

Environmental report

Vattenfall Heat Uppsala 2019



VATTENFALL

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Environmental report

Vattenfall Heat Uppsala 2019

Our integrated management system is certified in accordance with the environmental management standard ISO 14001, and we were the first energy company in Sweden to have an energy management system that is certified to ISO 50001.

We report carbon dioxide emissions according to two systems: the EU Emissions Trading System (ETS) and the Swedish system that was developed by Värmemarknadskommittén (VMK) in collaboration with Energiföretagen. Details of the latter can be found on Energiföretagen's website, www.energiforetagen.se.

We are part of the emissions trading system for carbon dioxide

Our plants are covered by the EU's emissions trading scheme for carbon dioxide. We trade one emission allowance for every tonne of fossil CO₂ emitted. This is our contribution to efforts to reduce emissions from EU member states.

Our products

Until 2019 we offered the additional products Carbon Neutral Heating and Cooling to our corporate customers in Uppsala. These customers received a supply of carbon neutral district heating or district cooling as a result of our replacing peat with biomass fuel, so that fossil carbon dioxide

emissions were reduced by the same amount that would have arisen from waste incineration.

The sale of these products reduced emissions by 18,540 tonnes in 2019, compared with the total if no customer had chosen them.

Now that we have phased out peat completely in Uppsala, the generation mix has become even better, with an even higher proportion of renewables. In conjunction with this, we have also discontinued the additional products Carbon Neutral Heating and Cooling.

As from 2020, we are offering the additional products Climate Neutral Heating and Climate Neutral Cooling. We create Climate Neutral Heating by allocating the quantity of biomass fuel required for the customers who purchase the product. In addition, we carbon offset the carbon dioxide emissions that have arisen from the production and the transportation of these biomass fuels. We do this by purchasing and cancelling the emission reductions classified as Golden Standard. Climate Neutral Cooling is produced in cooling machines powered by certified electricity from hydro power. We also offset the life value emissions that arise from hydro power, as well as any refrigerant emissions, through Golden Standard emission reductions.



Vattenfall is making fossil-free living possible within one generation

A lot has happened during the year in our work to reduce fossil carbon dioxide emissions. An era has come to an end, and on 29 March last year we burned peat in our CHP plant for the last time. We have replaced peat with wood pellets and bio oil, and improved and developed our district cooling product by means of the new 25,000 cubic metre cooling accumulator.

We are in the middle of a major conversion programme, and we are investing just over SEK 3 billion to replace fossil fuels. The largest project Vattenfall is running in Sweden is currently in progress in Uppsala. In the project, called Carpe Futurum (Seize the Future), we are building a biofuel-fired plant which is expected to be commissioned at the end of 2021. The plant has already begun to take shape, and preparations for its implementation form a substantial part of our employees' day-to-day work. The plant has a fluidised bed and will use recycled wood, wood chips and bark as its principal fuels.

We have started planning for the next stage of the conversion, in which our goal is to phase out all the fossil fuels we currently use in peak and reserve plants by 2025. We are conducting a pilot study together with Uppsala Municipality, Uppsala University and STUNS into the possibility of building a so-called Bio CCS plant in Uppsala. This is a means of capturing carbon dioxide molecules in the chimney and preventing them from escaping into the atmosphere. The captured carbon dioxide is then stored in the bedrock. This is a technology that already exists, and can enable us to become climate positive.

Corporate customers in Uppsala who want to have their properties environmentally certified at a high level are now receiving new energy products to support this aspiration. In conjunction with the phasing out of fossil fuels, we are launching two new products: Climate Neutral Heating and Climate Neutral Cooling.

The survey of our employees' work environment, well-being and commitment (My opinion) showed a big improvement during the year. This is a very gratifying result and a prerequisite for continuing to create the best energy solutions in a good workplace. During the year we have put a particular focus on safety, and implemented a new support system which has improved risk observations and incident reporting. We work continuously to optimise the work environment in our workplace.



Johan Siilakka
Facility Manager Uppsala

Our operations and plants

Heat Uppsala is a business unit in Vattenfall AB. District heating is the major part of our business and our customers are real estate companies, housing associations, home owners, industrial and public facilities such as schools, swimming pools and libraries. The business covers the entire value chain: production, distribution and sales. We also offer district cooling and steam, with the latter being used in industrial processes. Generating electricity and heat simultaneously delivers a high level of efficiency. Uppsala has Vattenfall's largest plant for district heating in Sweden

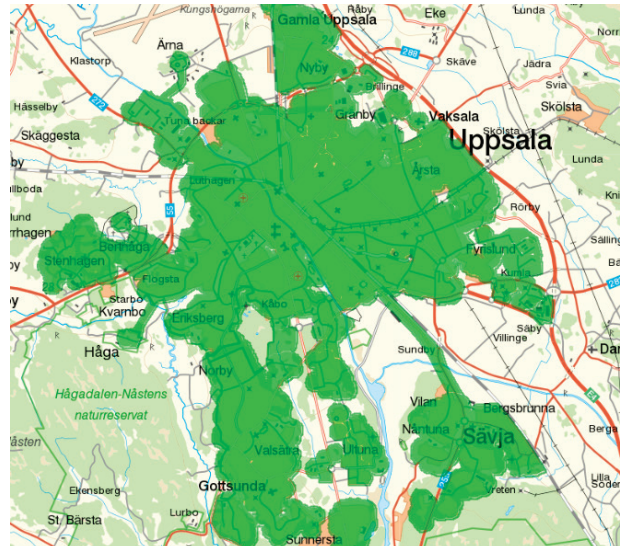


Image 1: The area highlighted in green shows the extent of the district heating network in Uppsala

Uppsala

Fuel mix

- 61% Waste (1,188 GWh)
- 9% Peat (176 GWh)
- 9% Wood (178 GWh)
- 8% Electricity (153 GWh)
- 5% Fossil oil (93 GWh)
- 5% Bio oil (92 GWh)
- 3% Coal (60 GWh)
- 1% Waste heat (21 GWh)

Energy supplied

- 83% District heating: 1,288 GWh
- 7% Electricity net: 109 GWh
- 6% Process steam: 97 GWh
- 4% District cooling: 56 GWh

The proportion of renewables in the district heating fuel mix was 55% (with peat counted as fossil). If peat is counted as slowly renewable, the proportion is 64%. Waste is calculated here as 60% renewable in terms of energy, which makes the remainder non-renewable, i.e. plastic with fossil origins.

In addition to the 56 GWh of cooling in the table above, 6 GWh was supplied using 'island solutions', i.e. independently of the district cooling network.

Knivsta

Fuel mix

- 95 % Biomass (76 GWh)
- 5 % Oil (4 GWh)

Energy supplied

- 100 % District heating (53 GWh)

Storvreta

Fuel mix

- 100 % Biomass (23 GWh)

Energy supplied

- 100 % District heating (13 GWh)

Energy efficiency

We are working systematically on increasing energy efficiency, e.g. improved utilisation of waste heat from hot flue gases in Uppsala and the installation of a new more energy-efficient compressed air compressor in Knivsta.

Our electricity consumption

In 2019, Uppsala consumed 80 GWh of electricity for pumps, fans and other equipment. This corresponds to 44.2 kWh of consumed electricity per total generated MWh to the customer. Electricity consumption in the previous year was higher (84 GWh); the reduction resulted, among other factors, from a mild winter and reduced use of the CHP and its fuel preparation.

Electricity consumption by Heat Uppsala (kWh per MWh generated)

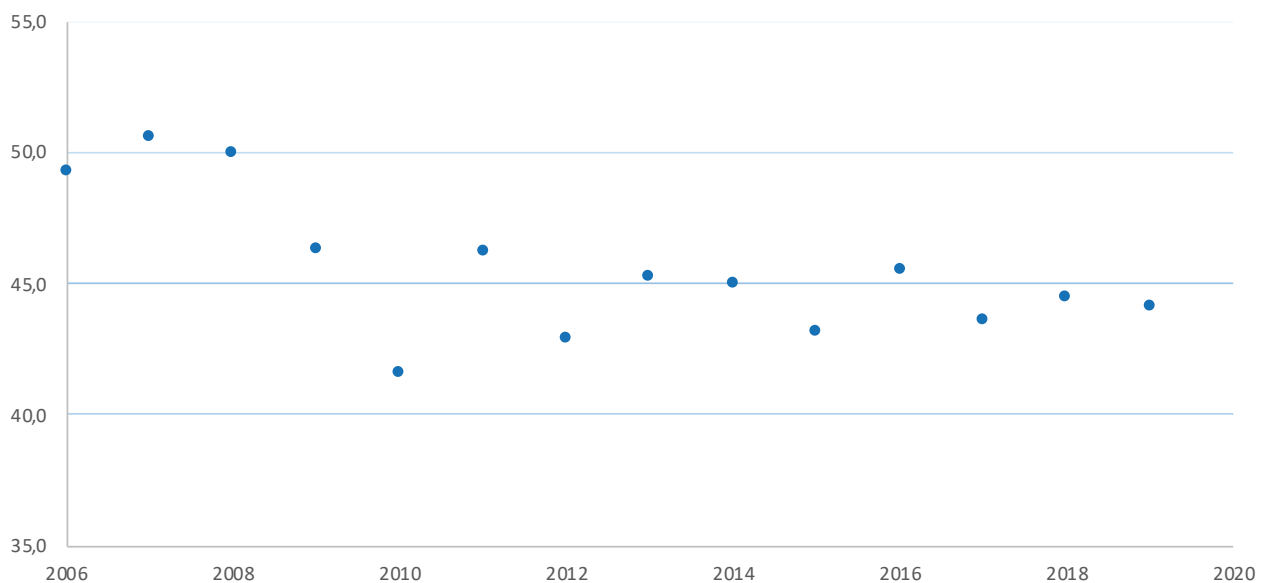


Image 2: Our electricity efficiency work is shown in the figure above. In cold years, such as 2010, electricity consumption is lower per generated MWh because the idling consumption is shared across a large production volume.

For Knivsta, we consumed 2.0 GWh of electricity (31 kWh per generated MWh), which is basically the same as last year.

For Storvreta, we consumed 0.19 GWh (11 kWh per generated MWh), which is somewhat higher than last year.

Customer electricity consumption and how we collaborate

Our customers' energy consumption affects society's use of resources and the degree of emissions. Examples of how we contribute to our customers' good energy housekeeping are outlined below:

In order to enable all our customers to see trends and changes, we offer energy statistics free of charge on My Pages via www.vattenfall.se.

- Flow charges benefit larger customers if their district heating units are more efficient than the norm.
- Dividing these charges into a power component and an energy component benefits customers who reduce their power requirements, e.g. through additional insulation. The need for heat is then reduced even during the coldest winter days, and oil can be used for peak loads.
- We recommend different types of energy optimisation adapted to the customer's situation. We have skills, expertise and experience to offer, such as service and heat exchanger replacement, to help customers achieve a high degree of efficiency in their heating system.

Air emissions from facilities in Uppsala

Climate-impacting CO₂

In 2019, fossil carbon dioxide emissions, including peat, were reduced because peat consumption fell considerably in comparison with 2018. However, the proportion of fossil fuels in the waste increased in comparison with the previous year, which is why the light blue graph rises. This is because, among other things, the amount of plastic in the waste has risen.

Fossil CO₂ Heat Uppsala

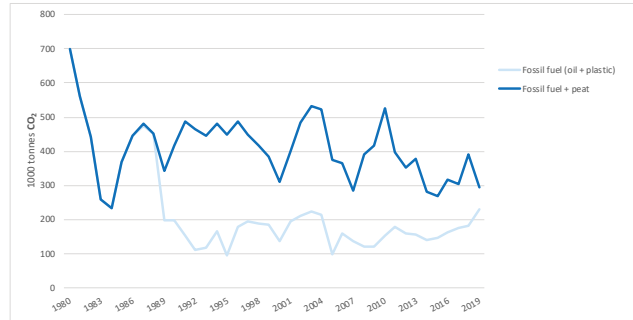


Image 3: Emissions of fossil carbon dioxide (CO₂) associated with the Uppsala plants between 1980 and today.

Acidifying substances

Sulphur dioxide reduced greatly, as peat has been replaced by fuel with a lower sulphur content. Nitrogen oxides increased slightly, mainly because our reserve oil boilers were used more during the conversion from peat to biofuels.

The total nitrogen oxide emissions of 234 tonnes correspond to 131 mg NO_x per generated kWh.

Emissions of acidifying substances

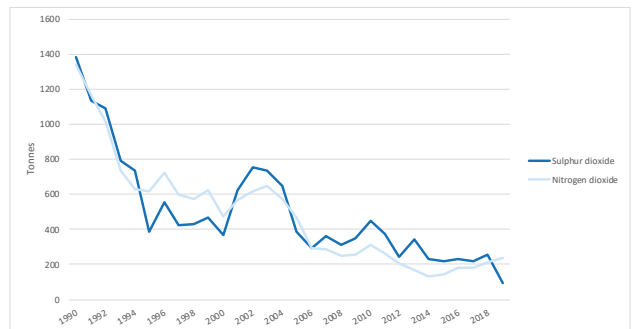


Image 4: Emissions of acidifying substances associated with the Uppsala plants between 1980 and today.

Dust

Dust emissions increased in 2019, because the reserve plants had to support waste incineration during the transition from peat/fossil oil to pellets/ bio oil in HVC, H3 and H4.

Dust emissions

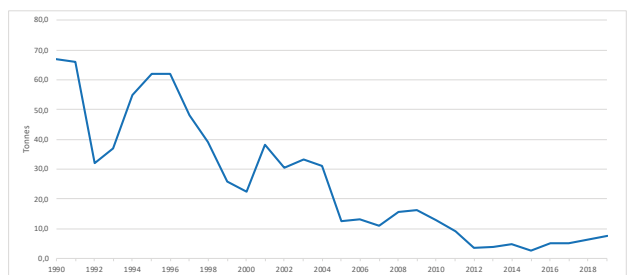


Image 5: Dust emissions associated with the Uppsala plants between 1980 and today.

Key indicators for generation in Uppsala, Knivsta and Storvreta

Uppsala - District heating

[kg/MWh = g/kWh]

	2019	2018	2017	2016	2015
CO ₂ in accordance with ETS	191	245	204	209	182
CO ₂ -equiv in accordance with VMK	181	225	194	182	159
NO _x	0.15	0.13	0.11	0.11	0.09
SO ₂	0.06	0.16	0.16	0.16	0.15

Uppsala - District cooling

[kg/MWh = g/kWh]

	2019	2018	2017	2016	2015
CO ₂ in accordance with ETS	189	116	105	110	56
CO ₂ -equiv in accordance with VMK	-	-	-	-	-
NO _x	0.15	0.1	0.08	0.09	0.04
SO ₂	0.01	0.01	0.01	0.004	0.002

The emissions reported do not include the district heating and district cooling volumes produced from waste that is covered by customer-specific agreements (Carbon Neutral Heating and Cooling, respectively).

Knivsta

[kg/MWh = g/kWh]

	2019	2018	2017	2016	2015
CO ₂ from oil	21	14.5	4	3	5
CO ₂ -equiv in accordance with VMK	26	20	10	16	19
NO _x	0.43	0.44	0.39	0.36	0.36
SO ₂	0.18	0.11	0.15	0.18	0.18

Storvreta

[kg/MWh = g/kWh]

	2019	2018	2017	2016	2015
CO ₂	0	4	0.26	0.13	0.04
CO ₂ -equiv in accordance with VMK	36	11	6	9	9
NO _x	0.47	0.46	0.38	0.38	0.36
SO ₂	0.00005	0.003	0.003	0.003	0.003

Efficiency

	2019	2018
Uppsala generation	92 %	93 %
Uppsala distribution	86 %	88 %
Knivsta generation	80 %	82 %
Knivsta distribution	82 %	82 %
Storvreta generation	77 %	81 %
Storvreta distribution	75 %	78 %

Uppsala plant - annually from 1980

Uppsala’s heat requirements control production

There is a big difference between Uppsala’s heat requirements during summer and winter and we adapt our production accordingly. The waste incineration plant provides Uppsala with heating and cooling throughout the year, but during the winter other furnaces are needed to support generation.

Fuel mix

During 2019 only approx. 480 tonnes of peat were consumed, compared with approx. 33,300 tonnes in 2018; this is a reduction of 98.6% compared with the previous year. The peat component was replaced primarily by bio oil and wood pellets. The last peat was fired from January to March, and then phased out completely as a component of the fuel mix in the Uppsala plants.

Fuel supply, heat and electricity generation in Uppsala

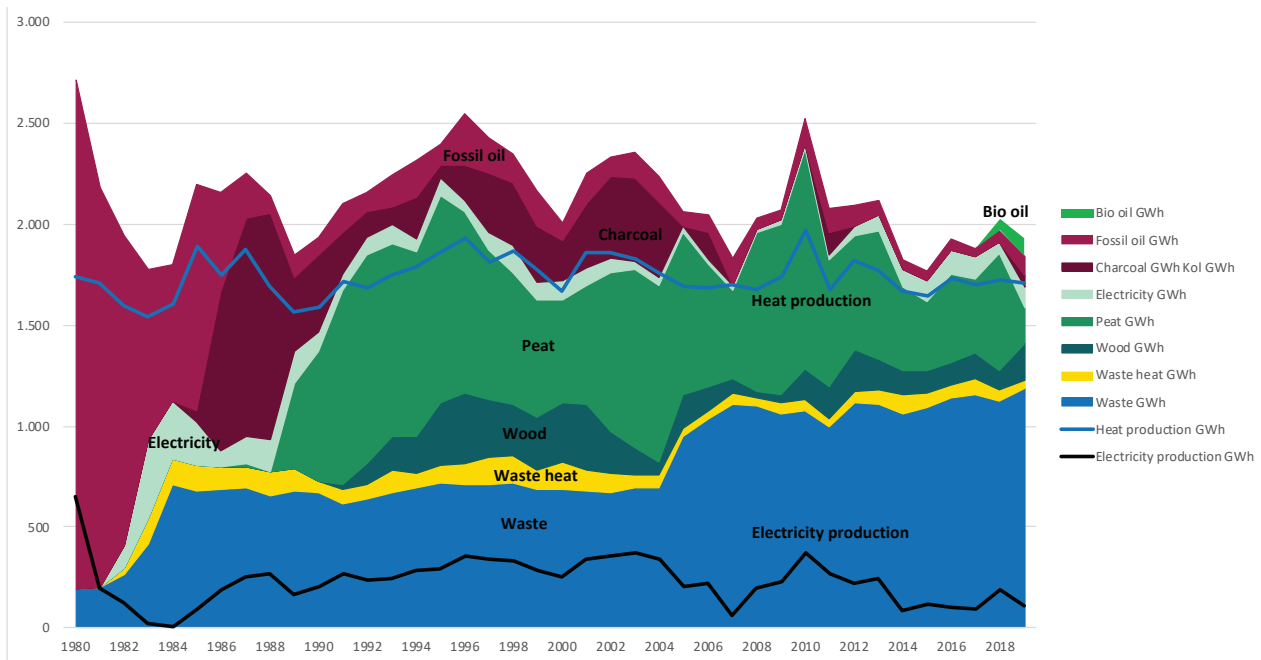


Figure 6: Uppsala’s fuel mix and electricity and heat generation from 1980 to 2019.

To find out more

- The municipal industry association Swedish Waste Management has information about waste disposal. www.avfallsverige.se
- Energiföretagen Sverige is an industry organisation that brings together close to 400 companies that generate, distribute, sell and store energy. www.energiforetagen.se
- The Swedish Peat Association industry association is a collaborative organisation for peat producers and users for e.g. energy purposes. www.svensktorv.se
- The Swedish Energy Authority has statistics on energy use in Sweden and information about energy and energy efficiency. www.energimyndigheten.se
- The Uppsala municipality energy and climate advisers offer advice and support for using energy efficiently. It is a municipal service financed by the Swedish Energy Authority. www.ekrul.se
- The Uppsala Climate Protocol is a collaboration between 40 local players and their 38,000 employees for contributing to the achievement of the municipality's environmental and climate targets and a sustainable Uppsala. <https://klimatprotokollet.uppsala.se/>
- Sveriges miljömål brings together eight of Sweden's environmental target agencies and county administrations to provide inspiration and tools to companies and municipalities wishing to work in a more structured manner to reach Sweden's environmental targets. www.sverigesmiljomal.se

Read more about Climate Neutral Heating and Cooling here:

www.vattenfall.se/foretag/fjarrvarme/tjanster-och-service/klimatneutral-varme-och-kyla/

For more information about Vattenfall, visit our website: www.vattenfall.se

