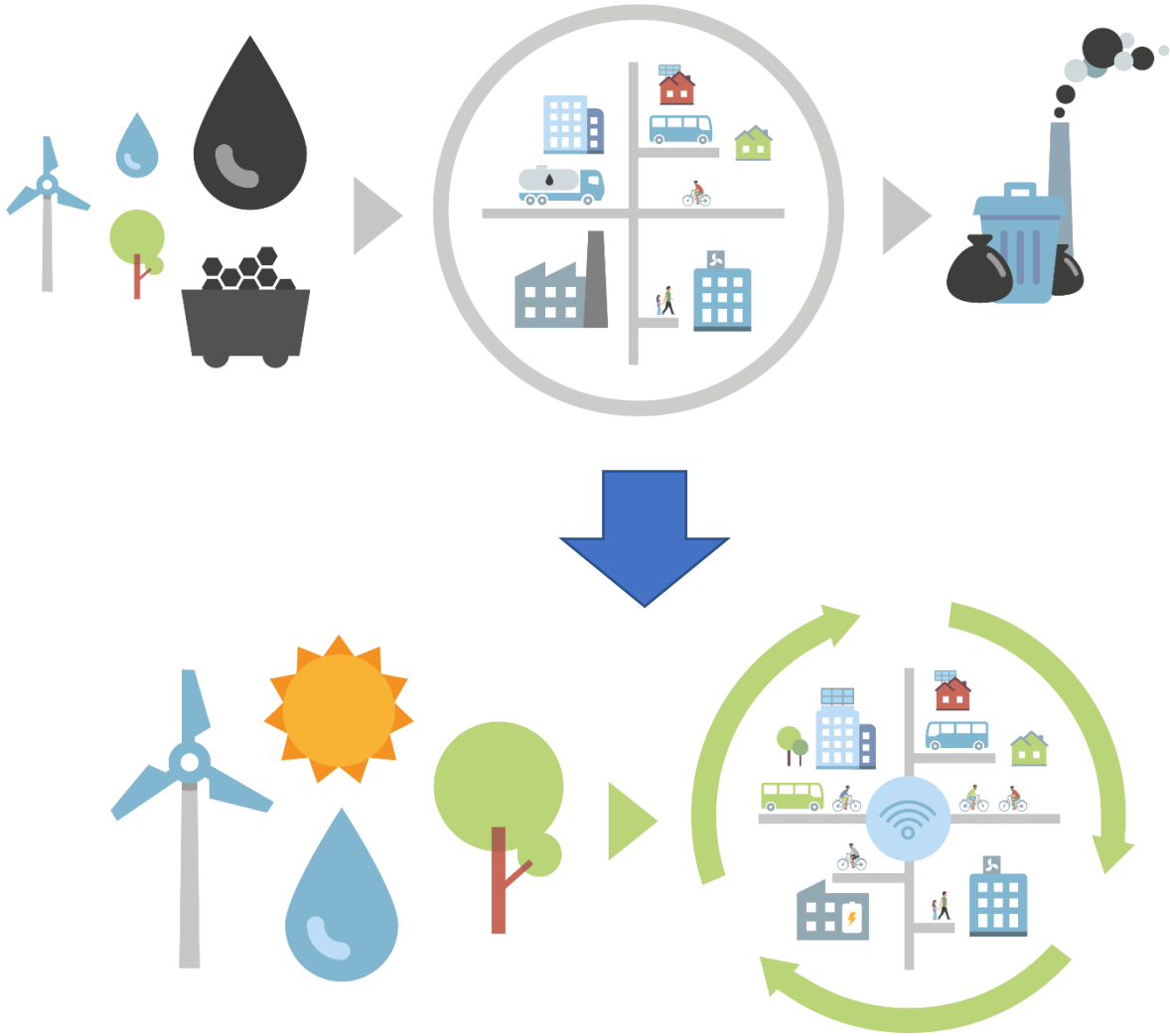
District heating in Sweden

Paul Westin, Swedish Energy Agency

for

International Webinar on District Energy in Chile

2020-06-16



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About the Swedish Energy Agency

National authority for energy policy issues

> **R&D funding**, policy analysis, statistical authority, information, testing, commercialisation, **internationalisation**, security of supply, electricity certificates, sustainability criteria, EU-ETS, **international climate investments.**

Ministry of Infrastructure , Anders Ygeman (S) Minister for Energy and Digital Development.

Director General Robert Andrén

Around 200-300 m€ per year in transfer of funding, R&D, grants, etc.

Around 400 employees, Eskilstuna

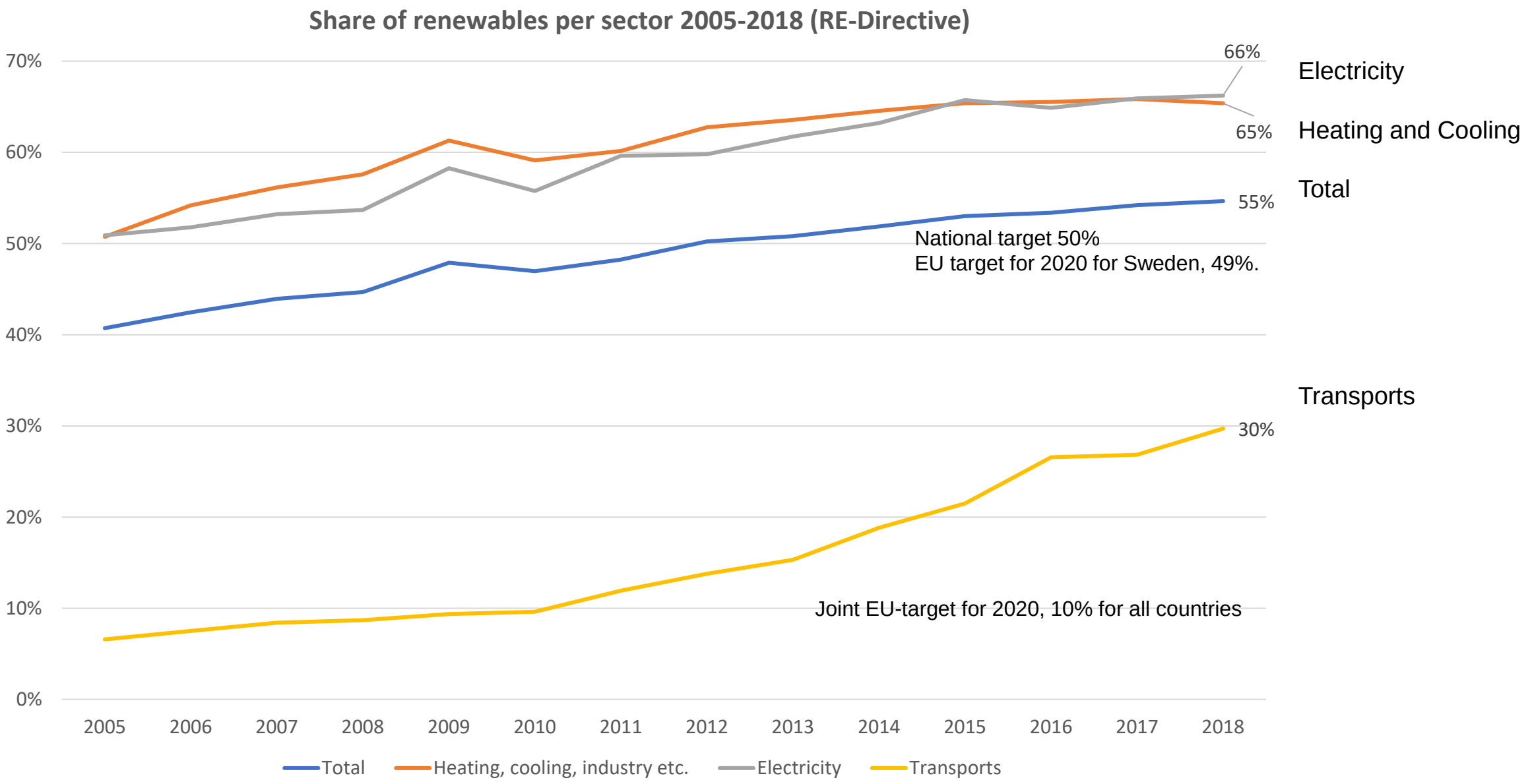
Energy policy targets for Sweden

100 per cent renewable electricity by 2040
(but not forcing nuclear out)

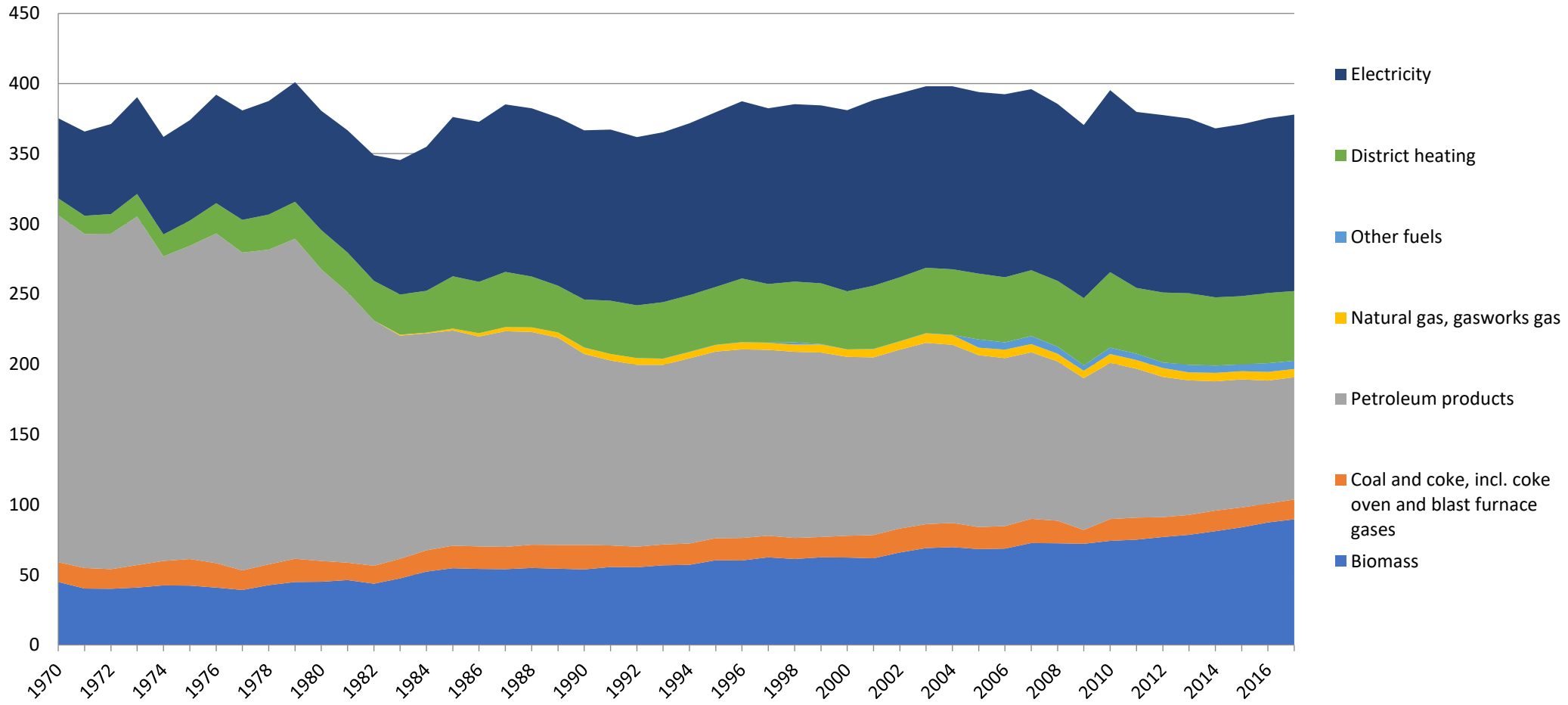
No net emissions of greenhouse gases in 2045
(Decrease of 70% in transport by 2030)

50 per cent more efficient use of energy in 2030,
(compared to 2005 and as intensity, by GDP)

Three pillars for Sweden's energy policy: • ecological sustainability • competitiveness • security of supply
In line with IEA and EU formulation of the energy trilemma.


Share of renewables per sector 2005-2018 (RE-Directive)
70%
60%
50%
40%
30%
20%
10%
0%
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
66%
65%
55%
30%
Electricity
Heating and Cooling
Total
Transports
National target 50%
EU target for 2020 for Sweden, 49%.
Joint EU-target for 2020, 10% for all countries
Total
Heating, cooling, industry etc.
Electricity
Transports

Energy use by energy carrier, 1970–2017, TWh



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Drivers for DH in Sweden – 1950-1990

1950's **combined heat and power** in medium to large cities, approximately 10 systems. Alleviate electricity supply shortage. "Block central heating" as well.

1960's and 1970's expansion to **new housing areas** during the "million-program" apartment construction phase. Both as municipal projects.

Oil crises during 1970's led to coherent energy policy, energy R&D programs, aiming to reduce **oil dependence**.

Heavy expansion of **nuclear** (1975-1985) lead to electricity surplus, direct electric heating of single family homes, and electricity-to-heat in DH.

Air quality concerns (sulfur dioxide, nitrous oxides) pushed for further connections in cities, replacing individual oil boilers in multi-family buildings.

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Drivers for DH in Sweden – 1990-2019

1986 **Tjernobyl** accident (and referendum 1980 result), decision to phase out nuclear by 2010. Barsebäck eventually closed. Investment programs for DH.

Rio and Kyoto; **carbon dioxide tax** introduced 1991 (biomass, rather than coal or peat). Environmental goals and environmental code launched in 1990's

Economic slump early 1990's. Some municipalities sold DH companies. Electricity market **deregulated** 1996 (and DH market as an unintended consequence too)

European Union Membership 1995. **Energy Efficency**, Renewables, Climate obligations. Green certificate scheme replaced some investment programs.

Contentious market design. **DH Act 2008 and increased transparency**. Continued innovation. Heat pump competition. Fossil fuel free target.

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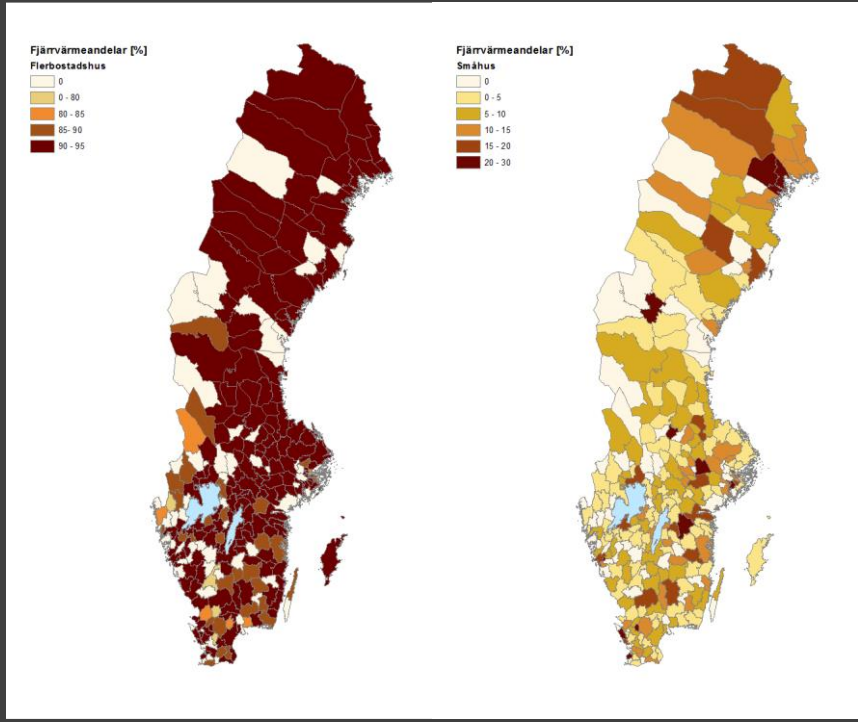
Market shares



Source: Comprehensive assessment of the potential for exploiting high-efficiency cogeneration, district heating and district cooling, Swedish Energy Agency.
https://ec.europa.eu/energy/sites/ener/files/documents/Art%2014%20Sweden_EN.pdf

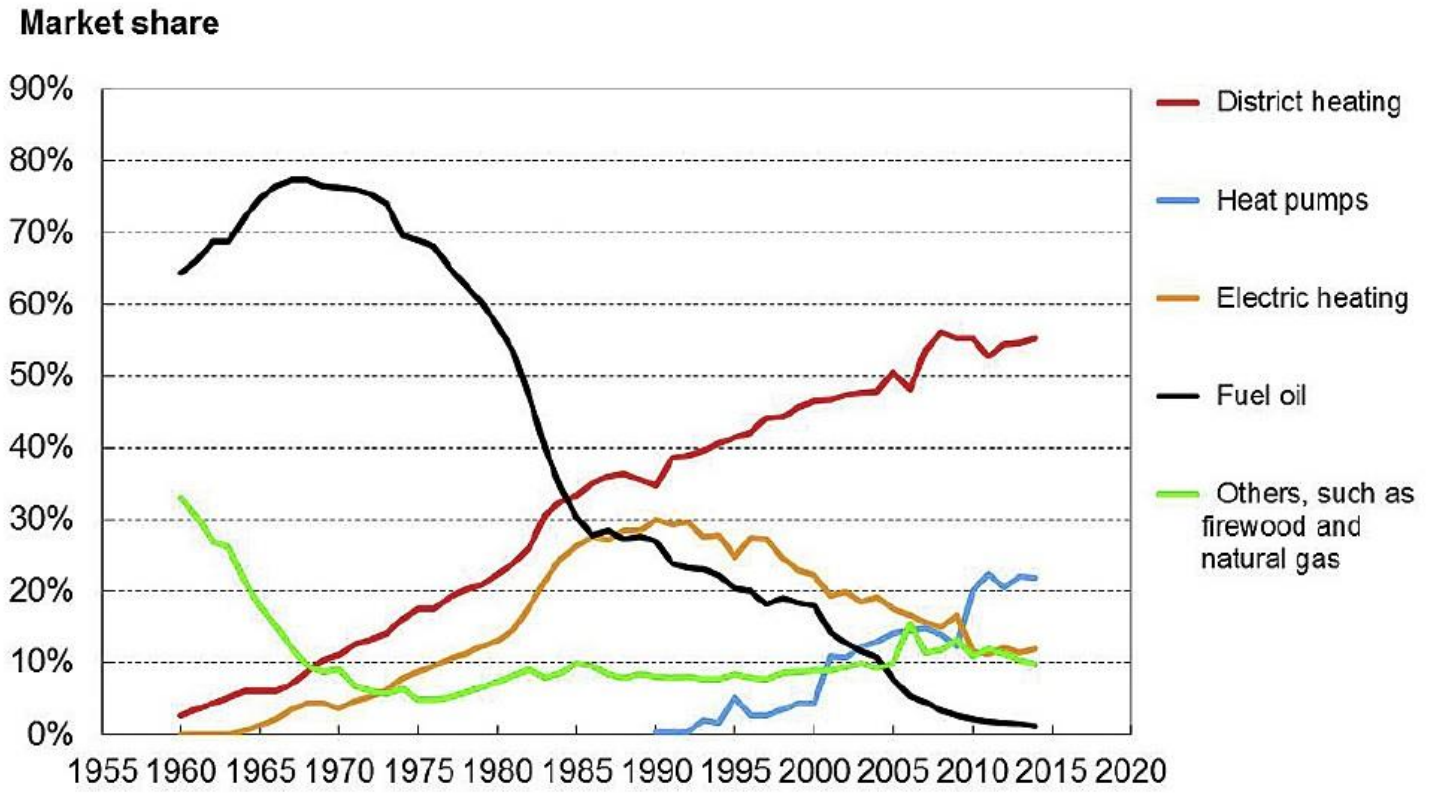


Fig. 1. Market shares for heat supply to residential and service sector buildings in Sweden between 1960 and 2014 with respect to heat delivered from various heat sources.

Source: Werner, Sven, Review: *District heating and cooling in Sweden,*
Energy , Volume 126, 1 May 2017, Pages 419-429.
http://www.sciencedirect.com/science/article/pii/S0360544217304140

Heat supply, by source

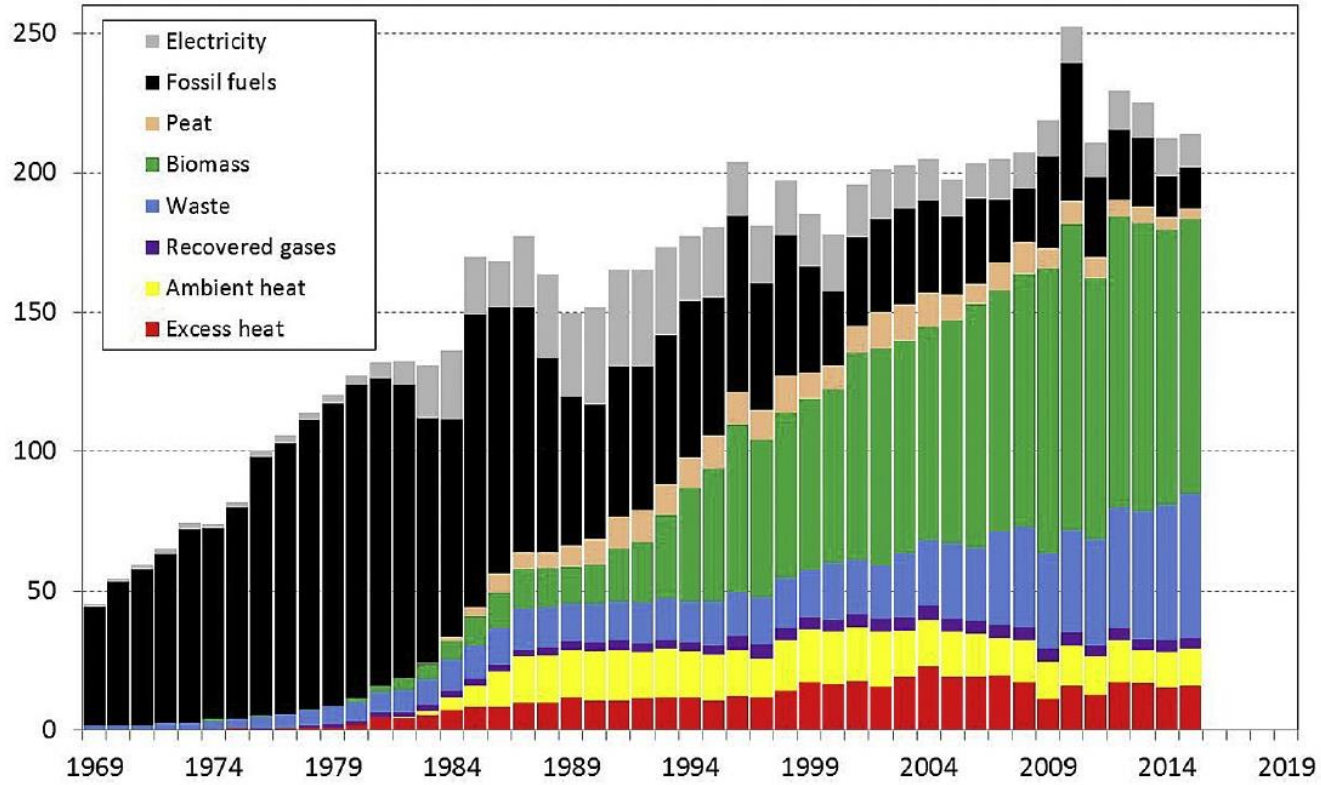


Fig. 3. Original energy sources used for heat supplied into Swedish district heating systems 1969–2015. Energy content in fuels used are based on lower heating values. Compared to Fig. 2, electricity also includes electricity used in pumps, fans, and fuel conveyers for operating energy conversion plants and distribution networks.

Source: Werner, Sven, Review: *District heating and cooling in Sweden,*
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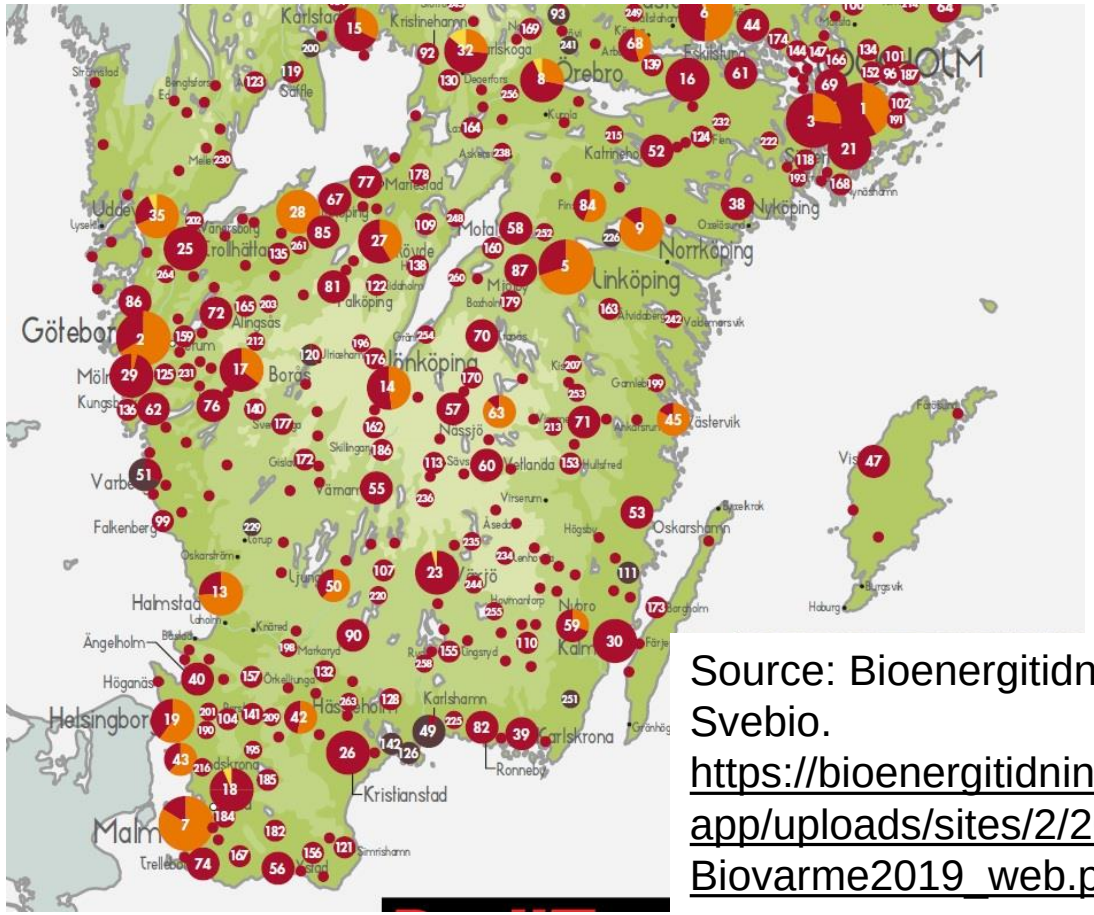
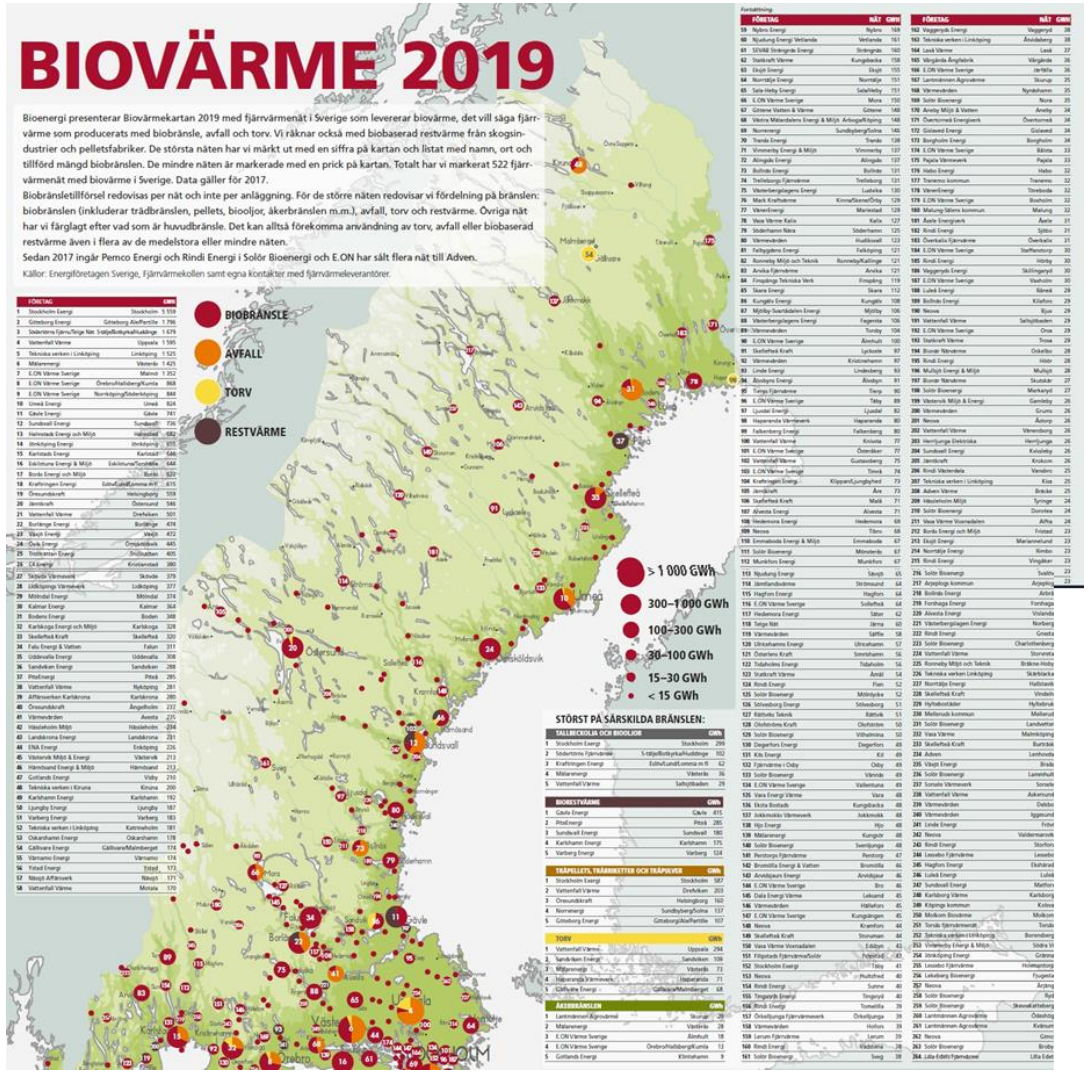
Heat networks with bioenergy in Sweden 2019



Source: Bioenergitidningen, Svebio. https://bioenergitidningen.se/app/uploads/sites/2/2019/02/Biovarme2019_web.pdf



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Ownership models in the market

Municipally owned company, e.g.

Most common category.

Public (listed) company, incl multinationals, e.g.

in at least 11 municipalities

Private company (non-listed), e.g.

in >12 municipalities, investor owned

Joint venture, municipal and public company, e.g.

50% owned by Stockholm city, active in 5 municipalities.

Joint venture, several municipalities, e.g.

owned by 2 municipalities, customers in 3

State owned company, e.g.

in at least 9 municipalities

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The Current Institutional Setup

The Government and the Parliament

Safeguarding consumers, transparency

- Authorities: Energy Markets Inspectorate, DH Arbitration Board, Consumer Agency, Competition Authority, Swedish Energy Agency
- Organisations: PriceDialogue, Nilsholgersson, Consumers Energy Market Bureaeu, Public Housing Assiociation, Property Owners Association, Swedenergy, and more

Laws and regulations

- District Heating Act, Municipal Act, Planning and buildings act, Building Code, Envrionmental Code, EU-legislation (RED, EPBD, EE)
- Authorities: Swedish Energy Agency, National Housing Agency, Energy Markets Inspectorate, Environmental Protection Agency, Regional State Boards, Muncipalities, Environmental Courts

Policy and measures, R&D and International Cooperation

- Fossil fuel free roadmap, taxation policies, energy efficiency targets,
- Climate-investment programs, electricity certificate scheme (now obsolete), EU-ETS
- Euroheat&Power, International Energy Agency, EU-Commission, Swedish Energy Agency R&D

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Policy measures over time in support of DH and its energy transition

- Energy and carbon taxation
- Investment grants for biobased CHP
- Conversion from oil and direct electric heating - grants
- Local & Climate-investment programs
- Electricity Certificate Scheme
- EU-ETS, opt-in for DH
- Landfill ban of sorted waste and of organic waste

The carbon tax and EU-ETS

CO2-tax introduced already in 1991

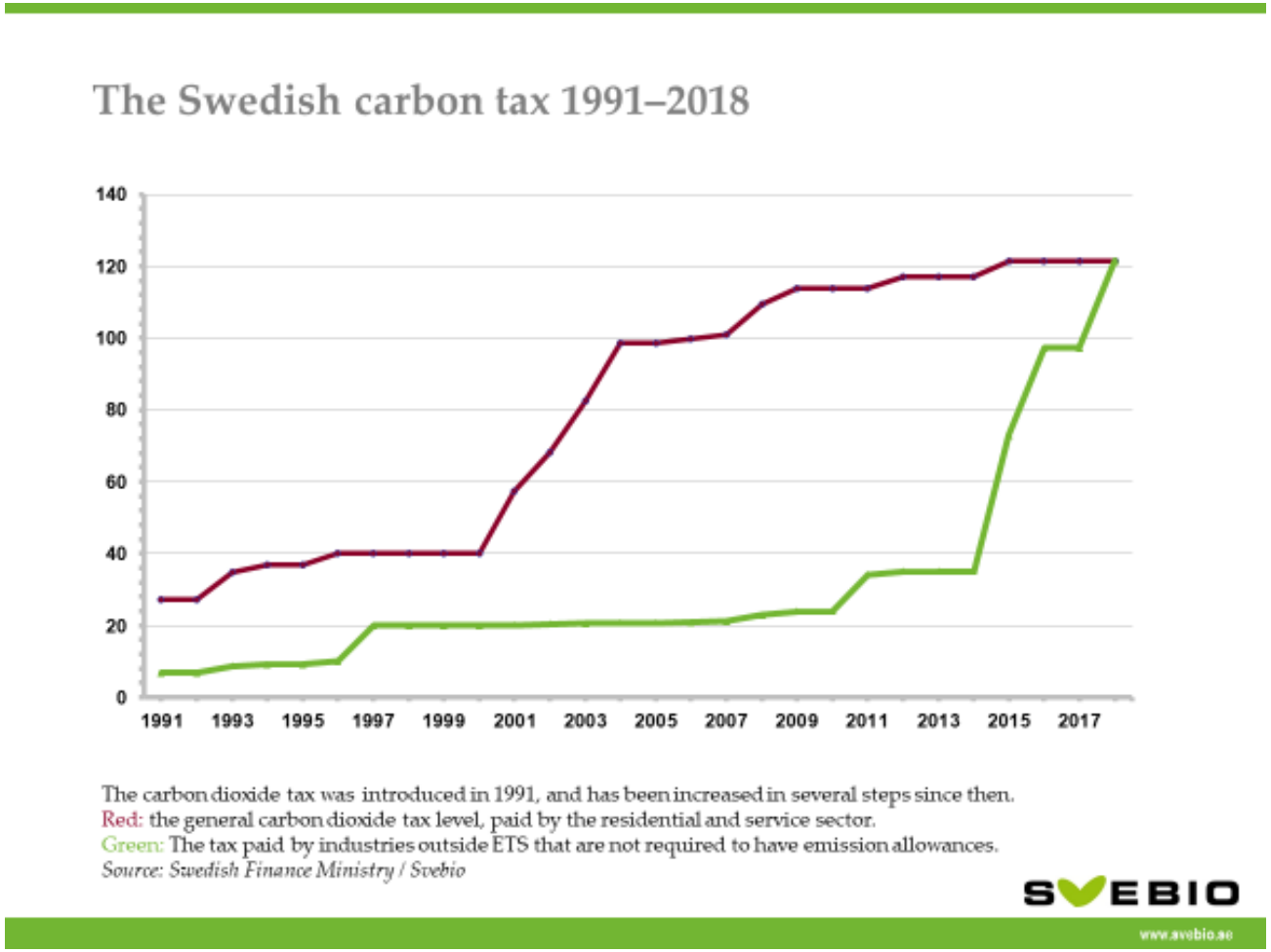
Increases accepted by the public through a ”green tax shift”, lowering tax on income.

DH plants only, subject to both EU-ETS and Carbon tax.

CO2-tax not applicable for electricity production and industry that is subject to EU-ETS

> However, in 2018, reintroduced for CHP

Heating plants <20 MW opt-in EU-ETS



Note: € per ton CO2 according to Svebio calculations

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Thank you for your attention!

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