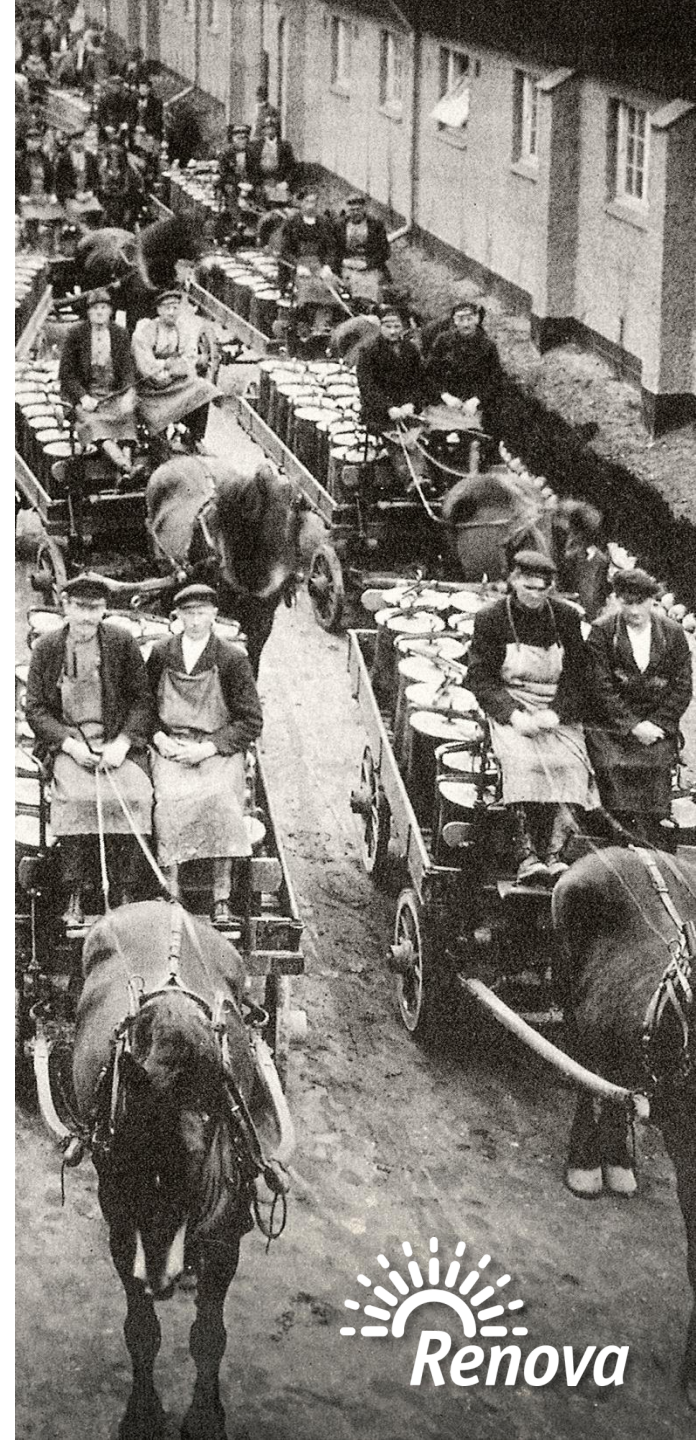


**The leading
company in
West Sweden
specializing in
environment**



130 years history

- Renhållningsverket
- GRAAB
- Renova was
founded in 1998



Our vision

We put a value into
everything for a
sustainable
tomorrow



Our business idea

We offer
environmentally
smart services
and recycle waste
to energy and new
raw material

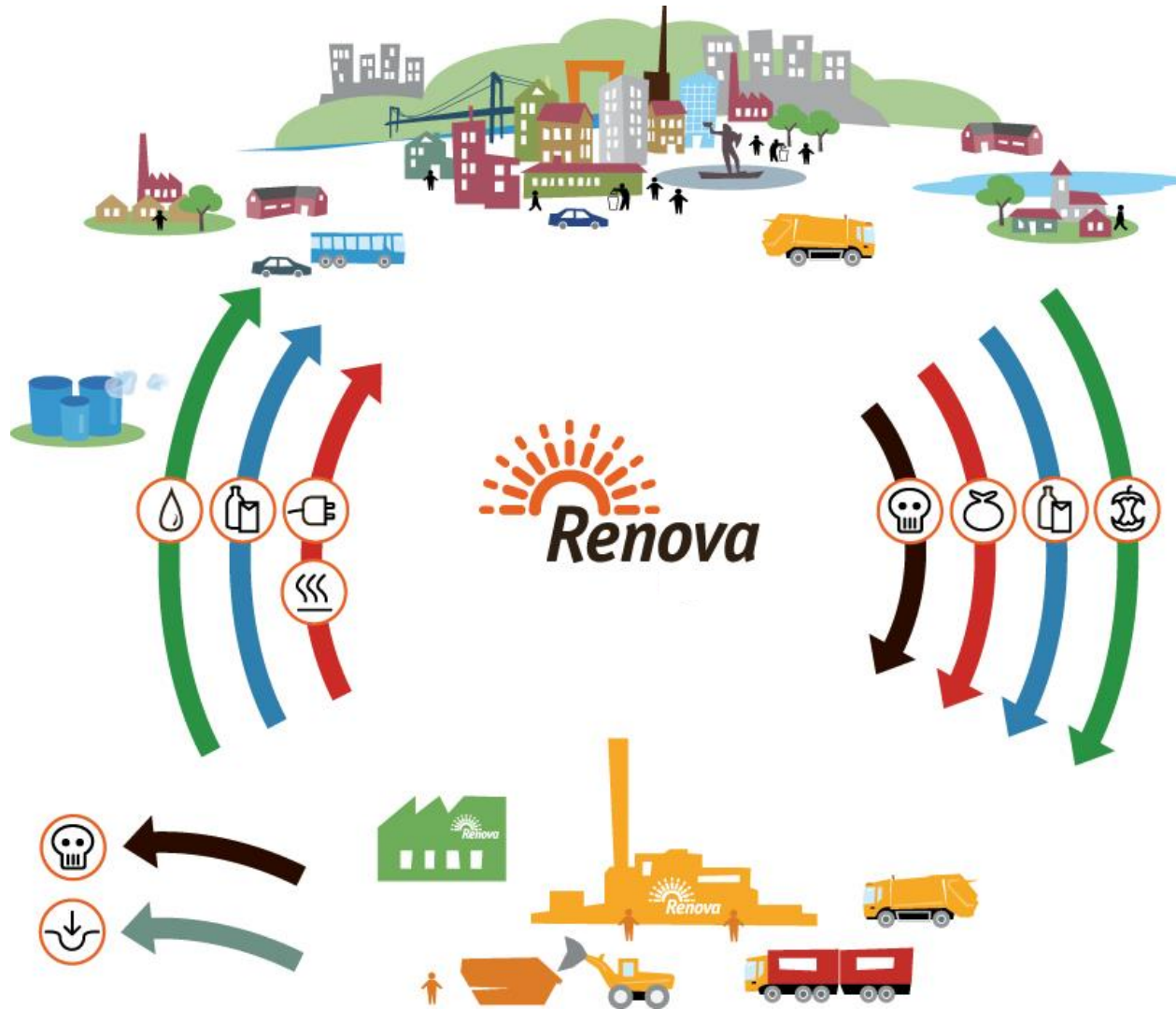


Core values

- Social benefit
- Business value
- Rethinking



Our role in a circular economy



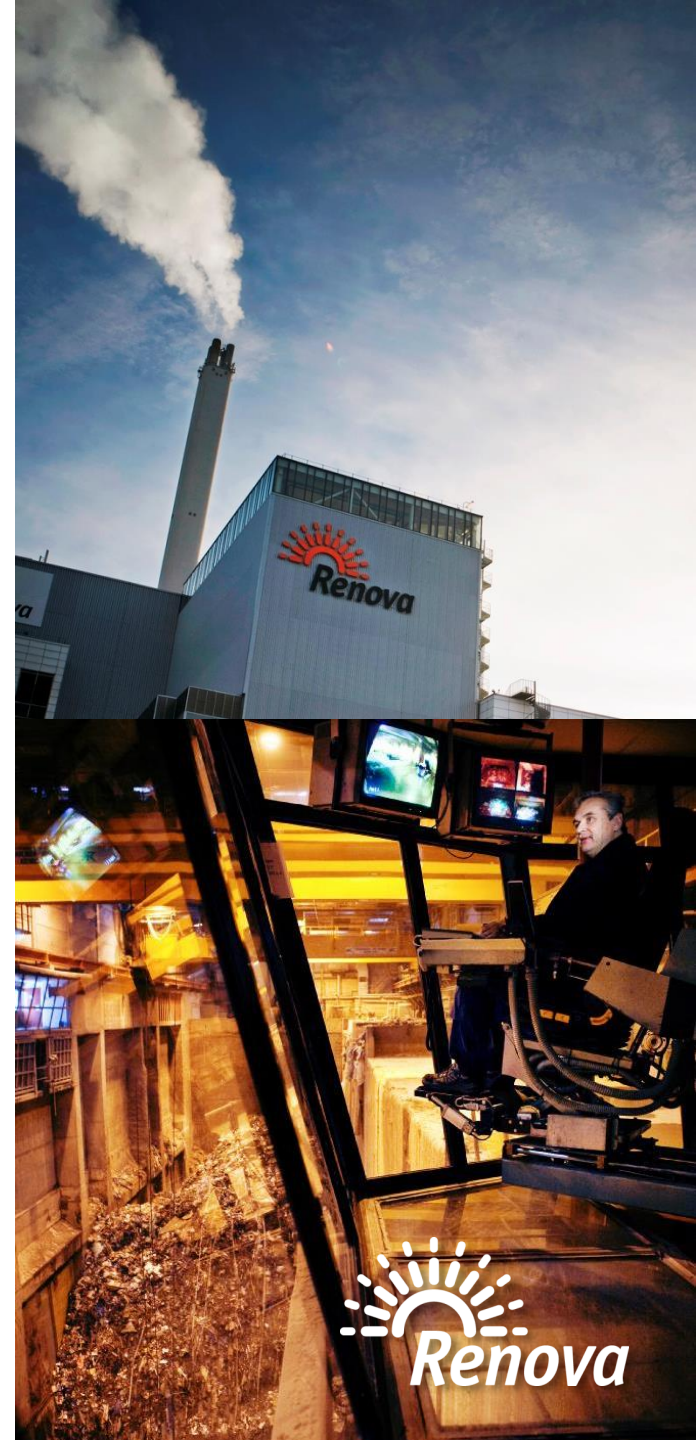
Sustainable transports

- 220 heavy vehicles
- Fossil free – 15 years ahead
- Three fully hybrids
- Driving innovation



Plants

- Waste-to-Energy
- Biological Treatment
- Hazardous Waste
- Sorting
- Landfills
- Workshops



Our offer

- Collection and transport
- Sustainable treatment
- Service
- Knowledge



Certificates

- ISO 14001
(Environment)
- ISO 9001
(Quality)
- OHSAS 18001
(Working environment)



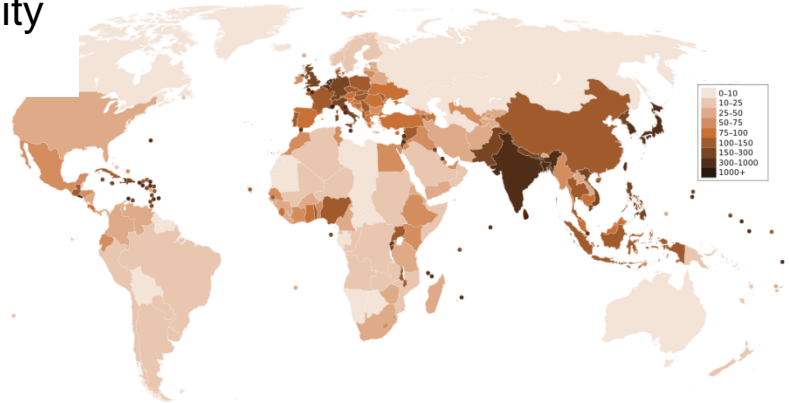
Environmental Research and Development

- Research Scholarship
- Research and collaboration
- Master's Thesis

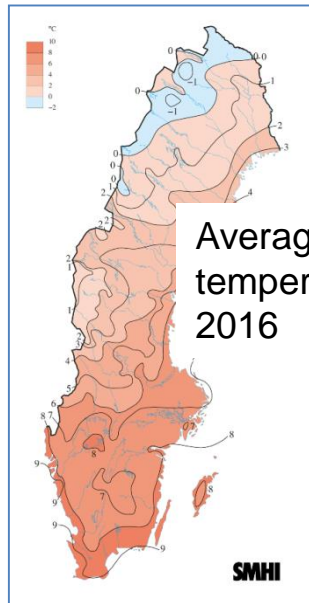


Sweden is a bit different...

Population density
(wikipedia)

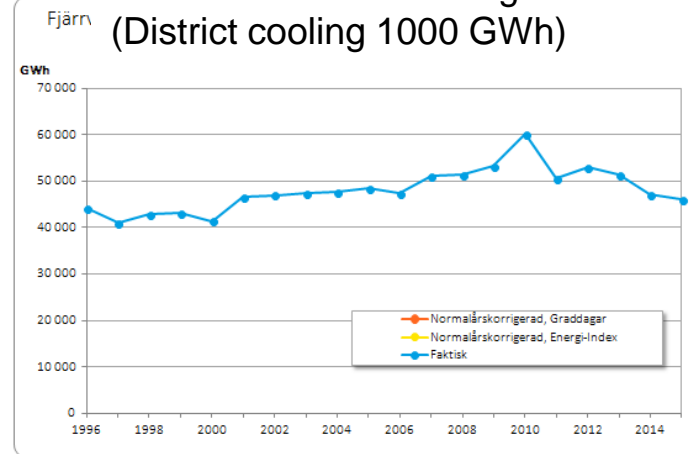


Woods



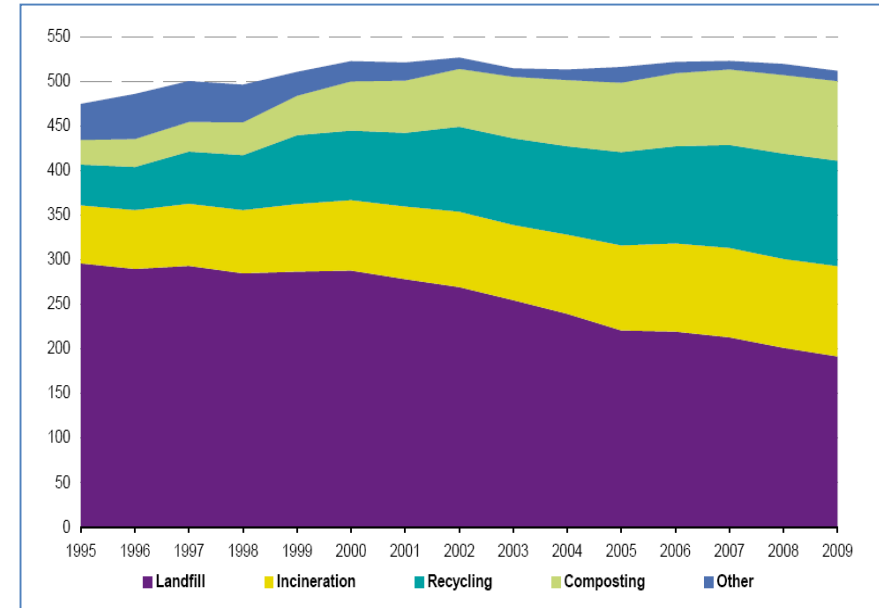
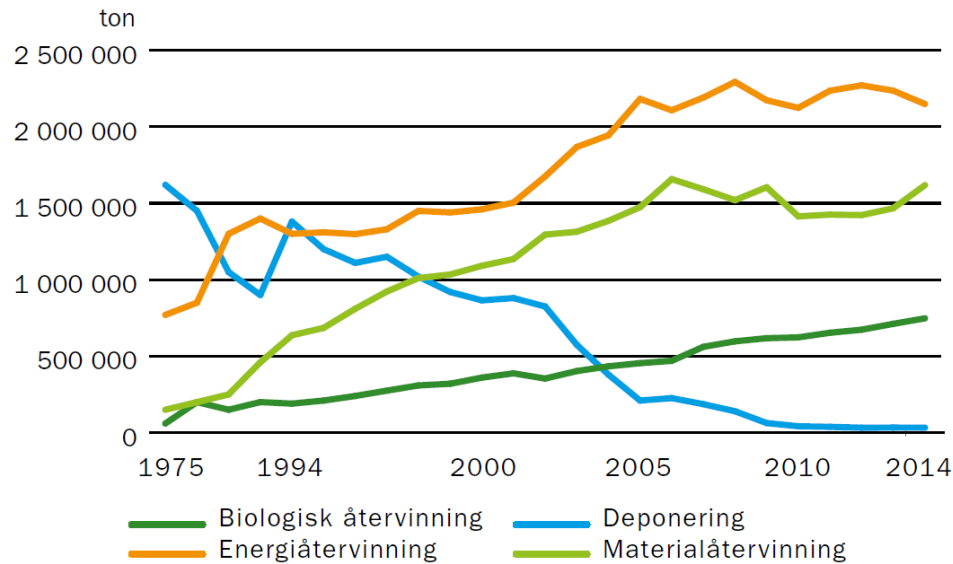
Average
temperature
2016

Delivered district heating
(District cooling 1000 GWh)



Treatment of Municipal Waste

Sweden and EU-27



Biologisk återvinning
Energiåtervinning
Deponering
Materialåtervinning

Biological Recycling
Energy Recovery
Landfilling
Material Recycling

Source: Avfall Sverige and Eurostat

Material recycling and Waste to Energy go hand-in-hand

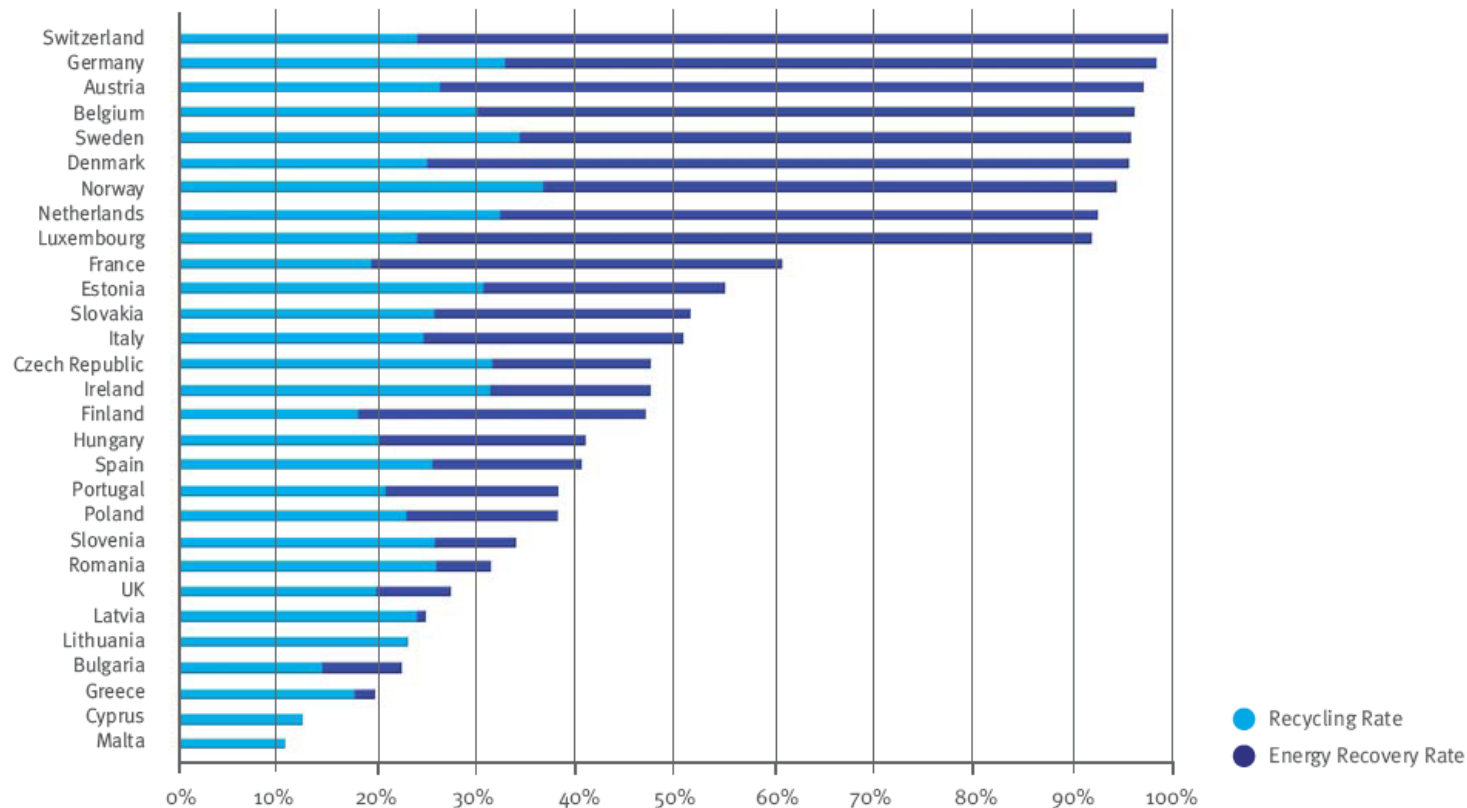


Figure 12: Total Recovery Rate by Country 2011

(Referred to Post-Consumer Plastic Waste)

Source: Consultic

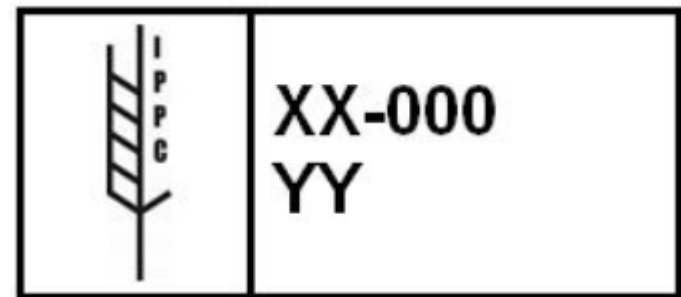
Wood products and waste

- 16 million m³ cut tree products produced
Where of 12,3 million m³ exported (2009)
- 136 000 pieces of wood packaging put on the market (2016)
- 1,2 million ton wood waste (2015)



Waste Wood in Sweden

- Producer's responsibility for packaging material
 - Goal 15 % material recycling
 - Today < 1%
 - Reuse?
- White wood
- Treated wood
- Impregnated wood



ISPM 15

National statistics

- Total amount of wood waste 1 200 000 ton
- Papper mills: wood waste and sludges make up to 135 000 ton per year. Statistics are depending on whether wood is considered waste or byproduct.
- Hazardous wood waste: 170 000 ton, but since crushed, impregnated wood will be calculated twice both as a primary waste and a secondary after crushing, the total actual number is lower.
- Non-hazardous wood waste from households 410000 ton.
- Wood waste to composting 26 000 ton
- Non hazardous Wood waste to Waste to energy: 1 600 000 ton
- Haz wood waste to Waste to Energy 98 000 ton
- Impregnated wood waste from building and demolition: 50 000 ton
- Non-haz wood waste from building and demolition 200 000 ton
- Wood waste to Waste to Energy: 250000 ton

Sorting plants

Skräppekärr och Högsbo

- Sorting mainly commercial and industrial waste
- 170 000 ton waste in total 2015





Sorting gives

- Recycling material
- Garden waste including waste wood
- Waste Wood
 - Non-treated
 - Treated
 - (Impregnated)
- incineration/Energy recycling
- Construction waste

Sorting plant Skräppekärr



Högsbo



2017-10-17/21

Waste Wood Renova 2015

	To Renova	From Renova to external recycling	Main type of recycling
Fresh wood larger sized >25 cm diameter	400		Waste to Energy Sävenäs
Twigs and other smaller sized fresh wood	9 000		Composting Marieholm and Waste to Energy
Impregnated wood	19 000		Waste to Energy
Treated wood painted	38 000	30 000	Waste to Energy plant and other Energy production plants such as paper mills and biomass energy plants
Untreated wood Not painted	3 000	4 000	other Energy production plants such as paper mills and biomass energy plants Material recycling Poland
Wood waste in mixed smaller fractioned waste	?		Waste to energy

Renova Waste to Energy plant

Avfallskraftvärmeverket i Sävenäs

Boiler name	Capacity (ton waste/h)	Power generation (MW)
1	15	45
4	22	56
5	22	56
7	14	43
Total	73	200

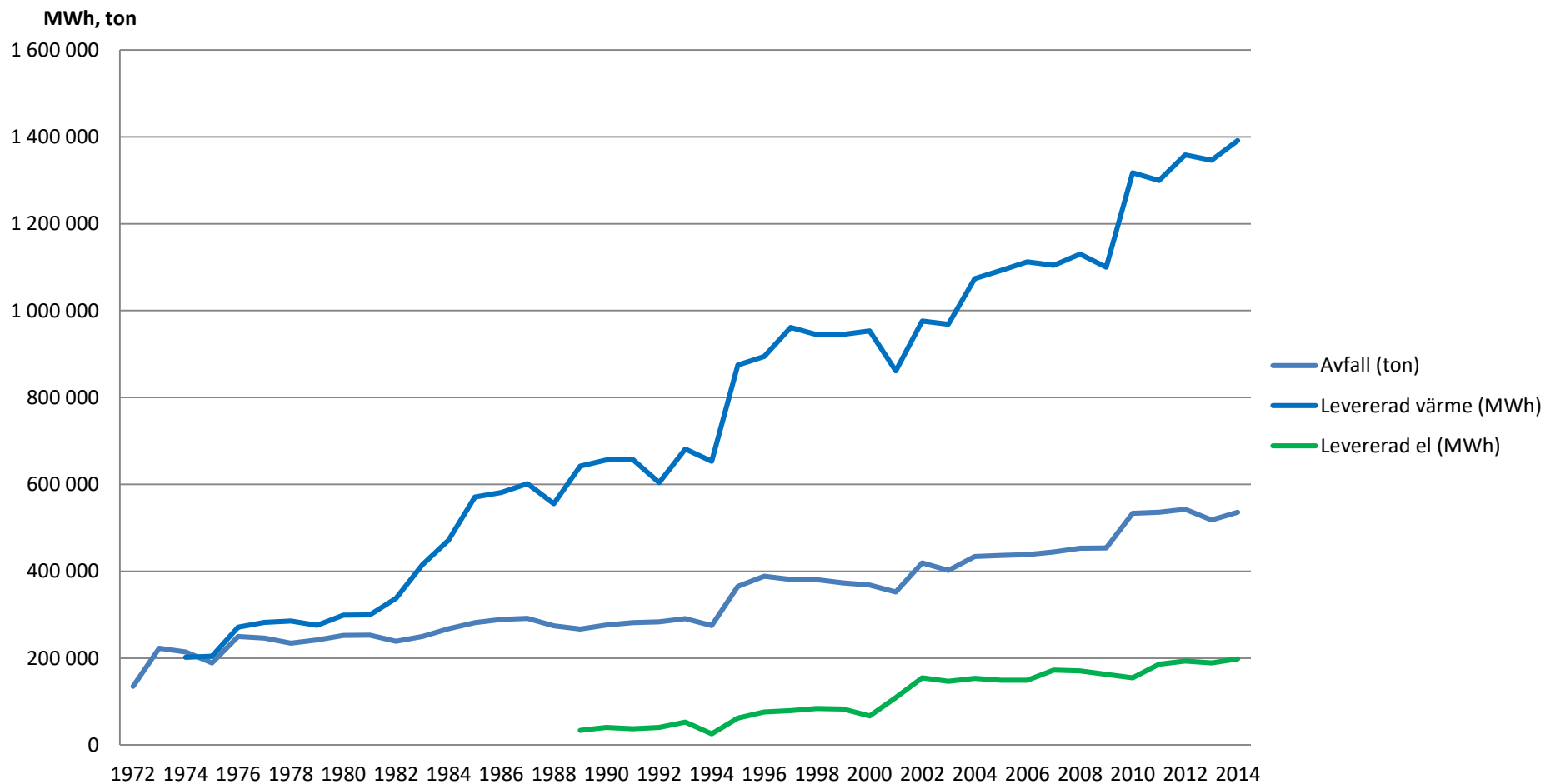
Grate incineration

Wet and dry flue gas treatment

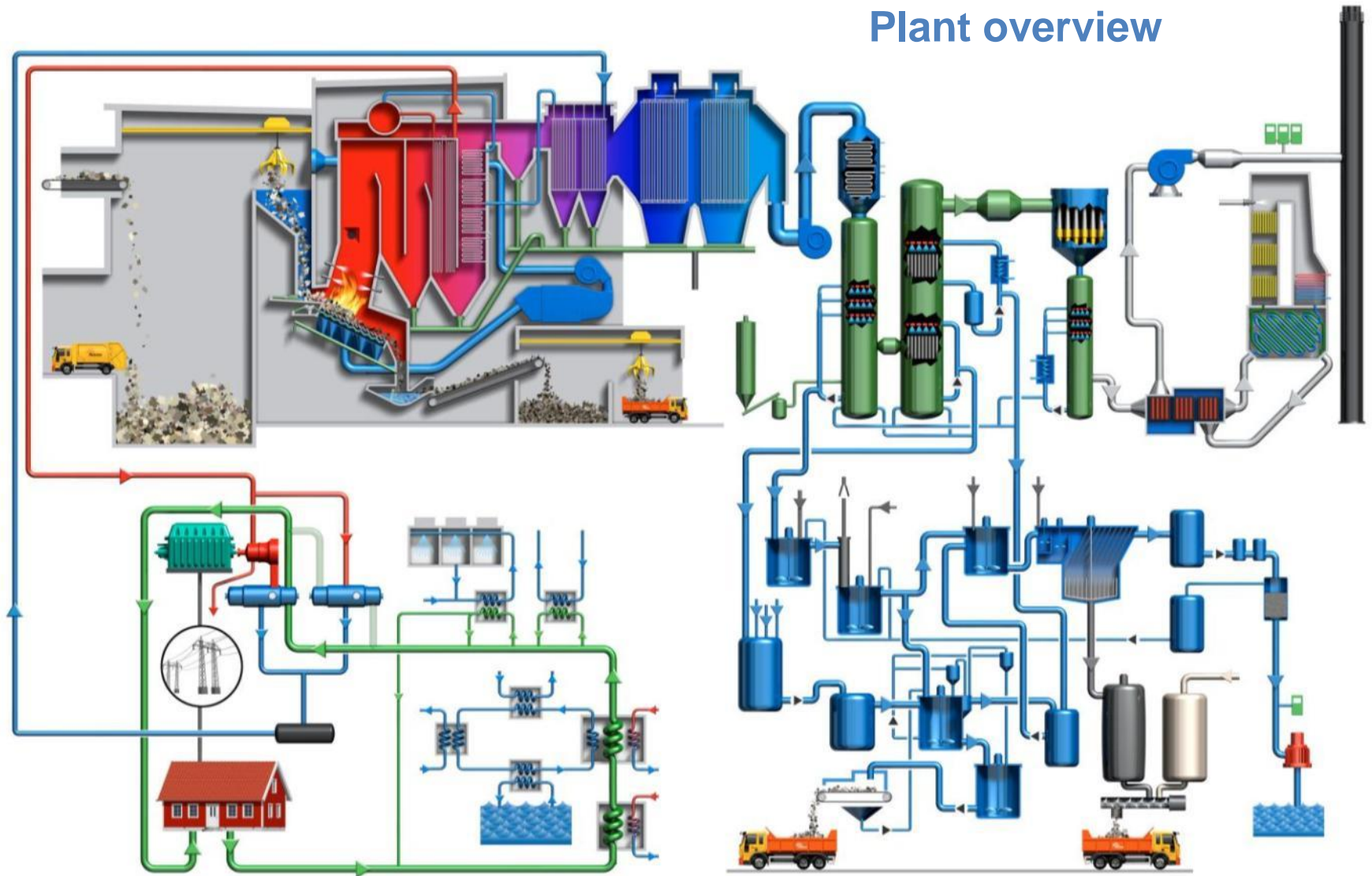
Energy efficiency as of the R1-formula = 1,2



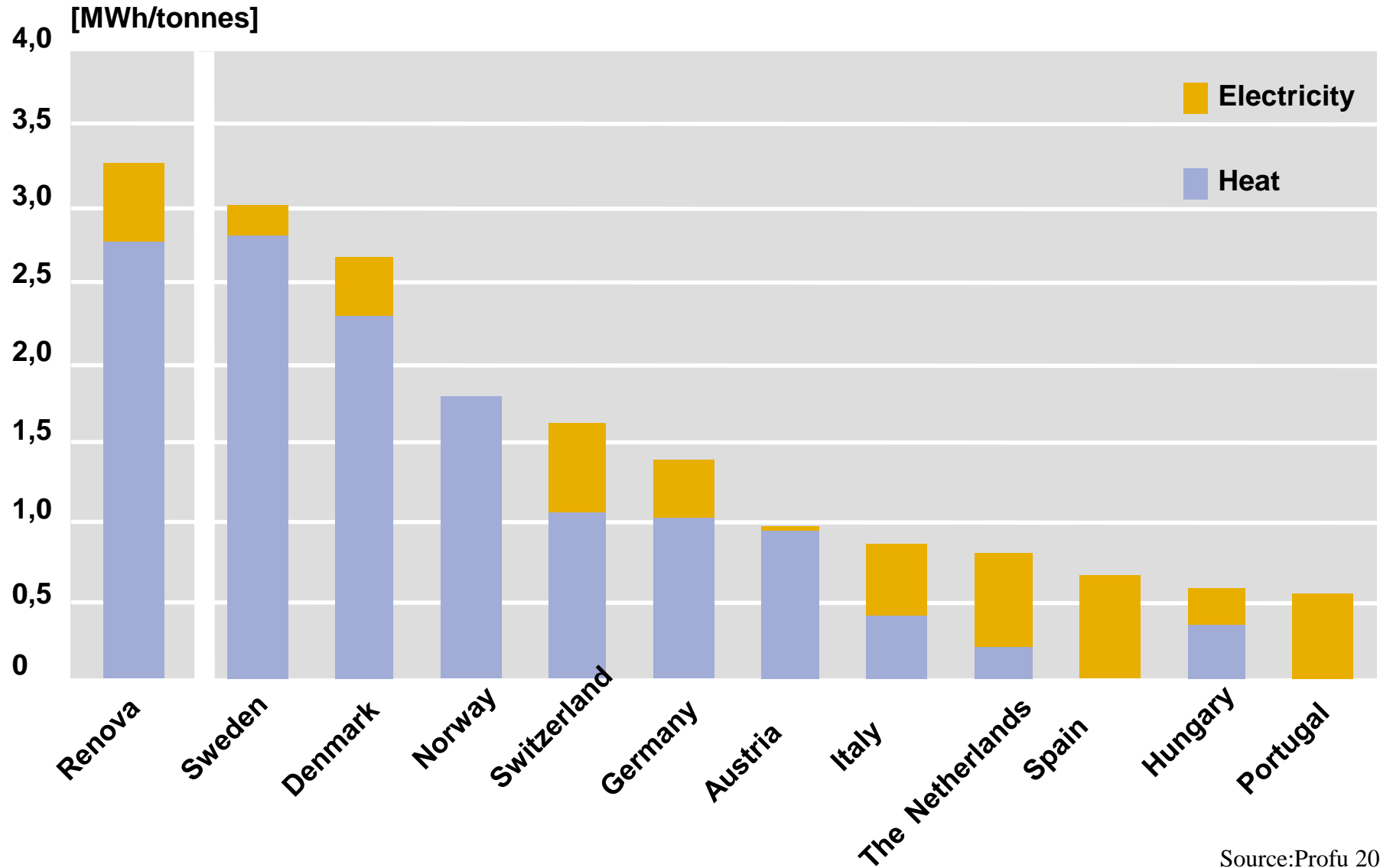
District Heat and Electricity from Renova



Plant overview

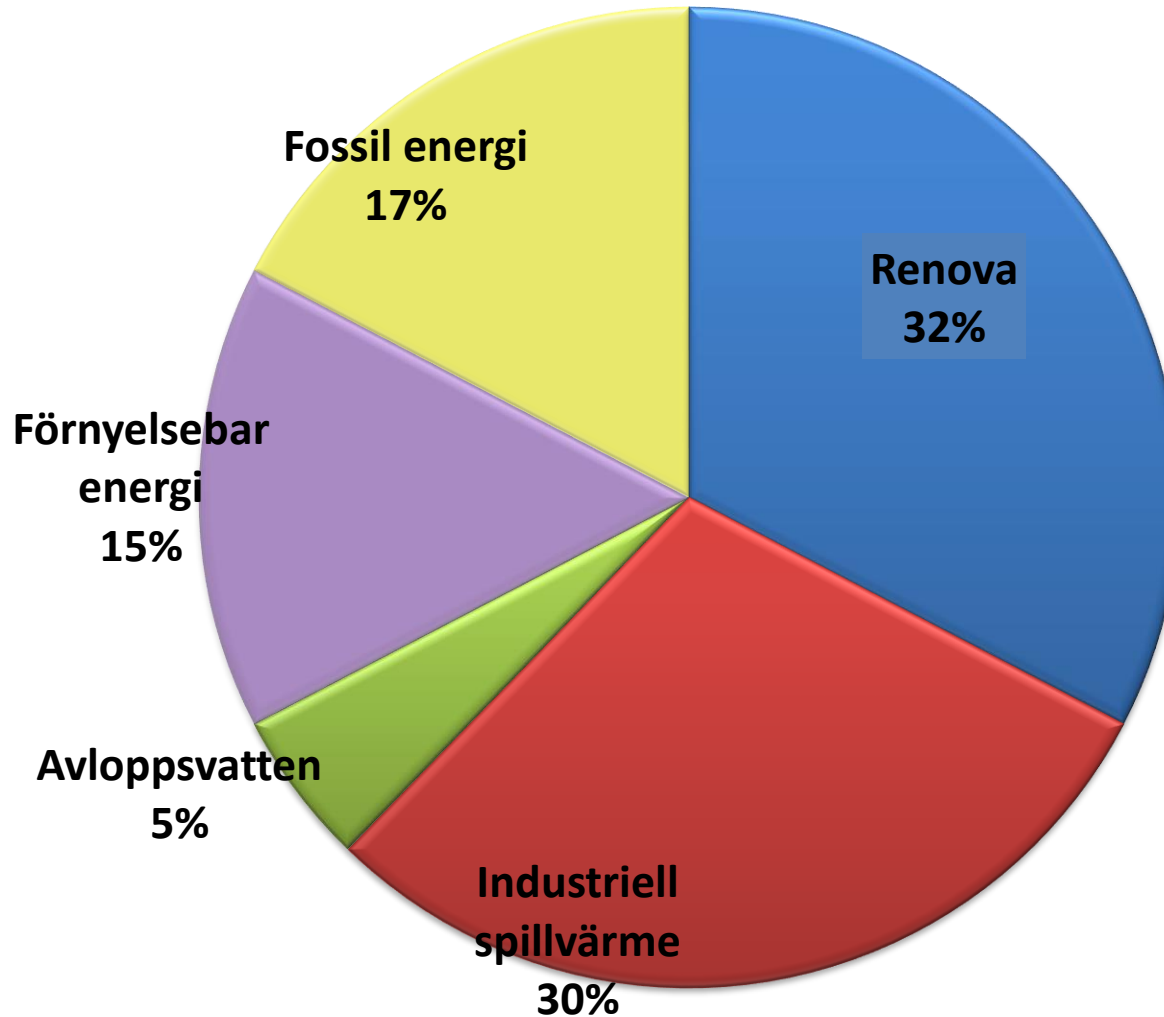


Energy recovered: House hold Waste to Energy Plants in Europe

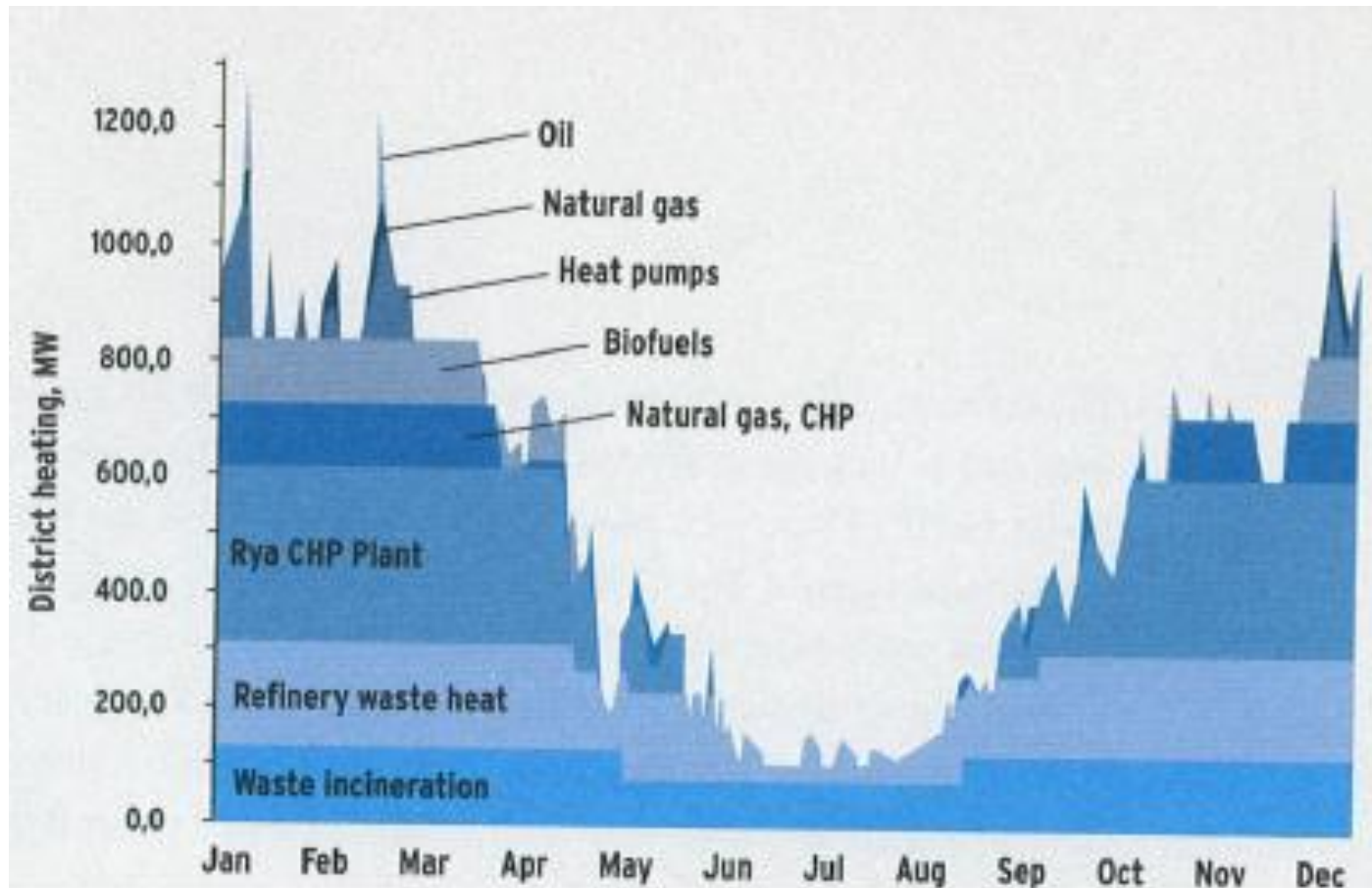


Source: Profu 2009

Producerad fjärrvärme 2016

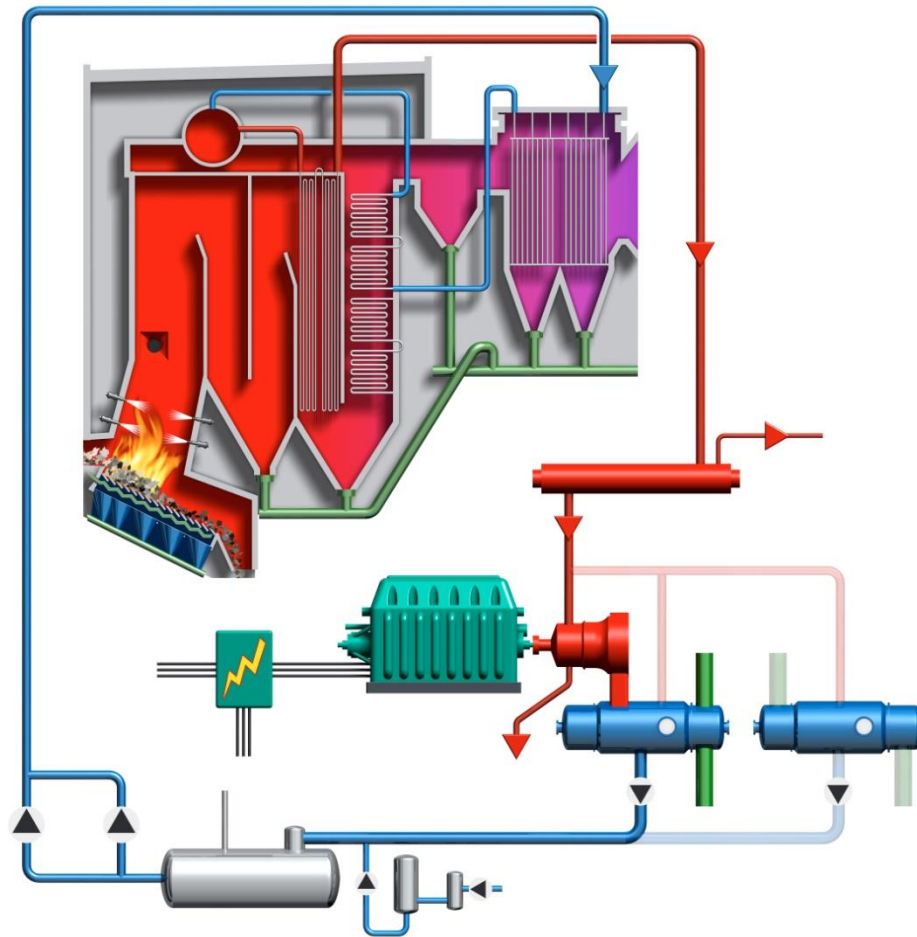


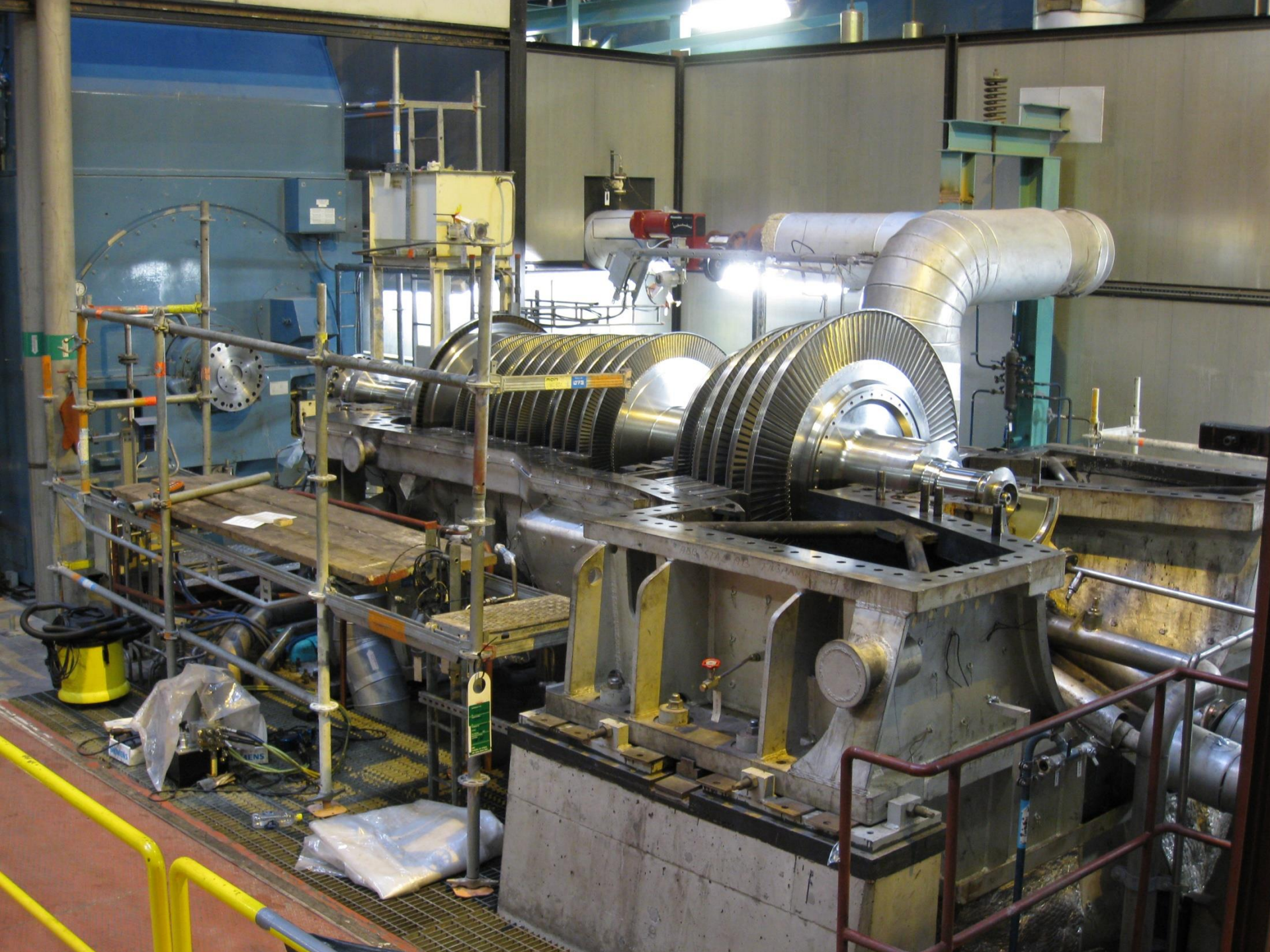
District Heat Production 2011



In 2014 Renova contributed with 38% of the heat

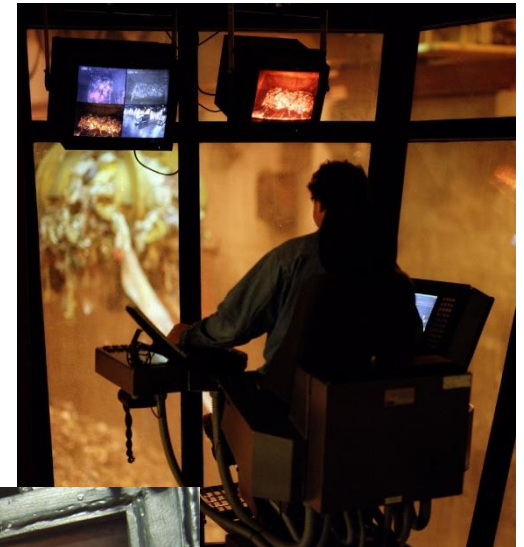
Superheated steam generates electricity





Waste to Energy at Renova 2016

- 32 procent of district heating in regionala network
- 5 procent Göteborgers' electricity use
- 536 000 ton waste – Municipal and industrial



**Ur en
kranskopa med
avfall utvinns el
och värme som
räcker i ca 9
månader för en
normalvilla.**

***(Om 20 MWh/år
och småhus)***



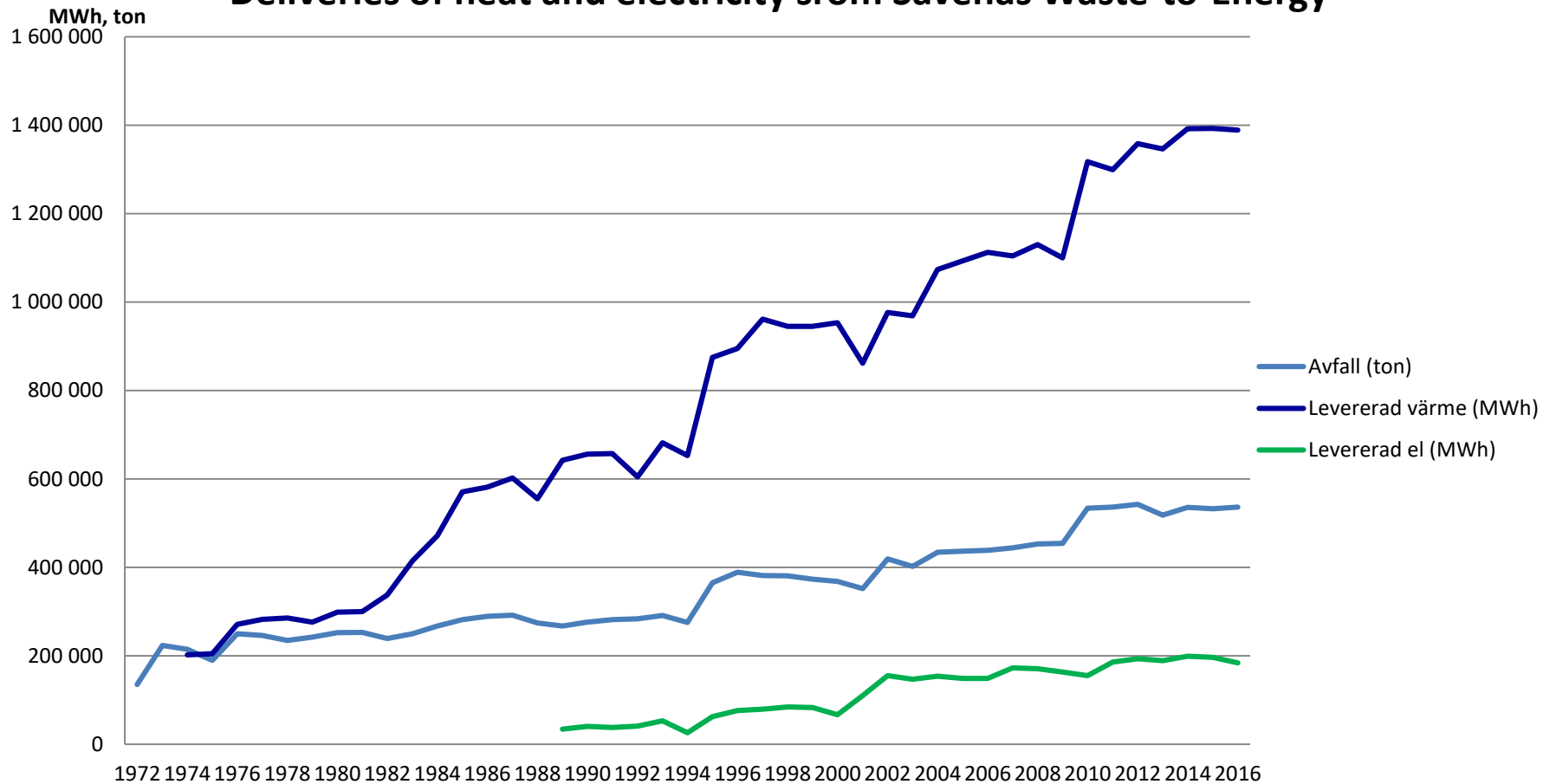
**5 ton avfall
motsvarar
ca 16 000 kWh**

Avfallskraftvärmeverket 2016

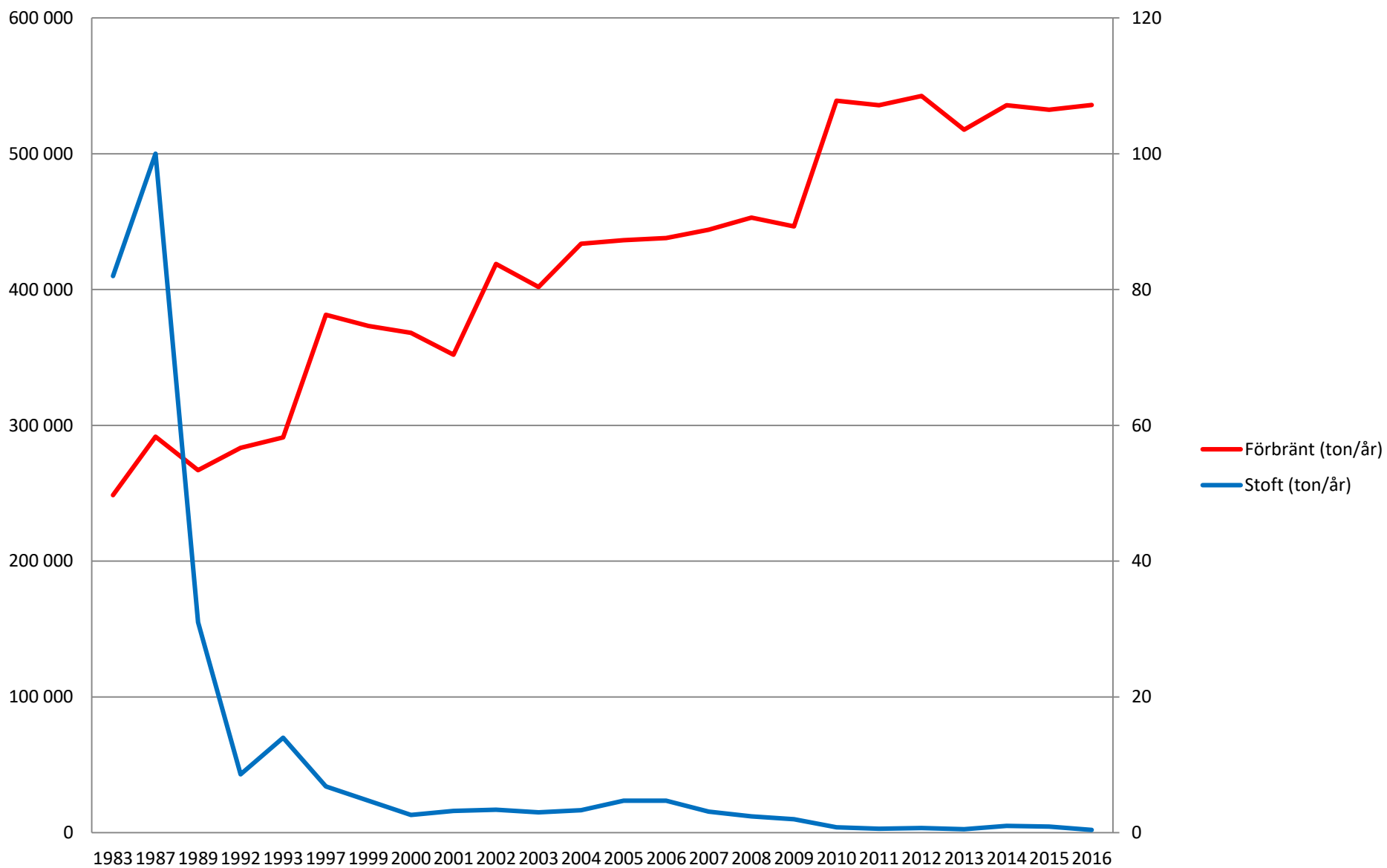
	Panna 1	Panna 4	Panna 5	Panna 7	Risk och sekretess	Special-ugnen
Förbränd mängd (ton)	110 118	155 946	153 262	113 976	2 633	66
Drifttid (h)	7 201	7 893	7 729	8 105		
Antal ton/h	15,3	19,8	19,8	14,1		

- Total energiproduktion 1 756 777 MWh
 - Värme 1 506 416 MWh
 - El 250 361 MWh
- Energiutbyte/ton avfall 3,28 MWh

Deliveries of heat and electricity from Sävsnäs Waste-to-Energy



Particles 1983-2016





Marieholm kompostering

Fertilized soils

- Grass soil
- Planting soil
- Pot soil
- Perenn soil
- Rhododendron soil
- Special mixtures



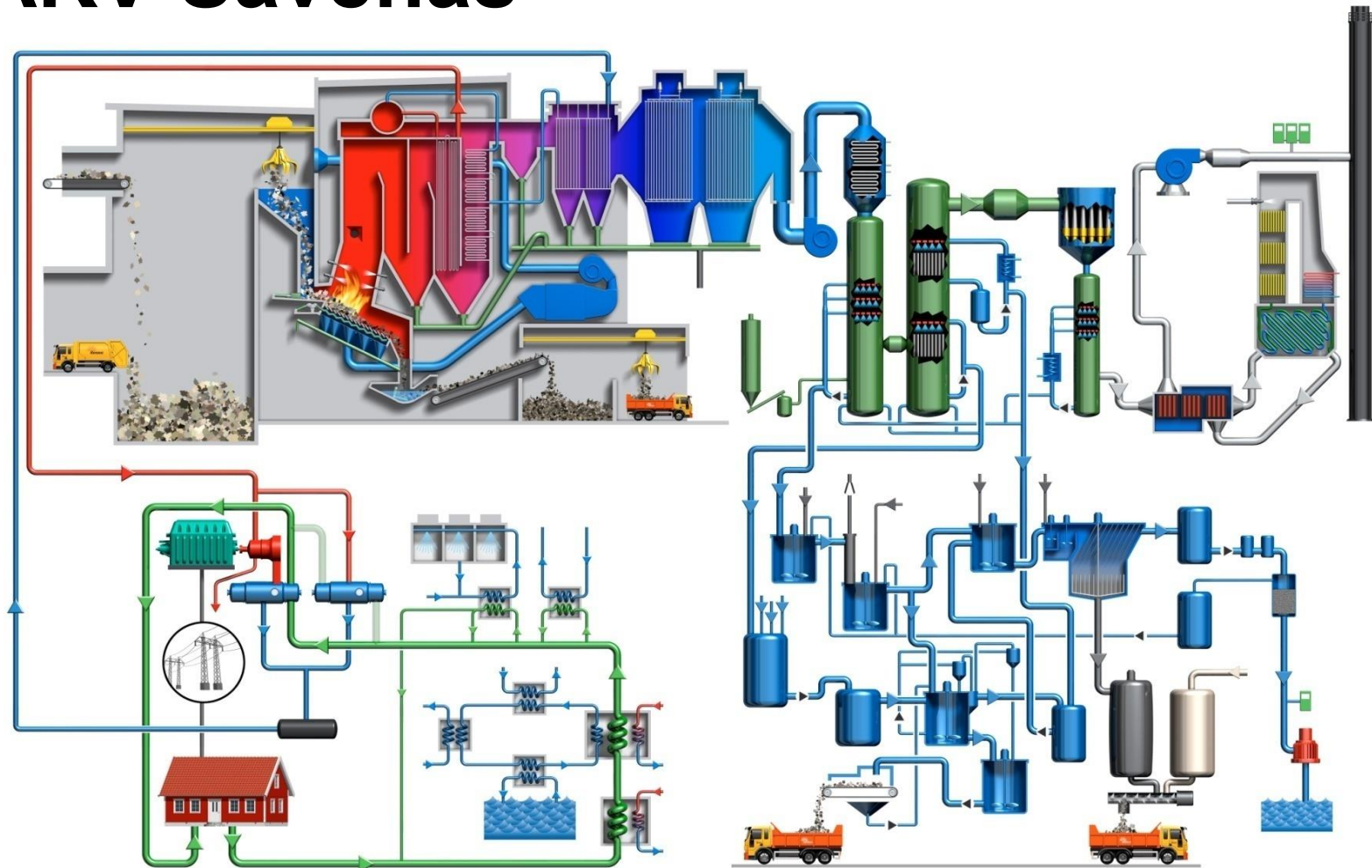
Our 130 years
old innovation
journey
continues...

Read more at www.renova.se

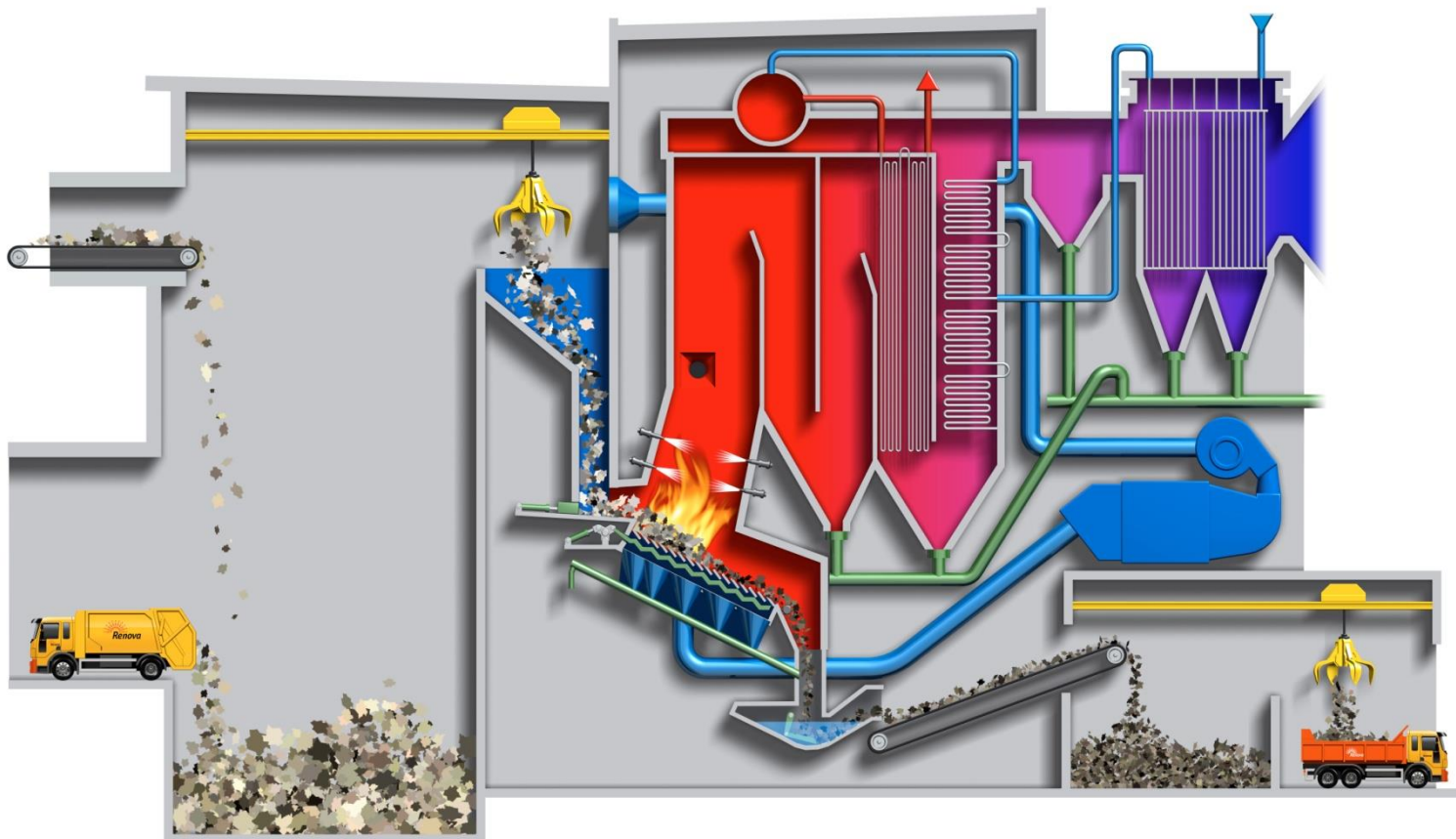


extras

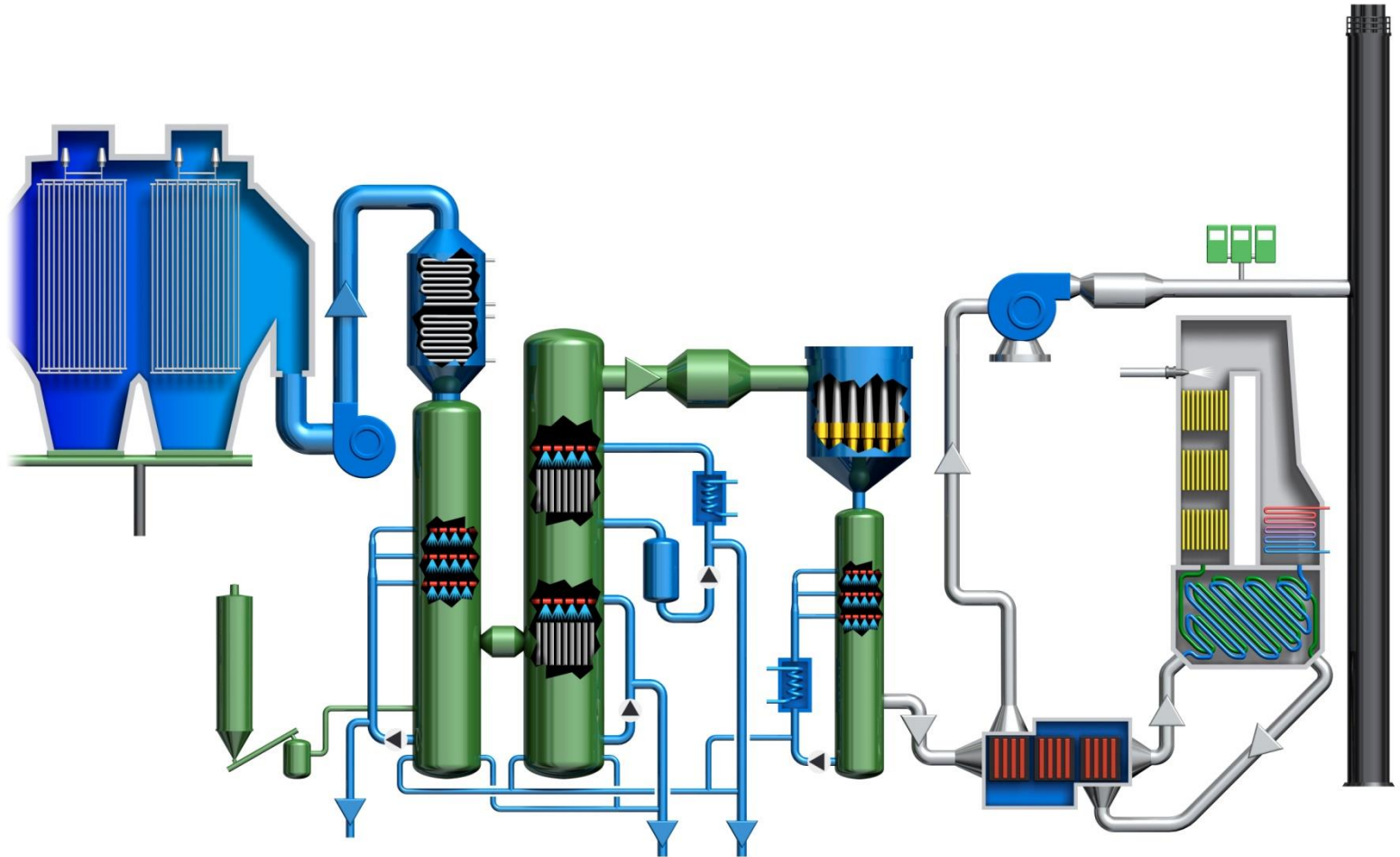
AKV Sävenäs



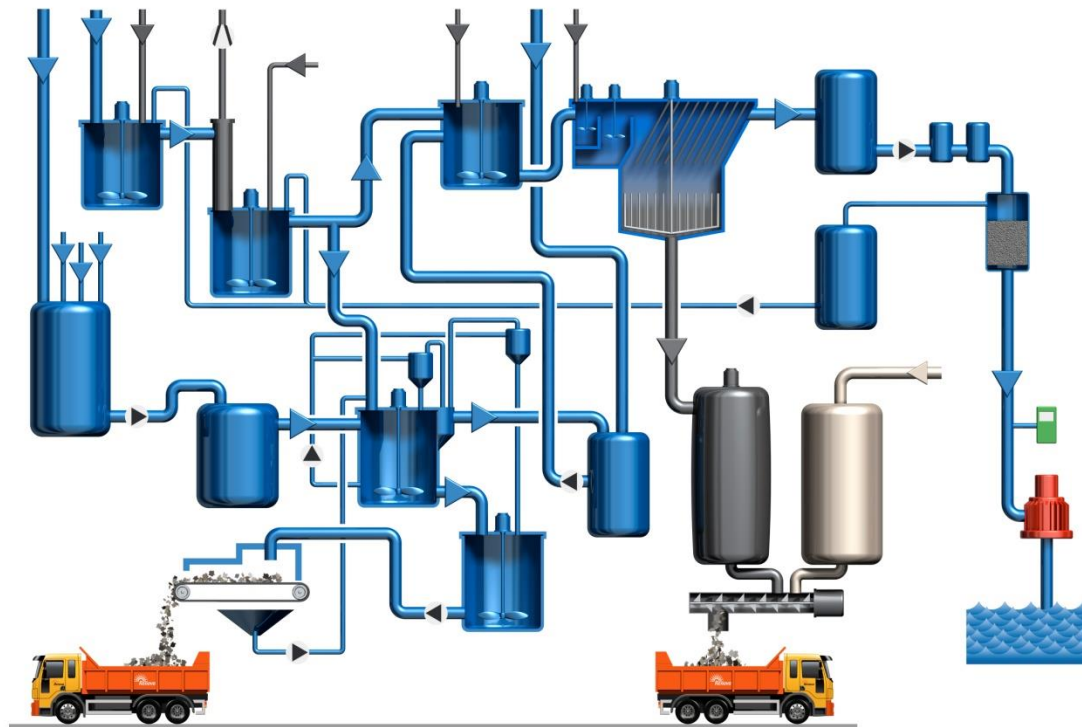
Förbränning



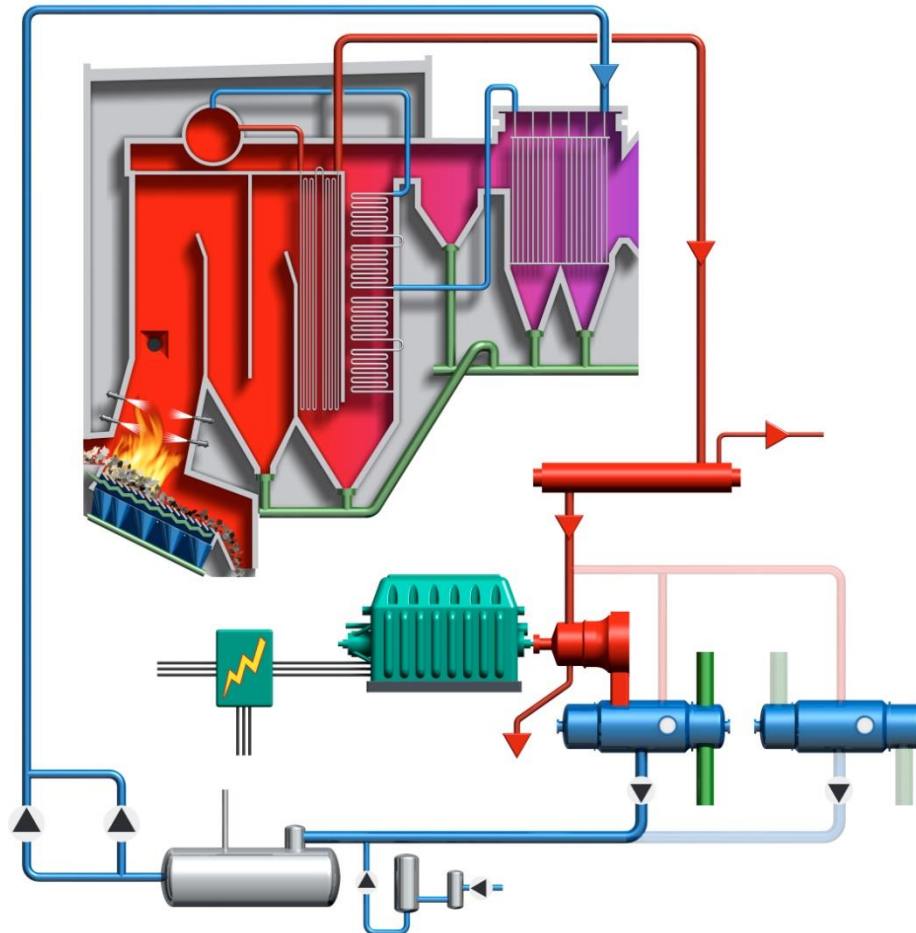
Rökgasrening



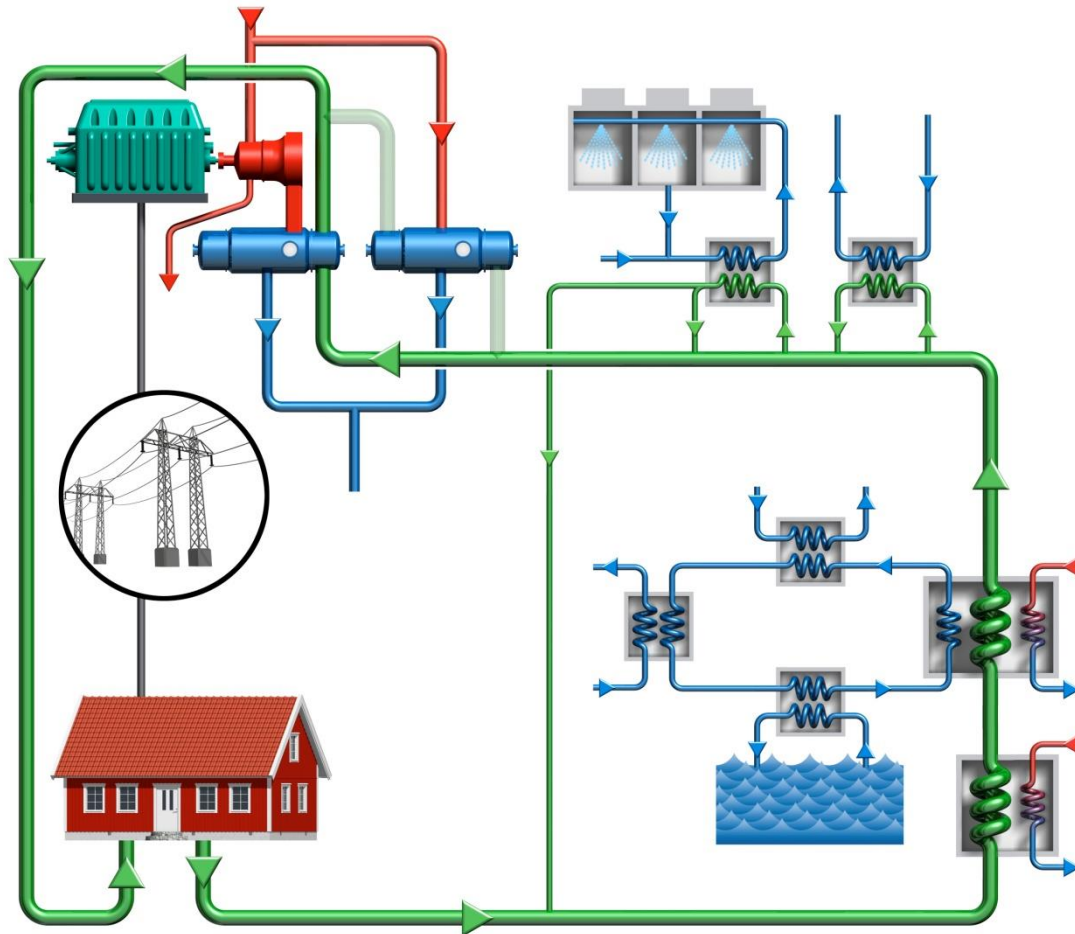
Vattenrening



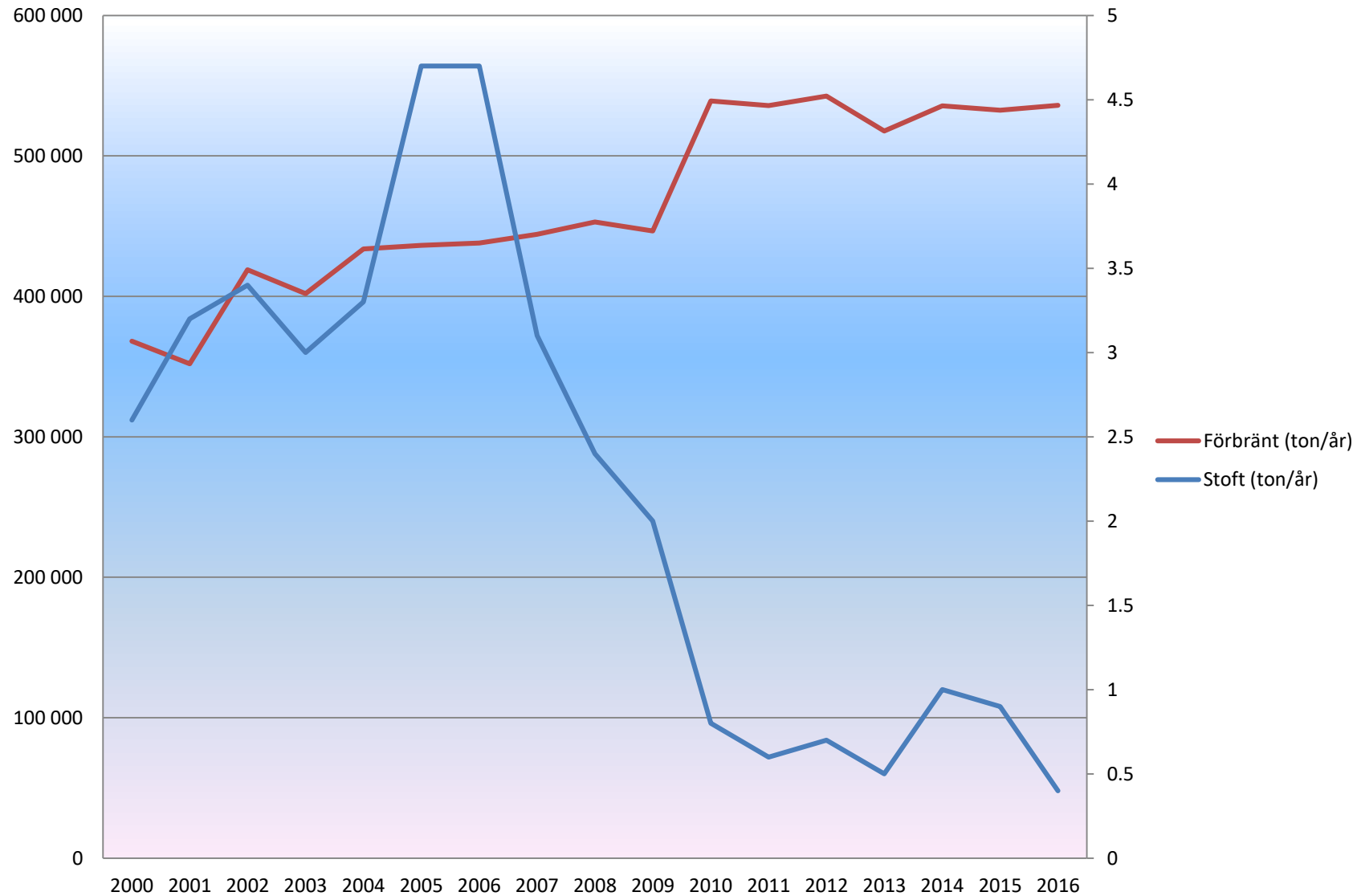
Ånga och el



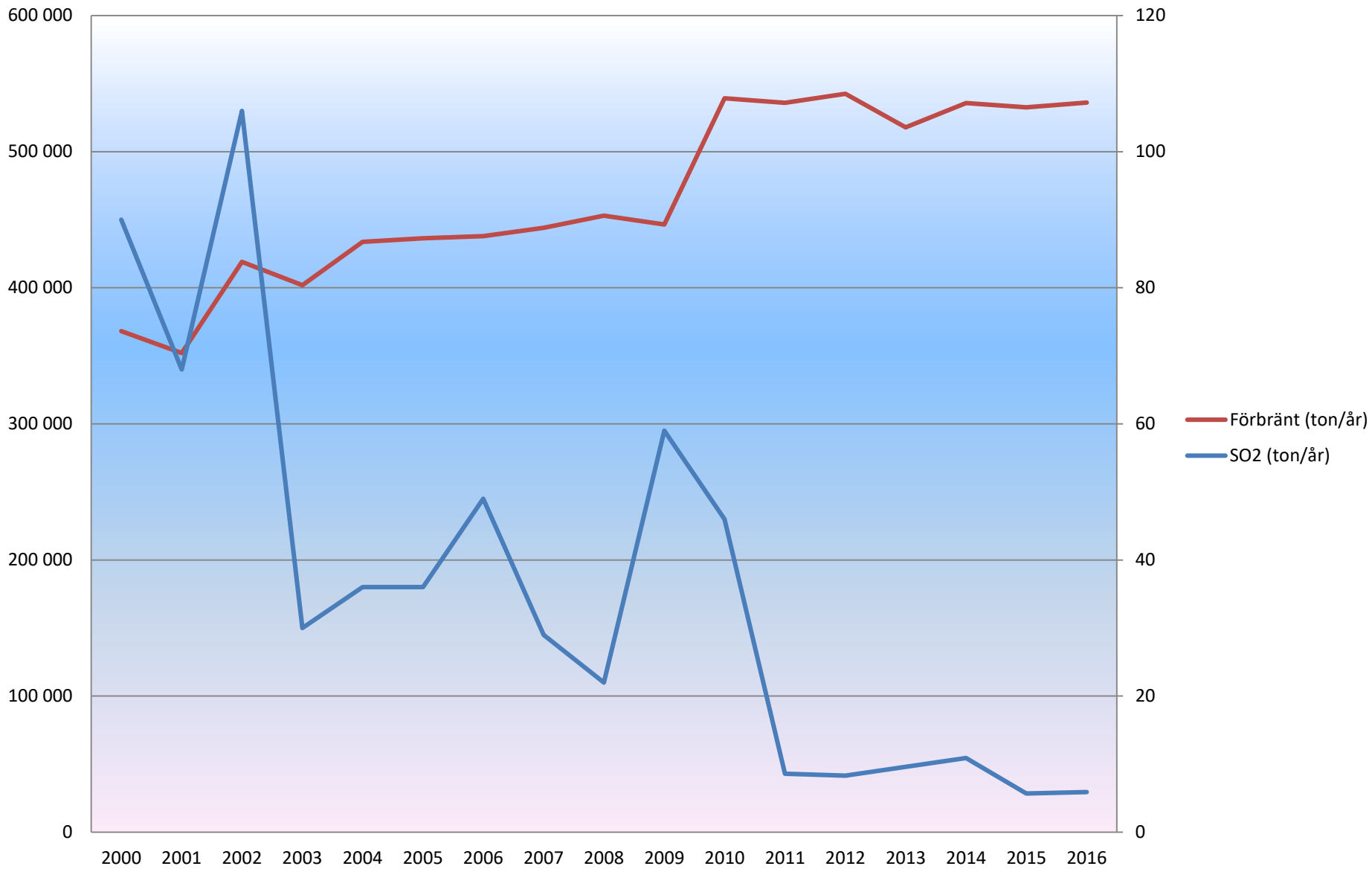
Fiärrvärme



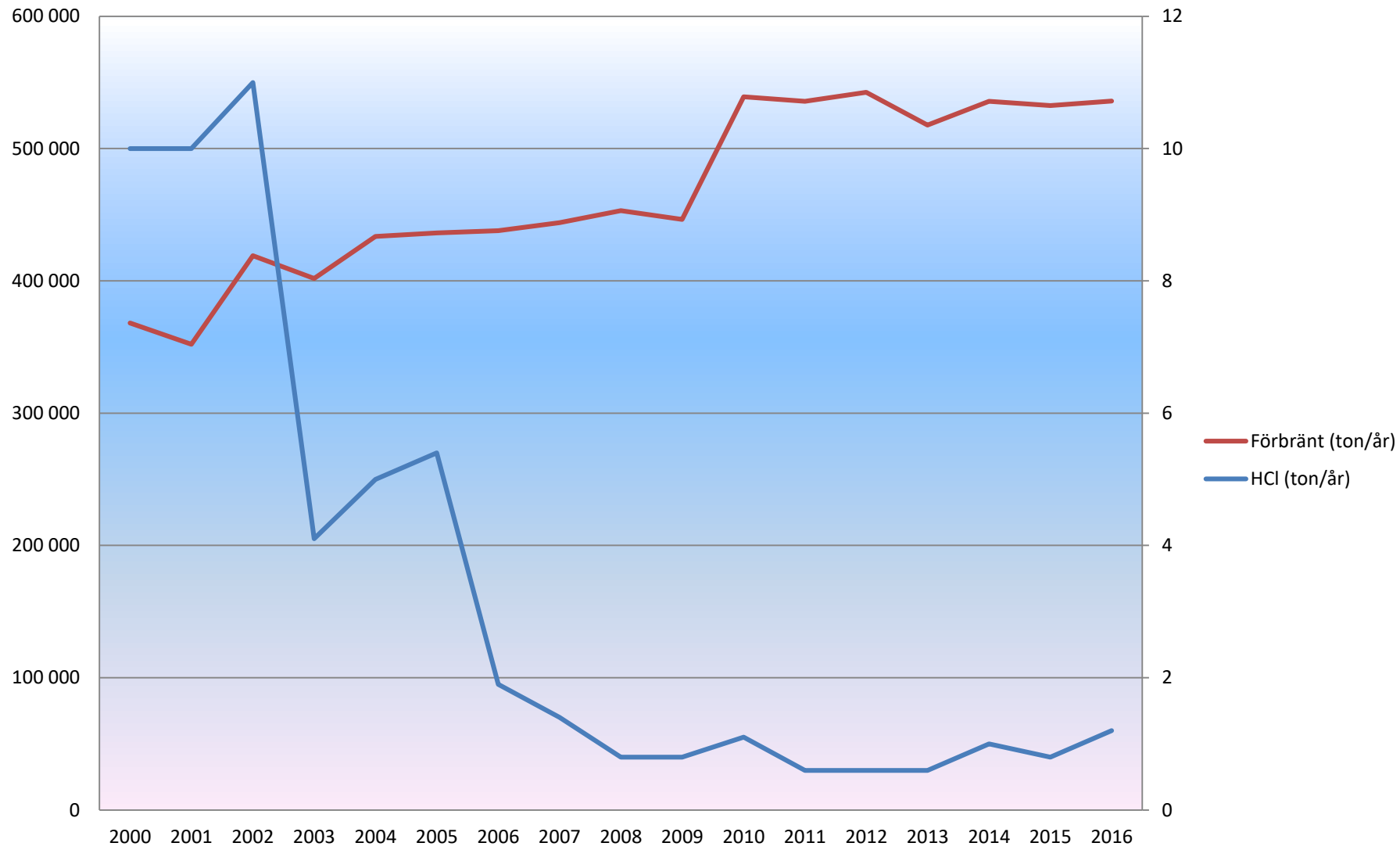
Stoft



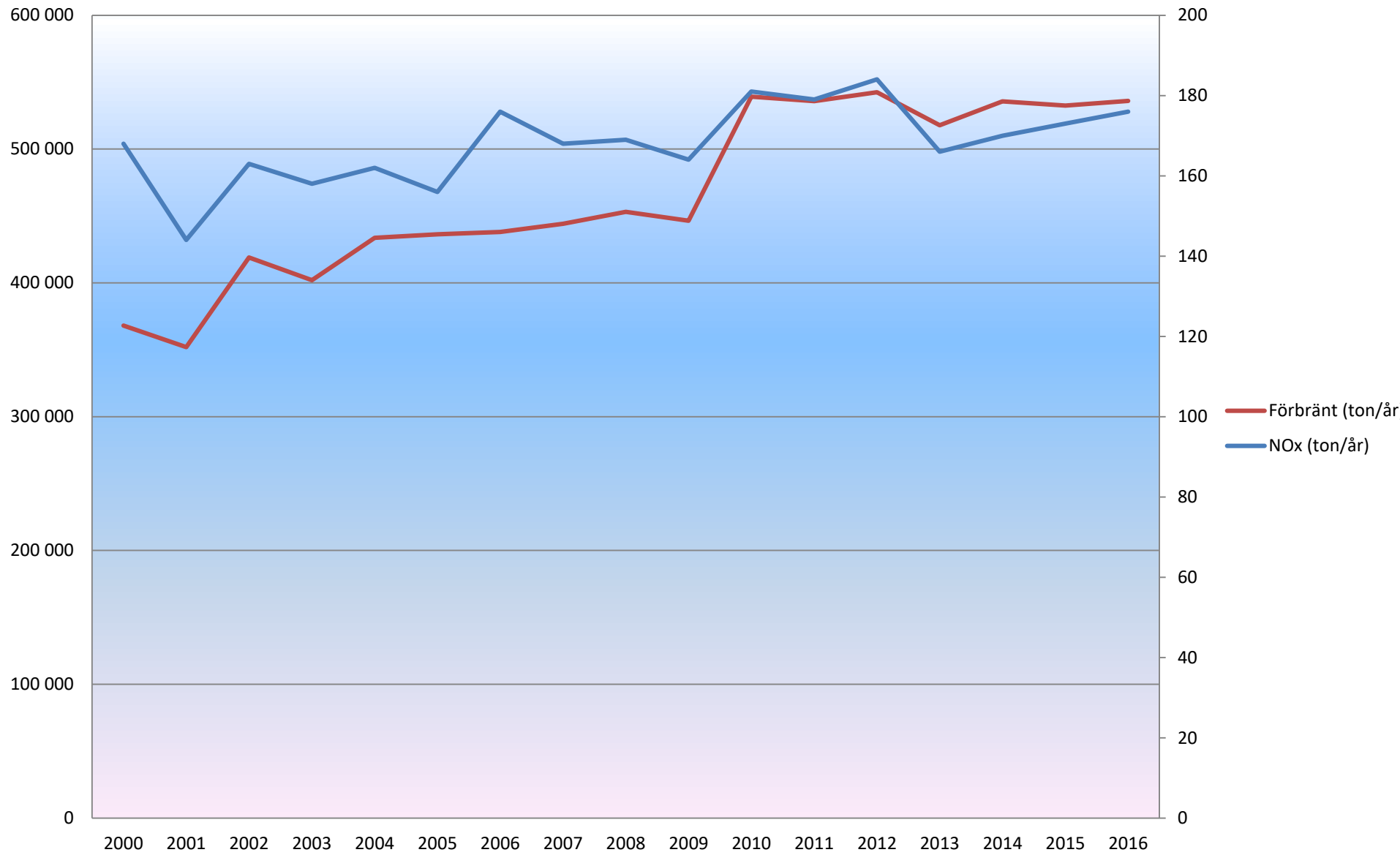
SO2



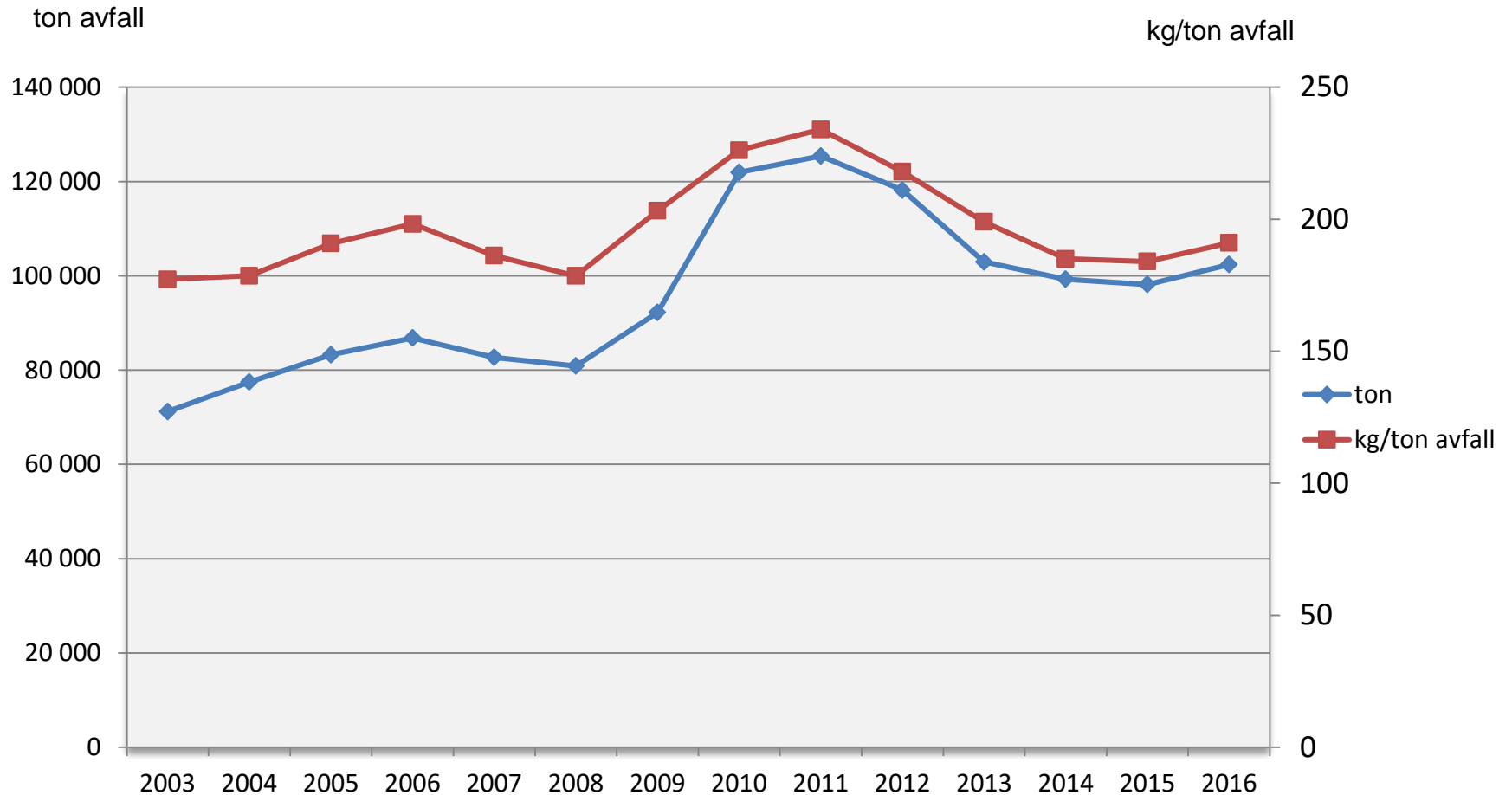
HCl



NOx



Slagg till sortering 2003 – 2016



Restprodukter 2016

	Mängd (ton)	vikt av förbränt (%)
Slagg	102 396	19,2
Bambergkaka	24 332	4,6
Gipsslam	1 505	0,3
TOTALT	128 234	24,0



Avfallskraftvärmeverkets kapacitet

Pannor

• Ugn 1	15 ton avfall/h	45 MW
• Ugn 4	22 ton avfall/h	56 MW
• Ugn 5	22 ton avfall/h	56 MW
• Ugn 7	14 ton avfall/h	43 MW
SUMMA	73 ton avfall/h	200 MW

Värmeproduktion

• Direktkondensering	18 MW
• AVP	65 MW
• Hetvattenväxling	9 MW
• Internvärme	- 3 MW
• Turbinkondensor	100 MW
SUMMA	189 MW

Elproduktion (40 bar/400°C) **42 MW**

TOTAL levererad effekt **231 MW**

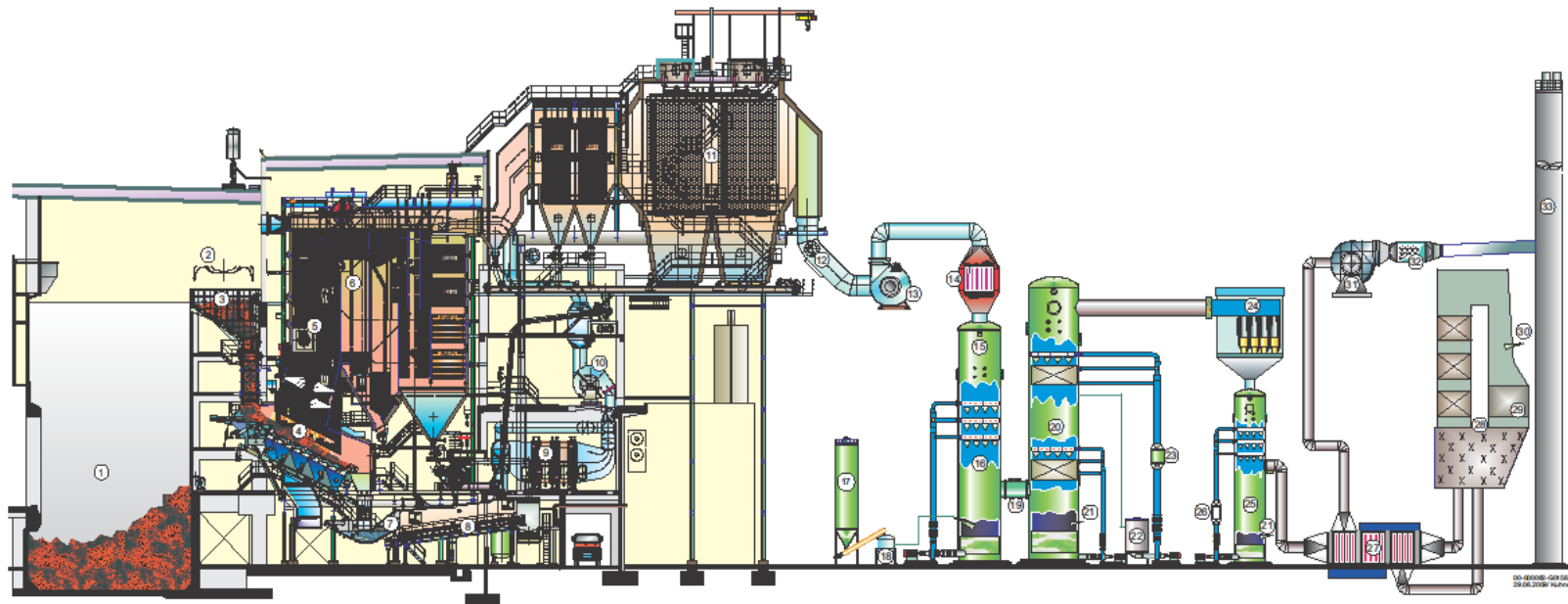
T



Nominell effekt: 41 600 kW

Hastighet: 3000 rpm

WASTE-TO-ENERGY FACILITY GÖTEBORG P7



LEGEND

1	Tipping hall	13	Booster fan	25	Condenser
2	Waste crane	14	Hot water economizer	26	Condenser for heat pumps
3	Feed hopper	15	Quench	27	Glass gas/gas heat exchanger
4	MARTIN® reverse-acting grate	16	HCl Scrubber	28	SCR
5	Ignition and support burner	17	Limestone silo	29	HP Steam heater
6	Steam boiler	18	Limestone station	30	Ammonia injection
7	Ram-type discharger	19	Droplet separator	31	ID fan
8	Bottom ash transport	20	NaOH scrubber	32	Silencer
9	Underfire air preheater	21	NaOH injection	33	Stack
10	Underfire air fan	22	Process water tank		
11	Electrostatic precipitator	23	Condenser for district heating		
12	Flue gas recirculation	24	Wet electrostatic precipitator		

Technical data:

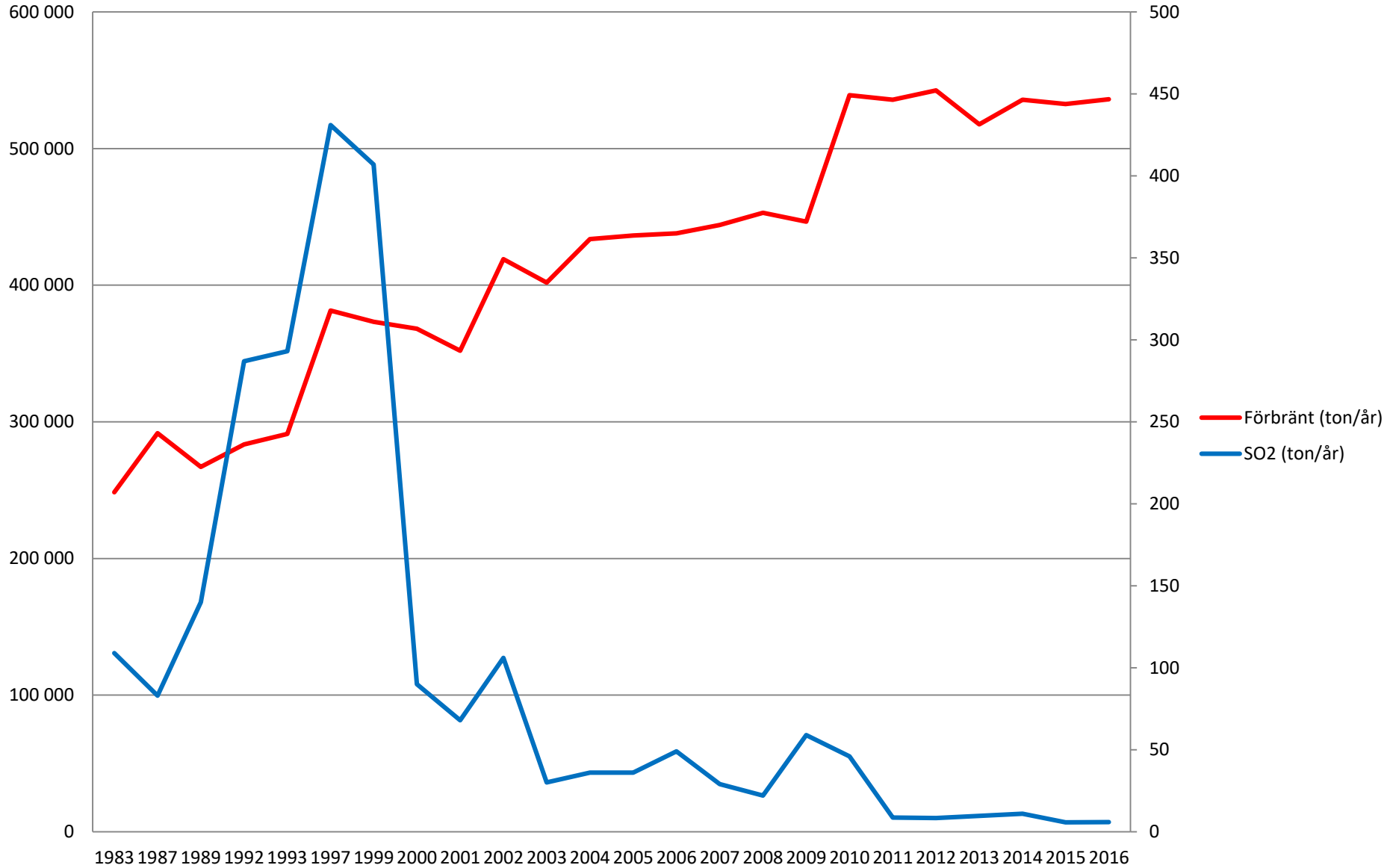
Waste throughput	=	15.7	Mg/h
Waste heating value	=	11,200	kJ/kg
Gross heat release	=	156.8	GJ/h
Superheated- steam pressure	=	42	bar
Superheated- steam temperature	=	400	°C
Feedwater temperature	=	140	°C
Flue gas temperature downstream of ECO 1	=	180	°C
Heat recovery for condensation	=	10	MW
Heat recovery with hot water	=	1.4	MW
NOx emissions	=	15	mg/Nm³ (11% O₂ dry gas)
Flue gas temperature at stack	=	70	°C



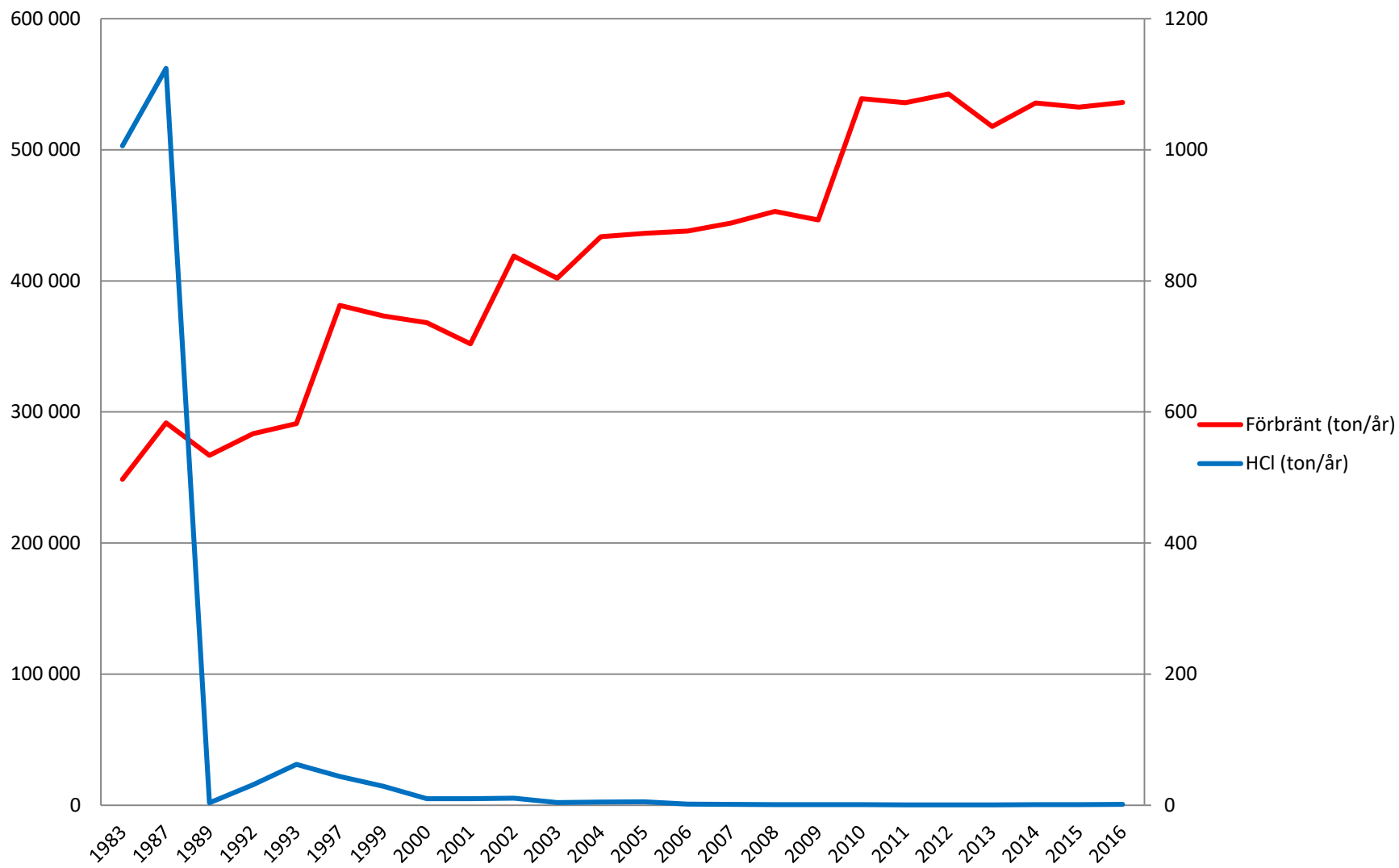
MARTIN reverse-acting grate:

Grate runs	=	3
Number of steps	=	15
Run width	=	1,750 mm
Grate width	=	5,570 mm

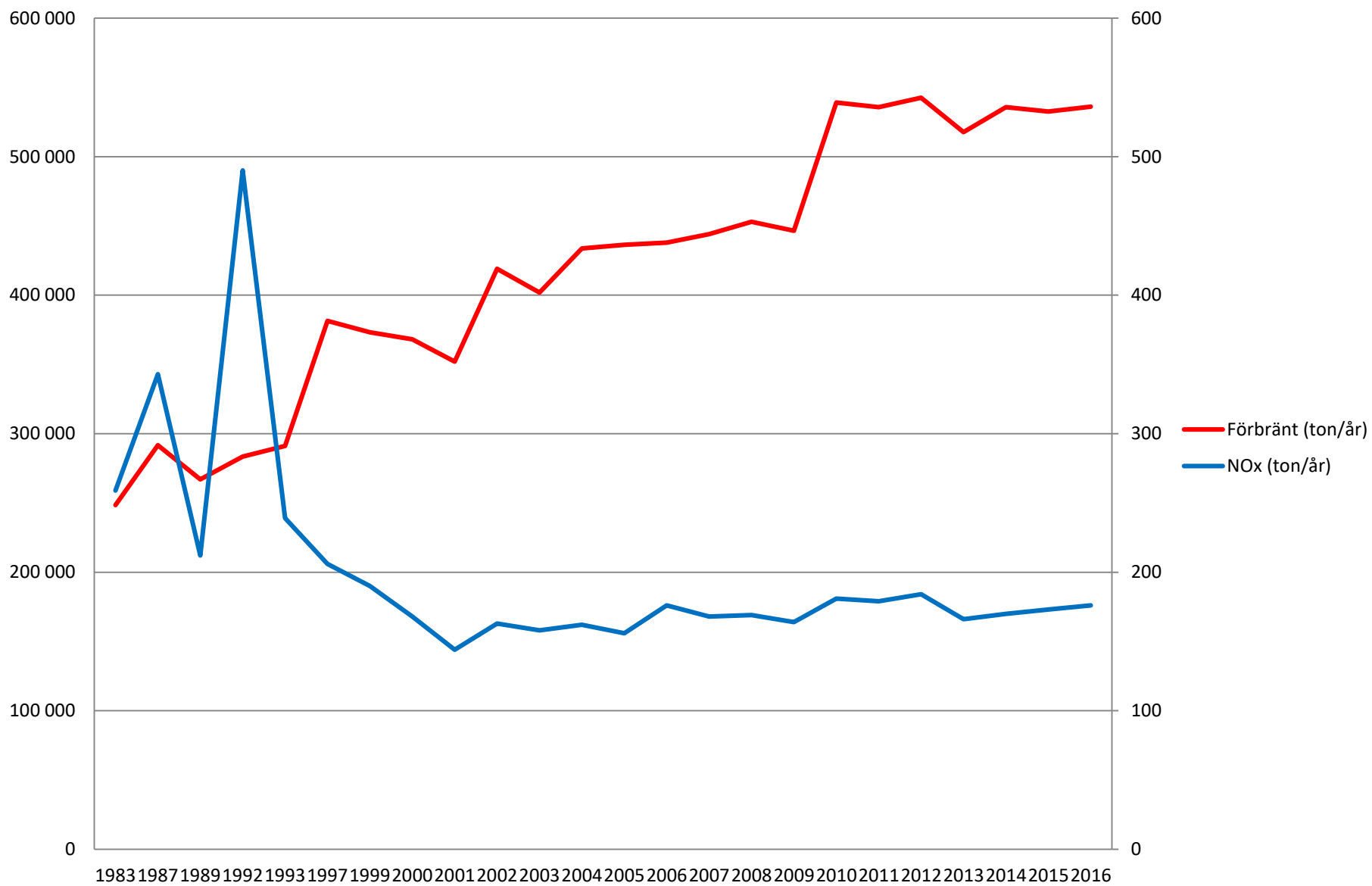
SO₂ 1983-2016



HCl 1983-2016



NOx 1983-2016



Waste to Energy in Sweden

