



# Bioenergy & Business the Swedish way

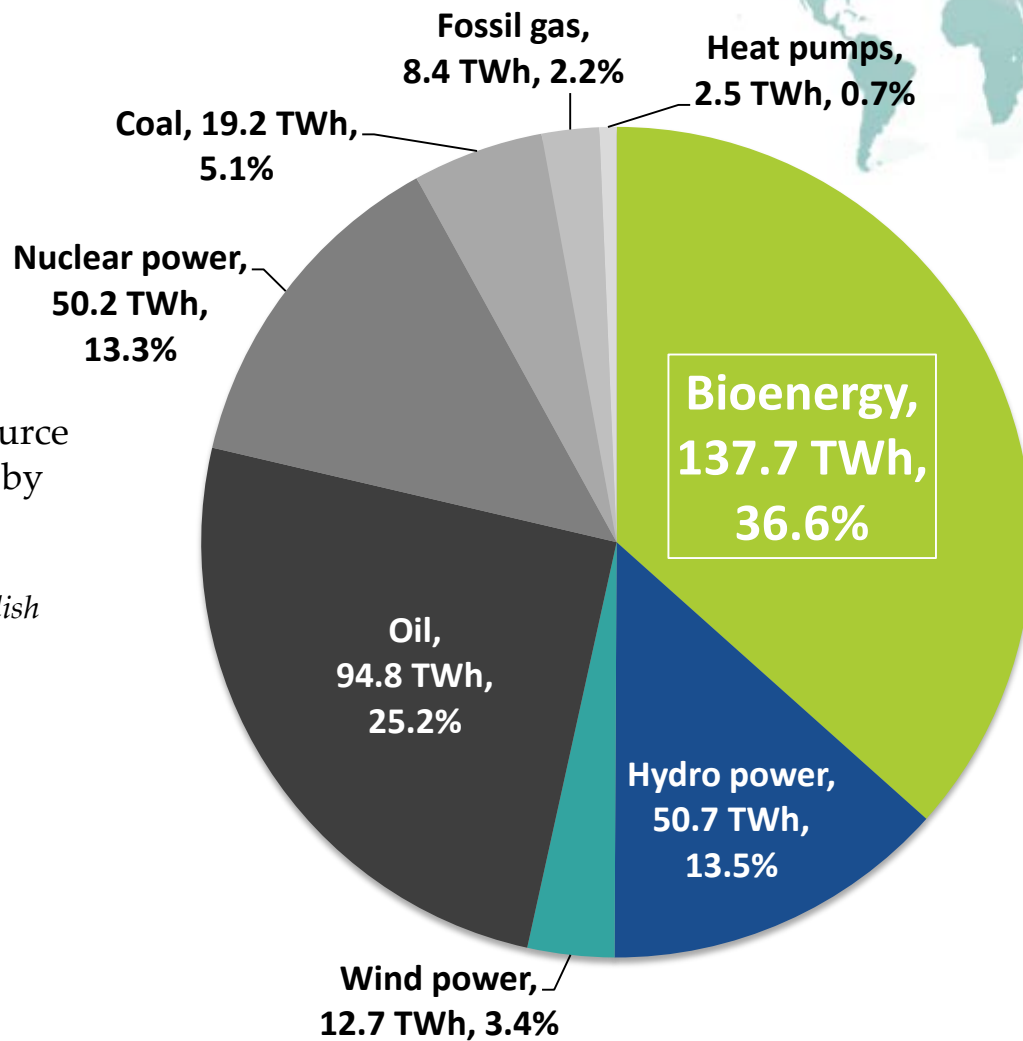
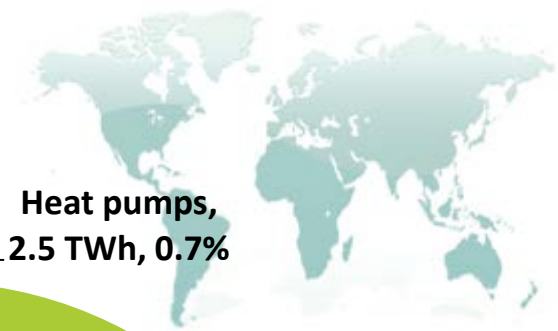
WBA Japan mission-workshop May 22, 2017

Karin Haara

World Bioenergy Association

Source of material about Sweden is from Svebio

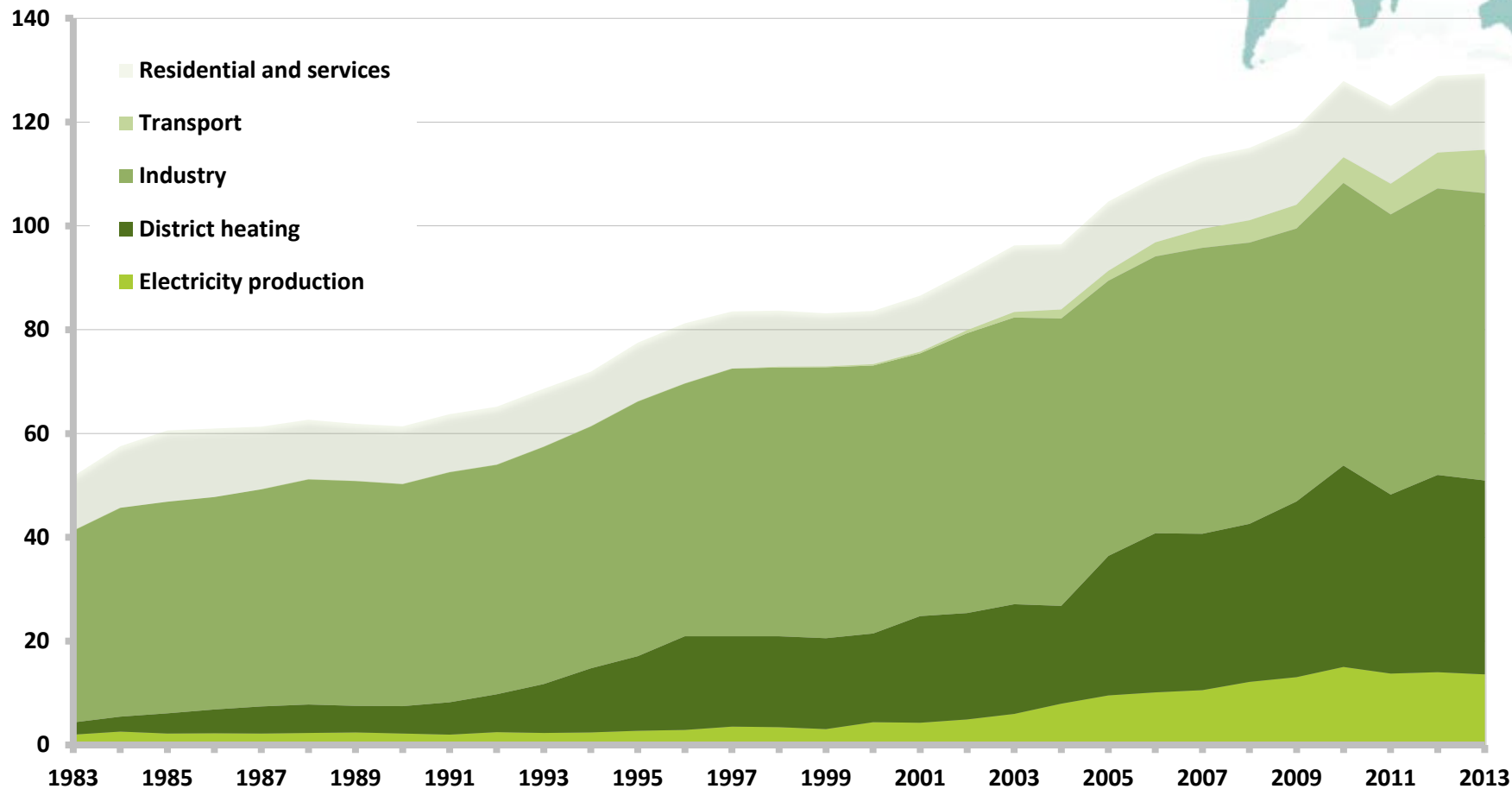
# Energy use in Sweden 2016



Bioenergy is the leading energy source in Sweden today. Final energy use by source 2016.

Source: Svebio based on statistics from Swedish Energy Authority, 2017.

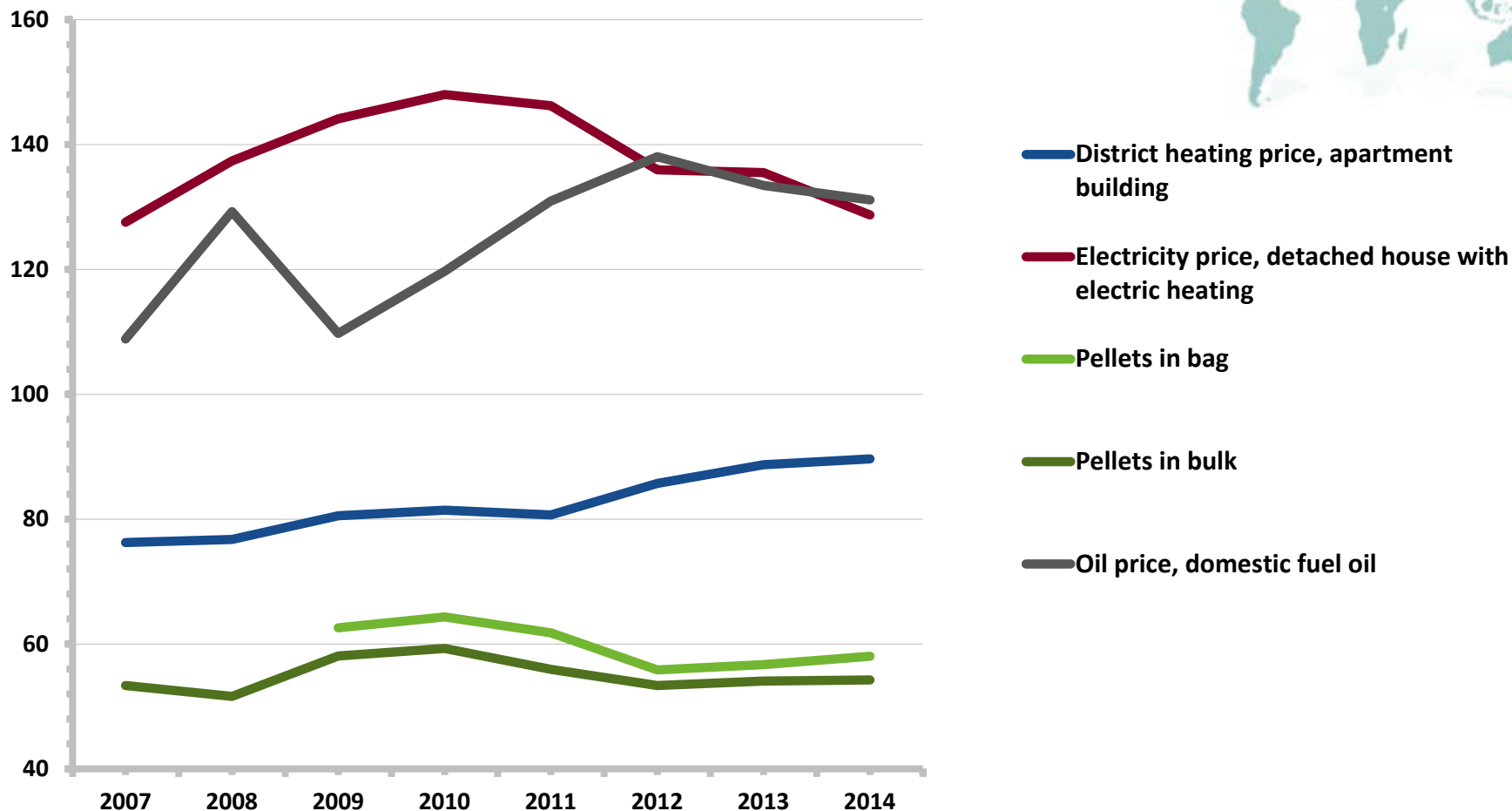
# Use of bioenergy 1983–2013 (TWh)



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

Source: Swedish Energy Agency.

# Energy prices for households (öre/kWh)



Prices of wood pellets have been steady in recent years and much lower than the equivalent prices of heating oil for heating and electricity *Source: Svebio*



# Background to the Swedish development

1. Long term stable incentives
2. Broad political support across the party line
3. Carbon Tax based on the polluter pays principle, ppp
4. Limited use of direct subsidies – trust in the market forces
5. No domestic fossil energy sources, No strong lobby.
6. Strong forest Industry, strong forest owners association
7. District heating well developed

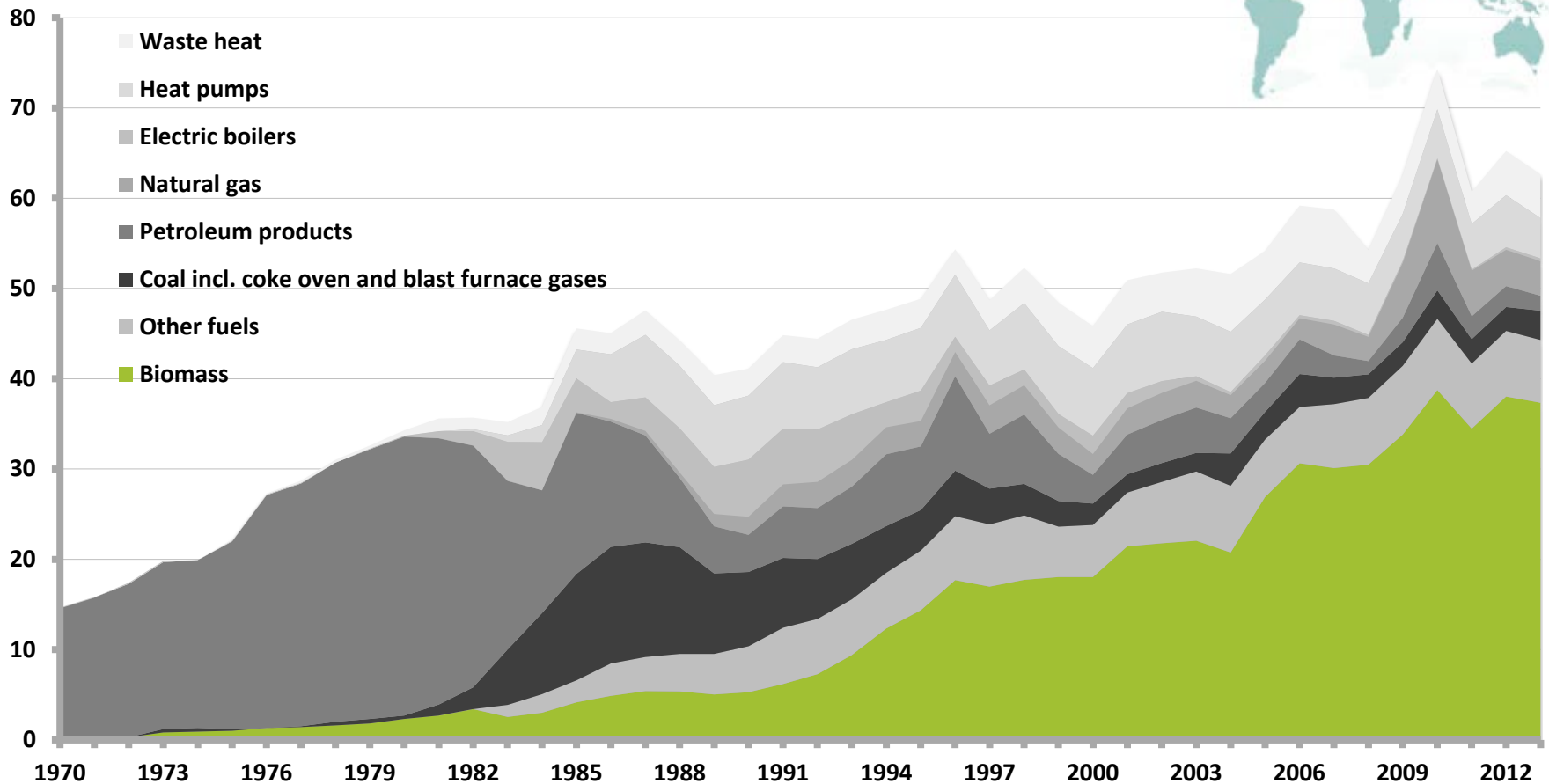


The city of Sundsvall in middle Sweden is located between two mountain ranges. Before district heating was introduced, smoke from hundreds of chimneys and smoke stacks caused serious air pollution, particularly on cold winter days. Today almost all of the houses are connected to the district heating grid, supplying 80 000 people with heat. And the air quality has improved accordingly.

Pictures supplied by Sundsvall Energi.

Photo: Torbjörn Bergkvist

# 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.

# Forest biomass management



Haulage/collection of forest residue.



Covered pile of forest residue is chipped for the heating season.



Chipping of forest residue.



Thinning near populated areas.



Stubs collected for crushing.



Bundling of forest residue.



Storage of composite residue logs.



Chips vehicle.



Spreading of ashes.



Forest residue (branches and tops), is collected at our timber felling areas and can be chipped directly, but is usually stored in piles near passable roads for transport to district heating plants during the heating season. It is beneficial to bring the ashes back to the forest.

Other residues used is material from parks, garden, landscaping, pellets, briquettes, woodpowder, recycled wood, bio-oil, tall oil



# Example CHP in Östersund



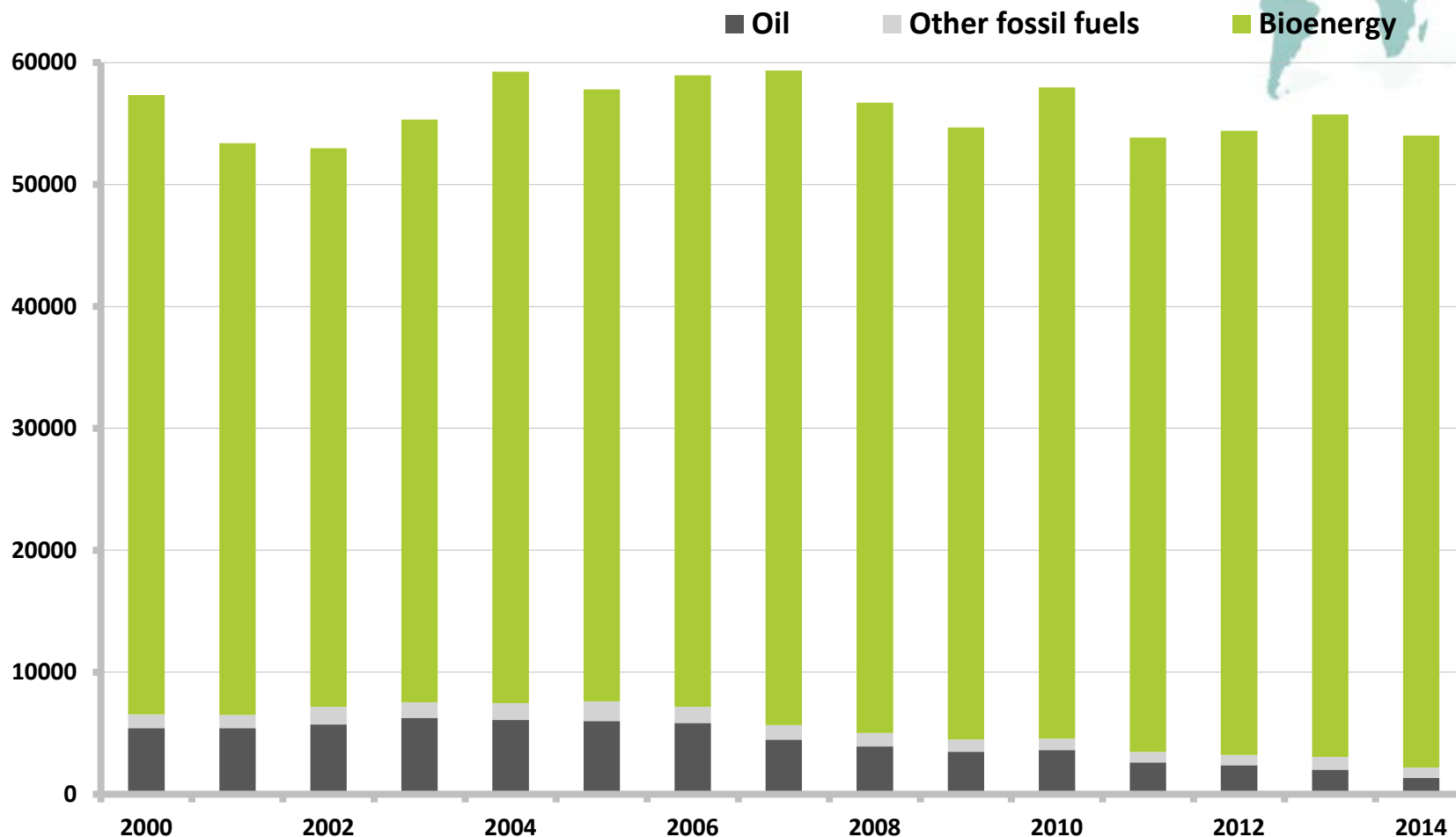
CHP Lugnvik, Östersund, Sweden. Compact circulating fluid bed technology. Capacity: 110 MW Heat, 45 MW electricity. Produces: 600 GWh heat, 200-250 GWh electricity in this plant. 1/3 electricity and 2/3 Heat. 90% of the city heat need. Started 2003 and the investment was 500 milj SEK (about 77 miljUSD) 130 milj SEK (20 milj USD) was support from the government (20 miljUSD) 44000 from the city



Heat plant around 1 MW using local wood chips and supplying heat to village with school, a few apartments buildings, and small industries



# Energy use in Swedish forest-based industries (GWh)



The total use of bioenergy in forest-based industries is more than 50 TWh. The use of fossil fuels, mainly heating oil, has decreased by 71 percent in the last ten years. Forest-based industries include pulp and paper mills, sawmills and woodworking industry.

Source: Statistics Sweden/Svebio



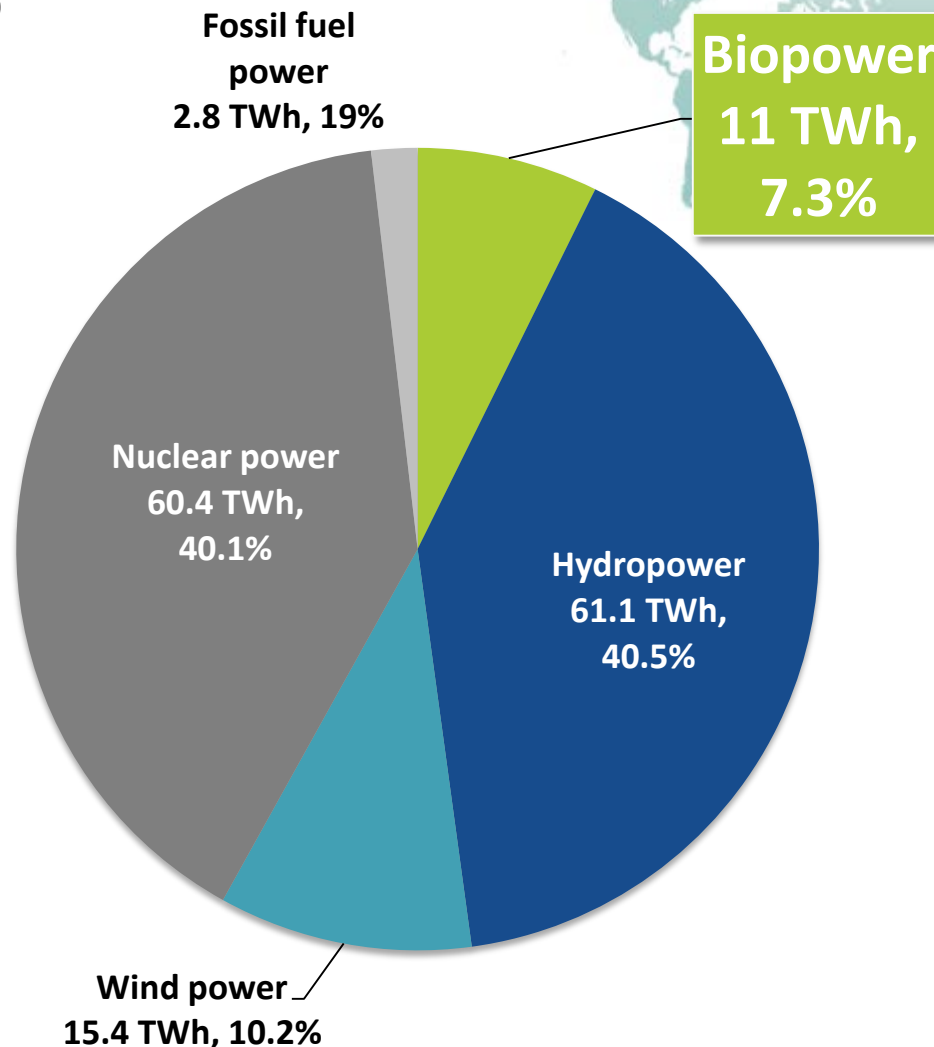
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# Electricity production 2016

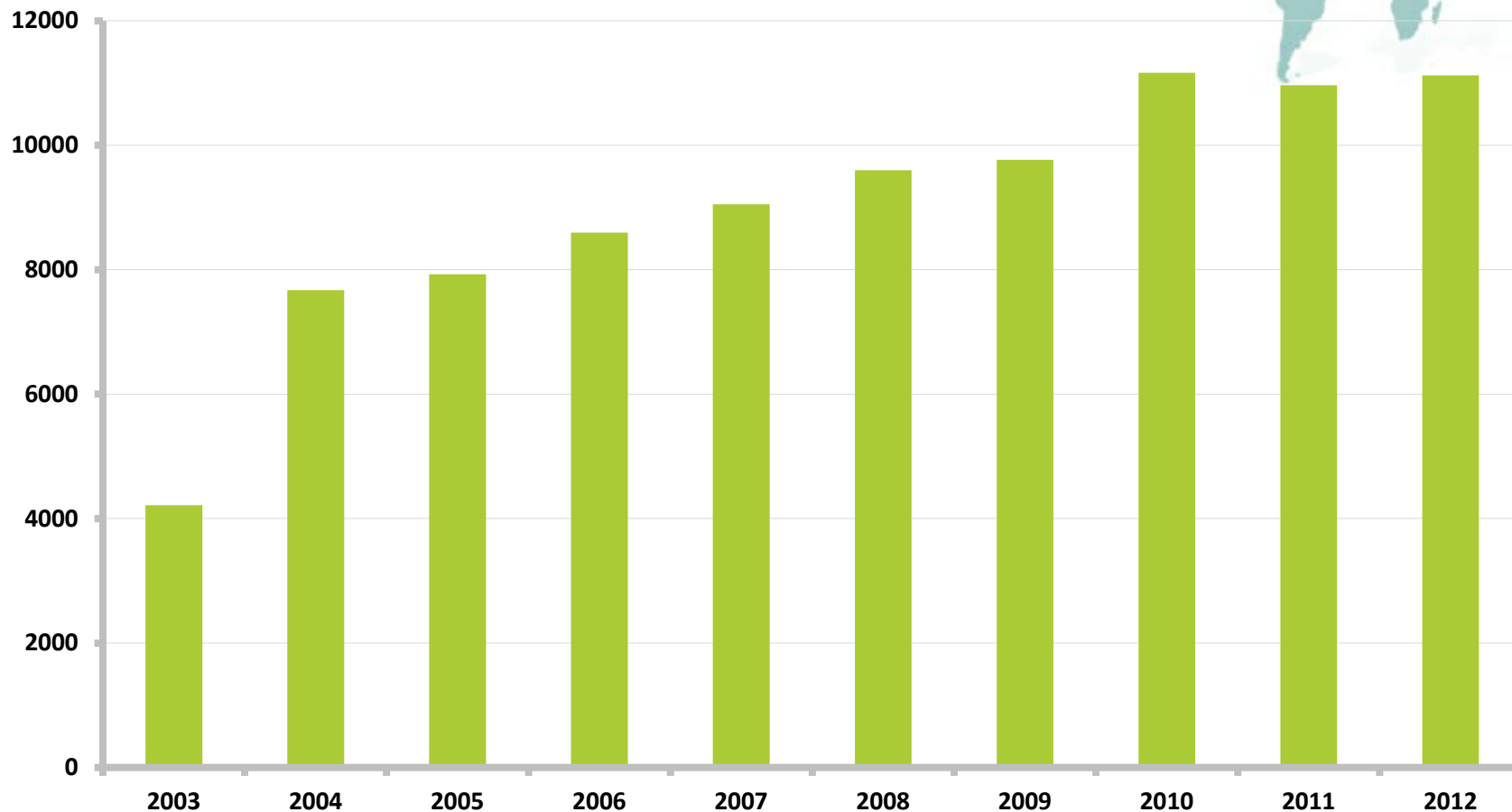
Biopower was the fourth largest source of electricity in Sweden 2016, trailing hydropower, nuclear power and wind power. Half of the biopower is produced in CHPs in district heating, half in generators in the paper and pulp industries.

Source: Svebio based on statistics from Swedish Energy Authority, 2017





# Bio-electricity production (GWh)

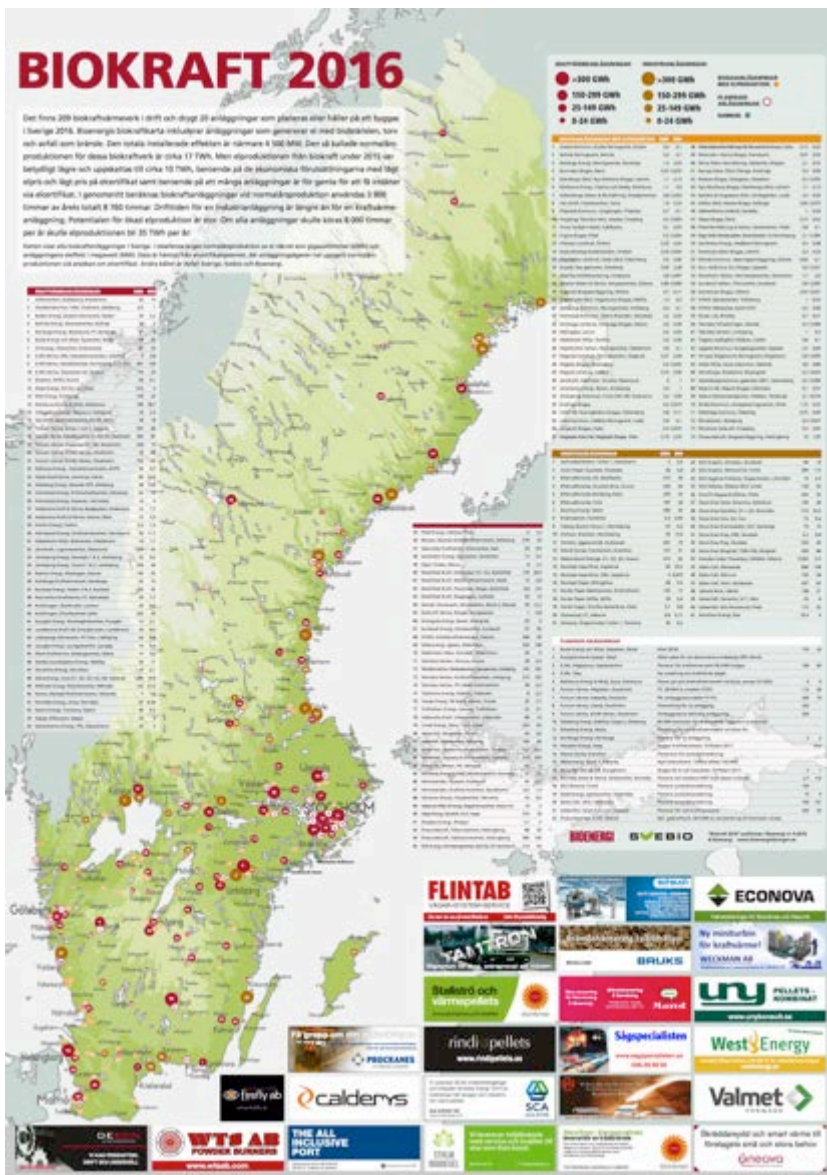


The production of bio-electricity receiving green certificates. After 2012 more than half of the production was phased out of the support system, and the statistics are since then uncertain.

Source: Swedish Energy Agency

# BIOKRAFT 2016

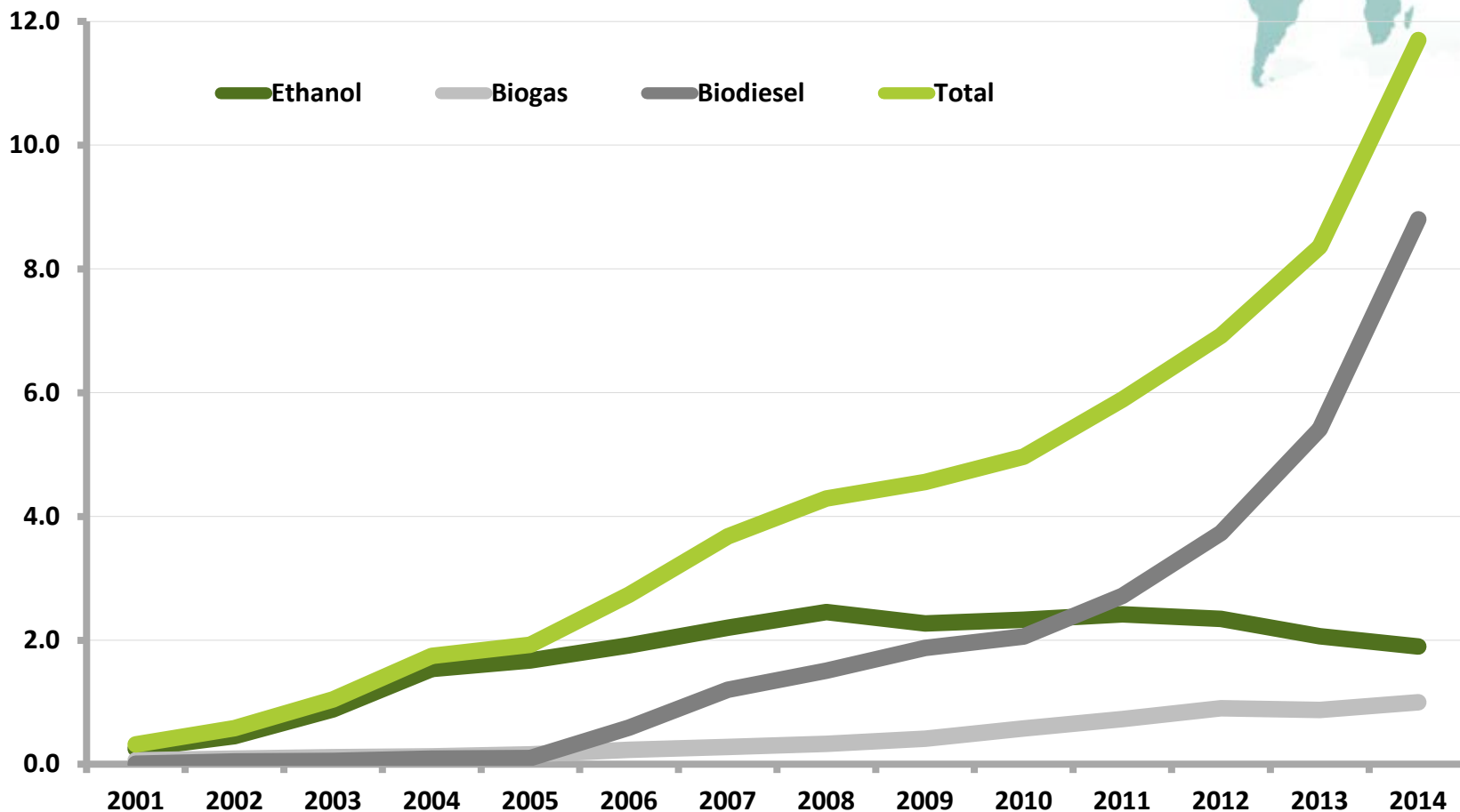
Den första 209 biokraftverksamheter i drift och drygt 20 anläggningar som planeras eller håller på att byggas i Sverige 2016. Sveriges biokraft är i huvudsak anläggningar som genererar el med bränslen som trä och avfall som biotiska. Den totala installerade effekten är närmare 4 100 MW. Den så kallade normala produktionen för dessa biokraftverk är cirka 11 TWh. Mer elproduktion från biokraft under 2015 är beaktligt ögre och uppskattas till cirka 10 TWh, beroende på de planerade förändringarna med tillägg av nya anläggningar och avveckling av gamla. Detta innebär att den totala elproduktionen från biokraft i Sverige under 2016 kommer att öka till cirka 12 TWh. Detta innebär att den totala elproduktionen från biokraft i Sverige under 2016 kommer att öka till cirka 12 TWh.



Every year Svebio produces a map of all bio-power production units in Sweden. The map from 2016 shows biopower production at 209 locations, and another 20 planned units.

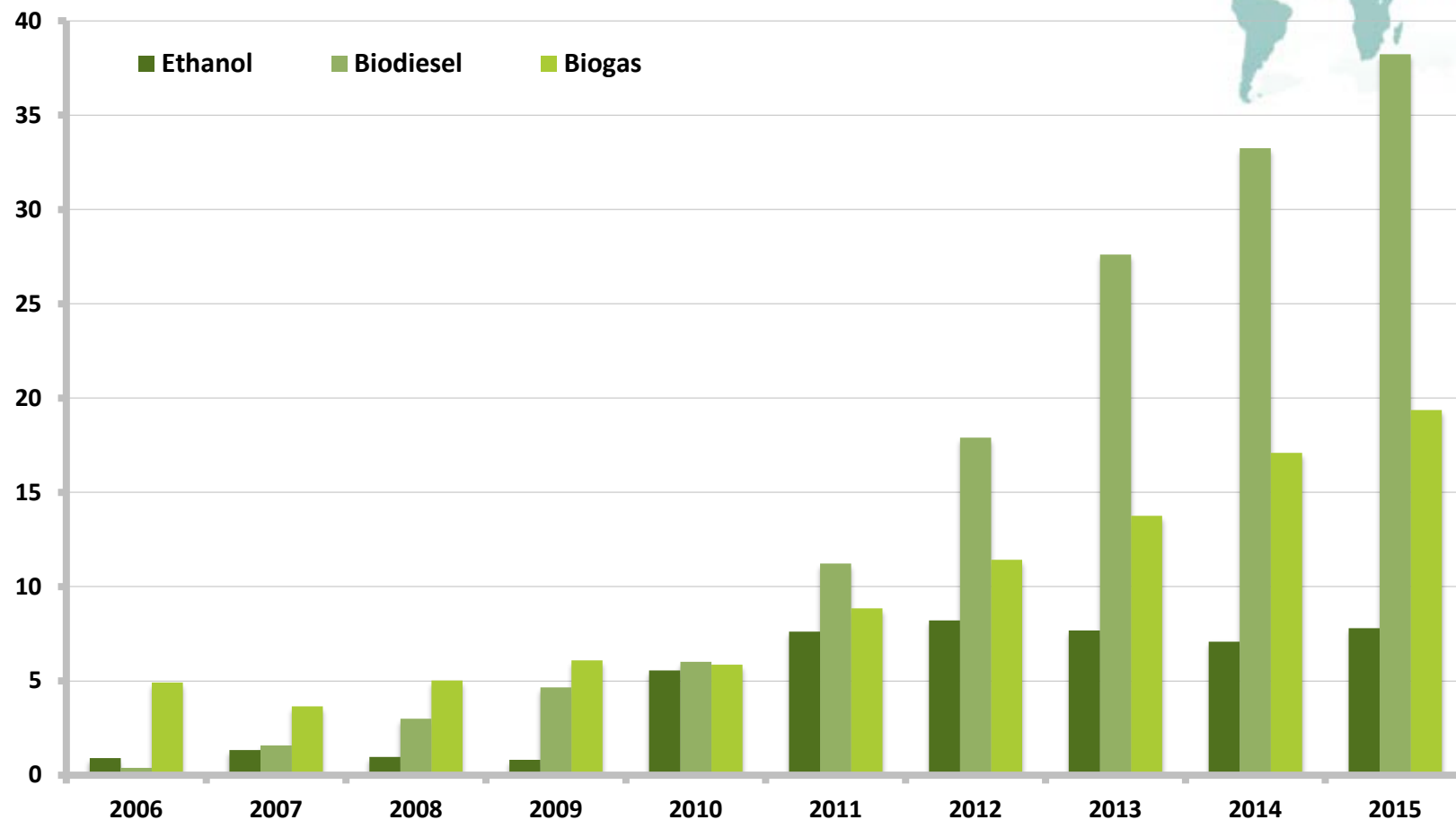
The map is available for download on [www.bioenergitidningen.se](http://www.bioenergitidningen.se). It is also possible to order printed copies.

# Use of biofuels for transport, 2001–2014 (TWh)



The use of biofuels for transport in Sweden has increased steadily since 2001. Together with renewable electricity for railroads, renewable fuels had reached the 10 percent EU target for 2020 during 2012, eight years ahead of time. Source: Swedish Energy Agency

# Buses in public transport using biofuels (%)

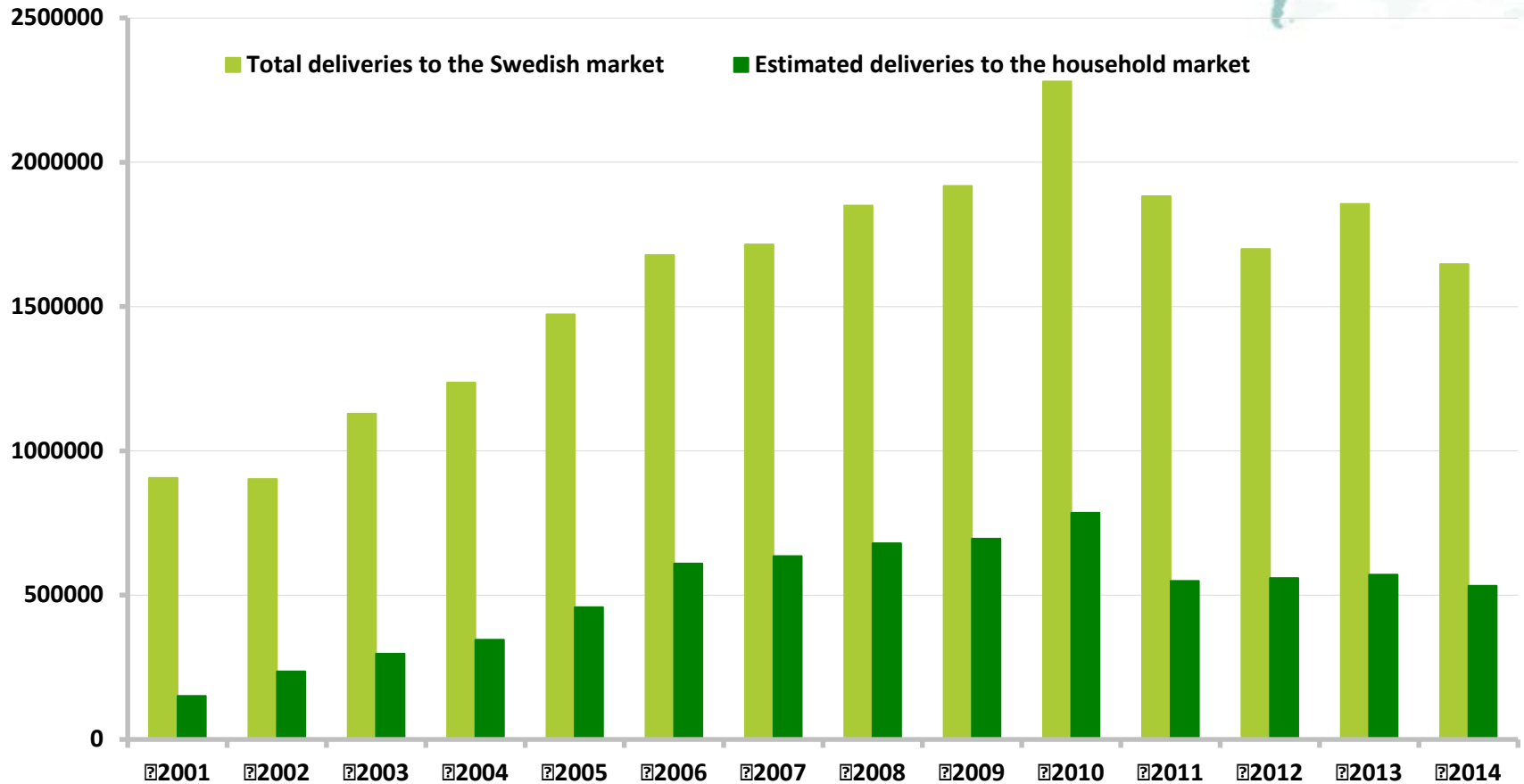


In 2015, almost two-thirds of all buses in local and regional public transport used biofuels. Number of buses using ethanol, biodiesel and biogas, as a percentage of all buses in public transport.

Source: Svensk Kollektivtrafik's database



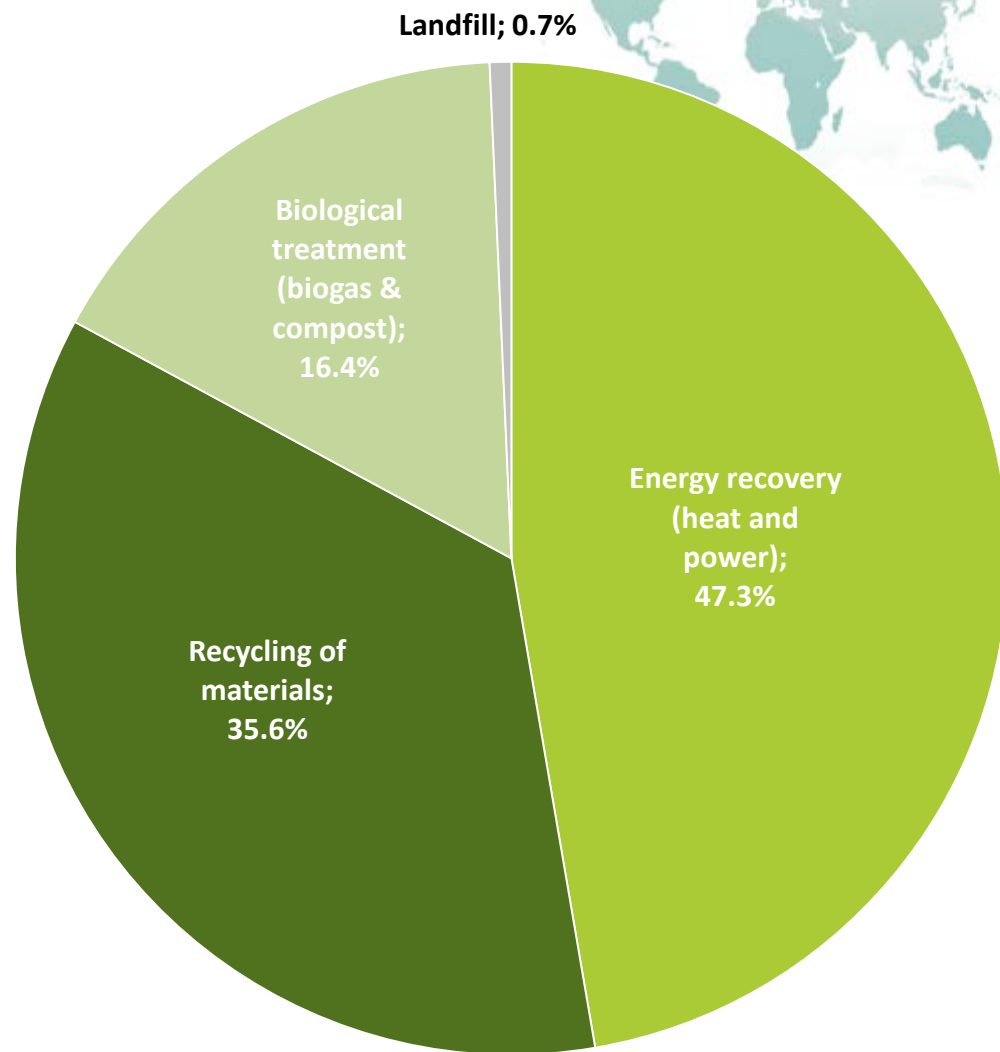
# Pellet deliveries from Swedish pellet producers, 2001–2014 (Tonnes)



The deliveries from Swedish pellet factories depend on weather conditions and competition from imported pellets.

Source: PelletsFörbundet

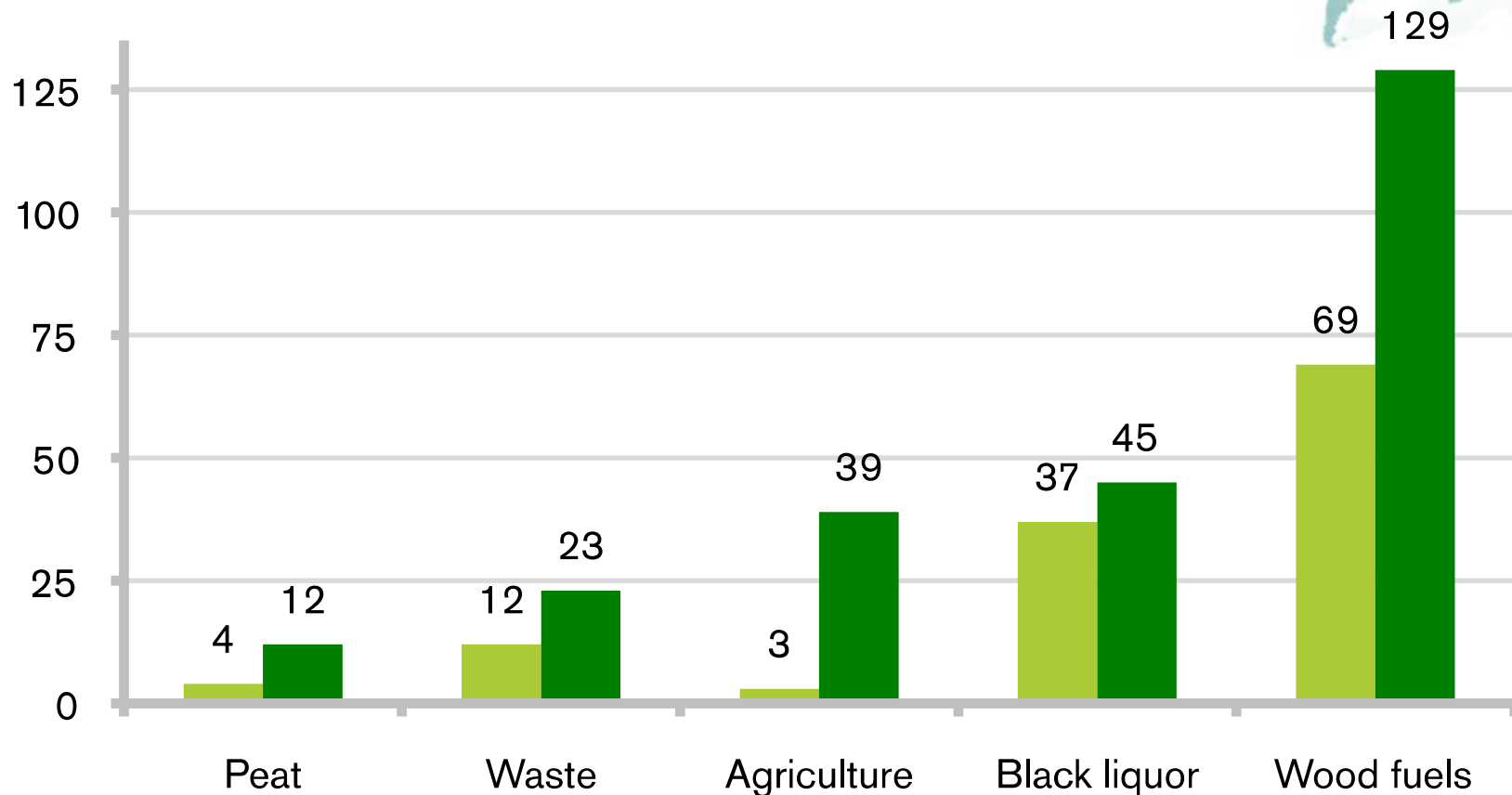
# Use of household waste 2014



Only 0.7 percent of all household waste in Sweden was taken to landfill in 2014. Half of the waste was used to produce heat and power.

Source: *Avfall Sverige*

# Potentials for biomass in the medium term (TWh)



Svebio estimated potentials for supply of bioenergy available in a study in 2009, here compared to the utilisation at that time. The largest remaining potentials are in agriculture and forestry.

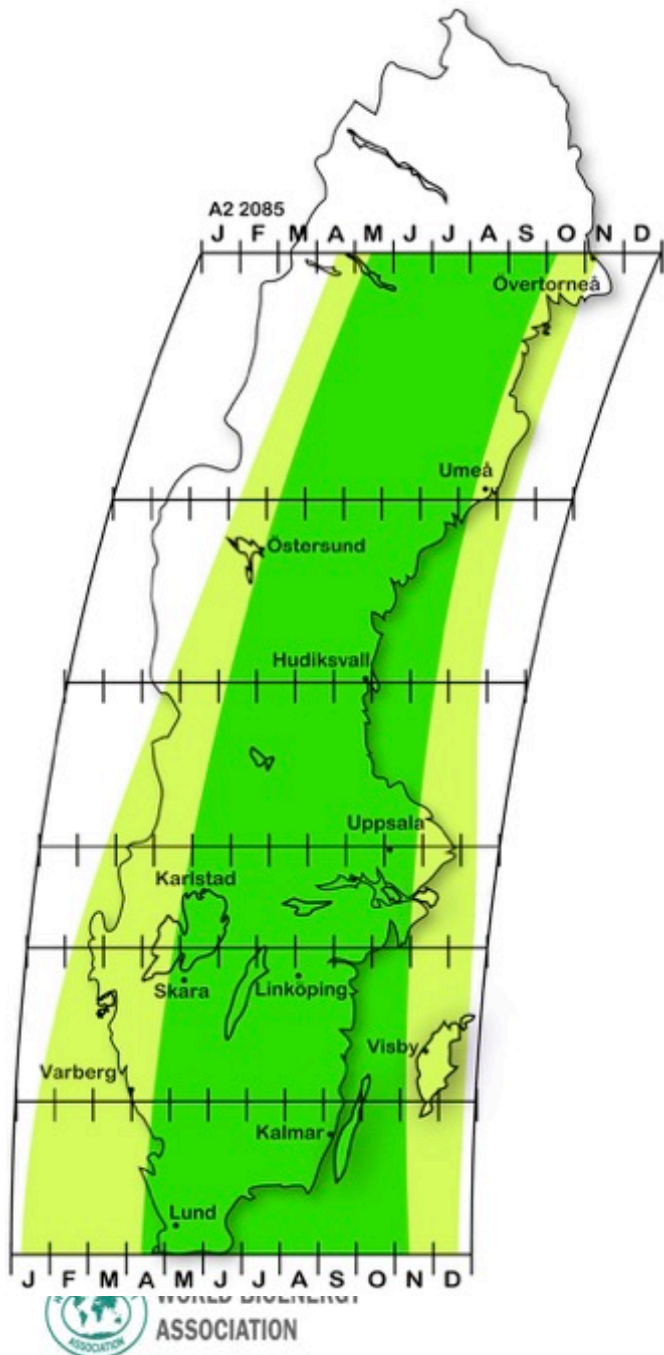
# Climate change will result in longer growing seasons

Climate change will have a profound effect on Scandinavia's regional climate, with prolonged growing seasons. The map shows how the length of the growing season is expected to change in different parts of Sweden. The growing season is defined as the period when the mean temperature is above 5 ° C. Dark green indicates the average in 1961–1990, and light green represents the prediction for 2085.

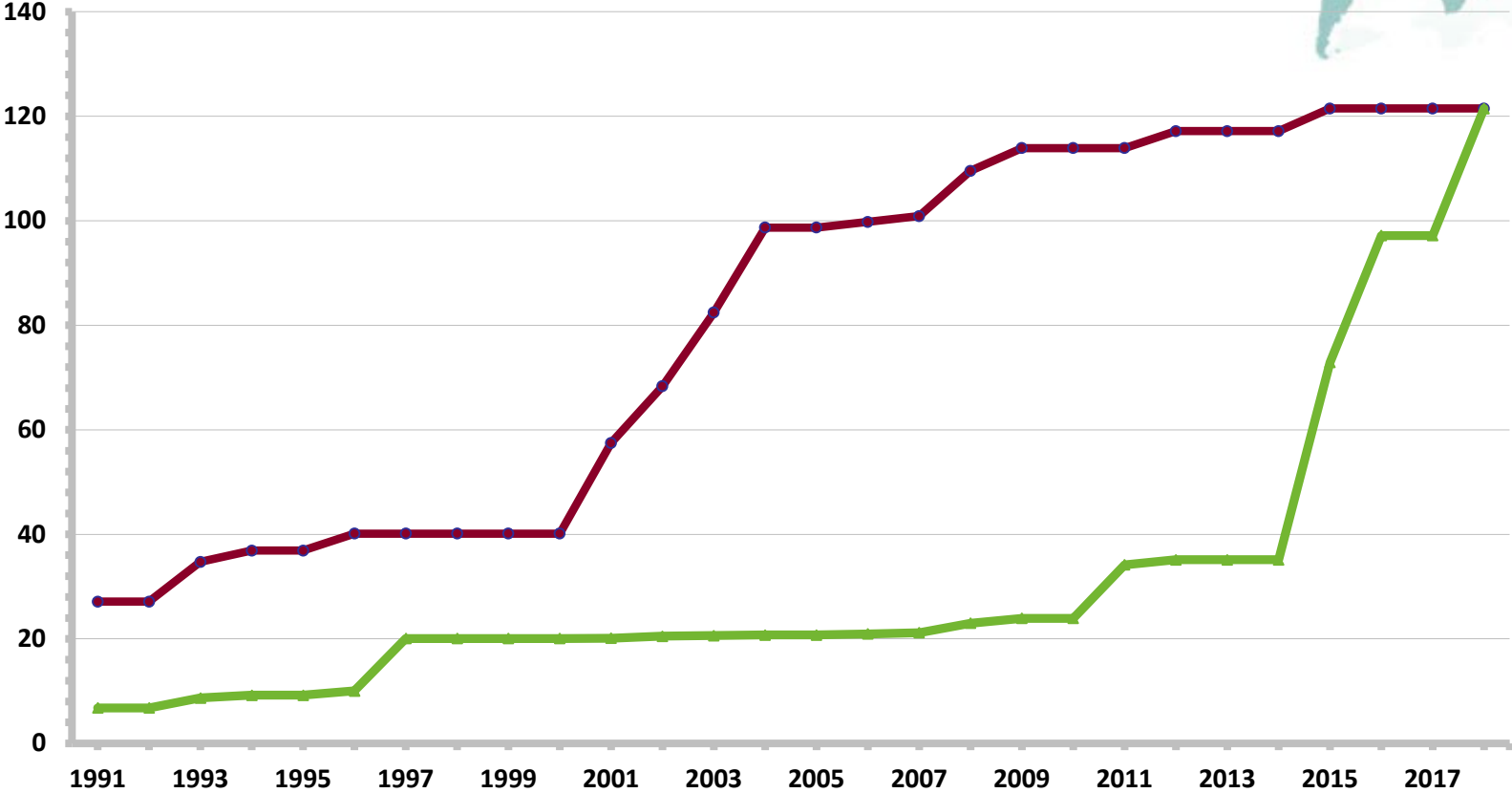
*Source: Swedish Agricultural University.  
(Fogelfors, Eckersten, Karlsson 2008)*

**Growing season: mean temperature above 5 °C.**

-  Growing season, average 1961–1990
-  Growing season 2085, prediction



# 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.

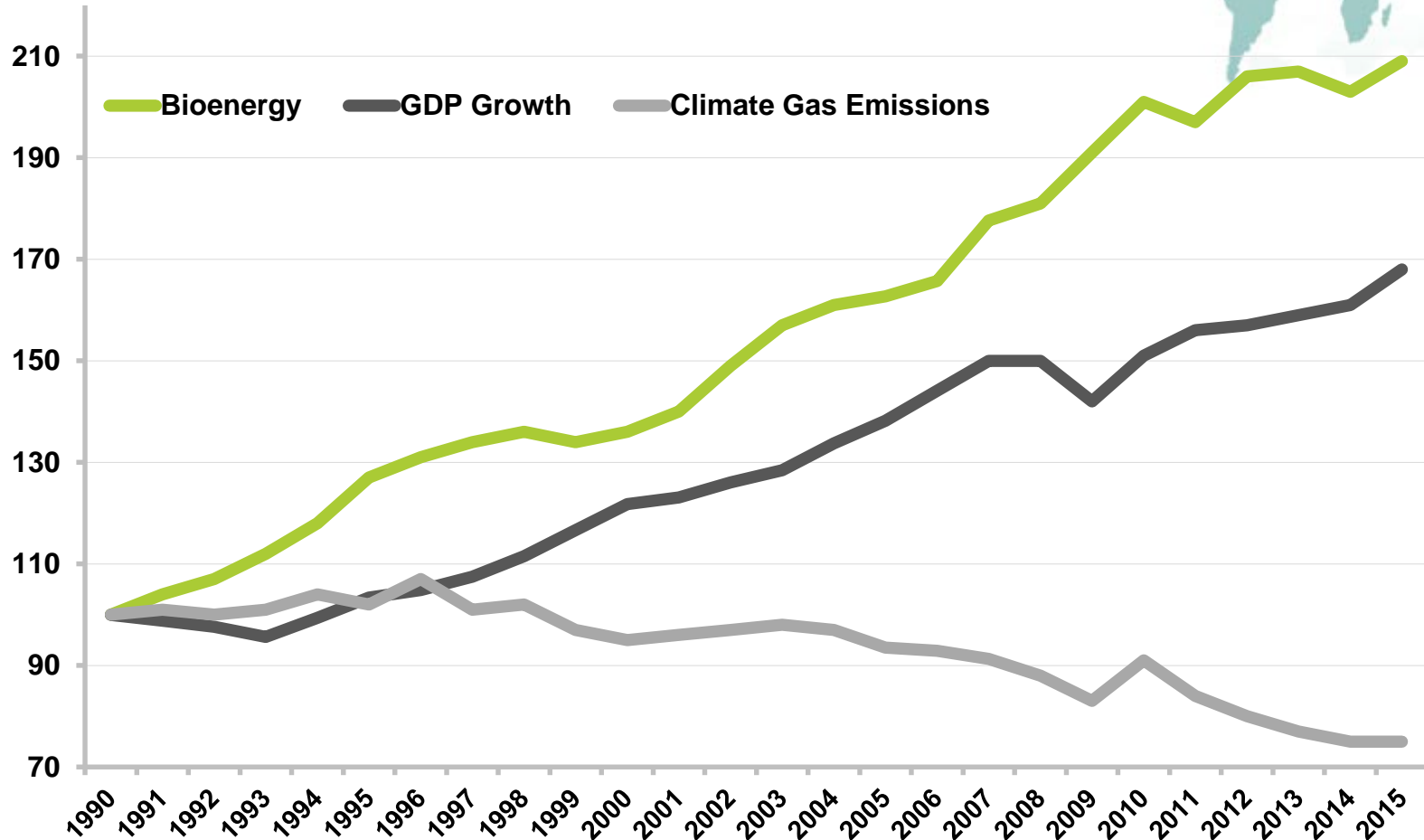
Source: Swedish Finance Ministry / Svebio



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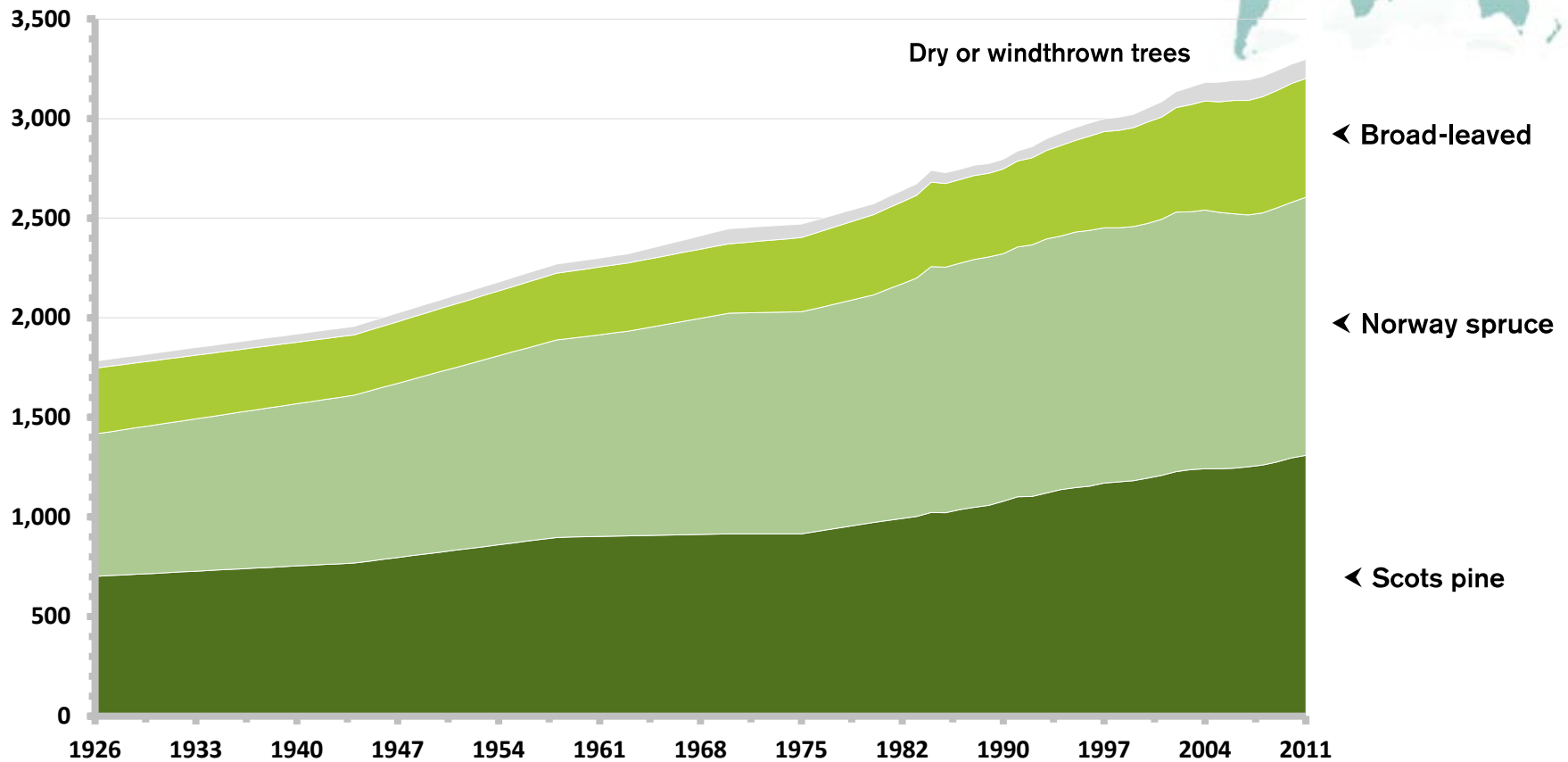


# Decoupling 1990–2015



GDP increased by 60 percent in real terms. Greenhouse gas emissions decreased by 25 percent 1990–2015, and the use of bioenergy doubled. The diagram shows changes from 1990 (1990 = 100 percent).

# 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



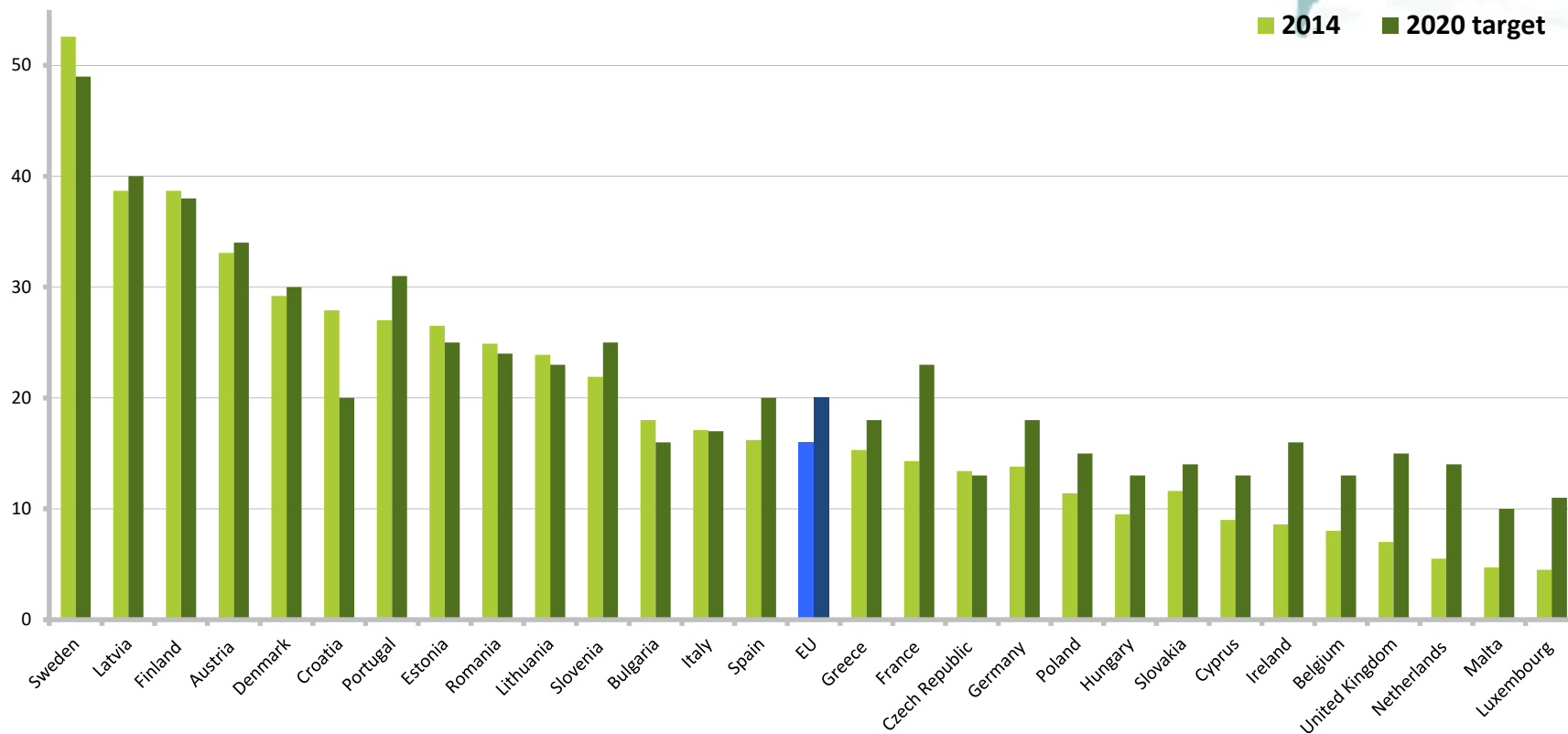
A postcard from 1902 shows barren surroundings around this church in western Sweden. Today there are trees everywhere. This is a common development in most parts of Sweden during the last 100 years. Less grazing (fewer milk cows and sheep), less use of firewood, better management of forests, etc, are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







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

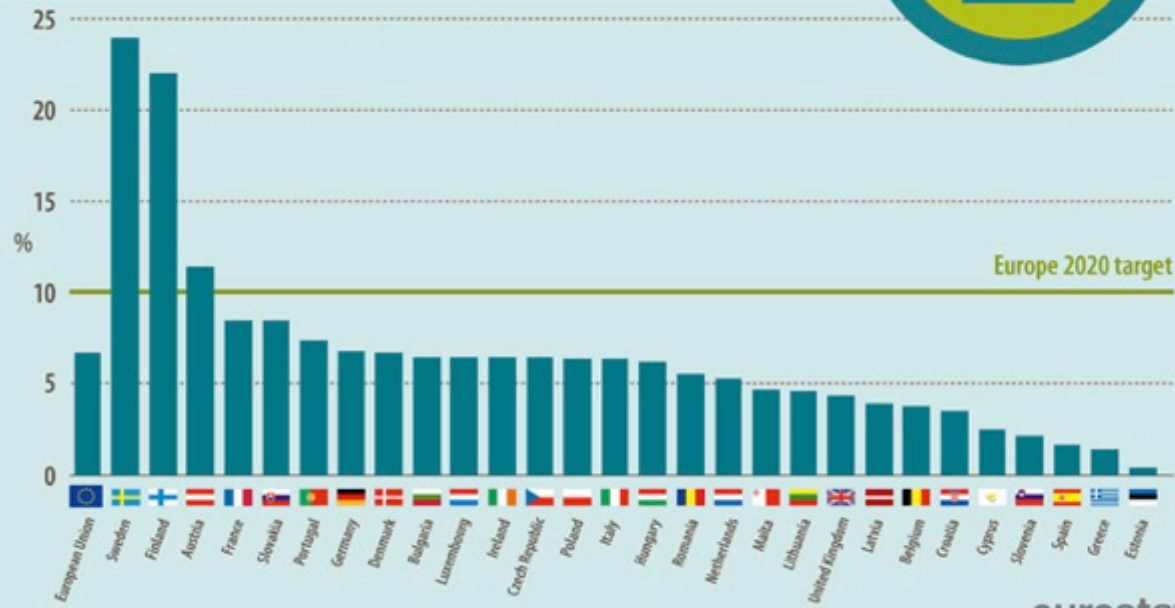


Since 2004, the share of renewable sources in gross final consumption of energy grew significantly in all Member States. Compared with a year ago, it has increased in 24 of the 28 Member States. With more than half (52.6%) of energy from renewable sources in its gross final consumption of energy, Sweden had by far in 2014 the highest share, ahead of Latvia and Finland (both 38.7%). 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*



# Share of energy from renewable sources in transport

(in % of gross final energy consumption)



eurostat



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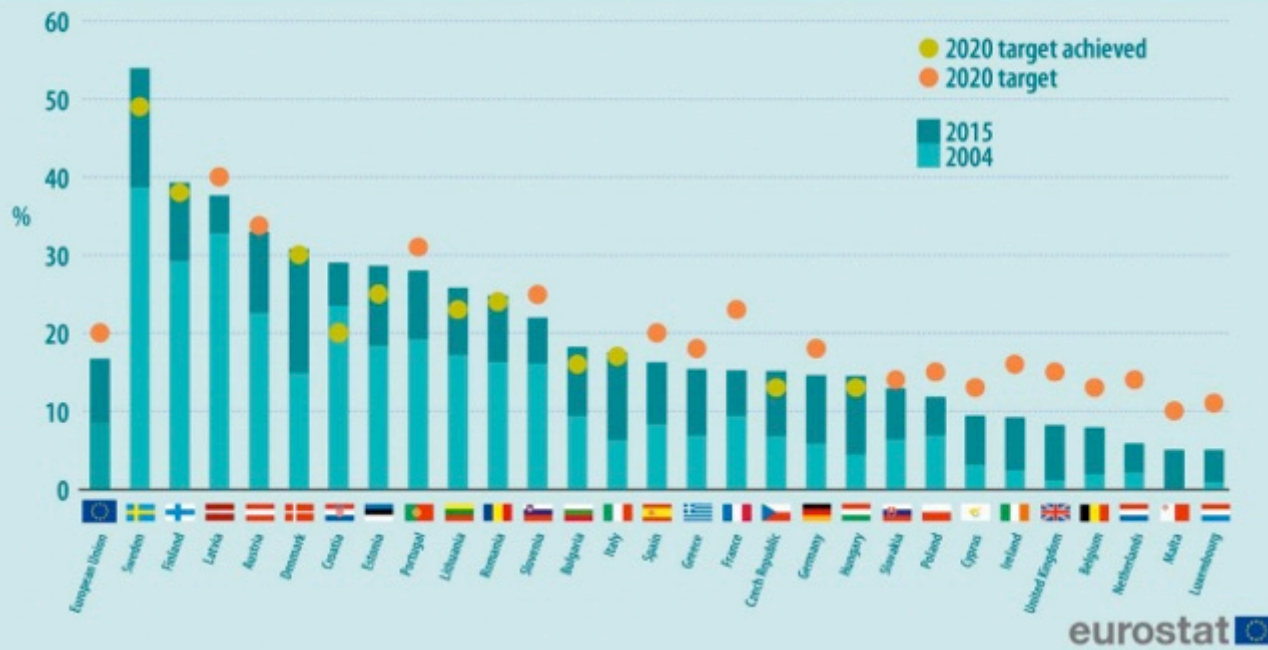
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# Share of energy from renewable sources in the EU Member States

(in % of gross final energy consumption)



europa



This example of Sweden shows how strong political instruments as carbon dioxide tax can change a whole energy system to

- Be more renewable
- Ensure security of supply of energy to the country
- Meet the climate goals



Thank you for your attention!

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