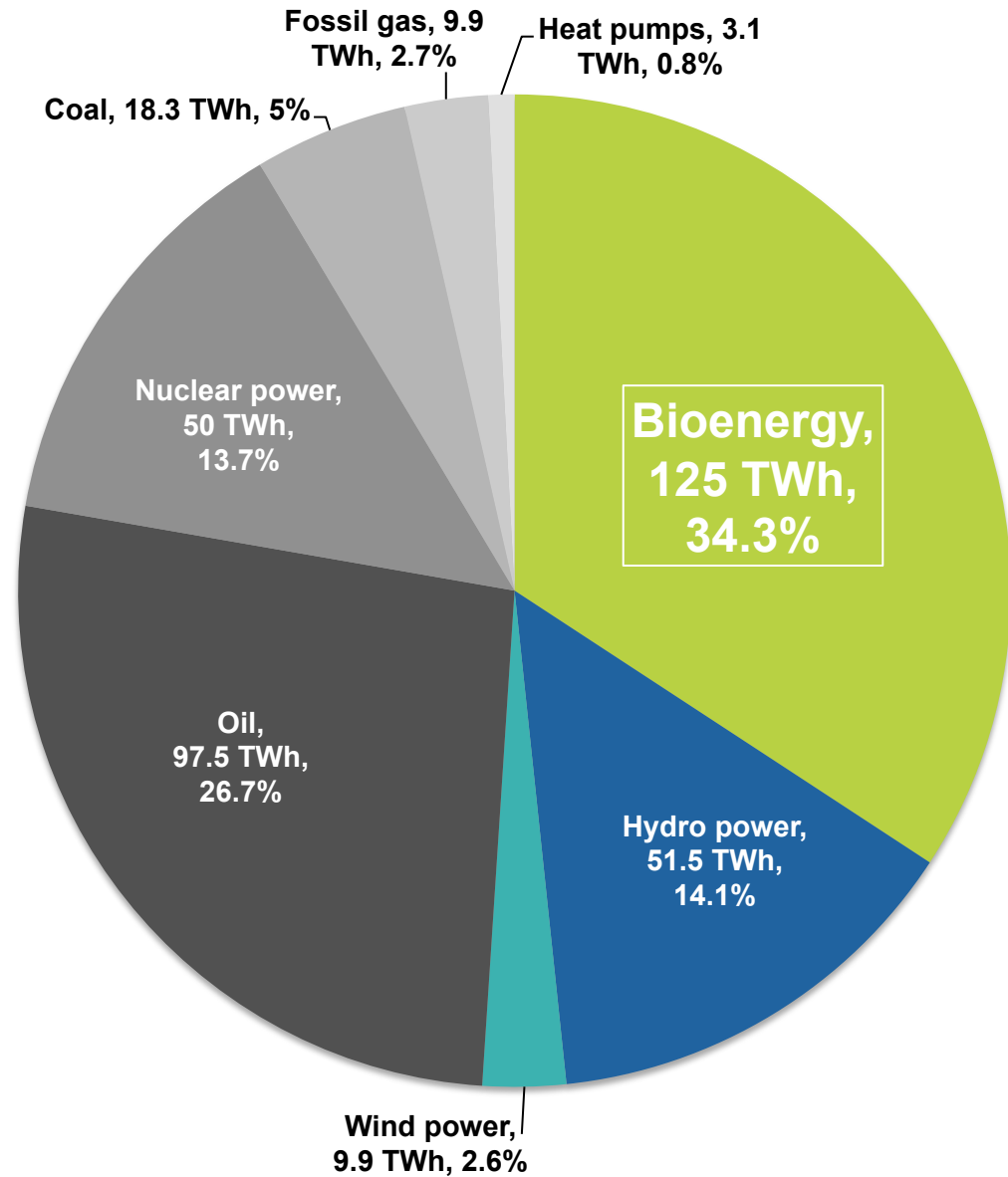

How bioenergy became the largest energy source in Sweden

Kjell Andersson, Svebio

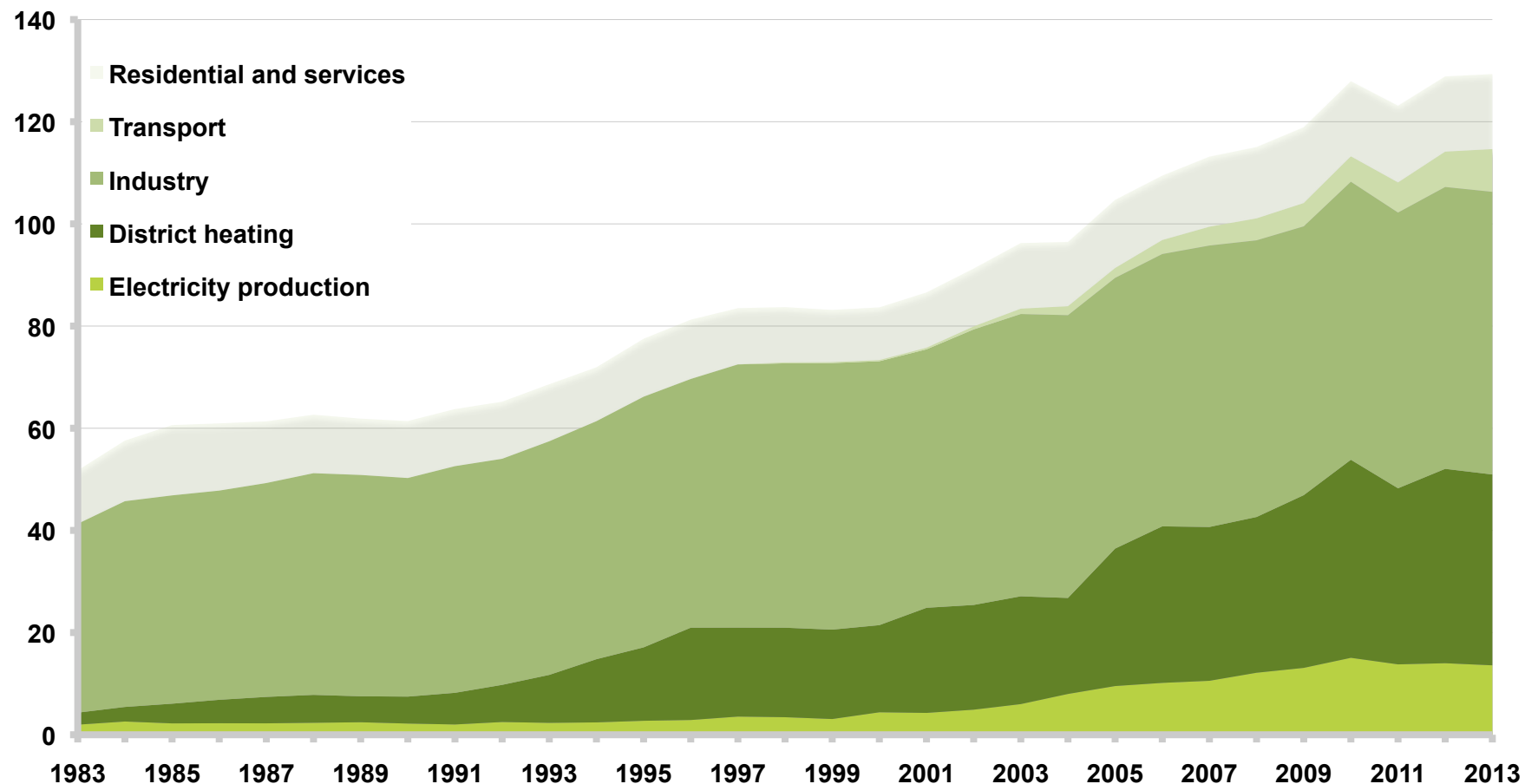
Energy use in Sweden 2014

Bioenergy is the leading energy source in Sweden today. Final energy use by source 2014.

Source: Svebio based on statistics from Swedish Energy Authority.



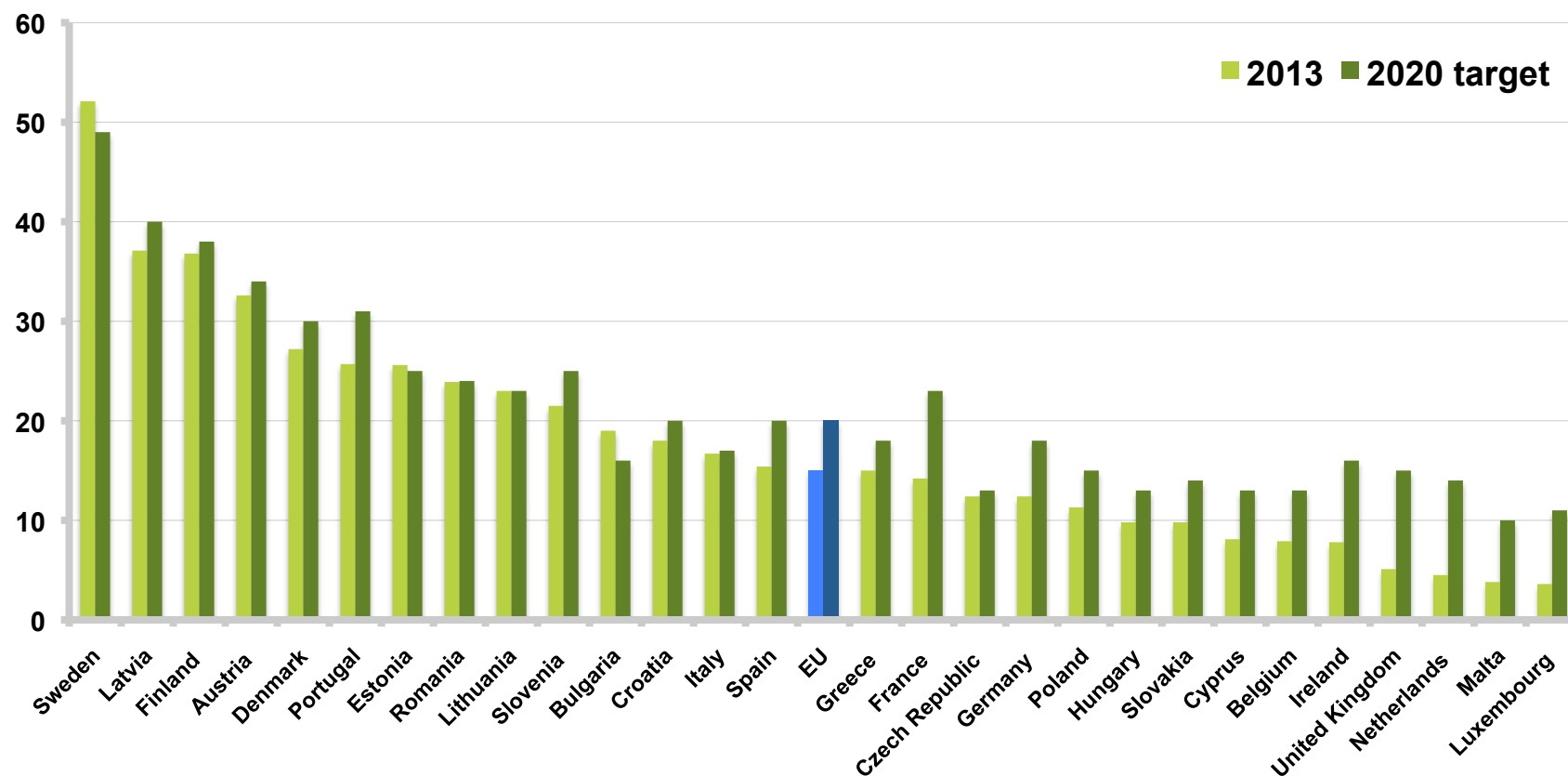
Use of bioenergy 1983–2013 (TWh)



The use of bioenergy in Sweden almost tripled in 30 years time, with growth in all sectors.

Source: Swedish Energy Agency.

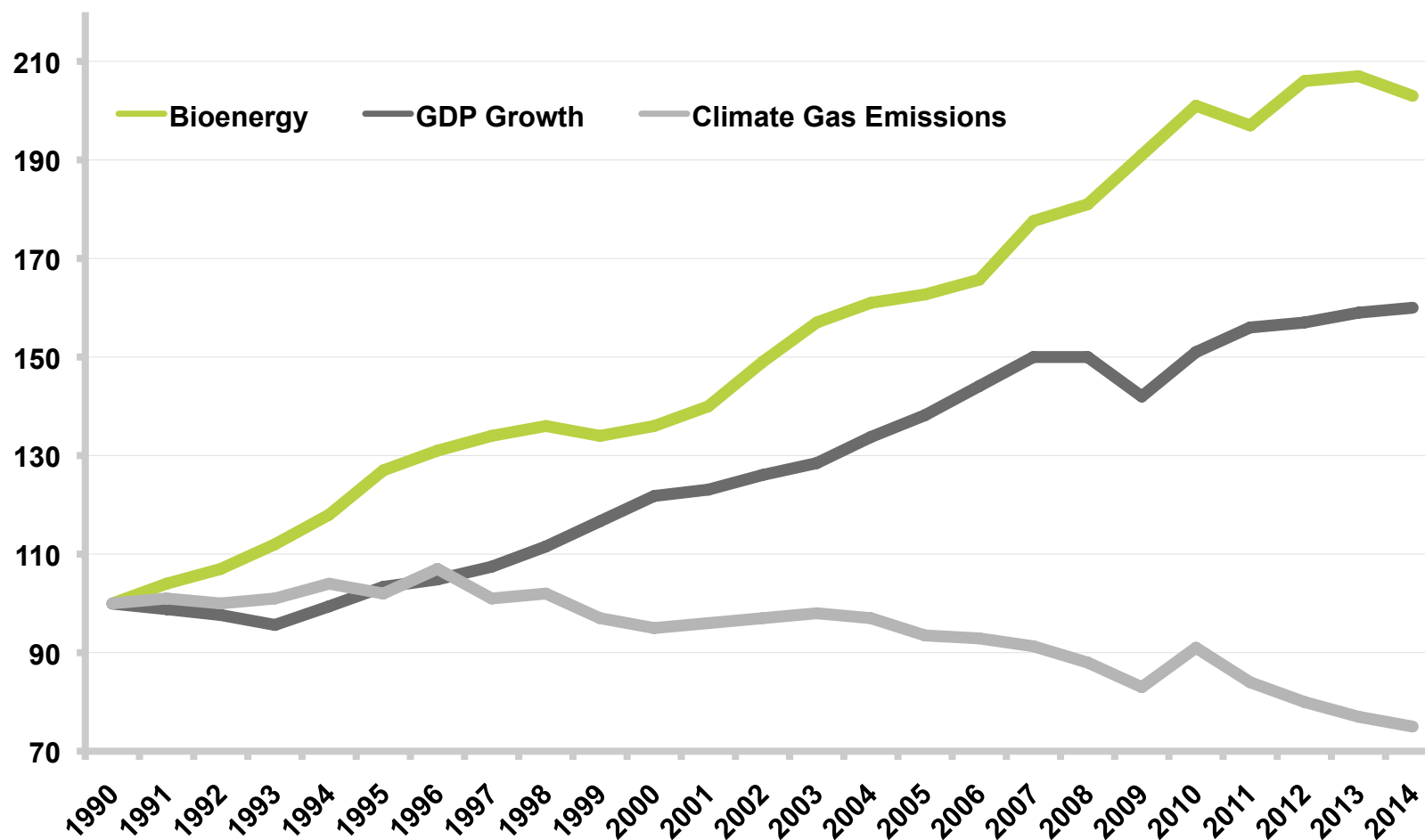
Share of energy from renewable sources (in % of gross final energy consumption)



Sweden is the EU member state with the highest share of renewable energy, and one of three EU member states that in 2013 have reached the EU renewable energy target for 2020. The other two being Estonia and Bulgaria. The blue staples show the renewable share for the EU as a whole. The numbers are percentages of renewable energy as a share of final energy consumption.

Source: Eurostat, ec.europa.eu/eurostat

Decoupling 1990–2014



GDP increased by 60 percent in real terms. Greenhouse gas emissions decreased by 25 percent 1990–2014, and the use of bioenergy doubled. The diagram shows changes from 1990 (1990 = 100 percent).

What made this development possible?

- Long-term and stable incentives.
- Broad political support across the party lines.
- Carbon tax based on the Polluter Pays Principle PPP.
- Limited use of direct subsidies. Trusting the market forces.
- No fossil fuel sources in Sweden. No strong fossil fuel lobby.
- Strong forest industry and strong forest owner's association.
- District heating well developed.



The city of Sundsvall in middle Sweden is located between two mountain ranges. Before district heating was introduced, smoke from hundreds of chimneys and smoke stacks caused serious air pollution, particularly on cold winter days.

Today almost all of the houses are connected to the district heating grid, supplying 80 000 people with heat. And the air quality has improved accordingly.

Pictures supplied by Sundsvall Energi.

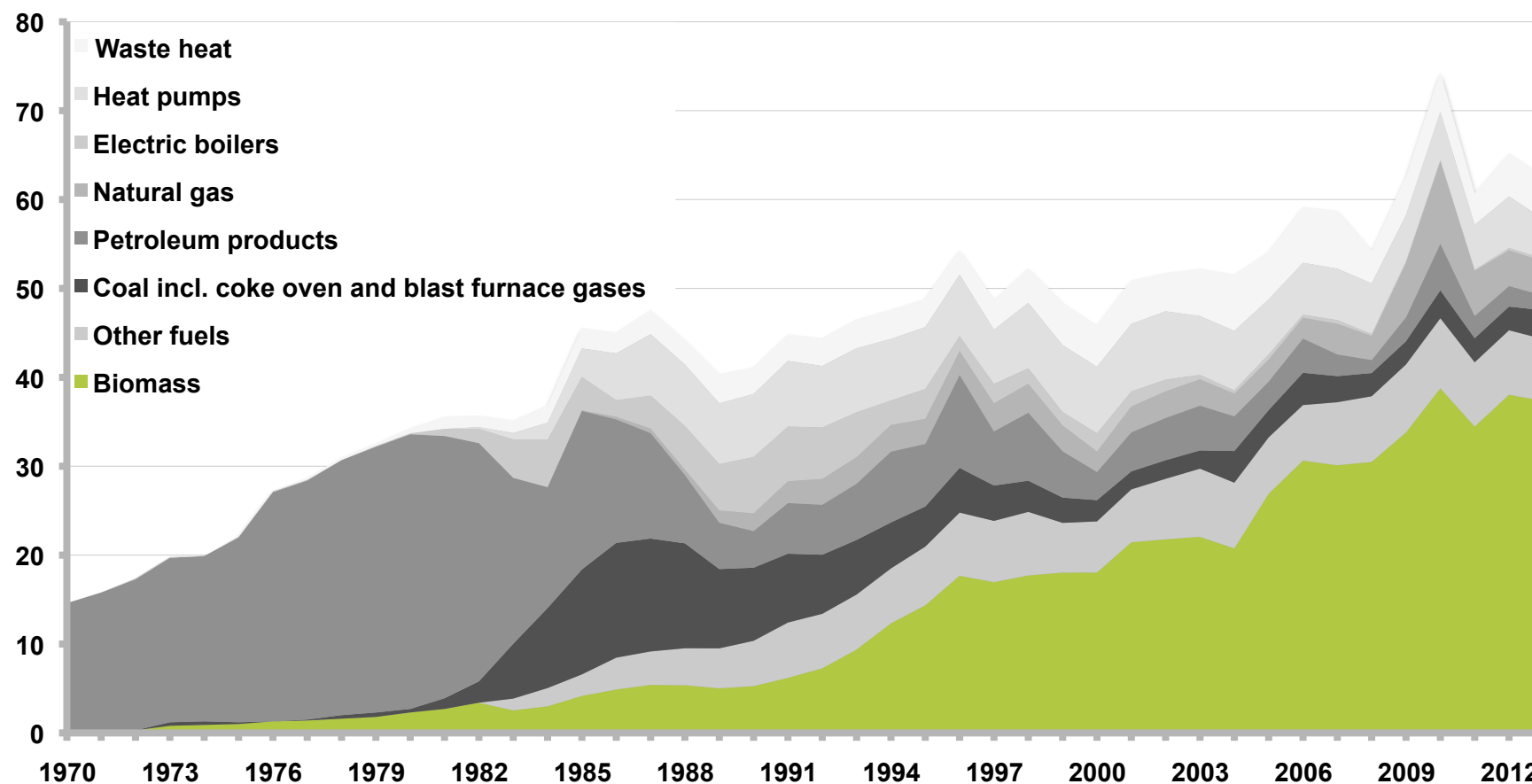


Photo: Torbjörn Bergkvist

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Energy supplied to district heating, 1970–2013 (TWh)



During the previous 30 years, biomass has taken over as fuel in Swedish district heating. Fossil fuels dominated in the 1980s, but today bioenergy and "other fuels" (peat and waste) account for 75 percent of consumed fuels.

Source: Swedish Energy Agency and Statistics Sweden.



Biomass for district heating

By-products from sawmills and pulp factories:
bark, sawdust, chips, discarded wood, shavings

Forest residues:
tops, branches, stumps, small trees from thinnings, trees of low value

Material from parks and gardens, landscaping wood

Pellets, briquettes, wood powder

Recycled wood

Bio-oil, tall oil



Agricultural fuel Salix

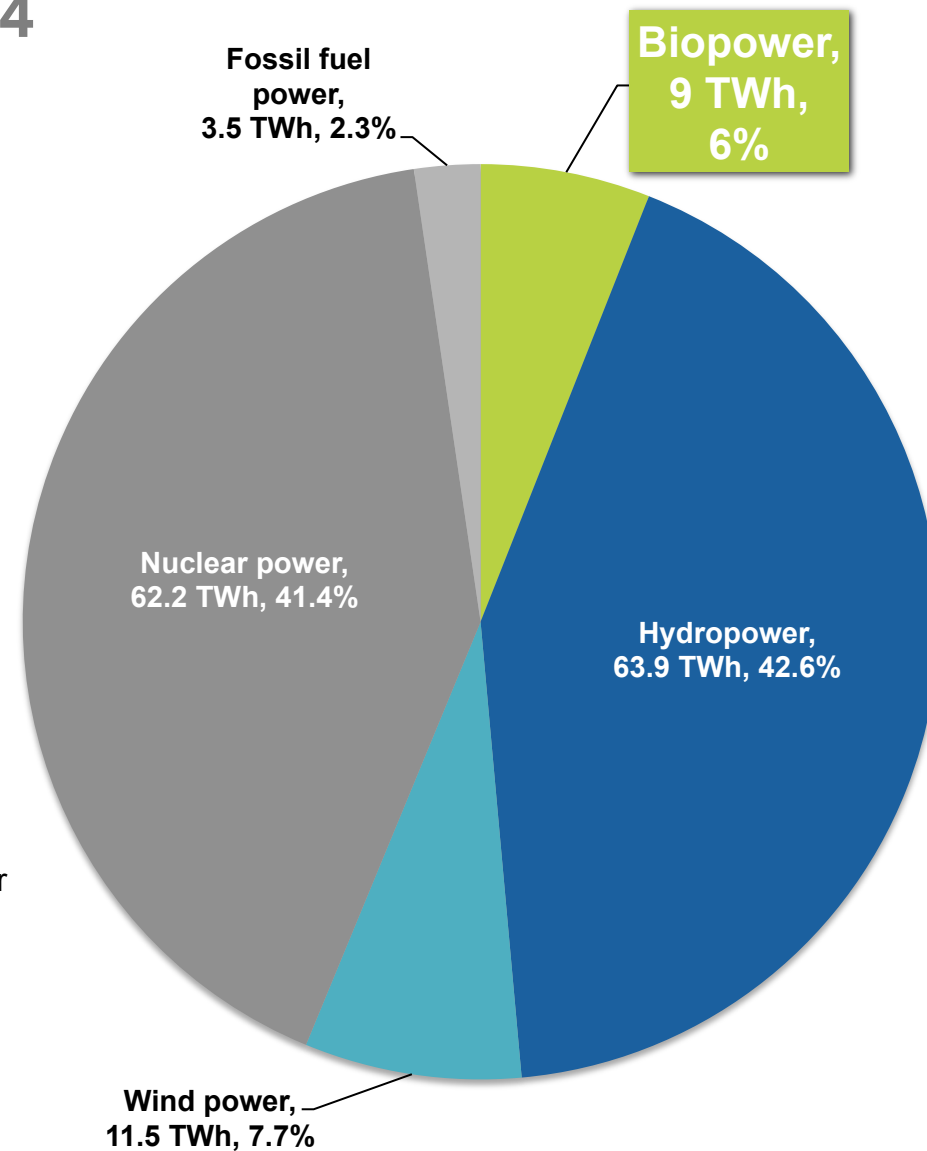
Short rotation coppice (SRC) using willows, Salix, for energy production was developed at the Swedish Agricultural University SLU around 1980.

12,000 hectares have been planted.

Can produce 10 tonnes OBD per hectare.

Harvested every 3 – 4 years.

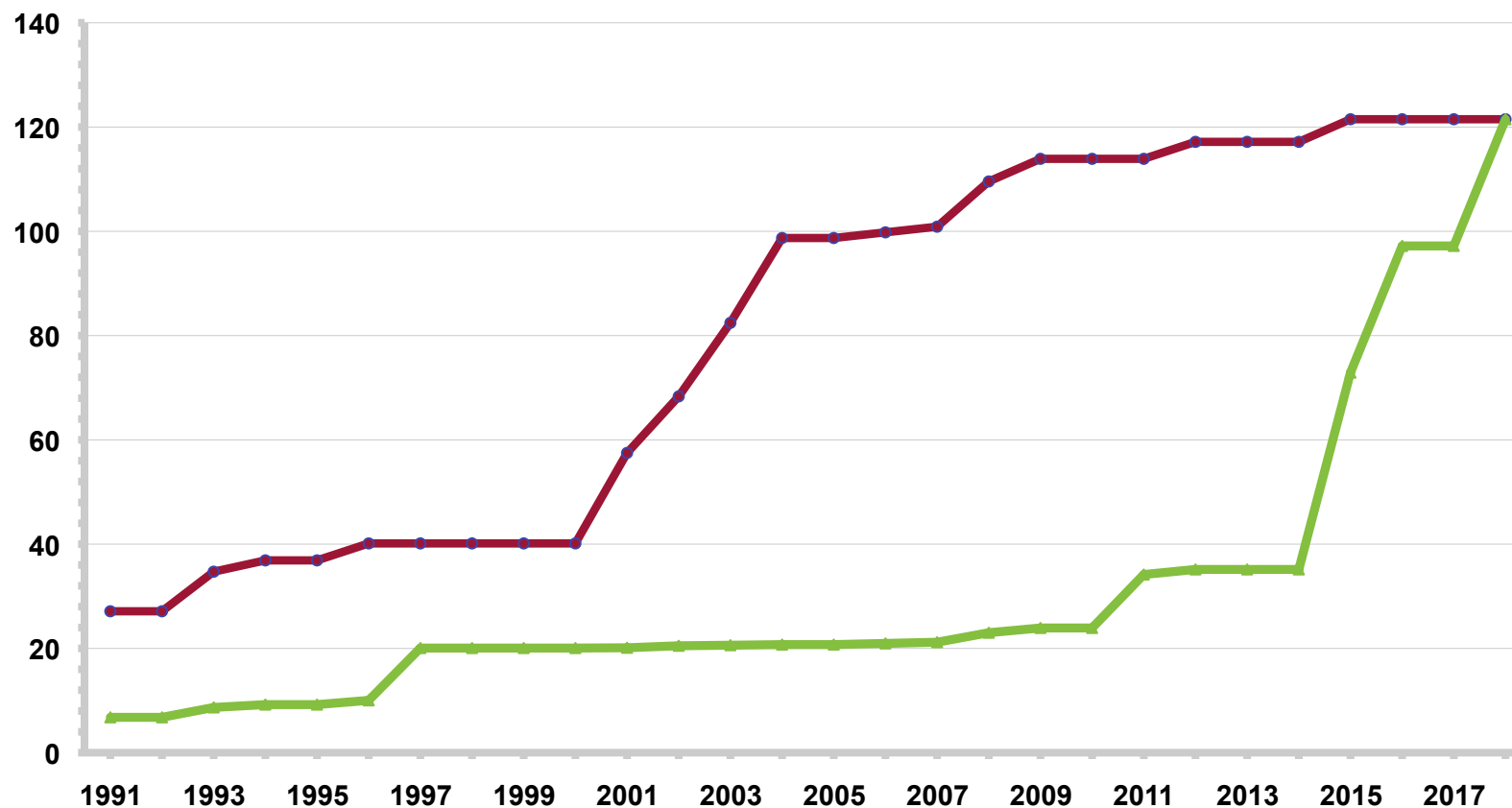
Electricity production 2014



Biopower was the fourth largest source of electricity in Sweden 2014, trailing hydropower, nuclear power and wind power. Half of the biopower is produced in CHPs in district heating, half in generators in the paper and pulp industries.

Source: Svebio based on statistics from Swedish Energy Authority.

The Swedish carbon tax 1991–2018



The carbon dioxide tax was introduced in 1991, and has been increased in several steps since then.

Red: the general carbon dioxide tax level, paid by the residential and service sector.

Green: The tax paid by industries outside ETS that are not required to have emission allowances.

Source: Swedish Finance Ministry / Svebio



Reduced oil use and emissions from heating

450 heat plants for district heating
– 90 of them with electricity production (CHP).

The use of oil for heating of buildings decreased from 30,9 TWh 1990 to 1,6 TWh 2014.

The emissions decreased from 9.48 Mton CO₂ in 1990 to 1.34 Mton CO₂ in 2014.

Total reduction of GHG emissions
85 %.



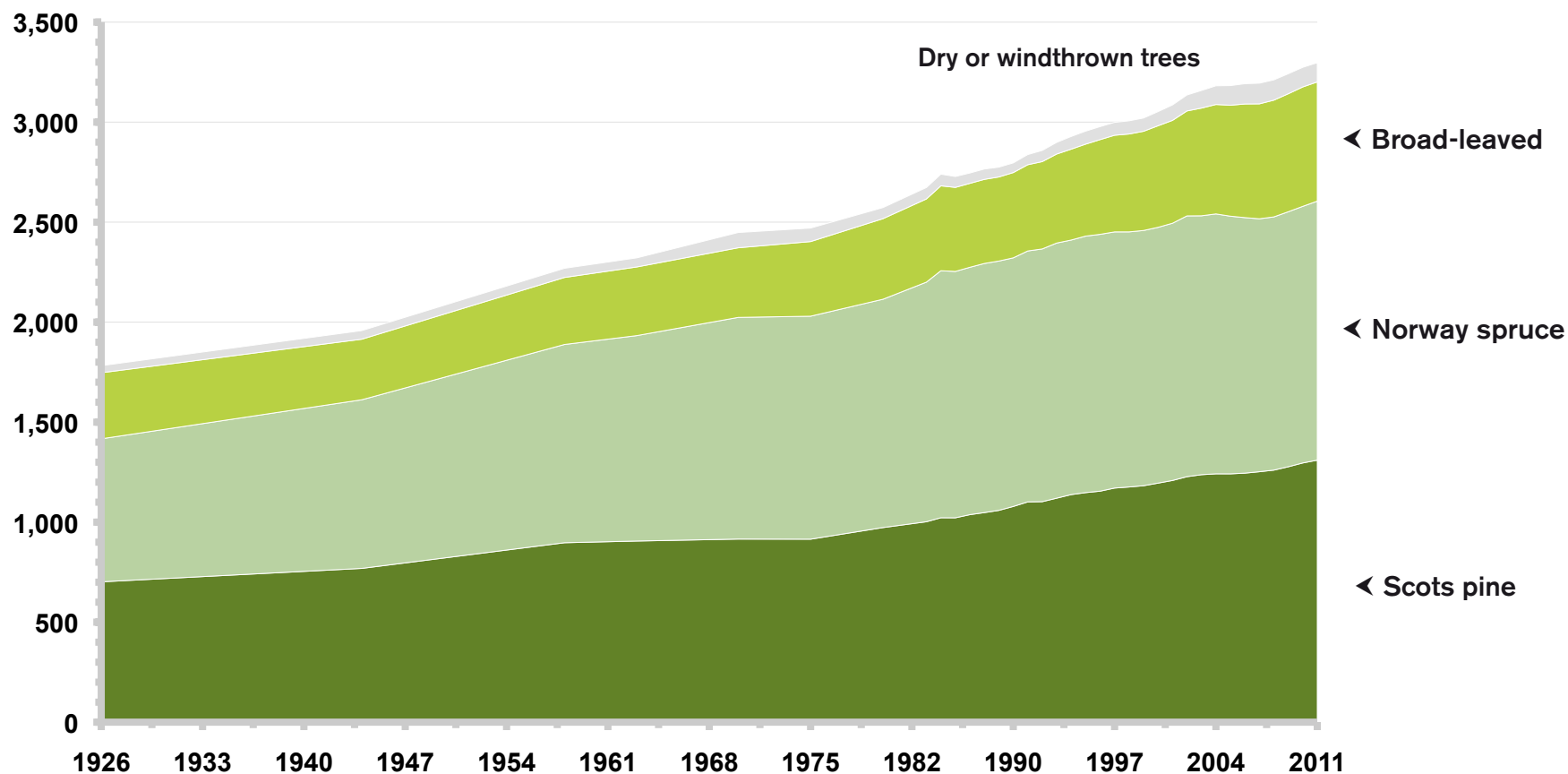
Greenhouses – from fossil fuels to biofuels and waste heat

Use of fossil fuels decreased by 83 % between 2002 and 2014.

Use of biomass (woodchips and pellets) increased five-fold, and is today the leading fuel in greenhouses.

One of the largest tomato greenhouses uses waste heat from paper pulp factory.

Trend for total standing volume in forests, 1926–2011



The total standing volume, and thus the amount of stored carbon, has doubled in Sweden's forests in the previous hundred years, thanks to reforestation and good forest management.

Source: Derived from official statistics from Swedish University of Agricultural Sciences, Swedish National Forest Inventory



A postcard from 1902 shows barren surroundings around this church in western Sweden. Today there are trees everywhere. This is a common development in most parts of Sweden during the last 100 years. Less grazing (fewer milk cows and sheep), less use of firewood, better management of forests, etc, are the causes of this development.





Sustainable biomass

Report from EU Com during 2016. Consultation this spring.

AEBIOM is preparing a common position.

Criteria already for biofuels.
Need to have harmonised rules.

U.K., Netherlands, Denmark
already has regulation.

Demand from NGO's, politicians,
and from consumers.



How to prove Sustainable Forest Management (SMF)

No common European forest policy, forestry national competence.

Forest Europe process listing criteria and indicators.

Rely on national systems and avoid new bureaucracy.

Many small actors. 15 million forest owners in EU. Many small heat plants and private use of firewood.



Risk Assessment approach

Use as an "umbrella" to enable use of existing systems and avoid new administrative burdens.

RA made by Member States or other nations or regions. Check if existing control systems satisfy requirements in criteria.

Report to EU Com. Feedstock covered by RA can be used.

If RA is negative, possible to use certification, as in RED.

Possible to make bilateral agreements, like in RED.

Challenges for the coming years

- Competition. Low electricity prices and low prices on fossil fuels.
- Low prices on ETS.
- Policies in EU may hamper development, e.g. state aid rules, cap on biofuels, and sustainability criteria.
- NGO:s on EU level negative to bioenergy.
- Many of our domestic markets are saturated.

Possibilities in the coming years

- Biofuels from cellulose and lignin – big opportunity for Swedish forestry and bioenergy sector.
- Biopower balancing variable power production (wind, solar).
- Biorefineries producing several products: pulp/paper, chemicals, textiles, biofuels, heat and electricity.
- New refined products: torrefied pellets, pyrolysis oil, charcoal, etc.
- Export opportunities.

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