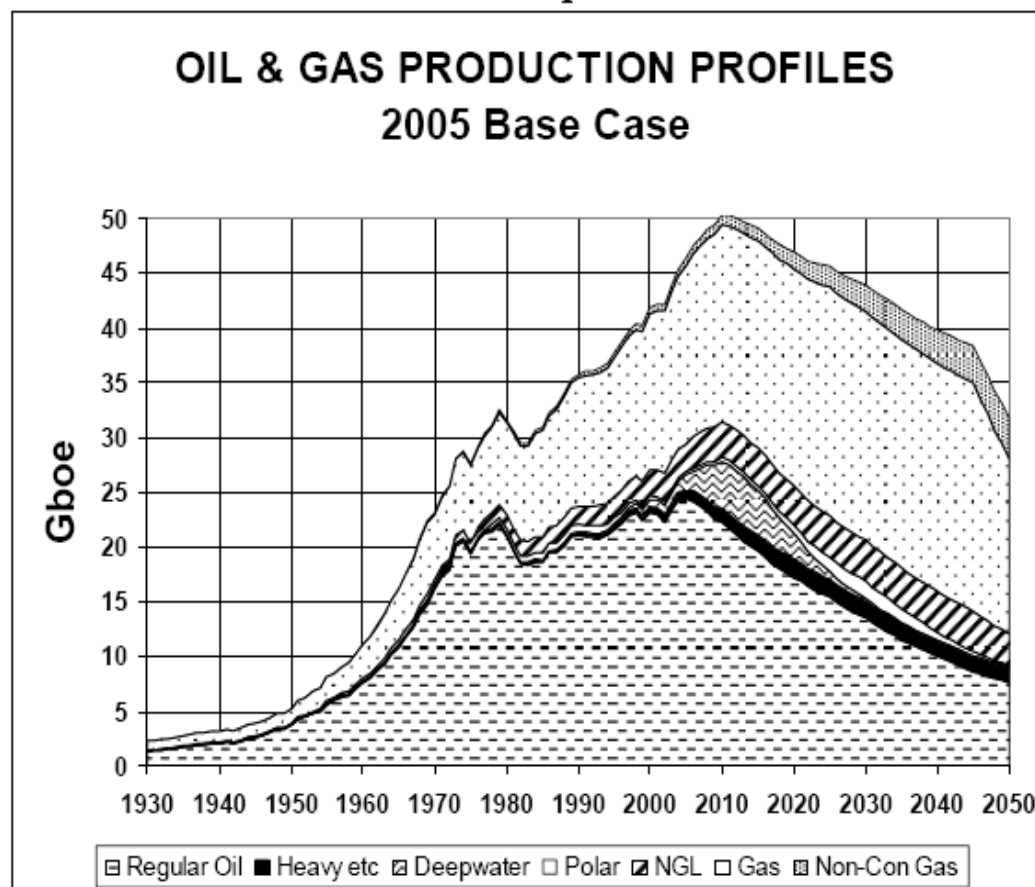
- like other renewable energy sources such as biomass or solar thermal, it is inexhaustible and located everywhere
- unlike other sources, the process is reversible so high grade heat can be removed thus producing space cooling



Heat Pumps in Europe

Peak oil and gas

The General Depletion Picture





Heat Pumps in Europe



Why renewable energy sources?

- to reduce electricity usage by replacing direct electric heating by heat pumps
- to replace oil heating systems in homes that are generally located in areas where natural gas is not available
- to reduce the consumption of fossil fuels
- to reduce environmental emissions
- to help prevent climate change



Heat Pumps in Europe



Seasonal variation

- this is not a concern for renewable energy heating sources if they are correctly designed and selected
- in very cold climates, it is best to use the ground or water as the heat source as these vary much less than air temperature
- another option is to mechanically ventilate a dwelling and use a heat exchanger to transfer heat energy from outgoing to incoming air





Heat Pumps in Europe



Characteristics

- mature technology
- range of sizes 1 kW to 8 MW
- room to district heating
- variety of heat sources (or sinks)
- can be used with renewable energy electricity because of the thermal inertia of buildings



Heat Pumps in Europe

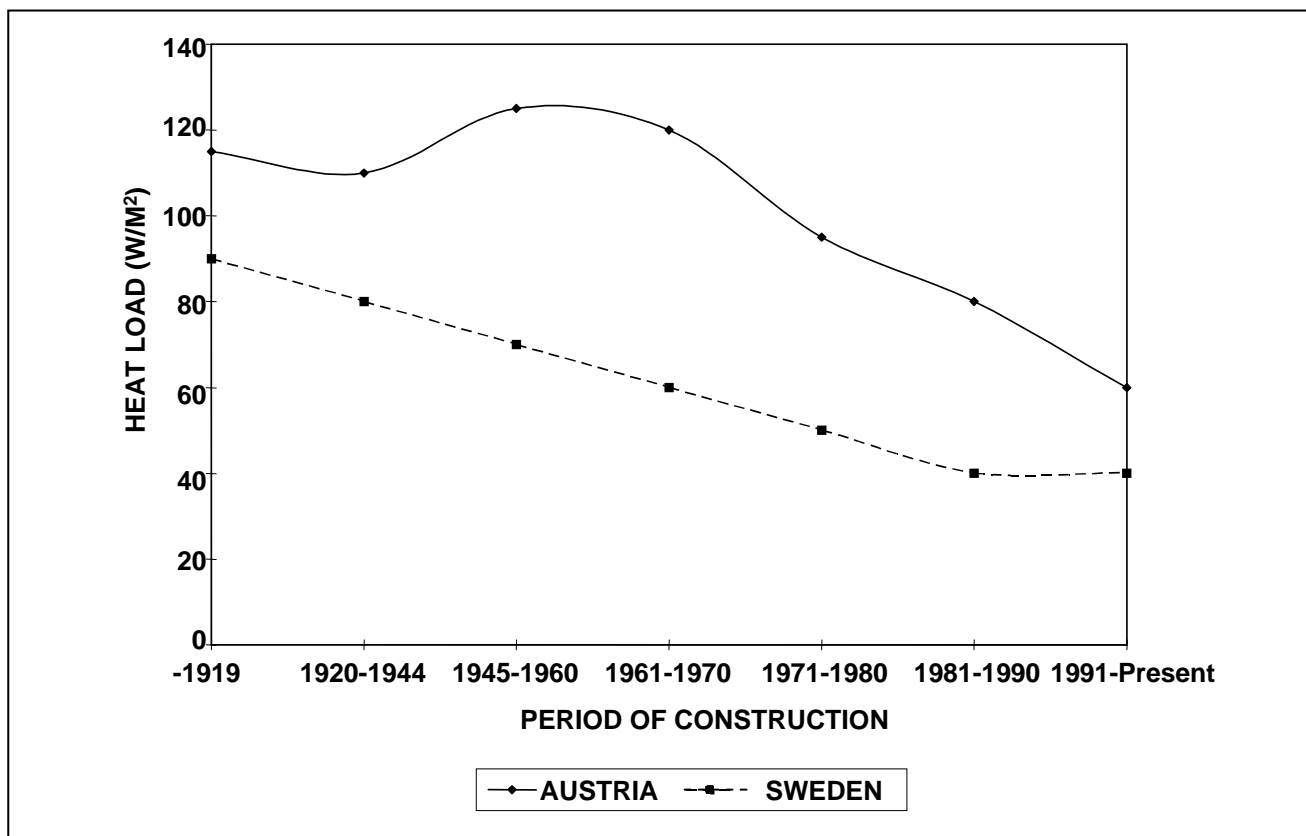


EU housing stock

- average life in excess of 100 years
- great variations in heat loss with newer buildings having better insulation
- family size is decreasing
- newer dwellings are smaller
- move from rural to urban areas

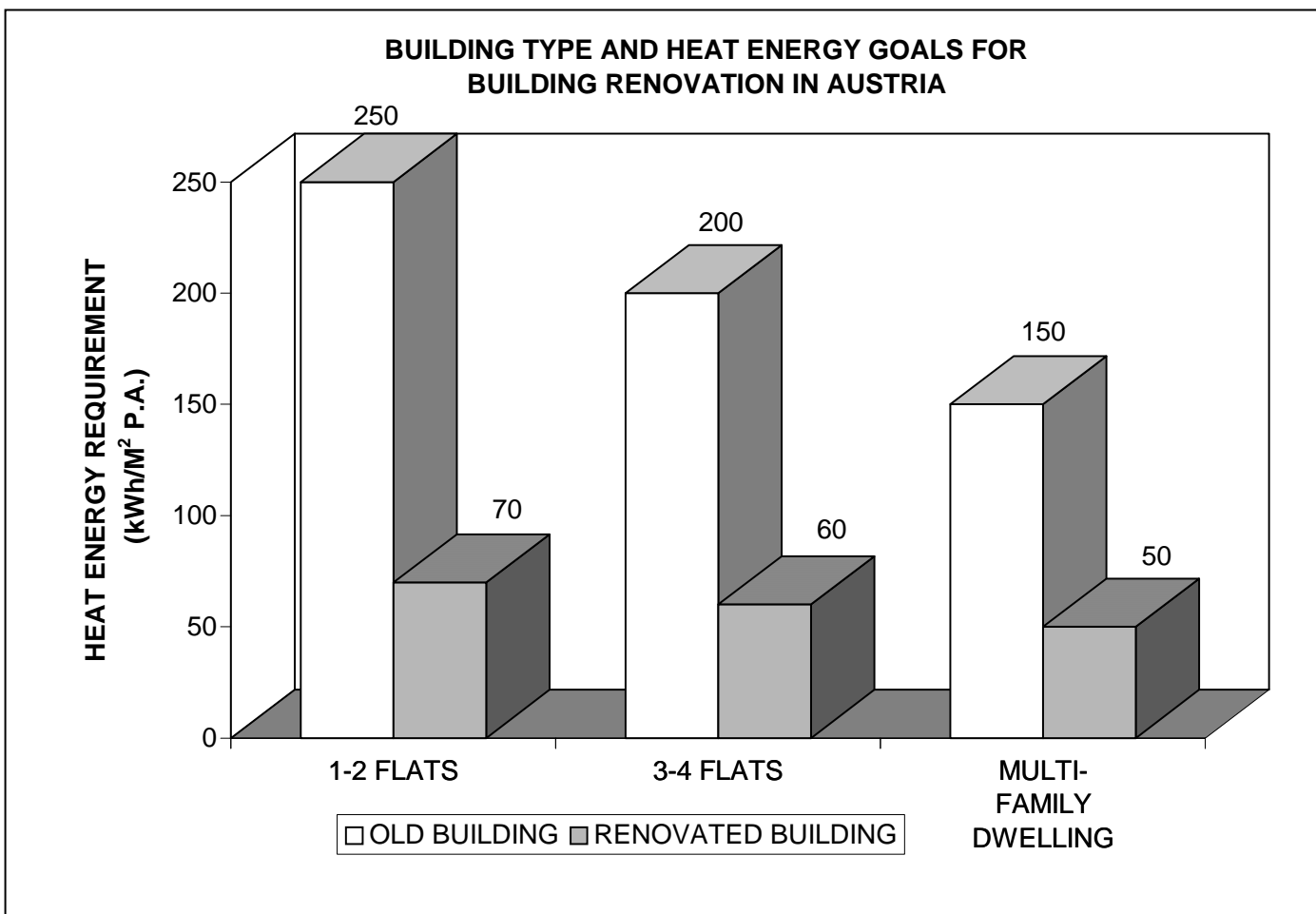
Heat Pumps in Europe

Average heat load with age



Heat Pumps in Europe

Reducing heat loss





Heat Pumps in Europe

Contribution to CO₂



Modelling scenario	Limited conservation	Extended conservation
<i>By 2010</i>		
Energy savings (TWh)	22	40
Reduction in CO ₂ emissions (million tons)	11	20
<i>By 2020</i>		
Energy savings (TWh)	46	100
Reduction in CO ₂ emissions (million tons)	23	50

Annual benefits to society in terms of energy saving and reduction in CO₂ output (millions of tons)



Heat Pumps in Europe

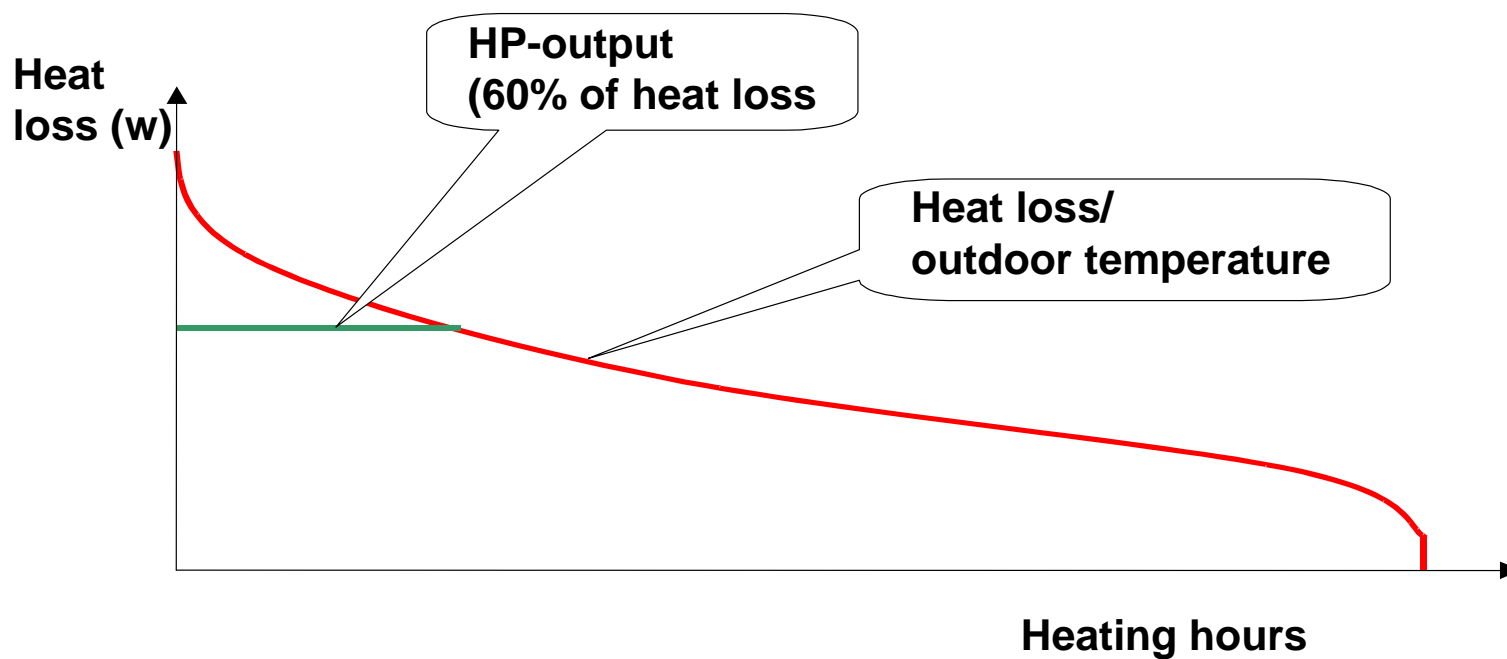


Cost-effective sizing

- calculate heat loss
- consider cost-effective insulation level
- recalculate load duration curve
- size heat pump to cover say 60% of heat loss
- provide an auxiliary heat system for very cold months

Heat Pumps in Europe

Load/duration curve





Heat Pumps in Europe



Labelling

- DACH label – regional label for Germany, Austria and Switzerland
- EU eco label – initiative to label all renewable heating sources
- framework under consideration
- mandatory criteria for all systems such as efficiency, CO2 emissions
- optional criteria which could be system specific such as natural refrigerants, certified installer, heat loss calculation
- possible to influence the choice of criteria at present



Heat Pumps in Europe



EU sales

	2004 units	1992
Austria	5,129	800
Czech Republic	2,400	20
Finland	12,648	100
France	17,300	4,000
Germany	20,636	2,000
Sweden	100,215	15,000





Heat Pumps in Europe



EU Directives

- energy performance in buildings –
requires RES to be considered in design and upgrading of heating system
- energy services –
Member States to increase energy efficiency by an additional 1% per annum for the next 10 years
- public procurement –
requirement to tender for a certain proportion of equipment to be energy efficient



Heat Pumps in Europe



Future trends

- social housing – affordable heat becomes more important as energy prices rise
- very well insulated homes – is an individual heating system cost-effective?
- availability of oil supplies – oil heating is no longer sustainable
- planning permission – could be altered to favour renewable energy heating over oil or gas



Heat Pumps in Europe



SHERHPA
Sustainable Heat and Energy Research
for Heat Pump Applications

Workshop on Natural Refrigerant Heat Pump Systems
– The Emerging Technology, Valencia, Spain 31/3/06