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# Heat pump in the energy system

**electricity system**

**heat pump**

**heat demand/system/market**

# Absorption heat pumps in waste incineration

**Uppsala waste incineration used available low pressure steam with heat pump to recover heat from condensing water in flue gases in 1980ies**

**Today new waste incinerator with high efficient CHP use heat pump to generate district cooling and heating from flue gas condensation in summer time**

# Forsmark nuclear power plant

- **CHP or heat pump – was the question**
- **CHP involved one massive investment in adapted turbine system and 120 km transmission pipe**
- **nuclear power work with saturated steam only some 330 degree C – more sensitive relatively to condensing pressure**

# **Forsmark nuclear power plant**

**NOT CHP**

**optimised generation of electricity using  
available cool sea water**

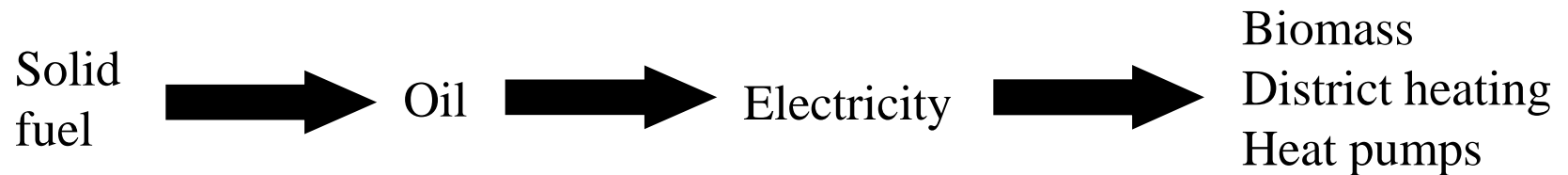
**heat pumps in Stockholm developed step  
by step to 400 MWth, providing flexibility  
to use surplus electricity and generate  
CHP electricity in Stockholm when  
electricity was in demand.**

# **small scale heat pumps – why in Sweden (first)**

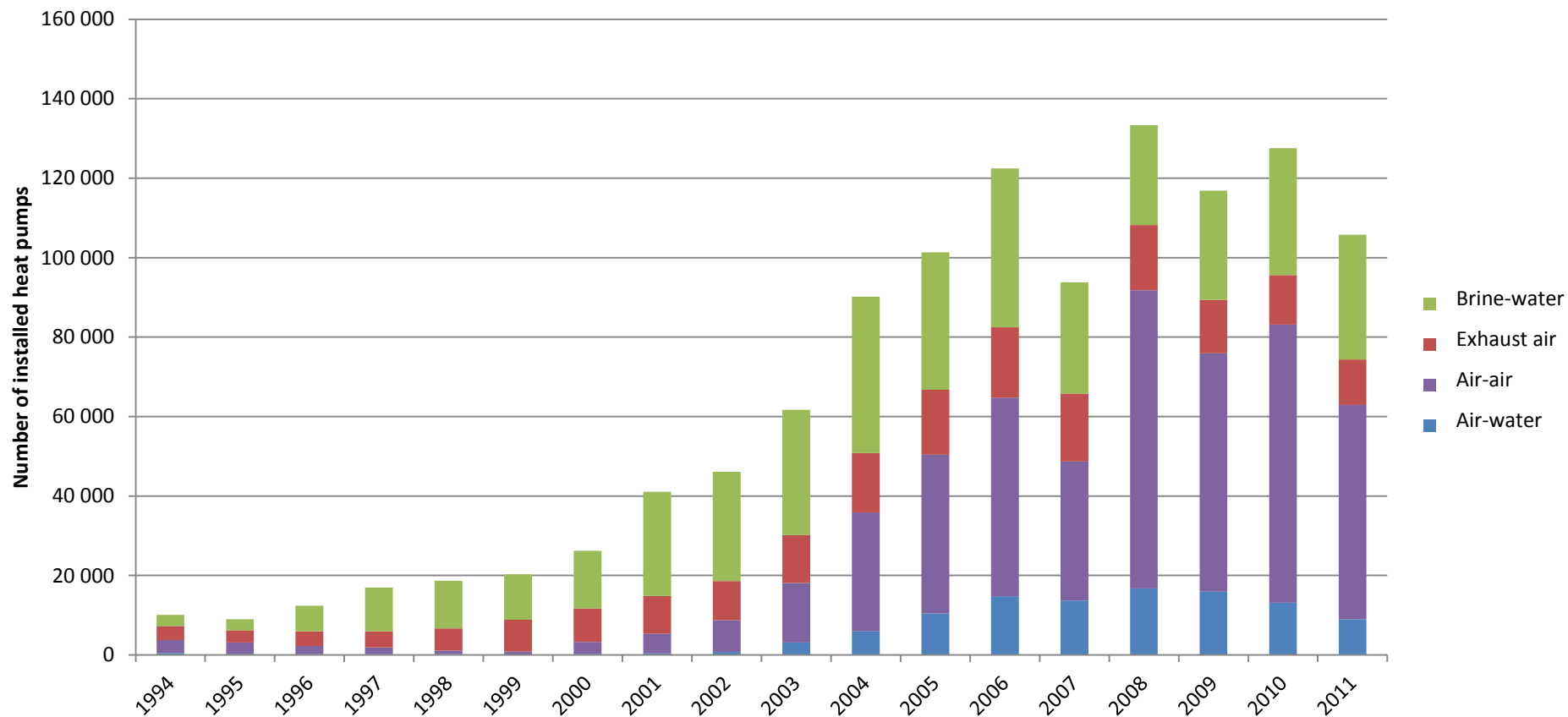
- **surplus cheap electricity**
- **no natural gas**
- **expensive oil – carbon tax**
- **economic key was ratio of electricity price and cost of alternative heating**

# Case study Sweden

## Heating of buildings in Sweden from a Historical perspective

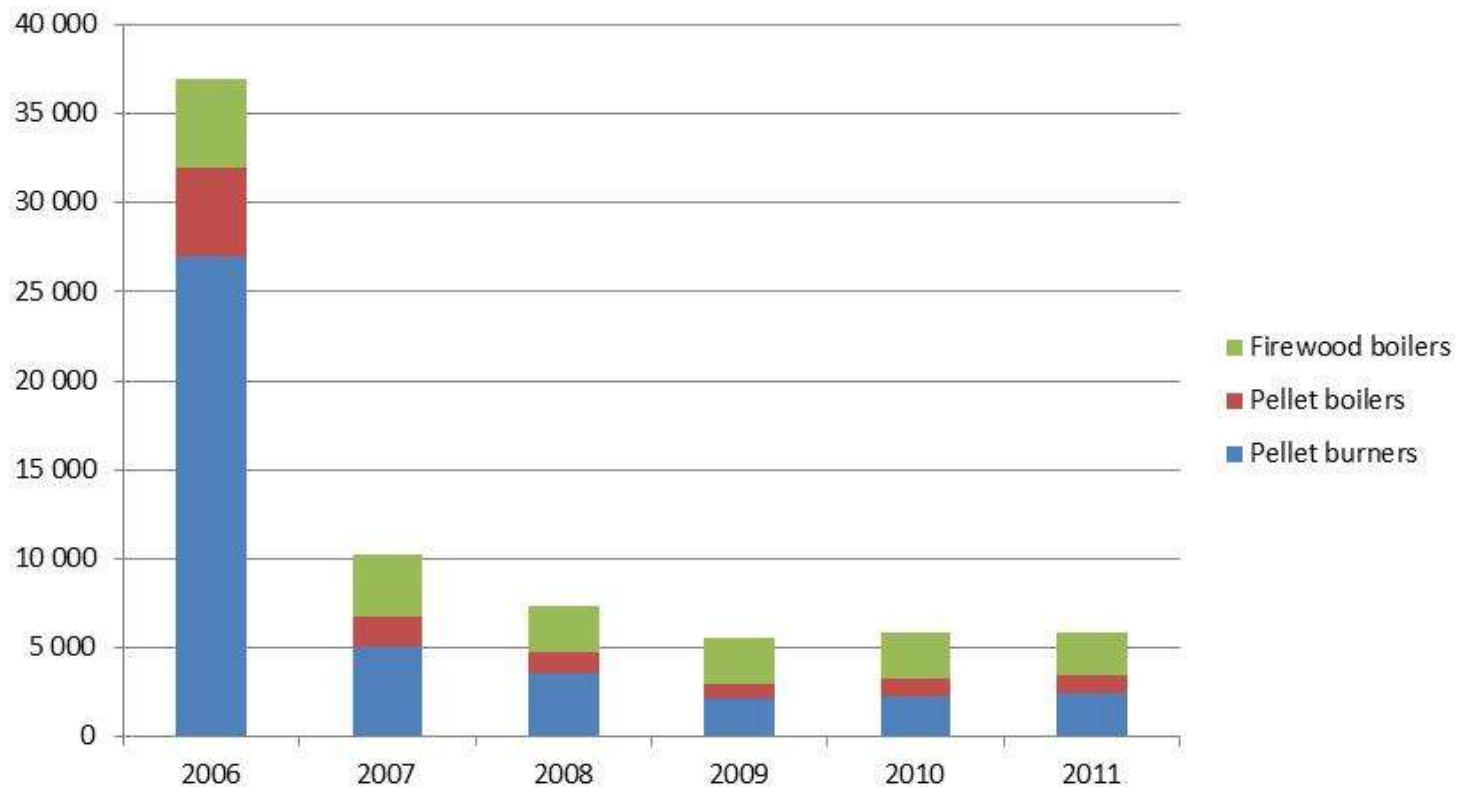


# Heat pump market development 1994-2011





## Sales of biomass boilers and burners 2006-2011



# Trends in European energy policy

**more RES**

**efficiency**

**near-zero energy buildings**

**het pump: efficiency or RES?**

# trends in energy system

- more RES
- wind is a challenge for base load nuclear and coal (especially with CCS)
- calls for smartness in electricity grid
- **HEAT PUMPS CAN OFFER SUBSTANTIAL SMARTNESS AT LOW COST**