



Safety, Health and Environment

Vattenfall Heat Uppsala

Activity Report 2010



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What are the main benefits of district heating, in your opinion?

"It's easy and takes very little space in the house."

Birgitta Blom,
heating customer in Uppsala

Our district heating customers contribute to locally-generated electricity

2010 will go on record as a cold year. For us at the heating plant in Uppsala, that means a year of high heat production, but also exceptionally high electricity generation, where our new waste-fired electrical turbine has made a valuable contribution.

Our installations have worked well, generally speaking, in particular our peat-fired combined heat and power plant, where each kilowatt hour of heat provides the basis for highly efficient local electricity generation. A high level of peat use, however, increases our CO₂ emissions.

To limit these emissions, we have increased the wood content in the peat, which has resulted in emissions 34,000 tonnes lower than they otherwise would have been. The increase in wood content is part of our strategy to limit the climate impact of our production until we have a new biomass-fuelled plant in place. Low CO₂ emissions are important for us and our customers and so, together with some of our larger commercial customers, we have come up with a new customer offer this year: CO₂-neutral district heating. This district heating is produced from waste, where the proportion



of plastic is compensated for by greater wood content in the peat.

In this way, the customer's choice leads to an even higher share of biomass fuel in our total fuel mix from 2011 onwards.

Dialogue is important

Greater dialogue, not just with our customers but also

with the city of Uppsala at large, is important to us. That is why we are participating in Uppsala Climate Protocol, which is Uppsala Municipality's network with the city's major players. The network cooperates in reducing climate impact, drawing on the participants' know-how and experience. The collaboration also involves commitments to concrete measures for helping to achieve the municipality's goal of a 30 per cent reduction in greenhouse gases by the year 2020.

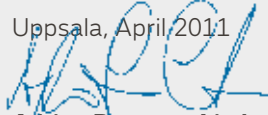
Higher production, as in 2010, not only means that the plants operate at a higher capacity than normal, but also that more demands are made on our staff. Fortunately, we have not had any really serious work-related accidents involving either our own personnel or that of our subcontractors for several years. The level of absence due to illness is also very low. One explanation for this is that we are working systematically with both occupational health and safety and environmental issues, and we are striving to make constant improvements.

Energy use in focus

We are now extending our work for safety, health and the environment to include an energy management system. Through systematic reviews of our own energy consumption, we can make our current operations even more efficient, which benefits both the environment and our customers.

Looking to the future, the most important issue for 2011 is a strategic decision to build a new biomass-fuelled plant that can be commissioned before 2020. This would be the single most effective measure for achieving climate-neutral district heating in Uppsala. We have now gathered so much information that a decision is near.

Uppsala, April, 2011



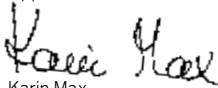
Adrian Berg von Linde

Plant Manager, Heat Uppsala

Environmental Inspector

Bureau Veritas Certification AB is one of the environmental inspectors accredited by SWEDAC (Swedish Board for Accreditation and Conformity Assessment) (accreditation number 1236) in accordance with EMAS (Eco Management and Audit Scheme). Bureau Veritas has inspected Vattenfall Heat Uppsala and found that the company has an environmental management system that conforms to the requirements of the EMAS Ordinance (No. 761/2001). Bureau Veritas has also examined the environmental sections in the report and has found them to be correct and sufficiently detailed to meet the EMAS requirements. EMAS registration number SE-000224.

Uppsala, 06/04/2011



Karin Max
EMAS Inspector
Bureau Veritas Certification Sverige AB



Management system for safety, health and environment

For a number of years, we have pursued our environmental work in accordance with the EU environmental management system EMAS and the international standard ISO 14001. This means that we focus not only on emissions, but also on the level of resources we use, the risk of environmental accidents and much more. This comprehensive thinking has also led to our including safety and health in the management system and certified activities, in accordance with AFS 2001:1 Systematic Work Environment Management. The illustration to the right shows our management system. It includes all the items being planned, managed and followed up in our daily activities. The management system is constantly being developed to improve our work on reducing environmental impact and improving safety and the work environment.



Our products

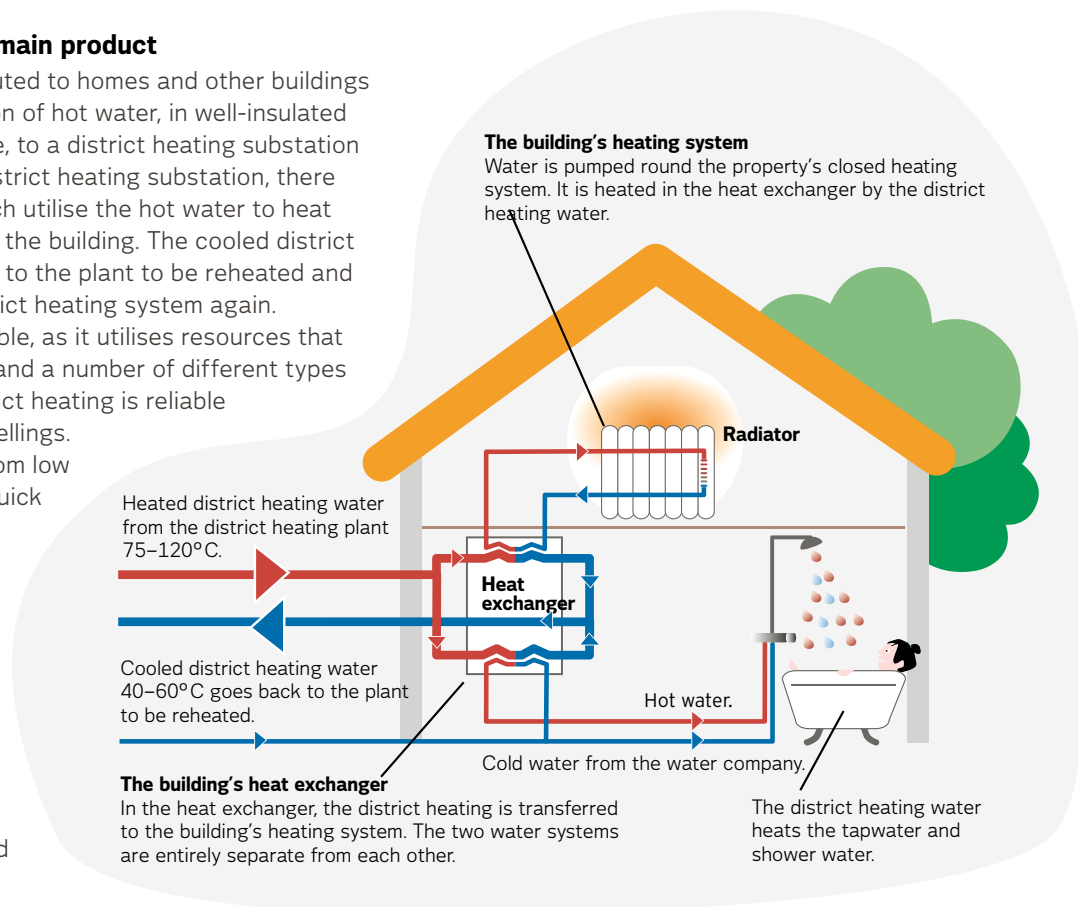
District heating is our main product

District heating is distributed to homes and other buildings through the transportation of hot water, in well-insulated pipes under high pressure, to a district heating substation in each building. In the district heating substation, there are heat exchangers which utilise the hot water to heat radiators and tapwater in the building. The cooled district heating water is fed back to the plant to be reheated and pumped out into the district heating system again.

District heating is flexible, as it utilises resources that would otherwise be lost, and a number of different types of fuel can be used. District heating is reliable and frees up space in dwellings. The customer benefits from low maintenance costs and quick assistance.

How heat reaches you

By using only a small number of furnaces with effective purification, we can make emissions to air, land and water considerably less than they would be if each property was heated by its own boiler.



District cooling

District cooling is based on the same principle as district heating, but with cold water instead of hot, and replaces a large number of local cooling units. There are many environmental benefits. Above all, there is a reduction in electricity consumption and leakage of refrigerant to the atmosphere. In addition, there is no noise from local units. In the summer, we have spare waste incineration capacity, as there is a decrease in Uppsala's heating needs. So we can use the existing installation to produce district cooling. For customers without access to our district cooling network, we can offer local solutions. Cooling can be produced, for instance, by means of district heating in a so-called absorption refrigerator.

Steam

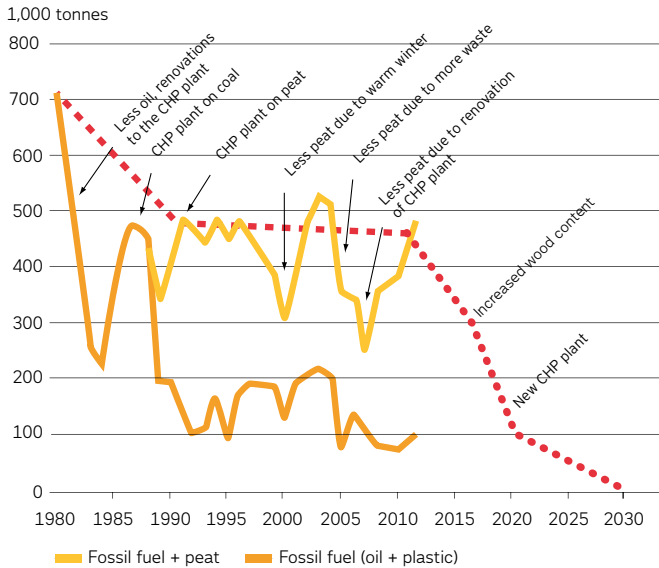
In Uppsala we also have a separate network for supplying steam to industry and to the Akademiska Sjukhuset hospital. The steam is used, for instance, in drying grain, inducing chemical reactions and sterilising medical instruments.

Electricity

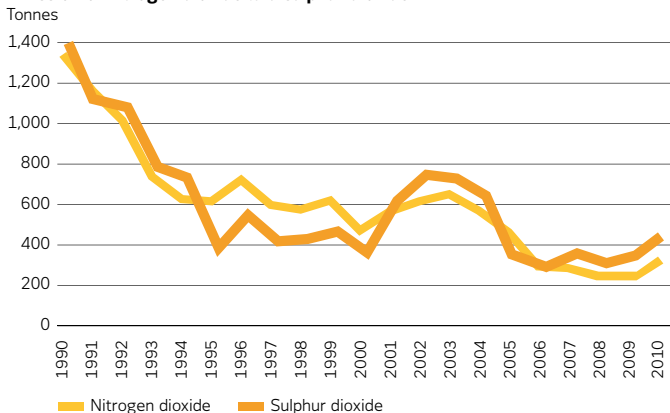
In Uppsala we produce both heating and electricity simultaneously and efficiently, which is an example of good use of resources. The electricity we produce is not sold directly to the end-user, but is part of Vattenfall's total electricity production.

Air emissions

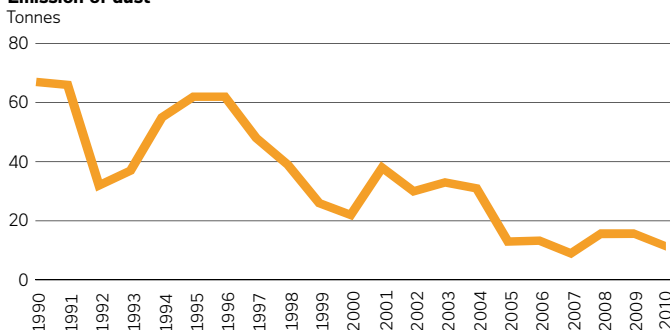
Emission of carbon dioxide



Emission of nitrogen dioxide and sulphur dioxide



Emission of dust



Climate-impacting carbon dioxide

The winter of 2010 was unusually cold; in fact, it was 18 per cent colder than in 2009. Demand for district heating rose by 14 per cent, which resulted in an increased requirement for peat. Another result was an increase in carbon dioxide emissions. Carbon dioxide emissions from district heating (see our key figures on page 7), however, rose by only 7 per cent, thanks to increased wood content in the peat mixture. Without this increase in wood content, carbon dioxide emissions would have been 34,000 tonnes higher than they actually were in 2010.

In 2007, extensive refurbishment of our peat-fuelled heat and power plant was carried out, which resulted in lower production and peat consumption that year. The dotted line in the diagram shows our long-term plan for achieving climate-neutral production by 2030. The measures consist primarily of increased wood content until a new plant based on renewable fuels is commissioned before 2020.

Acidifying emissions

Nitrogen dioxides and sulphur dioxide account for the greatest part of our acidifying emissions. Increased production during the cold year 2010 also had an effect on acidifying emissions. There are goals for further reduction of sulphur dioxide (see page 20).

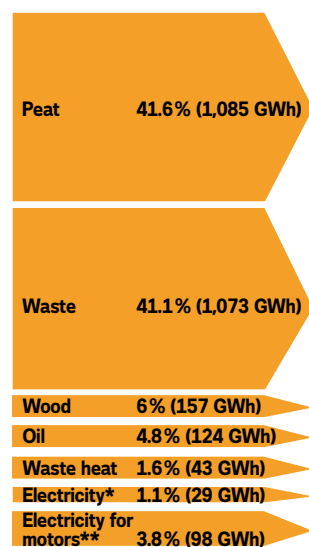
Dust

Dust emissions fell from 16 tonnes in 2009 to 13 tonnes in 2010, despite the increased production volume. This was due to reduced dust emissions from the combined heat and power plant following refurbishment during the summer of 2009, for example replacement of bag filters. The reduction from 2005 onwards was due to reduced use of peat fuel and increased waste incineration. Waste incineration has the most extensive flue-gas cleaning of all our production facilities. Waste contains more heavy metals than any other type of fuel, so good performance is important for this flue-gas cleaning. The facility meets current environmental demands (see page 18).

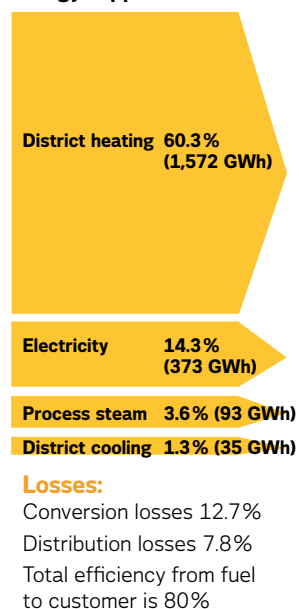
Operations in Uppsala



Fuel:



Energy supplied:



Key figures¹ for supplied district heating, in kg/MWh = g/kWh

	2010	2009	2008	2007
CO ₂ total from the fuel mix	220	207	215	166
of which from:				
- oil	18	8	10	26
- coal	0	0	0	0
- peat (including fossil or bio)	167	156	160	95
- percentage of plastic in waste ²	35	43	45	45
NO _x	0.15	0.15	0.15	0.19
SO ₂	0.20	0.20	0.19	0.22

In 2010, emissions from fossil carbon dioxide rose owing to the cold weather. For further commentary, see the graph on page 6.

¹ For revised key figures, waste-produced district heating volumes that are covered by customer-specific agreements have been deducted.

² See comments on waste in the energy balance to the left.

allowance. We pay for all carbon dioxide emissions from combustion of oil, coal and peat. The price is controlled by the market and since the economic downturn has been around SEK 150–200 per tonne of CO₂. The market price of CO₂ is affected only by those operators who pay for their emission allowances.

Joint industry reporting of CO₂

In 2011 Svensk Fjärrvärme will report on the CO₂ emissions of all district heating networks in Sweden in a uniform manner. Emissions will be divided between district heating production and electricity generation, using the 'alternative production' method. In brief, this means that more emissions are allocated to the against electricity as compared to the heat produced at the same time, since alternative methods for electricity generation would require more fuel.

The biggest change in the fuel mix is the increased wood content, from 2 % in 2009 to 6% in 2010. The proportion of renewables in the fuel mix is 83% if peat is counted as biomass fuel; otherwise it is 42%. Waste is considered 80% renewable in terms of energy (the remaining 20% is assumed to be plastic).

* Electricity for heat pumps and electrical furnace

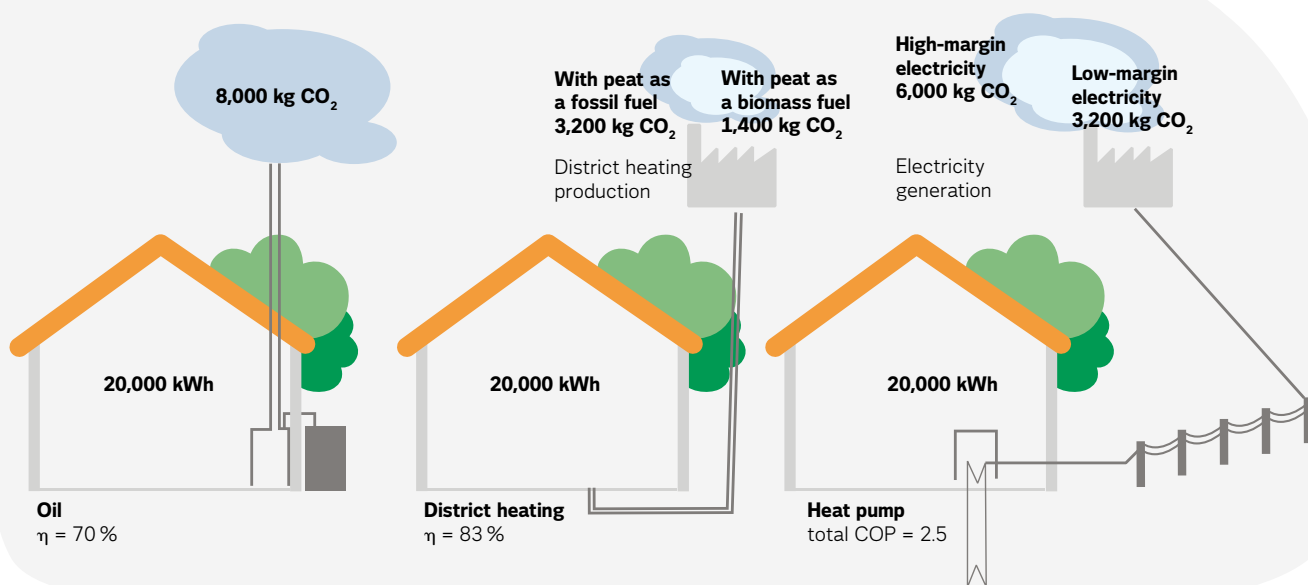
** Note that the energy balance is more comprehensive than in previous years, as it now also includes the company's own electricity consumption (indirect electricity) in the form of electricity for operating pumps and fans, etc.

No free emission allowances

Our facilities fall under the scope of the EU's emission trading system. The energy sector in Sweden has had to pay for all its emission allowances since 2008, unlike the steel industry, for example, which has a free

District heating performs well compared with other heating alternatives

Heating produces fossil CO₂ emissions, either directly or indirectly. The graph shows in a simplified form the emissions from different types of heating.



A good general rule is not to use electricity, a high-value form of energy, for heating if district heating is available.

Data for electricity is based on 'Environmental assessment of electricity use' (www.elforsk.se), where "high-margin electricity" is defined as 750 g/kWh and "low-margin electricity" as 400 g/kWh. Depending on how the notion of CO₂ impact from electricity is viewed, estimates of CO₂ emissions can vary considerably – for example, whether the electricity system is considered to be European or Nordic. Compared to the above graph, the European electricity mix, with 415 g/kWh, produces 3,300 kg of CO₂ and the Nordic mix (unspecified), with 227 g/kWh, produces 1,800 kg of CO₂.

In all types of heating, fossil CO₂ is released in fuel extraction, and in some cases in processing and transportation.

By way of comparison, a petrol-fuelled vehicle¹ driven 1,500 miles per year emits approximately 2,860 kg of CO₂ and a round-trip plane flight from Stockholm to Thailand for a family of four puts 12,000 kg of CO₂ into the atmosphere.

¹ An average car uses 0.079 litre of petrol per km, which generates 191 g of CO₂ per km, according to www.trafikverket.se

² The trip takes 10 hours one way, CO₂ according to www.klimatkontot.se

We also offer CO₂-neutral heat

Our customers have asked for district heating with even less environmental impact than we have produced so far. So we are offering larger customers a new solution with CO₂-compensated district heating from our waste incineration plant in Uppsala. It provides district heating that is CO₂-neutral, since we compensate for the proportion of the waste that is not renewable, i.e. the plastic in the waste. We do this by increasing the amount of biomass fuel in our total fuel mix beyond the amount already planned*. As part of our basic planning, we increase the portion of biomass fuel each year, and sales of CO₂-Neutral Heat mean that the proportion of biomass fuel is increasing further. By choosing CO₂-Neutral Heat, customers can join us in reducing CO₂ emissions even faster in Uppsala than planned (see page 19).

* The compensation is limited to the direct CO₂ emissions in our district heating production.

Facilities in Uppsala

Distribution network District heating and district cooling are distributed to the heating and cooling systems of properties in the form of hot and cold water circulating in closed pipe systems. Our district heating network is 460 km long, and the district cooling network is 14 km long. We also have a 7 km network for steam.

Waste-to-energy

Products: District heating, electricity, steam and district cooling.

Capacity and fuel: Total of 170 MW heat + 10 MW electricity + 11 MW cooling, with 55 tonnes of waste per hour.

Flue-gas cleaning: Nitrogen oxides – urea and ammonia injection and catalytic converters.
Dust – electro-filters and fabric filters.
Sulphur and hydrochloric acid cleaning – flue gas scrubber/condensation with energy recovery and fabric filter with limestone additive.
Organic substances – fabric filters with active charcoal.
Purification of flue gas condensate through limestone additive and complexing agent for heavy metals, then precipitation stage plus sand and charcoal filters.

Combined heat and power plant

Products: District heating and electricity

Capacity and fuel: 235 MW heating and 120 MW electricity with 80 tonnes of peat/wood briquettes per hour.
Oil and coal are used as back-up fuels.

Flue-gas cleaning: Sulphur – limestone additive in furnace and wet stage, (MDI), before fabric filter.
Nitrogen oxides - urea and ammonia injection and catalytic converters.
Dust – electro-filters and fabric filters.

Boland unit

Products: District heating and electricity.

Capacity and fuel: Peat-fuelled hot-water furnace (HVC) 100 MW, electric furnace 10 and 50 MW (steam back-up), oil furnaces 4 x 75 MW (back-up).

Flue-gas cleaning HVC: Sulphur – limestone additive in furnace.
Nitrogen oxides – urea injection.
Dust – electro-filters and fabric filters.

Gas turbine Backup for electricity production.

Product: Electricity for start-up of district heating power plant in case of electrical power cut.

Capacity and fuel: 16 MW electricity, light oil.

Flue-gas cleaning: Additive in the oil results in less particle formation through more complete combustion.

Husbyborg unit Peak load and production back-up.

Product: District heating.

Capacity and fuel: Oil-fuelled hot-water furnaces 3 x 50 MW.

Stallängen plant Heat pump facility located at Uppsala's sewage works.

Product: District heating and district cooling.

Capacity: 3 x 15 MW heating and 3 x 8 MW cooling from electricity and waste heat.

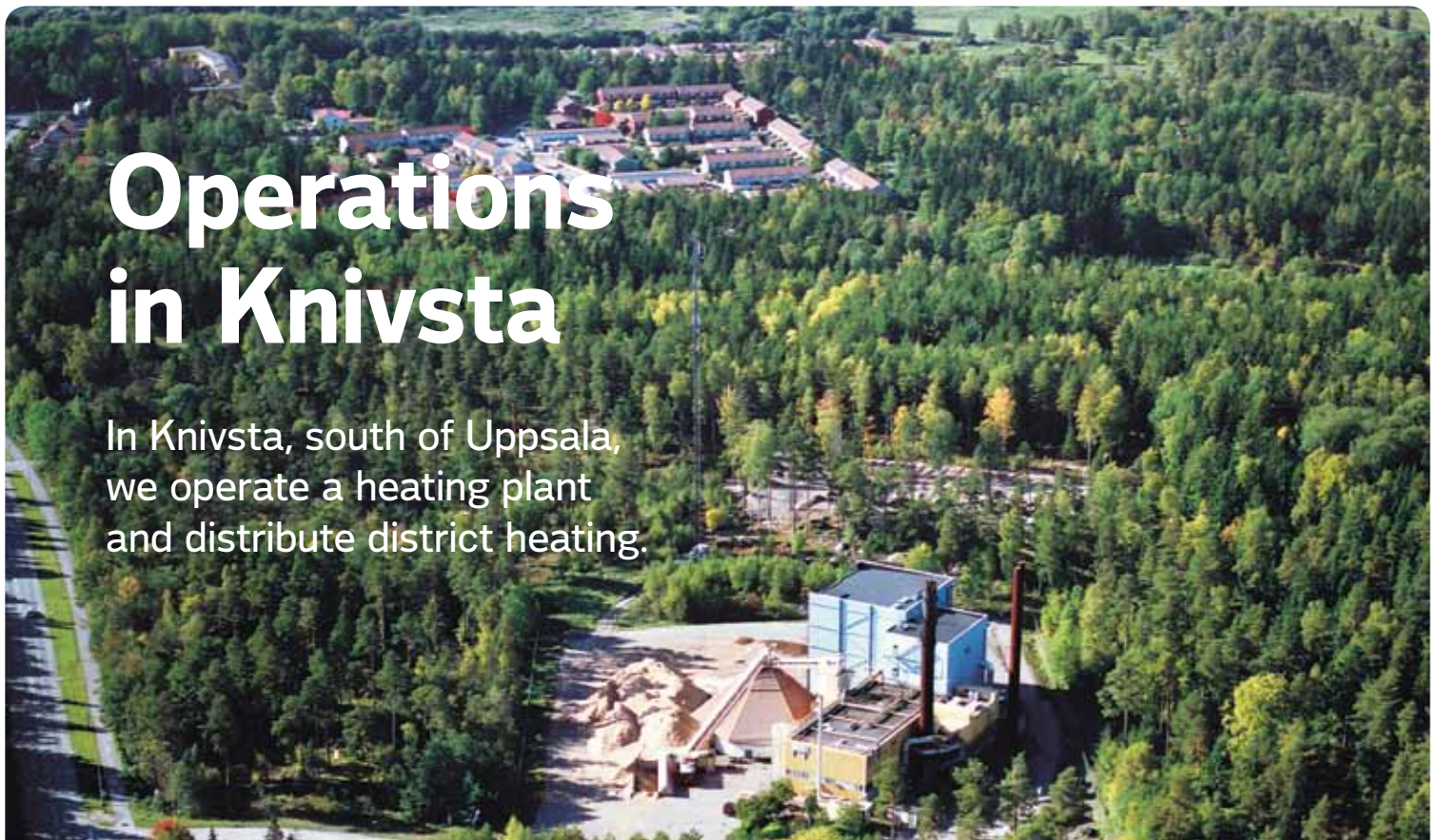
Cooling installation in Ultuna Located at Ultuna Campus.

Product: District cooling.

Capacity: District heat-driven absorption refrigeration 1.5 MW, cooling tower 1 MW, compression refrigerating machines 1.3 MW.

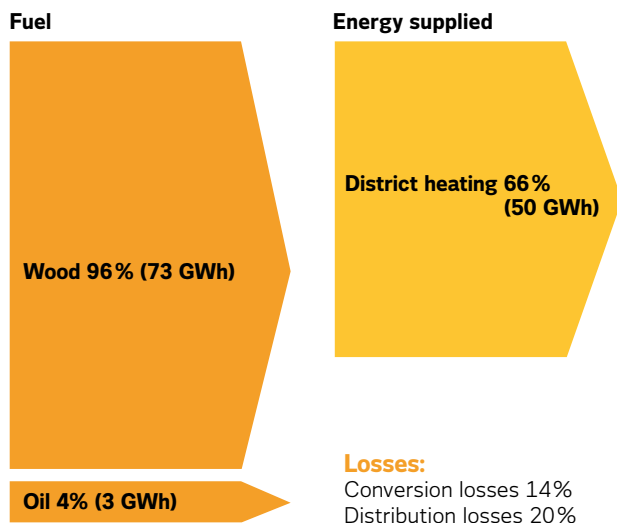
Operations in Knivsta

In Knivsta, south of Uppsala, we operate a heating plant and distribute district heating.



The heating plant has two biomass-fuelled furnaces of 8 and 15 MW respectively, and oil furnaces for back-up and peak load. The fuel used is wood chips, bark and forest slash (branches and treetops) from the forestry industry, including several local suppliers.

As much as 96 per cent of the fuel for the facilities is biomass fuel, which means that the district heating in Knivsta is practically climate-neutral. Knivsta has had district heating since 1976, and we have about 700 customers here.



Heat loss arises during both production and distribution. A study conducted in 2008 shows that distribution losses are reasonable for the type of distribution network found at Knivsta, where the majority of customers are detached home owners. Longer distribution lines have lower losses in relation to the total amount of energy delivered.

Key figures for delivered district heating, kg/MWh = g/kWh

	2010	2009	2008
CO ₂ from oil	16	17	18
NO _x	0.41	0.42	0.46
SO ₂	0.08	0.09	0.06

The plant in Knivsta

Solid fuel furnaces

Products:	District heating
Capacity and fuel:	8 + 15 MW wood chips, forest slash and bark
Flue-gas cleaning:	Dust – electro-filters

Oil furnaces

Products:	peak load and production back-up
Capacity and fuel:	District heating 15 MW light oil.

Operations in Storvreta

In Storvreta, outside Uppsala, we operate a heating plant and distribute district heating.



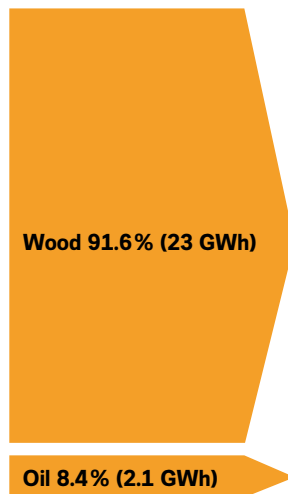
The heating plant has two 2 MW furnaces fuelled with biomass fuel and an oil furnace in Ärentuna school for back-up and peak load. The fuel used is more than 90 per cent wood pellets, with light oil for back-up and peak load. A large water-filled underground rock cavity is used for heat storage and can deliver 8 MW.

Key figures for delivered district heating, kg/MWh = g/kWh

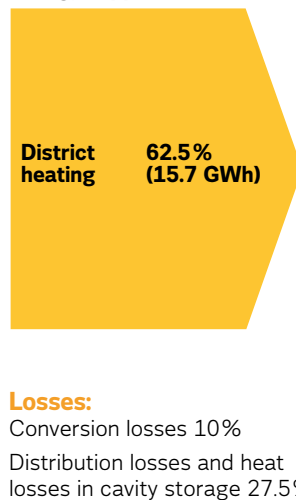
	2010	2009	2008
CO ₂ from oil	35	6,3	1,6
NO _x	0.7	0.7	0.6
SO ₂	0.01	0.002	0.0005

CO₂ emissions rose in 2010 due to the cold weather, which required oil-firing on the coldest days.

Fuel



Energy supplied



Heat loss occurs during production, heat storage in the rock cavity and in distribution, primarily through storage of hot water in the cavity.

Facilities in Storvreta

Solid fuel furnaces

Products: District heating
Capacity and fuel: 2x2 MW wood chips
Flue-gas cleaning: Dust – cyclones

Rock cavity

Large cavity for storage of hot water
Capacity: 2x4 MW storage volume
100,000 m³ (can store 5 GWh heat)

Ärentuna school

peak load and production back-up
Product: District heating
Capacity and fuel: 5 MW light oil

Modified fuel mix

Fuel supply

Our mixture of fuels has changed over the years. In the early 1980s, we were entirely dependent on oil. Since then, oil has actively been replaced, mainly by waste and peat (see diagram of Uppsala's district heating network).

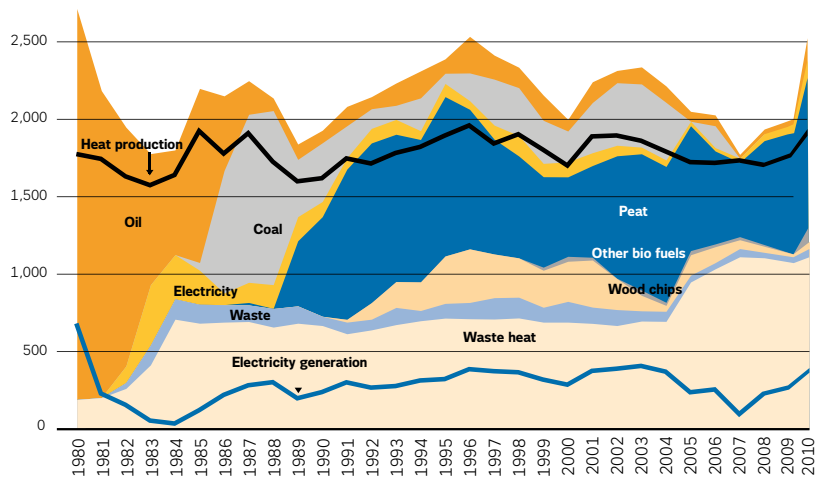
Uppsala's heating needs determine production

There is a big difference in Uppsala's heating needs in summer and winter, and we adapt our production accordingly. The graph shows the use of different installations in a normal year. Waste incineration heats Uppsala throughout the year, but in the winter the combined heat and power plant is also needed.

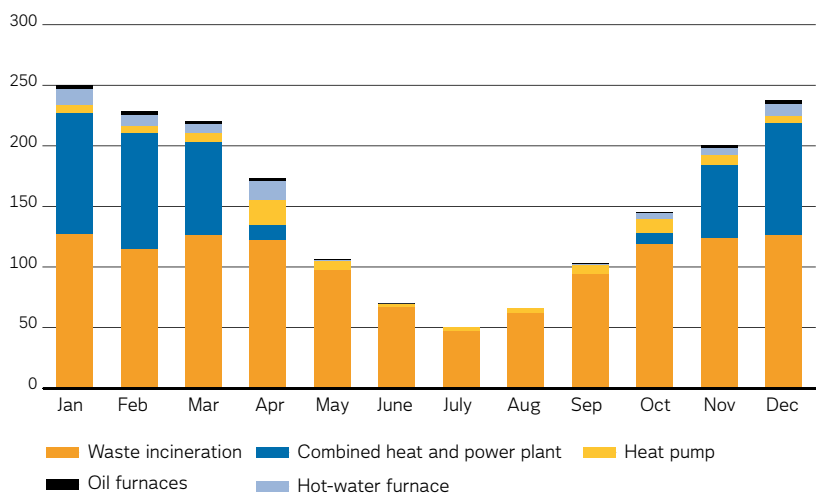
Storvreta and Knivsta

District heating in Storvreta and Knivsta is produced with as high a proportion of wood fuel as possible, normally around 95 per cent. Oil accounts for the remainder.

Fuel supply and heat and electricity production in Uppsala
GWh



Production in Uppsala
GWh/month



Fuel and ash



New turbine which also produces electricity from waste incineration.

Fuel in Uppsala

The waste is composed of 50% household waste and 50% industrial waste, primarily from the Uppland, Södermanland and Västmanland regions. Smaller amounts come from Norway and Åland.

The peat comes in the form of briquettes from Härjedalen, Västra Götaland and Belarus. The peat fuel is mixed with wood pellets and wood briquettes. Coal and oil act as back-up fuels in case of delivery problems with the normal fuel or inadequate capacity in the ordinary installations. Oil may also be needed for peak load during the very coldest winter days.

More than one kind of ash

Ash from waste incineration

Waste incineration produces two different types of ash, as well as water purification sludge. The first type of ash is bottom ash from the furnaces, also called slag. The metals in the slag are recovered and sent for recycling. The remaining ash is sorted into two different sizes. The fine fraction is used as a sealant and the coarse fraction as drainage blanketing of deposits.

The other type of ash is flue ash from the flue-gas cleaning. This ash contains material separated from the flue gases and is not suitable for roads, etc. Instead, it is handled at a dust tip for hazardous waste or treated at Langöya in Norway, where it is used to neutralise other hazardous waste, such as acids, which constitutes a kind of recycling.

The flue gases are also purified in wet cleaning stages. The water from these cleaning stages is treated in a water purification process which includes the addition of an organic sulphide, which binds heavy metals.

The impurities are precipitated as sludge, which is sent to a deposit for hazardous waste. This means that the heavy metals that make their way into the installation via waste are removed from circulation in society.

In order for the quantity of heavy metals in waste to be reduced, products must be manufactured without them, or those who use items such as batteries and energy-saving light bulbs must recycle them carefully, so that they are not disposed of with combustible waste.

Ash from peat

From peat, we get ash that is suitable for building roads and other surfaces. We have forest roads in Uppsala and a running path in Storvreta where peat ash was used as a construction material. The approach ramp at Librobäck's recycling station is also built with peat ash. The reason why peat ash can be used in this way is partly because limestone is added during the combustion in order to bind sulphur. The limestone content in the ash makes it hard but light.

As from 2011, about 40,000 tonnes of flue ash will be used as a replacement for cement. For each kilogram of cement saved, CO₂ emissions are reduced by one kilogram.

Ash from wood

From our wood-fuelled district heating facility in Knivsta we get wood ash which is mixed with peat ash and recycled together with it.

We have not yet found a suitable way of recycling the wood ash from our facility in Storvreta, which is also fuelled with wood, so work is continuing on this. For the time being, the ash is sent to landfill.

District heating in Sweden

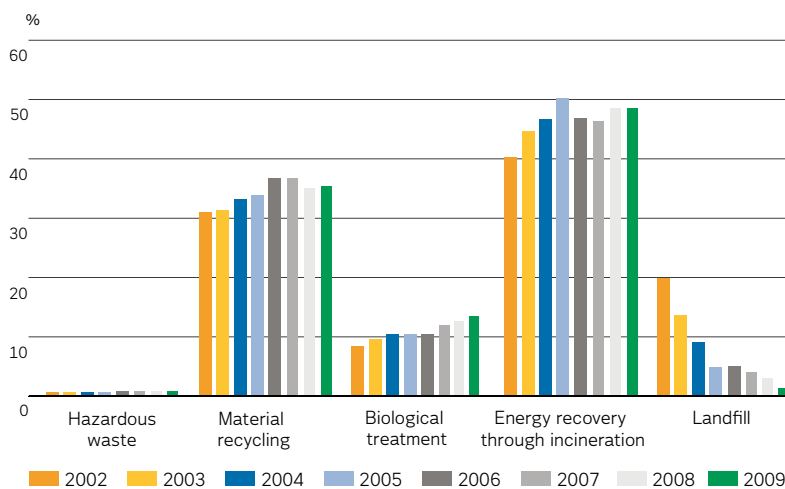
Half of all Swedes, nearly four million people, get their heating from district heating – at home, work and school.

District heating is supplied to 270 of Sweden's 290 municipalities and accounts for half of all heating of dwellings and other buildings, about 50 TWh per year. District heating is the main reason why Sweden has succeeded in reducing its emissions of greenhouse gases. District heating has doubled in Sweden since 1982, and in the same period, oil in the district heating system has been replaced by wood, peat and waste. Uppsala's modified fuel consumption is shown on page 12.

For more information about district heating: www.svenskfjarrvarme.se

Waste as fuel

Household waste in Sweden 2002–2009*



* www.avfallsverige.se

The graph shows how the treatment of household waste has developed in recent years. The total volume of household waste is 4.5 million tonnes, or 480 kg, per person per year. Increased recycling, biological treatment and waste incineration with energy recovery made it possible to reduce the proportion of waste sent to landfill (refuse tips) from 20 per cent in 2002 to a record low of 1.4 per cent in 2009.

Peat as fuel

A quarter of Sweden's surface area consists of peat (bogs and marshes). Peat is used both for soil improvement and as a fuel. The annual harvest is less than 25 per cent of annual growth in Sweden. Between 0.1 and 0.2 per cent of the peatlands are used.

The Intergovernmental Panel on Climate Change (IPCC) places peat in a category of its own: neither fossil, like oil or coal, nor biomass, like wood. Peat is still part of the European system for carbon dioxide trade, but in Sweden it is approved for a green electricity certificate, and is not subject to CO₂ tax. Until a common position is adopted as to peat's possible climate impact, we will report CO₂ emissions both with and without contributions from peat (see page 8).

For more information about peat: www.torvproducenterna.se

Working towards improved health and safety

Working at Vattenfall should allow for development – both as an individual and as an employee in a safe, healthy and motivating environment.

Our goal is to become a leading company in work environment and safety and we therefore have an ongoing improvement process to ensure sustainable high quality in these areas. Read our entire work environment policy at www.vattenfall.se

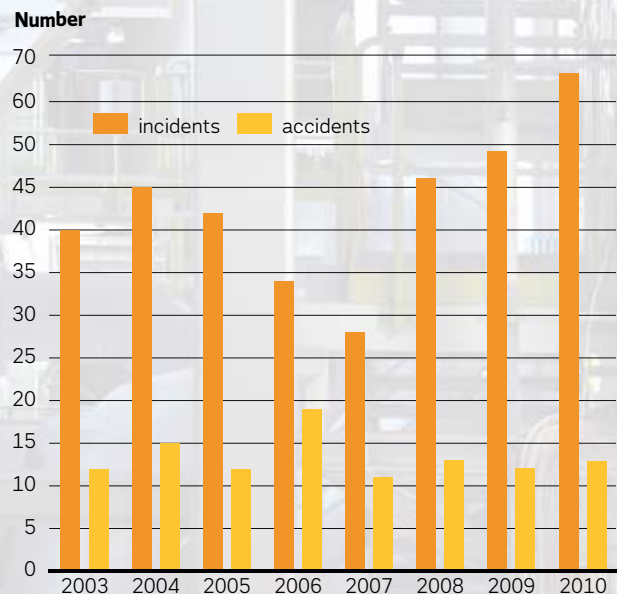
We strive to reduce the risks of working at heights, working with mobile machine parts, electricity and steam, and to prevent fire and explosions.

Because part of our operations take place in an environment with heavy traffic, we also work actively to reduce risks, for example through road closures and high-visibility clothing. There were no serious accidents (death or serious injury) in 2010. Accidents reported involved primarily crush and impact injuries. There were also a few accidents to contractors in the form of scalding by hot water in connection with work on our distribution network. The statistics include accidents which did and did not result in absence among employees and among contractors who worked over the course of the year at our facilities and on our distribution operations. The means we use to identify

risks and be able to adopt preventive measures include incident reporting.

In addition to incident reports we have other useful tools for identifying risks, such as risk assessments, plant inspections and internal audits. This work is an ongoing process.

Number of reported accidents/injuries and near-incidents in Uppsala



Our active work contributes to high levels of incident reporting, while accidents are few and relatively minor.

Working to reduce our environmental impact

To reduce our environmental impact, we are working on what we have identified as our significant environmental aspects.¹ Environmental impact is indicated below in the form of core indicators, both as total consumption and as consumption per kWh supplied.

Energy efficiency

Our total energy turnover can be seen on pages 7, 10 and 11, which show the degree of efficiency from fuel for delivery to the customer.

- **Internal electricity consumption**
For Uppsala we use about 98GWh of electricity (47 kWh/ MWh) per year for pumps, fans and other equipment, which is less than in 2009, when 53 kWh/MWh was used. For Knivsta 1.8 GWh of electricity (36 kWh/MWh) was used, a reduction from 2009's figure of 40 kWh/MWh. For Storvreta 65GWh of electricity (4 kWh/MWh) was used, an increase from 2.6 kWh/MWh. Measures to reduce internal electricity consumption are being taken, including energy mapping to identify additional opportunities for improving energy efficiency (see our safety, health and environment goals).
- **Heat loss in the distribution network**
Water leakage from our district heating network causes heat loss through leakage of hot water, but especially through deterioration in the insulation capacity of the resulting wet insulation around the district heating pipes. Humidity also causes greater corrosion. Work is ongoing to reduce such leakage. Distribution losses are at the same level as

last year. For Uppsala, this is shown on page 7; for Knivsta, on page 10, and for Storvreta, on page 11.

- **The customer's energy consumption also impacts the environment**
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:
 - Energy statistics for all our customers, allowing them to track trends and changes.
 - Flow charges benefit larger customers if their district heating units are more efficient than the norm.
 - 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.

Resource efficiency

Our fuel consumption has refuse as a basis, which is a waste resource and thereby resource-efficient. All our fuel consumption is shown on Page 12.

- **Use of finite resources – coal and oil**
Coal is now only used as a back-up fuel, and oil for very cold weather and in case of interruptions in production. With increased waste incineration, our oil-fuelled back-up installations are used less often. The proportion of oil in our fuel mix is less than 5 per cent.

Water

For Uppsala we used 450,000 m³ of water in 2010 (217 litres per delivered MWh), which is 15 per cent less than in 2009. For Knivsta we used 11,000 m³ of water (220 litres/MWh), which is more than in 2009 (161 litres/MWh). For Storvreta we used 6,000 m³ (390 litres/MWh), which is more than in 2009 (213 litres/MWh).

¹ Contact us for more information about our assessment. See the back page for contact details.



An important part of Vattenfall's vision is to be one of the companies leading the development towards environmentally sustainable electricity and heat production. Read our entire environmental policy at www.vattenfall.se

Waste

Scrap metal is sorted from the slag from incinerated waste and recycled. Peat ash is recycled for road construction and, in the future, as replacement for cement.

- **Flue ash and sludge from waste incineration**
Each year about 10,000 tonnes of flue ash and sludge are produced from waste incineration. This is about 5kg per MWh delivered, and does not change from year to year. The content of metal in the waste determines the amount of metal in the ash from Waste-to-Energy. The mercury content in the waste dropped significantly during the 1990s. Cadmium and lead levels remain unchanged, with no reduction.

The sludge separated through Waste-to-Energy's water purification is treated with an organic sulphide, which binds metals such as mercury and cadmium. The sludge and flue ash are considered hazardous waste and treated according to current regulations, which means that leaching from landfills is minimal.

Good incineration reduces the content of organic matter in flue ash and sludge. This means that efforts to optimise incineration are important.

Biological diversity

- **Suppliers can impact the environment and the work environment in different countries**
Oil extraction impacts the environment, and oil transportation entails a risk of oil leaks. In harvesting peat, both the environment and work environment are important. We have visited both our Swedish and Belarusian suppliers to ensure that the conditions in which the work is done are acceptable.
- **Risk of environmental accidents**
Measures to prevent accidents such as oil leaks and fire are an important part of our work. We do this,

for instance, through systematic handling of maintenance, inspections, risk analyses and noncompliance reports. No major accidents occurred in 2010.

Emissions

- **Emissions of CO₂** see the diagram on page 6 and emissions per delivered district heating on page 7. Uppsala also has emissions of other greenhouse gases. Emissions of nitrous oxide (N₂O) amount to approximately 12 tonnes per year which, with a conversion factor of 290, means a contribution of less than 1 per cent compared to CO₂ emissions. We also use cooling medium R134a, which contributes less than 0.2 per cent compared to CO₂ emissions.
- **Emissions of acidifying substances such as nitrogen oxides and sulphur dioxide** (see graph on page 6 and emissions per delivered district heating on page 7).
- **Risk of disturbances in the local environment**
We prevent disturbances in the local environment, such as dust from peat and ash, by treating the fuel and ash in-house to the greatest extent possible. Disturbances can also arise through odours from the waste fuel. Here, our prevention work includes actively working with delivery planning, waste inspections and management of air circulation on receipt of the waste.
Noise from our installations in Uppsala and Knivsta has been reduced during the year. Measures have been taken in dialogue with our inspection authorities in the municipalities concerned, and now seem to have had the intended effect.

In May, some of our neighbours were affected by particle discharge from our facility in Storvreta. Those affected were promptly contacted and were satisfied with our post-dialogue measures.

Emissions and environmental limits

Below is a selection of substances and limits which are of importance from an environmental perspective. More information is available on page 23 under “Environmental terms”.

Air emissions from waste incineration	Emission limits	2010 results	Mean annual value
Dust, mg/m ³ as mean daily value, measured continuously	10	No days over 10*	0.69
Mercury, µg/m ³ , measured twice per year	25	0.1–0.7	
Dioxins µg/m ³ , measured twice per year	0.1	0.001–0.44**	
Total organic coal mg/m ³ as mean daily value, measured continuously	10	No days over 10	0.97

* No normal operating days over 10; we did, however, have one day at 11 during refurbishment of the nitric oxide catalyst for Block 5.

** The dioxin content exceeded the limits for part of the year; following measures, the levels are now normal, i.e. far below permitted levels.

Dust is important from an environmental perspective, as it can carry both heavy metals and hydrocarbons (uncombusted). It is therefore important to keep the level of particle emissions down. Mercury, on the other hand, is a heavy metal which is mostly not particle-borne, and is therefore reported separately.

Explanation

mg	milligram	thousandth of a gram
µg	microgram	millionth of a gram
ng	nanogram	billionth of a gram

Emissions to water	Discharge conditions	2010 results
Condensate from waste incineration		
Mercury kg per year, limit value, continuous measurement	0.5	< 0.004
Lead kg per year, limit value, continuous measurement	12.5	2.7
Cadmium kg per year, limit value, continuous measurement	0.75	0.11
Dioxins ng/l, measured twice per year, guideline value	0.1	< 0.006

A full report on emissions and environmental limits can be found in our environmental report, which is available from Vattenfall Heat Uppsala.

Our objectives for safety, health and environment

An important part of our ongoing improvement work is setting clear short-term and long-term objectives. The result of our work on objectives in 2010 and our continued work is set out below.

Objectives	Outcome 2010	Trends	Current and future work
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Working environment and health

A maximum of 10 work-related accidents resulting in sick leave per 1,000 employees.

2 accidents leading to sick leave and affecting company personnel were reported in 2010. The target figure was 1.7.



Vattenfall has a joint goal of achieving a 15% reduction in the number of accidents in 2011 compared to 2010. This is measured in LTIF (lost time incident frequency) per 1 million working hours.

For Heat Uppsala this means a LTIF score equal to or lower than 7.58 for 2011 (2010: 8.91).

High-priority substations will be improved from an electrical safety point of view through conversion or replacement of equipment. Our long-term goal is to increase personal safety at all substations. Completion date: 2011.

In 2010, electric arc guards were installed in Lyckebo (Storvreta) and Knivsta. This was the target for 2010.



In line with the priority action plan, relay protection still has to be replaced in Knivsta and at the Stallängen plant. The replacement is planned for 2011.

Limited climate impact

Reduce CO₂ emissions for the period 2011–2013 compared to 2008–2009 during normal operation.

Wood content for Uppsala in 2010. Combined heat and power plant and hot water boiler met the interim target of 8%.



At least 9% of wood content for Uppsala combined heat and power plant and hot water boiler for 2011. The sale of CO₂ neutral district heating further increases the wood content.

Study objectives for 2011: to determine how we can reduce CO₂ emissions from company cars in Uppsala for budgeting operations for 2012–2015.



Objectives

Outcome 2010

Trends

Current and future work

Limited climate impact

Internal electricity consumption reduced by 750 MWh in 2010.

Uppsala: Economy measures for 2010 corresponding to 800MWh have been implemented.



Internal electricity consumption reduced by 2% compared to 2010 achieved by installing a new air fan and exhaust fan in the combined heat and power plant. In addition, premature replacement of the exterior lighting at the power plant is to take place in 2011–2013. The furnace will be fitted with energy-efficient fixtures.

Electricity generation from waste. Commissioning of the waste turbine in 2010.

The inauguration took place in May 2010.



Ready.

Energy inventories of facilities at Heat Uppsala and the introduction of an energy management system in accordance with SS EN standard 16001:2009. Completed in 2011.

Is progressing as planned. The Stallängen plant, Waste-to-Energy, the Boland plant, the combined heat and power plant and the energy flow for cooling and steam have been surveyed. The survey also includes a systematic review of energy efficiency measures.



In the spring of 2011, the remaining facilities and distribution networks will be surveyed. An external audit of the management system will conclude the project after the summer of 2011.

Only natural acidification and no eutrophication

Purpose of the survey: Reduced sulphur emissions. Completion no later than July 2010 so that objectives for 2011 can be set.

In 2010, objectives have been set: By increasing the availability of the gas cleaning equipment, sulphur emissions to the air will be reduced in 2011–2013.



By 2013, the annual average sulphur dioxide emissions from the combined heat and power plant will be lower than in 2010 (258 mg/m³) or a reduction of at least 60% for the desulphurisation unit.

A reduction in nitrogen oxide emissions (NO_x) from the combined heat and power plant of at least 15% compared to 2008 (i.e. from 110 to 93 mg/m³).

The result for the combined heat and power plant was 84 mg/m³.



Our operations are well within applicable limits. Emissions are monitored and optimised within the framework of the fees system for NO_x emissions.



Objectives

Outcome 2010

Trends

Current and future work

Non-toxic environment

Minimise discharge of metals and oil to surface water at the power plant in Uppsala. Completion in 2011.

Surveys and measures have been carried out, and the risk analysis has been updated.



Remaining measures have been budgeted and are part of an activity plan.

Resource management

Study objectives: Evaluate the possibility of reusing slag outside landfill sites (replacing gravel). Completion in 2011.

A project is in progress with Mälarenergi, but activity level has been low in 2009 and 2010.



The slag project will continue in 2011.

This is how we contribute to meeting environmental objectives in Uppsala county and municipality

Uppsala county

Uppsala municipality

Trends

Heat Uppsala

Limited climate impact

Emissions of greenhouse gases in Uppsala county for the period 2008–2012 will be on average at least 4% lower than emissions in 1990.

By 2020, emissions of greenhouse gases per citizen will fall by 30% compared with the 1990 levels.



We have reduced our carbon dioxide emissions per kWh of delivered district heating by more than 13% since 1990, even if peat is included as a climate-impacting fuel. Environmental objectives exist - see previous entry.

Fresh Air

Environmental quality standards for outdoor air will be met in 2010, for example: maximum 20 µg/m³ (daily average) for particles and maximum 60 µg/m³ air (hourly average) for nitrogen oxides.

There are no objectives at present.



Our maximum contribution to outdoor air is 0.06 µg/m³ of dust and 3 µg/m³ of nitrogen oxides. District heating contributes to cleaner urban air in Uppsala.



Uppsala county

Uppsala municipality

Trends

Heat Uppsala

Only natural acidification

By 2010 sulphur dioxide emissions to the air in Uppsala county will have fallen to 600 tonnes.

There are no objectives at present.



Our contribution of sulphur dioxide is usually around 350 tonnes per year; however, 2010 was a cold year with higher fuel consumption and therefore higher emissions, 447 tonnes. Environmental objectives exist; see the previous section.

By 2010 emissions of nitrogen dioxide into the air in Uppsala county will have fallen to 3,700 tonnes.

There are no objectives at present.



Our contribution of nitrogen oxides is about 250 tonnes per year; however, 2010 was a cold year with higher fuel consumption and thus higher emissions, 312 tonnes. Our emissions have decreased by 34% over the last ten years.

Non-toxic environment

By 2015, the exposure of the population to cadmium via food and work will be at a level that is safe from a long-term public health perspective.

There are no objectives at present.



Our emissions of cadmium were 0.08 kg to air and < 0.11 kg to water. The Fyris river transports between 10 and 20 kg of cadmium annually and has the rating 'low metal concentrations' according to the Environmental Protection Agency. Environmental objectives exist; see previous entry.

Zero eutrophication

By the year 2010, the nitrogen supply from human activities to lakes, rivers and coastal waters will have decreased by at least 15% based on the levels in 1995. The largest reductions will occur in the most sensitive areas.

There are no objectives at present.



Our emissions of nitrogen consist primarily of emissions to the air in the form of nitrogen oxides, and have decreased by 34% compared with 2000. The annual nitrogen load in the Fyris river is 900–1,200 tonnes, of which our emissions into water are 2–3 tonnes.

Environmental concepts

Sulphur, nitrogen oxides, hydrogen chloride and ammonia

These substances cause acidification. Nutrients in the ground are leached out and metals, which are normally bound, are released. Sulphur emissions have been reduced throughout the country, thanks to the reduced use of coal and oil. Nitrogen oxides are formed during all combustion and affect the environment in four different ways because they lead to acidification, eutrophication, intensification of the greenhouse effect and the formation of ground-level ozone. Hydrogen chloride is a corrosive gas. Together with water it forms hydrochloric acid, which is acidifying. Common salts can form hydrogen chloride during waste incineration. Hydrogen chloride is purified from flue-gas by means of condensation. Ammonia also has an acidifying effect because it easily produces ammonium ions, which are weak acids.

Dust

Dust consists of ash particles released into the air from industry and vehicles. The dust can carry heavy metals and hydrocarbons. We clean the flue-gases from dust with electro- and fabric filters. Dust from waste (fly ash) is hazardous waste. Fly ash from peat and wood contains low concentrations of pollutants and can be used in road construction and as a cement substitute, for example.

Carbon Dioxide

Carbon dioxide is a gas which occurs naturally in the air and is one of the most important substances in photosynthesis, but a distinction is made between the amount of carbon contained in the natural cycle and the surplus added through the use of fossil fuels, a surplus which is believed to intensify the greenhouse effect. The increase which disturbs the balance is caused mainly by traffic and combustion of fossil fuels such as oil and coal. The carbon released from combustion of bio fuels, in contrast, is reabsorbed by vegetation. Opinions differ as to whether or not peat should be considered a bio fuel.

Dioxins

Dioxins are a group of over 200 different chlorinated hydrocarbons. Some varieties are highly toxic. In principle, dioxins arise in all kinds of combustion. The

worst kinds are landfill fires. One single short landfill fire causes higher emissions of dioxins into the air than Heat Uppsala's waste incineration in ten years. This is why there is a ban on landfilling of combustible waste.

Heavy Metals

The heavy metals with the greatest impact on the environment are mercury, lead and cadmium. They occur naturally in all animals and plants, but only in small quantities. If the levels increase artificially, they become very strong environmental toxins. In Sweden, emissions of many heavy metals have declined sharply in recent years, partly thanks to new processing techniques, improved treatment techniques, a ban on mercury, extended battery collection and a ban on leaded petrol. The largest sources of mercury are crematoriums and chlor-alkali industries. The largest source of cadmium is from metal industries. Waste incineration in Sweden accounts for less than one per cent of total emissions of heavy metals into the air.

More Information

- Avfall Sverige – Swedish Waste Management (formerly Renhållningsverksförningen – Association of Waste Management) has information on waste management in Sweden: www.avfallsverige.se
- Swedish District Heating: www.svenskfjarrvarme.se
- Swedish Peat Production: www.torvproducenterna.se
- The Swedish Energy Agency (Energimyndigheten) has statistics on energy use in Sweden and information about energy and energy efficiency: www.stem.se
- Energy advice and environmental programme, Municipality of Uppsala www.uppsala.se as well as the city of Uppsala's Climate Protocol (Klimatprotokoll).
- Uppsala county's environmental objectives, www.c.lst.se
- Follow-up of Sweden's environmental objectives can be found at www.miljomal.nu

If you would like to know more about Vattenfall, you can visit our website at www.vattenfall.se

VATTENFALL

Heat for the environmentally aware



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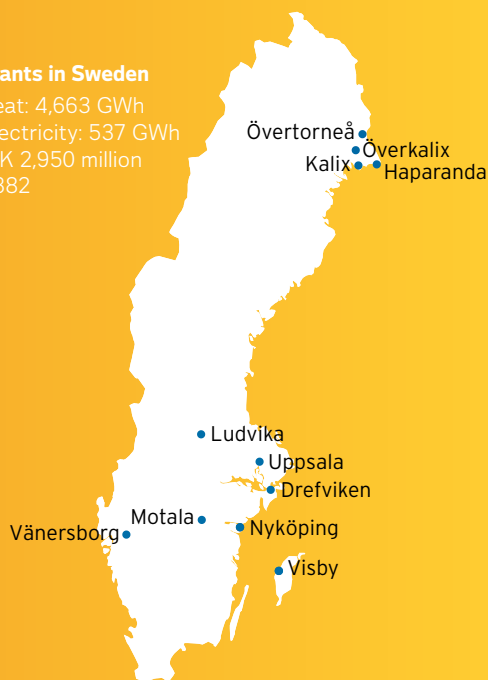
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Heat Uppsala is a unit within Vattenfall AB. District heating is the largest part of our business and our customers are real estate agencies, homeowners, industries and public facilities such as schools, swimming pools and libraries. Our operations cover the entire value chain: production, distribution and sales. We also offer district cooling and steam. The latter is used, for example, in drying cereals and in industrial processes. By generating electricity and heat at the same time, we also generate electricity at our power plants with high efficiency. Uppsala is Vattenfall's largest district heating plant in Sweden. EMAS registration* includes the following facilities: the combined heat and power plant, Waste-to-Energy, the Boland plant, the Husbyborg plant, the gas turbine, the Stalläng plant and the cooling plant in Ultuna as well as the distribution network in Uppsala. This report also includes our district heating activities in Knivsta and Storvreta.

* The EU Commission's regulatory framework for environmental management and audit.

Our major plants in Sweden

Volume of heat: 4,663 GWh
 Volume of electricity: 537 GWh
 Turnover: SEK 2,950 million
 Employees: 382



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