

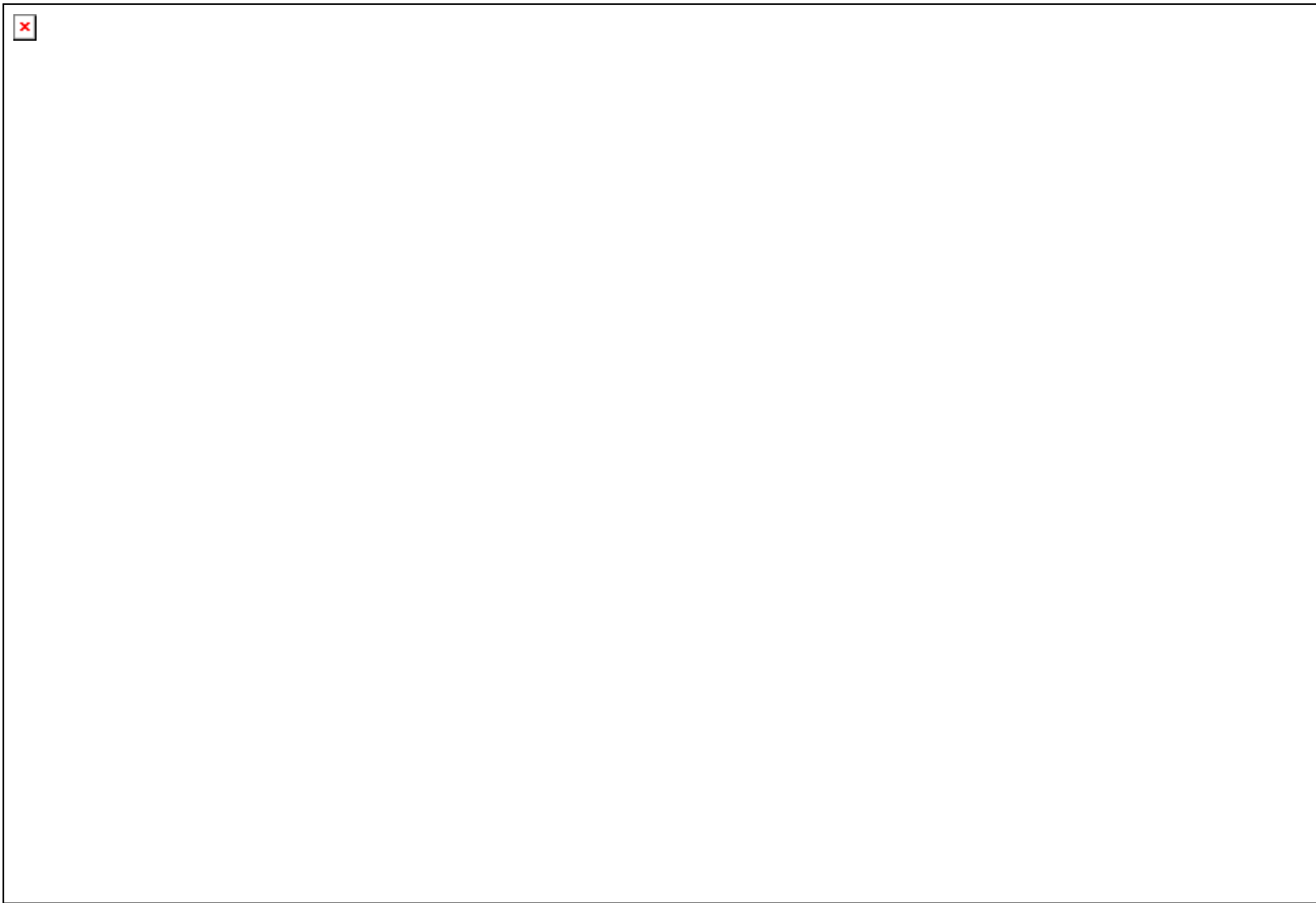
# Potential for biomass and waste for energy

Kjell Andersson Svebio

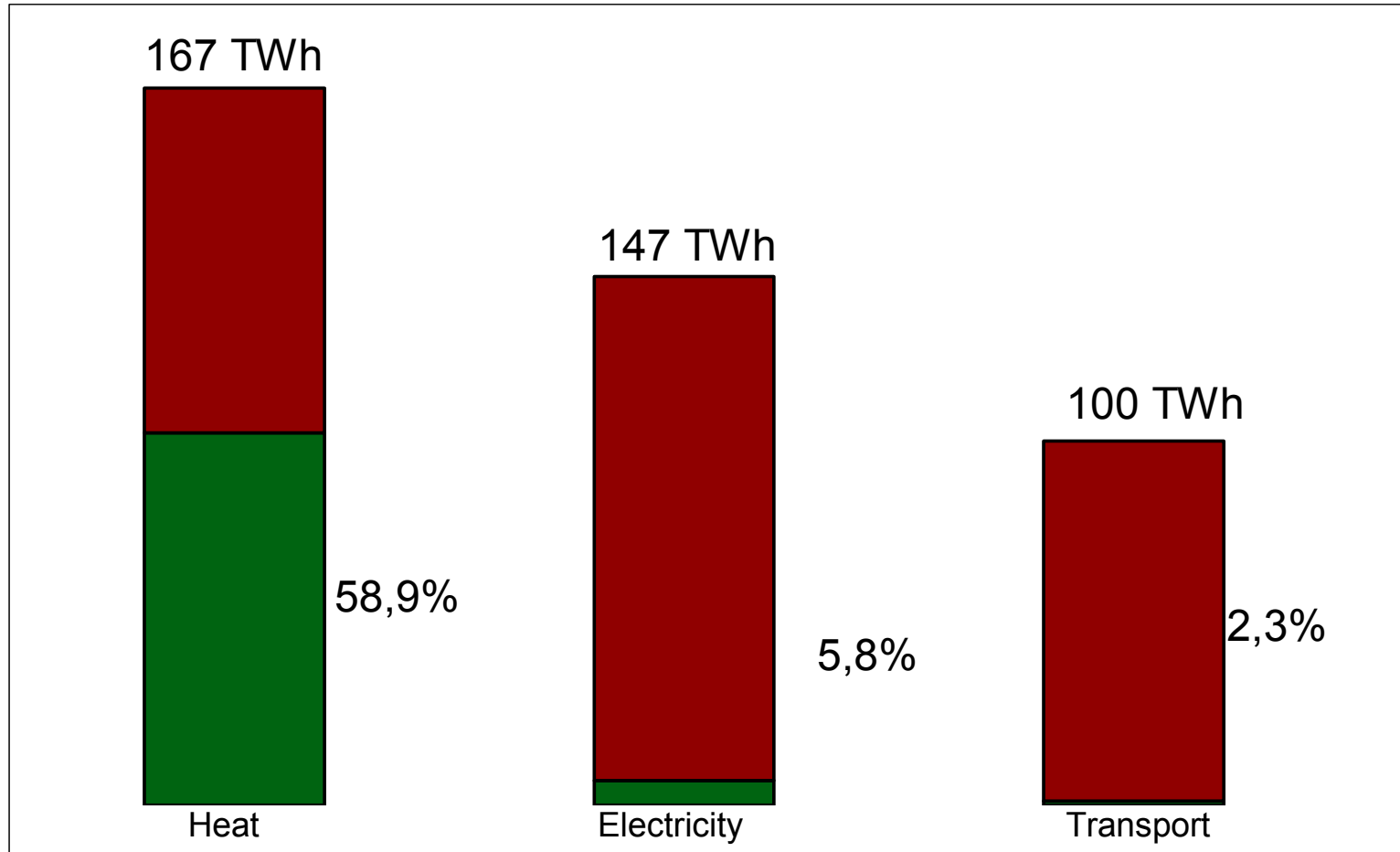
Vilnius 20 June 2008

# Swedish Bioenergy Association

- Non governmental, non profit organisation
- 400 members, 300 companies & organisations
- Representing both supply and demand of fuel, equipment and knowledge
- Aim: to increase the use of bioenergy in an economically and environmentally optimal way



# Share of bioenergy in total use in 2005





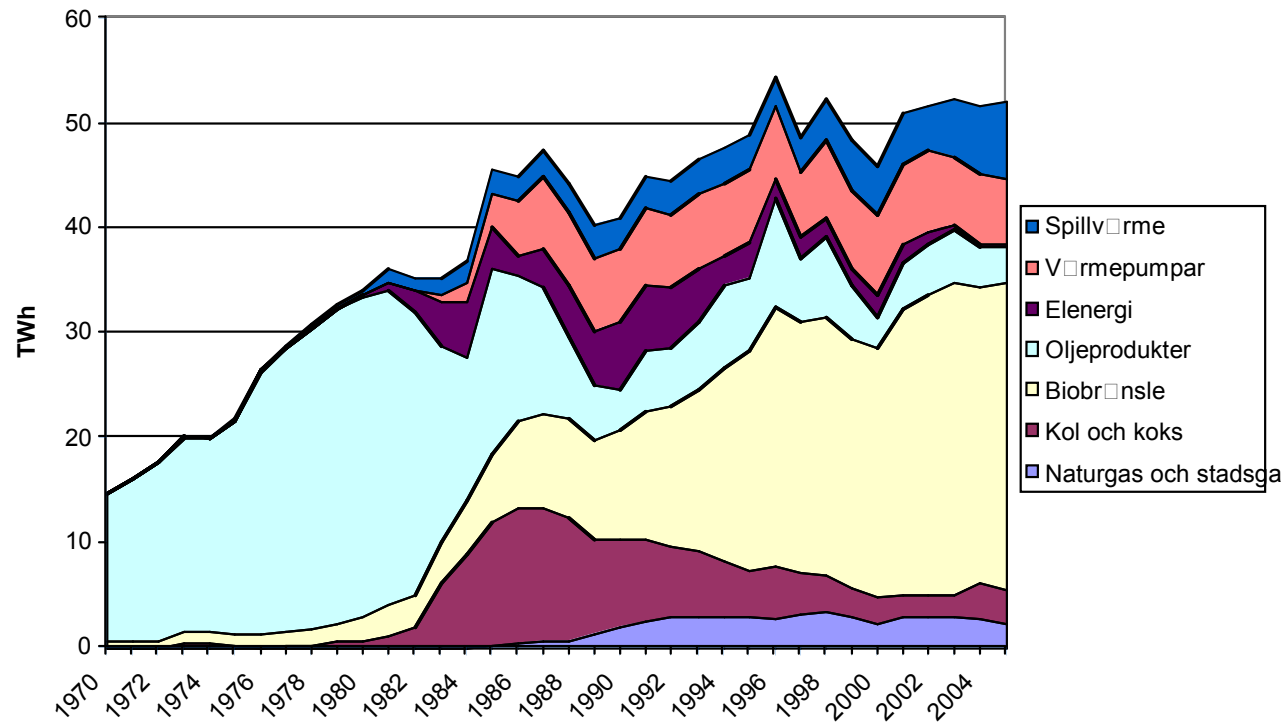
Bottom to top: black liquor, industry, industrial biopower, district heating, district heating biopower, firewood and pellets, biofuels for transport.

# From heat to power and liquid fuels

- Started by converting boilers from heating oil to biofuels (chips, bark, saw dust, firewood)
- Expanding district heating systems.
- Building CHP:s with conventional steam turbines. Electricity as "by-product".
- Few examples of more advanced technology. Gasification for biopower at Värnamo.
- Today 480 heat plant (2 GWh - 1 TWh/year) - 40 with power production - all steam cycles.

# Now 66 percent bioenergy in district heating

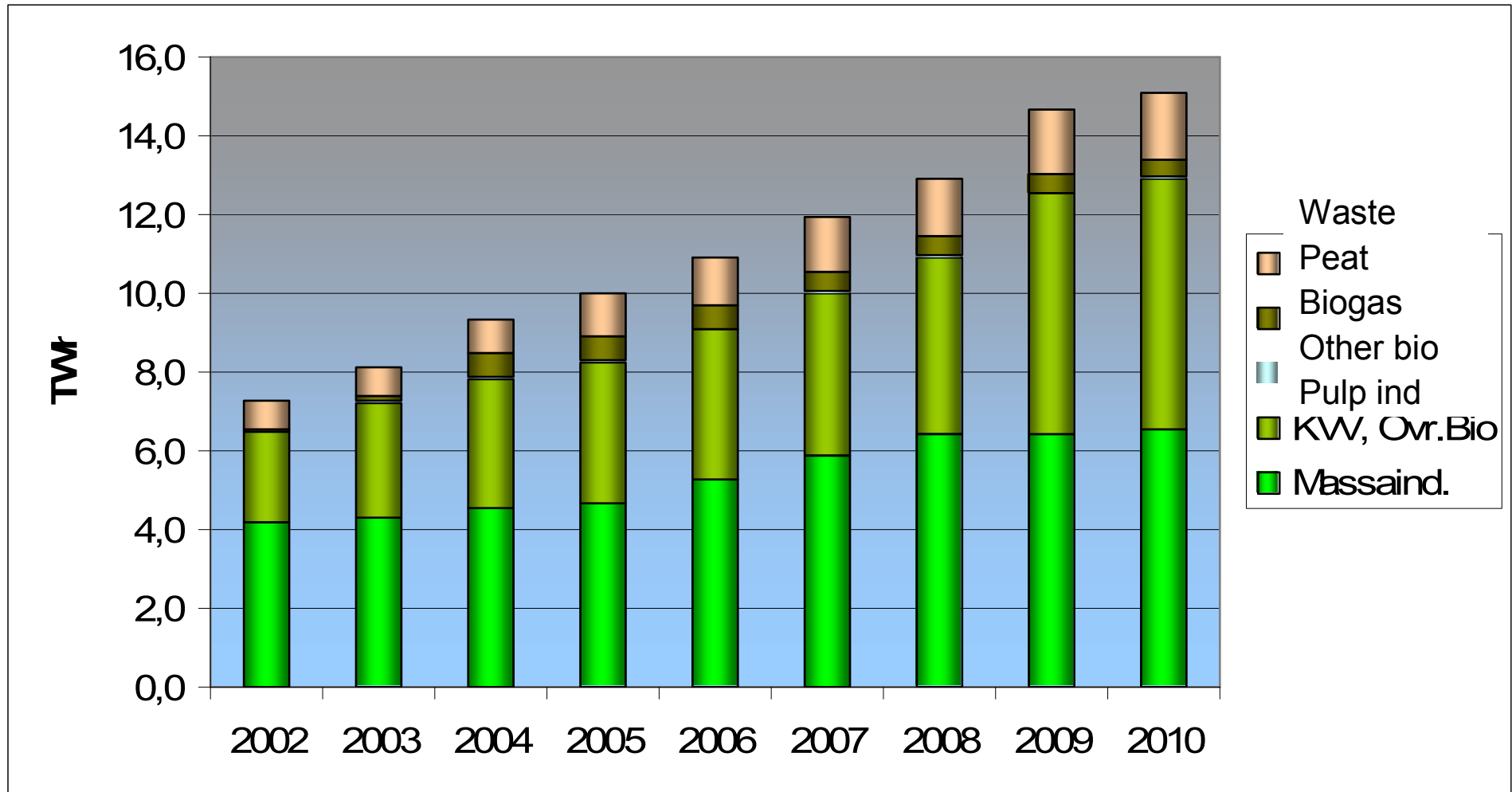
E. Totalt tillförd energi för fjärrvärmeproduktion fördelad på olika energibärare



# Driving forces behind the growth in the heating market

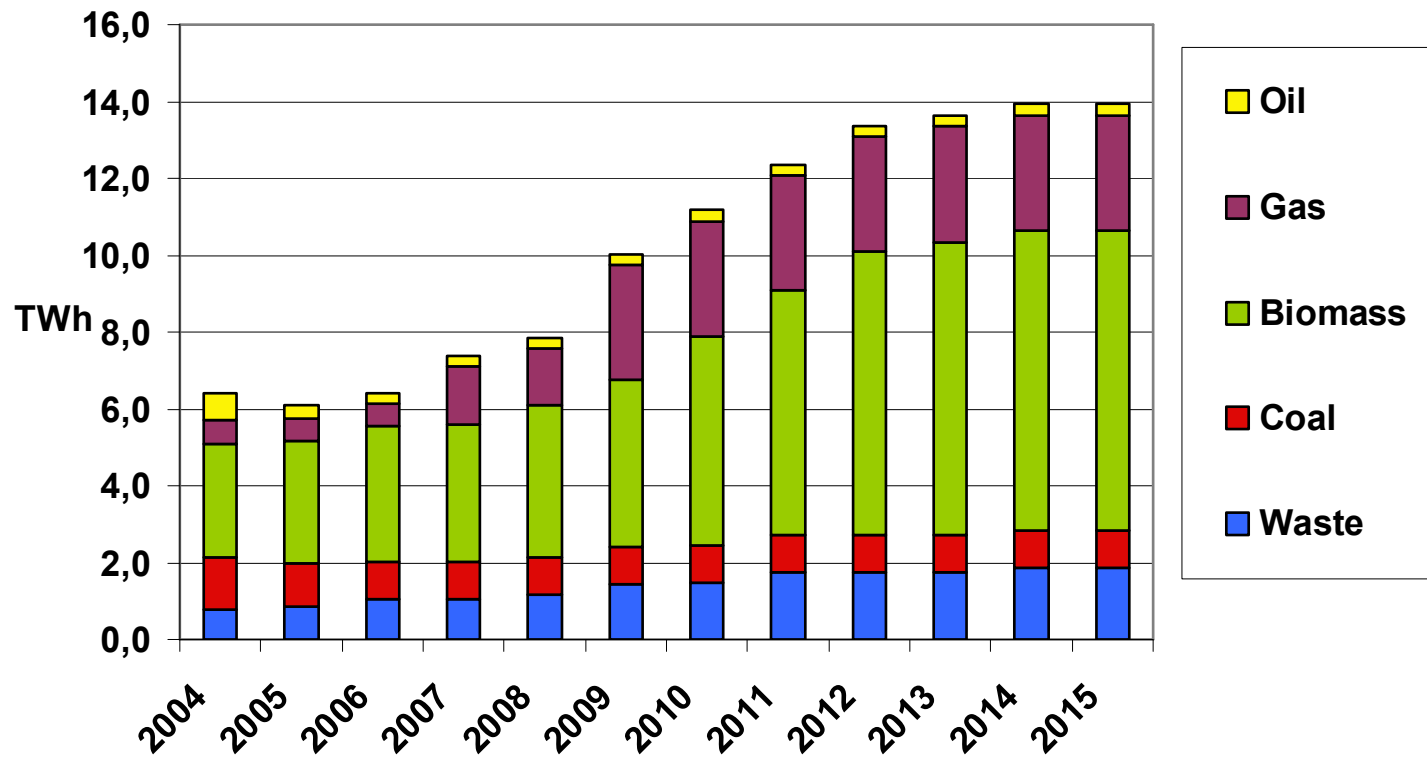
- CO2 tax introduced in 1990/1991 - on all fossil fuels
- Further raised CO2 tax paired with lower income tax
- Support for district heating
- Investment grants for biofuel projects
- Investment grants for conversion from oil heating to heating with pellets.

# Biopower 2002-2010



# Electricity from heat and power production 2004 to 2009

Electricity from CHP plants 2004-2015



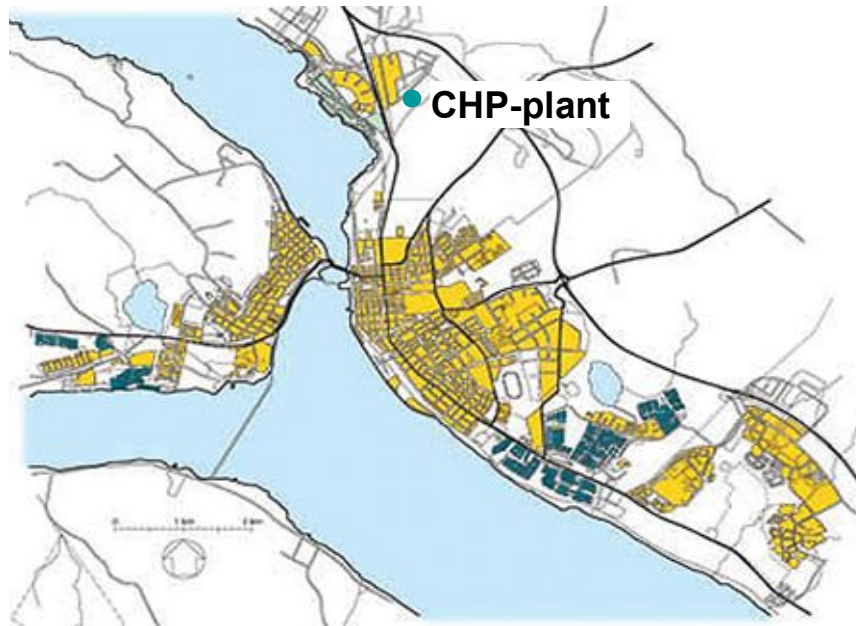
# Bio power policy

- 1991: Investment grants, 25-30%. No CO<sub>2</sub>-tax on electricity, only on heat.
- 1997: Investment grants, 1 billion SEK to biomass based CHP plants
- 2003: 6.5 TWh biopower produced partly as a result of earlier policy
- 2003: Renewable Electricity certificates

# Example CHP in Östersund

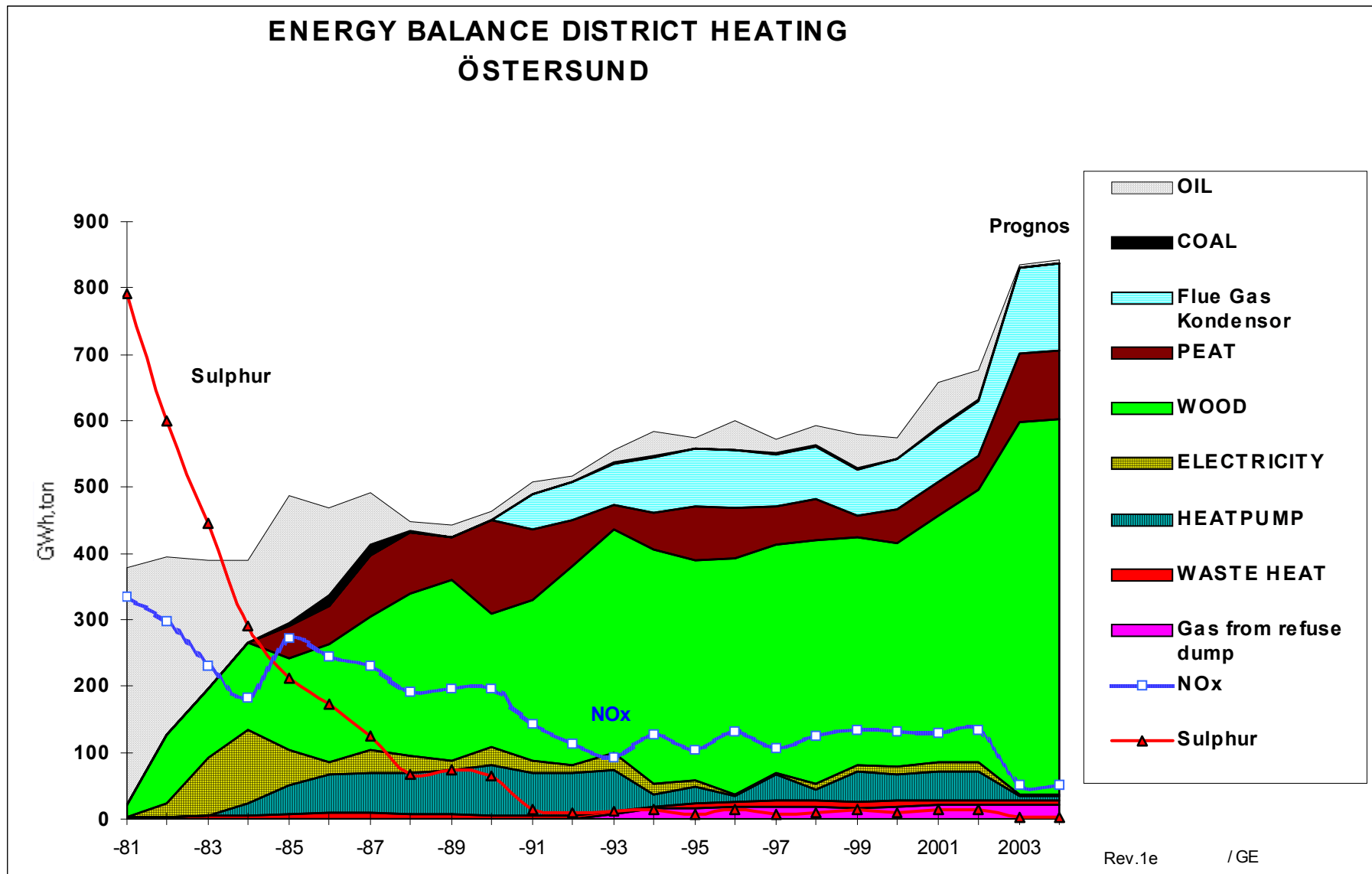


# District heating in Östersund



- Investment in new CHP (56 €, 520 miljoner kronor)
  - Foster Wheeler
  - Siemens
  - BMH Wood
- In operation December 2002
- Covers 80 percent of the heat demand in Östersund (500 GWh thermal/year)
- Covers 20 percent of the total electricity demand (200 GWh electric)

# Fuel use Östersund 1981 - 2004



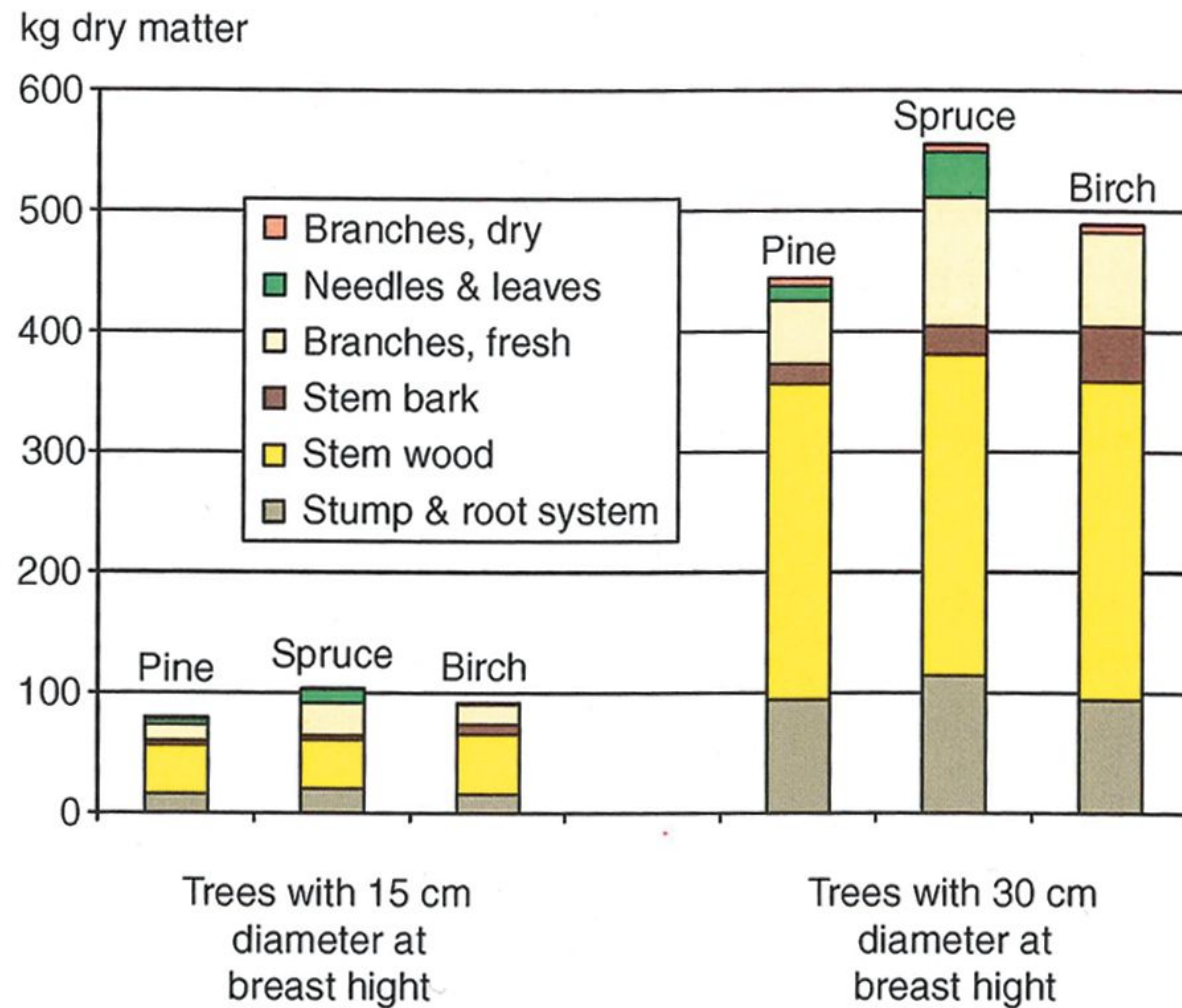
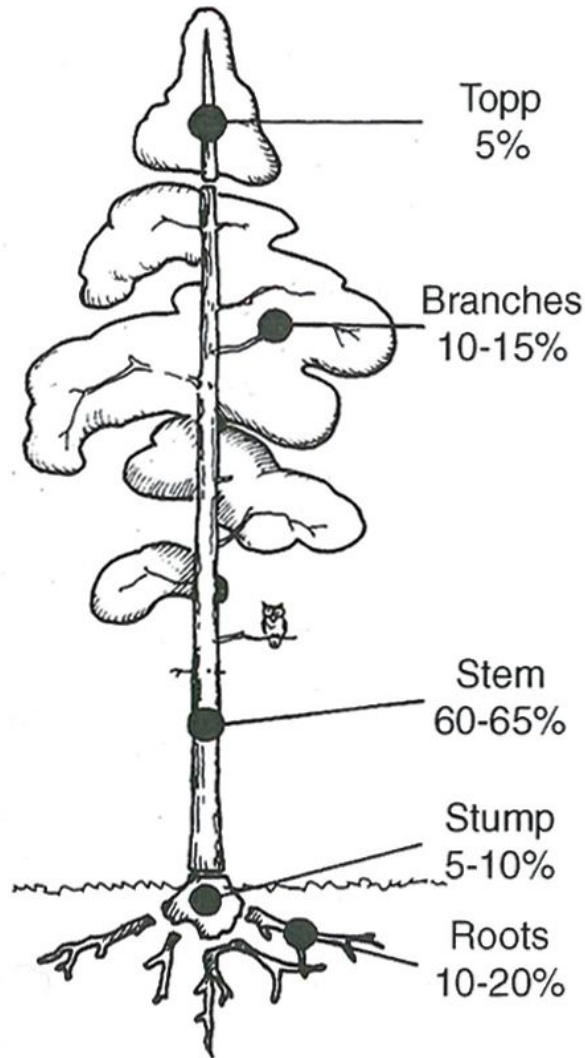
# Biofuels waiting to be burned



# Tops and branches harvested after clear-cutting



# How much is available after cutting down the trees?



# Handling forest residues



# Bark and other residues



# Sawdust - mainly for pellets



# Recycled wood



# Ash recycling from clean wood fuels

- A way to compensate for woodfuel removal
- A way to fertilize stands for higher yield
- A substitute or complement for liming
- An environmentally positive way to get rid of a waste problem

Either way - a strong increase in ash recycling is a positive development!



# Biofuels from agriculture

- Short rotation coppice/willows - for heating (chips)
- Reed canary grass - for heating (bales, pellets)
- Wheat and other grains - for ethanol
- Rapeseed - for RME (bio-diesel)
- Hemp - for heating (briquettes, bales)
- Straw - for heating (bales)
- Manure - for biogas - heat, electricity or bio-fuel
- Ley crops - for biogas

# Salix - short rotation plantations with willows

- Planted in the spring on regular fields with cuttings.
- First harvest after 3 - 4 years, full harvest after 7 - 8 years. Replanted after 25 - 30 years.
- Grows back from the same stumps.
- Harvested in winter, chipped in the field. No further drying.
- Total area in Sweden 15 000 hectares, most of it planted in early 1990:ies. New plantations 500 - 1000 hectares per year.
- High per acre yield. Low input of energy, thus very good energy and carbon balance.
- Can be used to clean waste water and contaminated soil.
- Contact [www.agrobransle.se](http://www.agrobransle.se)



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# EU:s Waste Management Hierarchy

Prevention

Re-use

Recycling

Energy-recovery

Landfill

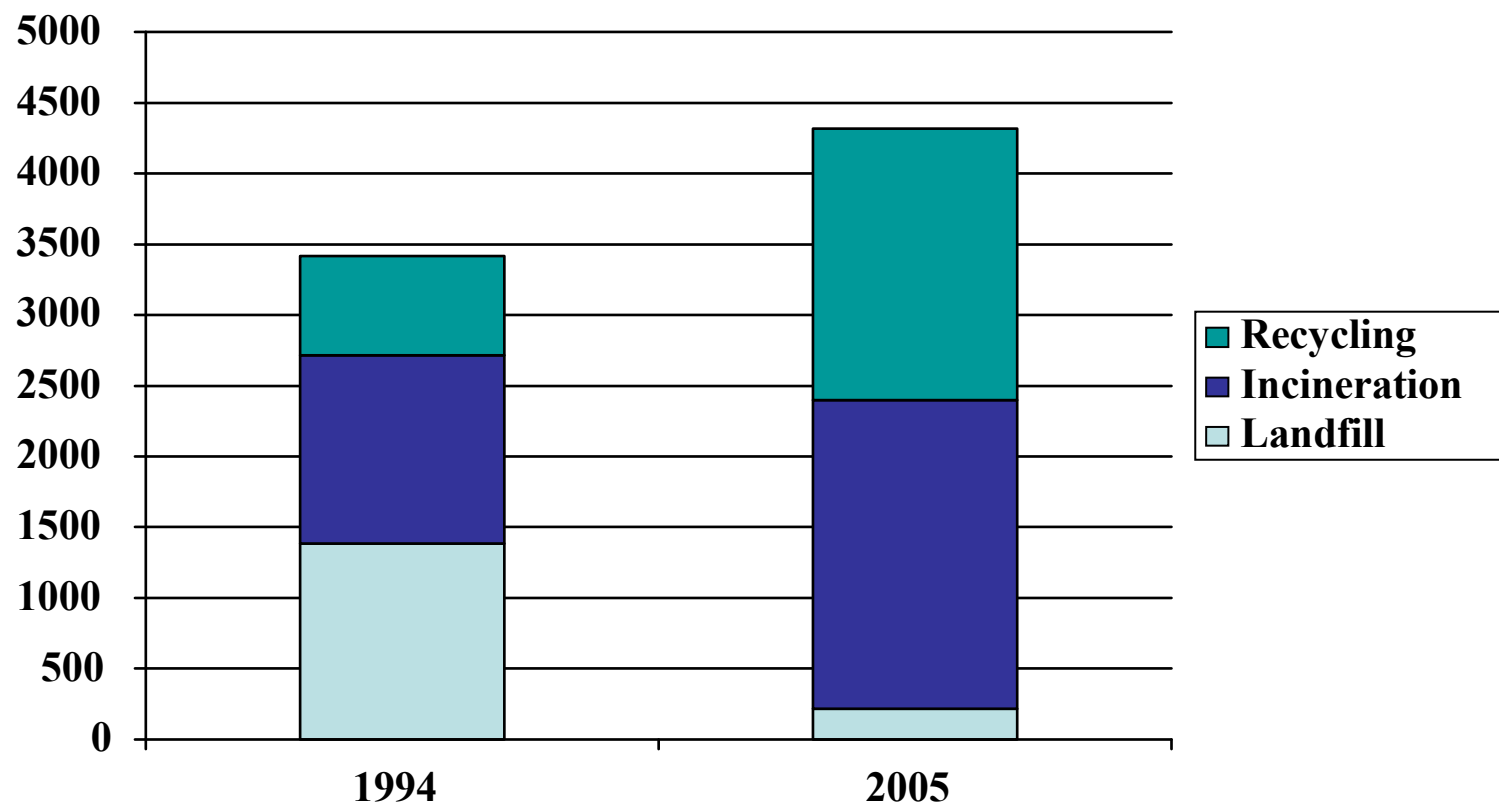


# Important policy tools

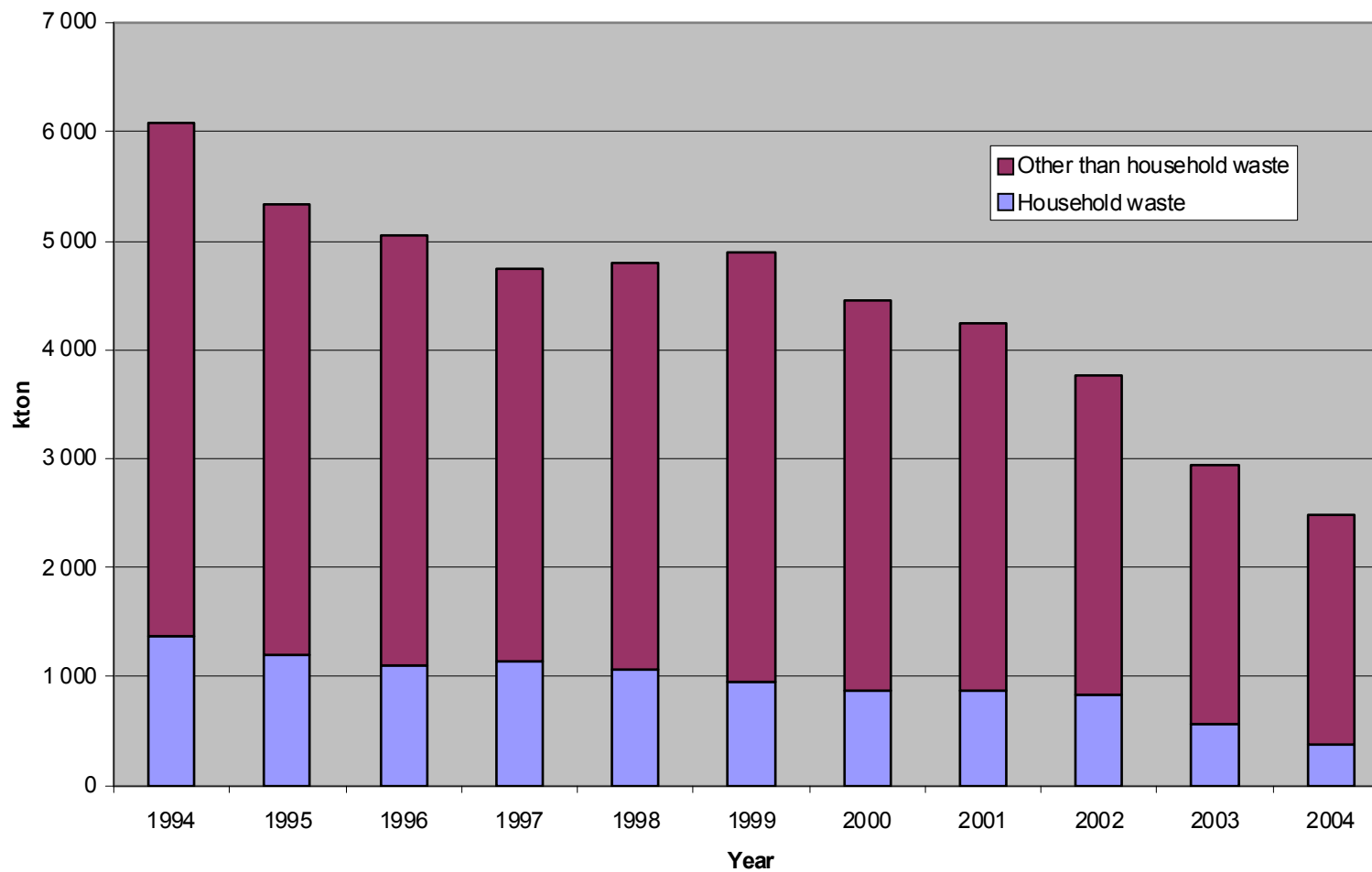


- Environmental Code 1999
- Municipal waste planning in the 1990-ties
- Producer responsibilities since 1994
- Landfill ban on combustible (2002) and organic waste (2005)
- Landfill tax since 2000 (27 E/t => 40 E/t)
- Governmental investment support in recycling

# Treatment of household waste (kton)



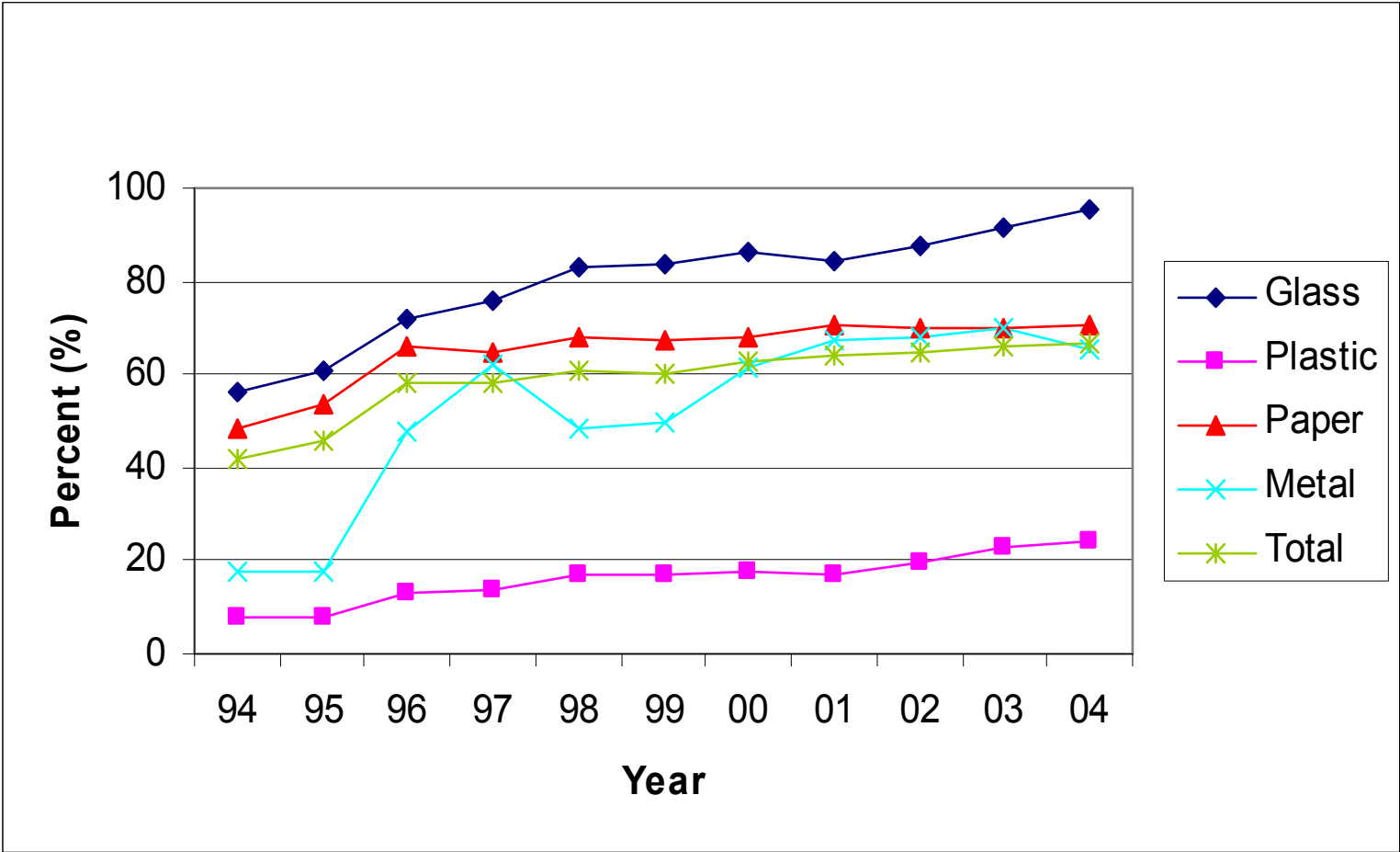
## Waste disposed of to landfill (excluding mining waste)



# Collection site for paper, packages, small batteries, clothes for reuse



# Material recycling of packaging waste



# Producer responsibility - areas

- Electrical/electronic products (SFS 2005:209/2000:208)
- Cars (SFS 1997:788)
- Packaging (SFS 1997:185)
- Newspaper (SFS 1994:1205)
- Tyres (SFS 1994:1236)
- Office paper (voluntary agreement)
- Building- and demolition waste (voluntary agreement)
- Farming plastics (voluntary agreement)

# Producer responsibility - requirements

- Definition of producer: Manufacturer, producer, importer or similar.
- Producers responsible to establish and operate a system for management of their products when discarded
- Recycling goals: % of waste that must be material recycled
- Financed by fees on sold product

- **Secondary activities at landfills**
  - 40 % of the received waste is sorted out for recovery:
    - fuel from waste
    - materials: scrap, corrugated cardboard, wood
    - construction material: inert wastes



# Heat and power



- About 30 plants outside of industry, (3,8 million tonnes)
- All cities have large district heating systems which need energy most of the year
- Emissions of dioxins and heavy metals down 95-99%

# Reduction of dioxin levels

- T = Tid (time), prolonging the time for the waste in the furnace to brake up dioxins
- T = Tryck (pressure) in the furnace
- T = Turbulence, creating a swirling flow in the furnace
- T = Teknik (technical design) of the furnace
- S = Syre (oxygene), not too high, not too low
- These factors more important than filters

# Biological treatment

- Plants in 2007:
  - 22 composting facilities (not including garden waste),  
total amount: 350 000 tonnes
  - 20 anaerobic digestion facilities  
total amount: 280 000 tonnes



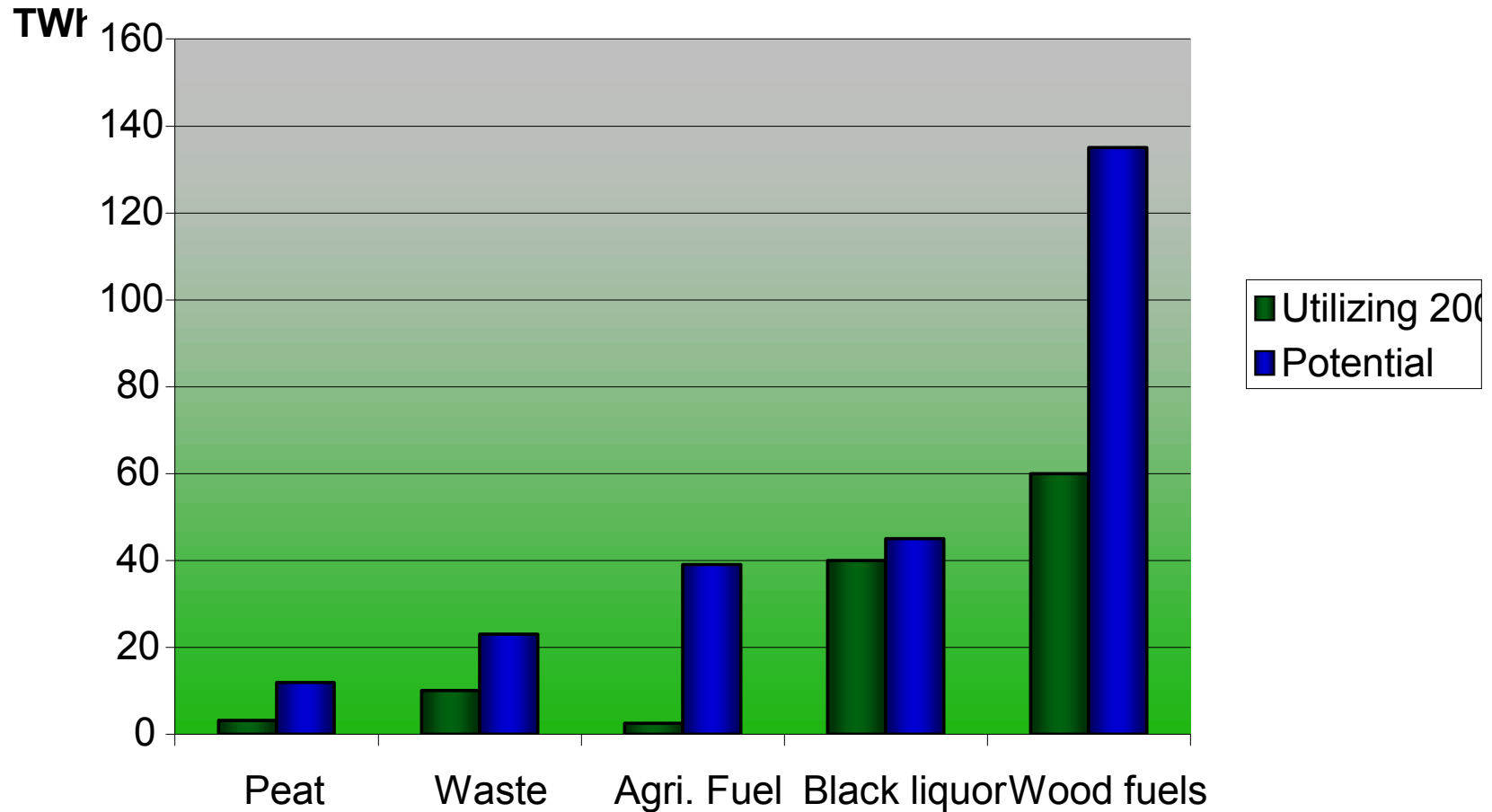
# Production of biogas

- 20 anaerobic digestion facilities
- Digestion of sludge at 139 waste water treatment plant
- Collection of biogas at 70 landfills
- Biogas production at 4 industries

How much more bioenergy can  
we produce and use in Sweden?

Svebio's calculations show that we can double

# Utilization and potentials for different biofuels in Sweden



Sources:

”Utilizing 2006”: Swedish Energy Agency

”Potential”: The Geological Service of Sweden, The Swedish Association of Waste Management, LRF, SLU, Skogsstyrelsen

Thank you for your attention!

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