



# The City of Stockholm's Climate Initiatives



**Photos:** Mats Bäcker (page 7), Yanan Li (front cover and pages 5, 9, 13, 15, 17, 19, 25, 27), City of Stockholm (pages 4 and 11), Mikael Ullén (page 23), Per Westergård (page 21)

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# Stockholm

## European Green Capital 2010

The reasons that Stockholm was named Europe's first Green Capital include:

- The City has an integrated administrative system guaranteeing that environmental aspects are taken into account in the budget, operational planning, reporting and monitoring.
- The City has reduced carbon emissions by 25 per cent per resident since 1990.
- The City has established the target of reducing emissions from today's 4 tonnes of CO<sub>2</sub> equivalent per Stockholmer to 3 tonnes in 2015.
- The City's aim is also to be fossil fuel-free by 2050.

The nominated cities were assessed on several environmental criteria:

- climate change,
  - local transportation,
  - green areas,
  - air quality,
  - noise,
  - waste,
  - water and wastewater,
  - sustainable land use,
  - biodiversity and environmental control,
- and a preliminary programme for the green capital year.



# Stockholm – the green capital



Stockholm was named Europe's first Green Capital for 2010 following a competition with 35 other European cities. Stockholm's success was partly due to decades of climate efforts and partly due to the environmental and climate goals we have established for the future. As Vice Mayor of the Environmental and Traffic Division at the City of Stockholm, my top priority is reinforcing Stockholm's climate efforts and maintaining and developing Stockholm's pole position among the world's cities.

Stockholm is eager to share its experiences with other cities and would like to cooperate to expand efforts focusing on the capacity of major cities to reduce climate impact.

Despite its geographic location in the north and its increasing population, Stockholm has very low emissions, 4 tonnes of greenhouse gases per resident. Through active energy policies, we have established an energy distribution infrastructure that has few equivalents elsewhere in the world. Stockholm has district heating production that is 80 per cent renewable, a district heating network that utilises energy resources rationally and a system that converts waste into energy. Add to that the City's expansive public transport network based on renewable fuel and its tradition of sustainable city districts with exciting architecture and a comprehensive perspective on energy, waste and transport. The city's generous green areas and denser built structure are also of great significance.

The city's long-term goal is to be fossil fuel-free by 2050, and the City has now established the ambitious target of reducing greenhouse gas emissions to 3 tonnes per resident by 2015. To achieve this target, we must increase our efforts even more. We are investing in increased biogas production for vehicles, and our vision is to become an "electric car city" by 2030. We are developing two new districts with environmental profiles and making major investments in increasing the energy efficiency of our own property holdings. We are making a particularly extensive investment in increasing energy efficiency in social housing units built during the 1960s.

The Green Capital award and the signing of the Covenant of Mayors have encouraged us to further increase our ambitions.

You are welcome to enjoy our green Stockholm!

*Ulla Hamilton*

*Vice Mayor of the Environmental and Traffic Division, City of Stockholm*



# Long-term, goal-oriented efforts

Stockholm has a long and unbroken tradition of ambitious environmental efforts. One hundred years ago, the main goal was to create healthy residential environments. Today, the City works on a broad scale within all areas to improve the environment.

Toward the end of the 1800s, housing was rejuvenated in many of the city's central districts. In conjunction with the modernisation of infrastructure, with pipe and cable systems for water, sewage, electricity and gas, the city plan was completely redrawn. The city then took on an appearance that has mostly been preserved, with many parks and housing near Lake Mälaren and the banks of Saltsjön. Today, this means that almost all Stockholmers live less than 300 metres away from parks and green areas.

During the 1900s, suburbs with single-family homes were built, with gardens and extensive green structures. Rental housing was also established with existing natural areas preserved nearby. Public transport initially comprised tram lines. Today, a wide-ranging network of underground, tram and bus lines connects the entire city.

In the mid-1950s, Vällingby and several other traffic-segregated centres were constructed on the outskirts of

the city, with a mix of workplaces, housing and services surrounded by tall tower blocks in park landscapes.

During the current decade, the city was built inward. The denser city is more energy-efficient at the same time as green areas can be preserved. An example is Hammarby Sjöstad.

Since the 1960s, wastewater treatment facilities have been expanded to all developed areas. With continuously refined technology, the water in Stockholm has become so clean that today it is possible to swim in the middle of the city. Wastewater sludge is now also an important resource for biogas production.

Construction of the city's first district heating system began at the end of the 1950s. Since the mid-1960s, oil and coal have been gradually replaced with biofuel.

Waste-sorting began in the 1970s and now includes glass, plastic, paper, cardboard, metal, electronics and chemicals.

Efforts related to the climate issue have gained an increasingly prominent role. All of the City's companies and administrations have now been instructed to carry out their operations in a manner that minimises their impact on the climate.

## Stockholm at a glance

- Stockholm was mentioned for the first time in 1252. It was mentioned as a capital city for the first time in 1436.
- Today, the city has about 800,000 residents and is growing rapidly.
- Stockholm's surface area is 216 km<sup>2</sup>, of which 188 km<sup>2</sup> is land and 28 km<sup>2</sup> is water.
- Slightly more than 160 km of waterfront and quays.
- In all, 40 per cent of the land area comprises parks and green areas.
- Average temperature in June-August is 16 °C.
- Average temperature in January-March has increased from -4 to -2 °C in 200 years.



# Climate investments

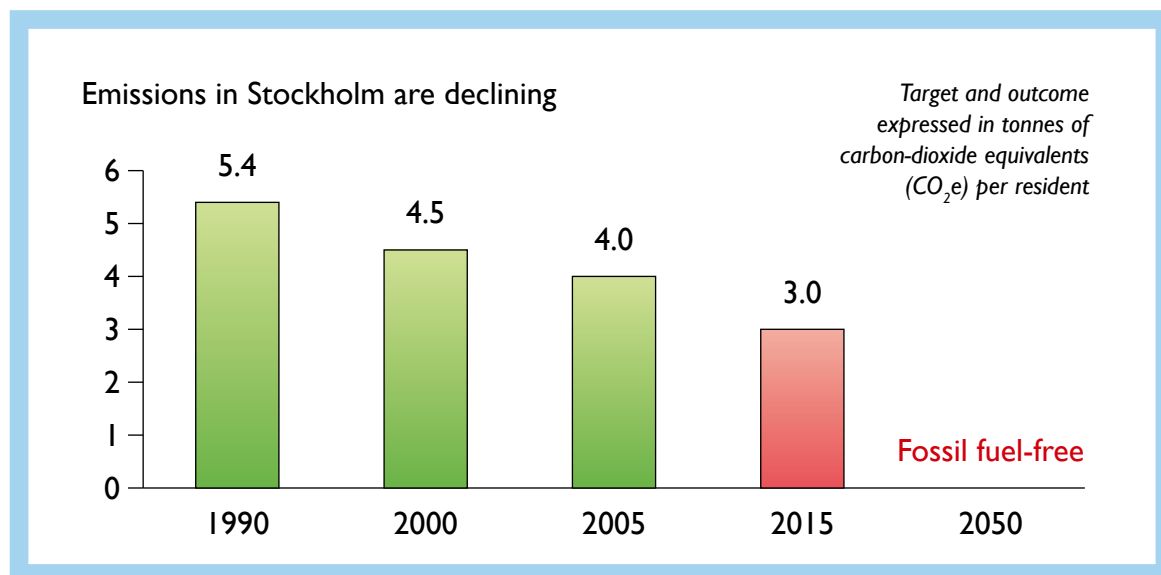
The City of Stockholm has undertaken several ambitious initiatives and driven developments to reduce climate impact. The City's long-term goal is to continue to reduce greenhouse gas emissions at the same rate as in the past. This will allow Stockholm to become fossil fuel-free by 2050.

On the way to this unique goal, the City has implemented two action programmes against greenhouse gases. The target for the first programme (1995-2000) was to reduce greenhouse gas emissions from electricity, heating and transports to 1990 levels, i.e. 5.4 tonnes of carbon-dioxide equivalents (CO<sub>2</sub>e)\* per Stockholmer and year. The target was surpassed; by the end of 2000, emissions were approximately 4.5 tonnes CO<sub>2</sub>e per resident and year.

The target for the second action programme (2000-2005) was also achieved; emissions declined to four tonnes CO<sub>2</sub>e per Stockholmer and year. Emissions in Stockholm had thereby decreased by a total of 655,000 tonnes CO<sub>2</sub>e. Taking into account the city's population increase during this period, annual emissions per resident declined from 5.4 tonnes CO<sub>2</sub>e to 4 tonnes CO<sub>2</sub>e, a decrease of slightly more than 25 per cent. During the same period, total emissions in Sweden declined by 7 per cent.

Stockholm is now working with citizens and other stakeholders in the city to achieve the target of 3 tonnes CO<sub>2</sub>e per resident and year by 2015.

*\*Carbon-dioxide equivalents (CO<sub>2</sub>e) are the greenhouse gas effects of various gases.*







# Strategy for reduced emissions

The City of Stockholm is working with industry and commerce and with government authorities to achieve the City's established climate targets.

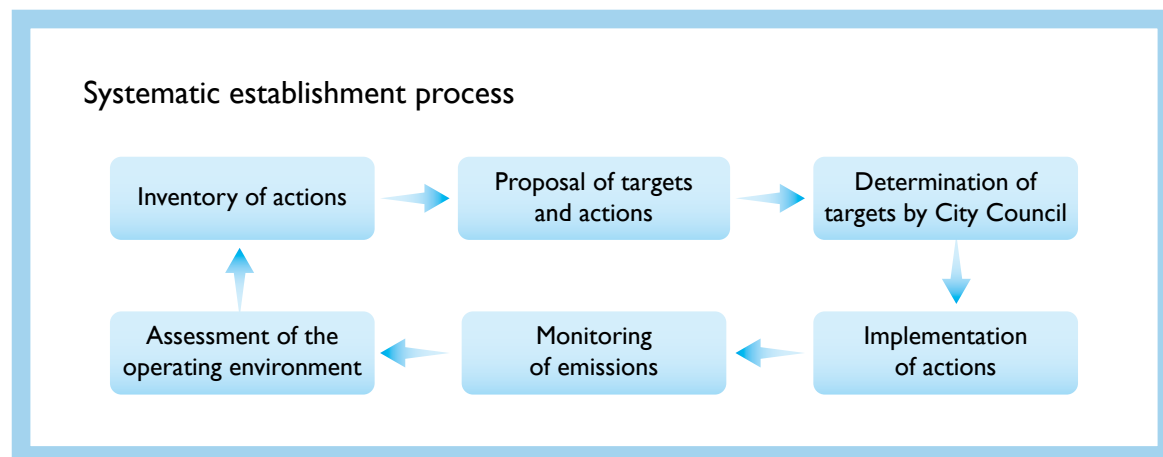
A success factor for Stockholm's climate efforts is the City's systematic establishment process in advance of political decisions. Emissions are mapped out and emission targets proposed based on analyses of which actions are cost-effective and can be carried out in the coming years. Because the City Council determines the climate targets, their impact is evident throughout the organisation. The targets are then monitored prior to new political decisions.

The City's strategy is that companies and administrations themselves should choose the most cost-effective climate actions to take to achieve the targets. These can include avoiding or reducing energy consumption, using energy more efficiently and using renewable energy. Responsibility for implementing energy-efficiency enhancements is included in the City's budget, and all administrations and companies are obliged to carry out these enhancements.

Following strategic efforts involving analyses and inventories, the City's climate efforts have been aimed at energy-efficiency enhancements in social housing units built during the 1960s, the expansion of cycle paths, and an increase in the number of clean vehicles, including private cars and buses. The action that has been most significant is the increased proportion of biofuel in district heating production, combined with the expansion of the district heating network.

As part of the journey toward a fossil fuel-free Stockholm in 2050, an ambitious new emissions target was established in the City budget for 2009. Emissions are to be reduced to 3 tonnes CO<sub>2</sub>e per resident by 2015, which will entail a 44 per cent reduction from 1990 levels. Prior to the decision, an analysis was carried out of the most cost-efficient actions to reduce emissions by 2015.

Climate efforts have been financed by the City itself, through government subsidies and above all, using the resources of various stakeholders who are active in the city.





# Adapting to a warmer, more humid climate

We have already seen indications that climate change is under way. The city must adapt to the climate changes that are expected to occur even if emissions decline to the UN-recommended level of 1.5 tonnes of CO<sub>2</sub>e per person.

Through climate adaptations, the City of Stockholm wants to deal with climate change in the best possible way. This includes how we plan and construct buildings, parks and other infrastructure systems so that we can offer a favourable housing environment in Stockholm even with a changed climate.

It is expected that, by the year 2100, the average annual temperature in Stockholm will have risen by 2.5 to 4.5°C, and we will also receive increased amounts of precipitation and higher water levels in the sea and lakes. Greater amounts of precipitation could entail environmental and health risks as the burden on rainwater and sewage systems increases. In addition, changes in

groundwater levels could mean that soil contamination spreads. A more humid climate will increase the risk of moisture damage and mould in buildings.

The green areas that surround the city and extend in wedges into the city's central districts will contribute to mitigating the effects of the future climate. They even out the water flow, filter contaminations, produce oxygen and provide refreshment.

Norra Djurgårdsstaden and Västra Liljeholmen are new city districts with environmental profiles that entail both greenhouse gas emission reductions and an adaptation to the anticipated climate changes. In addition, the social housing units built during the 1960s will be refurbished and will gain environmental profiles.

The lock (Slussen) between Saltsjön and Lake Mälaren will be rebuilt so that the outflow of water from the lake to the sea can be increased when there is a risk of flooding.

## Cold winter days could become just a memory

Here is what Stockholmers could experience in the future:

- The disappearance of very cold winter days (below -10°C).
- It will probably rain as often as it does today, but much more intensively.
- The risk of flooding will increase, with dry heat waves in the summer.
- The growing season will be extended by one or two months and the conditions for Stockholm's natural environment will change.
- The average water level in the Baltic Sea might rise by 0.5 metres or more during the next 100 years.



# Success with district heating and cooling

An increased market share for district heating and changes in district heating production have been the greatest contributors to greenhouse gas emission reductions in Stockholm. The city is supplied by four major production plants. In addition to heat, electricity and district cooling are produced.

Today, district heating is produced by Fortum Värme, and comprises nearly 80 per cent renewable fuel or energy from waste or residual heat. The district heating system covers nearly 80 per cent of Stockholm's total heating needs. The district heating network is being continuously expanded to further increase the proportion of district heating in the city. The use of district heating is increasing by 200-300 GWh\* annually in Stockholm.

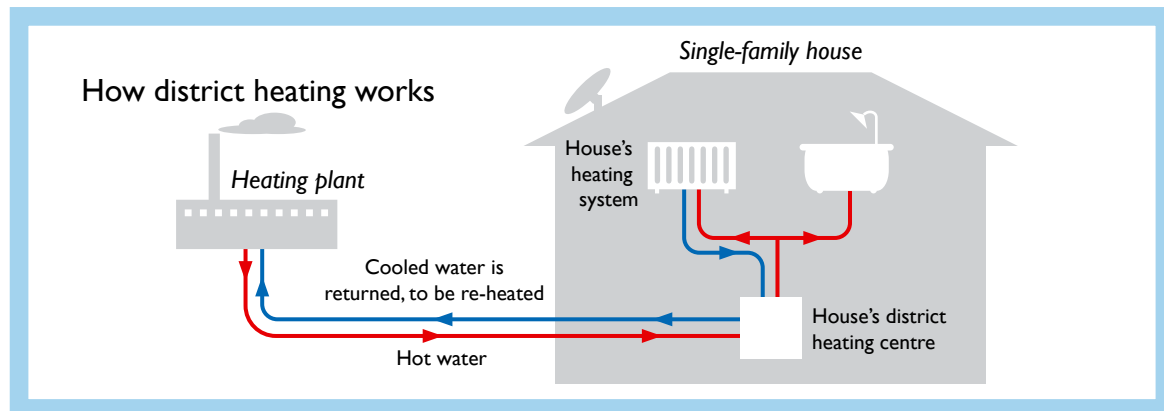
The conversion from oil heating to district heating has reduced greenhouse gas emissions by 593,000 tonnes since 1990. The use of district heating with advanced pollution control and optimised processes has reduced small, old oil boilers. This has not only reduced CO<sub>2</sub>-emissions, but has also led to reductions in emissions of substances that are hazardous to health. Sulphur dioxide emissions have decreased by 95 per cent since the beginning of the 1960s.

The larger plants produce both electricity and heat, known as co-generation. One of the combined power and heating plants is the Högdalen plant, where the city's waste is used for energy production. Heat in wastewater is also used for the production of district heating.

For the production of district cooling, cold water from lakes and the sea is used. In addition, the process utilises the cooling effect that arises in heat pumps that extract energy from seawater or wastewater. The use of district cooling reduces carbon dioxide emissions in Stockholm by about 50,000 tonnes annually. The same heat pumps can be used for both district cooling and district heating according to the season.

Fortum Värme's Stockholm network for district cooling is the world's largest network of its kind, and covers nearly the whole of central Stockholm. District heating offers the greatest benefit at workplaces with a large amount of heat-producing technical equipment and within the food industry. District cooling also replaces small individual cooling plants that are less efficient.

*\*1 GWh is equivalent to 1,000,000 kWh.*





# Energy-efficient buildings

Stockholm Energy Centre, the City's internal energy advisory service, works to reduce energy consumption and thereby operational costs in Stockholm.

To reduce energy consumption, the City surveys which energy-efficiency enhancements are the most cost-effective. Actions are then taken, such as investments in more energy-efficient technology and façade insulation. It is often most cost-effective to improve control and regulation systems for ventilation and heating.

To encourage an increase in energy efficiency-enhancement measures, the City has increased allocations for investments and decreased allocations for the operation of its own building stock.

According to surveys in Sweden, large-scale, long-term energy-efficiency enhancements are seldom carried out for properties, although they are profitable in the long term. Accordingly, the City is setting aside funds for the municipal housing companies to make these investments. It is now planning comprehensive actions for energy efficiency in the city's social housing units built during the 1960s, including improved façade insulation.

The City is testing a new model for implementing large-scale energy-efficiency enhancement in its property holdings. The contractors who are making the investments are

also responsible for operation, maintenance and follow-up for a number of years. The City and contractors will share the profits of the energy efficiency-enhancement efforts.

Another example of such actions is the installation of diode lighting (LED) in schools, offices and parks. LED provides a more natural light and reduces energy consumption by at least 25 per cent.

Stockholm is also working to reduce energy consumption and greenhouse gas emissions in private properties. In cooperation with all municipalities in the Stockholm region, the City provides free advisory services to residents and companies regarding how they can decrease their energy consumption and climate impact while reducing their costs.

The City has also worked with targeted information regarding alternatives to oil and direct electric heating for single-family homes. In addition, it has arranged energy efficiency-enhancement training for tenant-owner associations.

The City also uses the facilities provided by environmental legislation to check whether property owners have sufficient knowledge about their energy consumption and their opportunities to increase energy efficiency.

## Energy consumption in the city's own building stock

- Heated building area: total 13 million m<sup>2</sup>.
- Average annual energy consumption: 180.8 kWh of energy per m<sup>2</sup> (2007).
- City's annual energy purchases: about 2.28 TWh\* in the form of heating, electricity and cooling.
- Annual cost: approximately € 270 million.
- Identified annual savings potential: 328,000,000 kWh, 30,000 tonnes of CO<sub>2</sub> and € 28 million.

\*1 TW= 1,000,000,000 kW





# More Stockholmers are travelling together

Several steps have been taken to make Stockholm's transportation system more environmentally friendly and to increase the proportion of pedestrians, cyclists and users of public transport. For example, public transport now uses more alternative fuels, and more cycle paths have been laid out.

Stockholm Public Transport (SL) is responsible for the county's public transport. Nearly 75 per cent of SL's traffic now runs on renewable energy. For example, rail-bound traffic runs on electricity generated by wind power and hydropower. In Stockholm's city centre, all buses run on renewable energy, while the corresponding figure for the county is 30 per cent. SL has about 400 ethanol buses, meaning that it has the world's largest fleet of ethanol buses, and approximately 100 biogas buses.

SL is constantly testing new technology to reduce greenhouse gas emissions. From 2003 to 2005, fuel cell buses were tested, and in 2009, electricity/ethanol hybrid

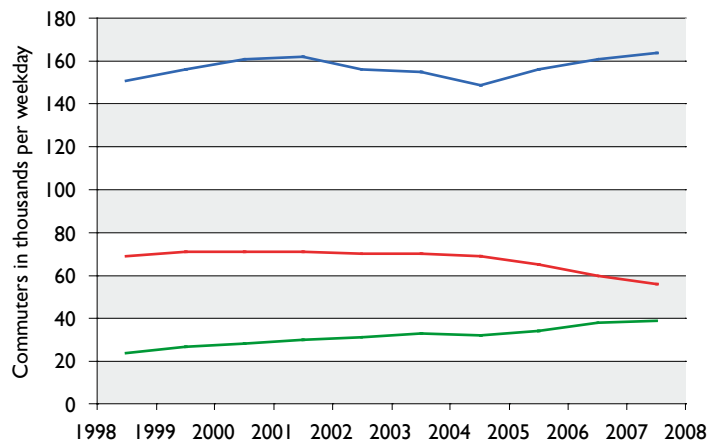
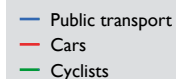
buses will be tested. Through an increased investment in biogas buses, 50 per cent of the buses in Stockholm County will be fossil fuel-free by 2011. The goal is for all public transport in Stockholm County to be fossil fuel-free by 2025.

During the most intensive hour of the morning rush hour, 78 per cent of journeys to the city centre take place with public transport, and during the day, the average figure is 60 per cent. In 2006, SL's share of fossil carbon emissions from road traffic in Stockholm County was only 5.3 per cent. Within the city itself, the figure is becoming even lower.

SL is actively working to increase the number of Stockholmers using public transport, through such strategies as providing environmental information and increasing the frequency of services. SL is also attempting to encourage the region's companies to increase the number of business journeys made using public transport.

## Transportation by car, bike and public transport to the city centre

Since 1998, the number of cyclists has seen an increase of 75 per cent. Winter cycling on the other hand (December-March), has experienced a sharp upsurge of over 100 per cent since 2005.





# Stockholm is investing in clean vehicles

Since the mid-1990s, the City has been working to increase the proportion of clean vehicles in the market and the use of renewable fuels in vehicles. This occurs in close cooperation with manufacturers and retailers of renewable fuels and clean vehicles and with stakeholders who have large fleets of vehicles. The aim is to increase the number of filling stations for renewable fuels and increase the availability of environmental fuel.

The City of Stockholm drives clean vehicles. The target is for 100 per cent of the City of Stockholm's vehicles to be clean vehicles by 2011. Stockholm has also consciously focused on motivating and assisting companies and organisations to purchase clean vehicles.

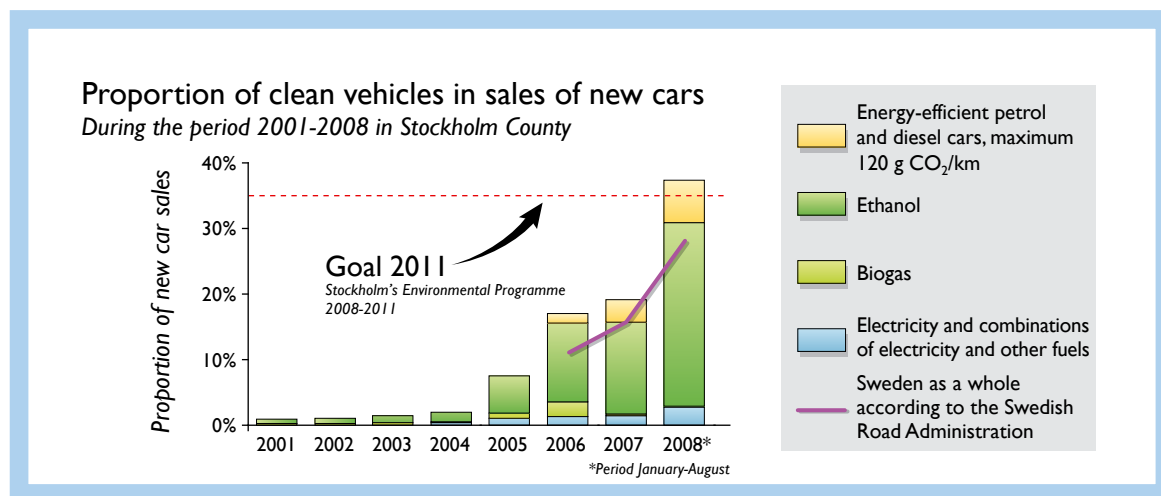
Overall, the approximately 70,000 clean vehicles in Stockholm County at year-end 2008 had the annual potential to reduce emissions by more than 140,000 tonnes of CO<sub>2</sub>e if they were 100 per cent driven on renewable fuel.

All petrol sold in Stockholm contains 5 per cent etha-

mol. In 2007, this low-blend fuel comprised more than half of the county's use of renewable fuels. However, in the long term, low-blend fuel will not be sufficient to achieve Stockholm's goal of being fossil fuel-free by 2050. Instead, completely renewable fuels are required.

Ethanol cars reduce CO<sub>2</sub>e emissions by at least 65 per cent when they are driven using only ethanol instead of petrol. Ethanol is produced using sugarcane, Swedish trees and Swedish wheat. Biogas vehicles reduce CO<sub>2</sub>e emissions by 85 per cent. In Stockholm, biogas is mainly produced from wastewater sludge, but there are also plans to produce biogas from agricultural by-products and food waste. In cooperation with biogas producers and distributors, the City is working to increase the market share for biogas.

Since 2008, the City has been particularly involved in the establishment of infrastructure for electric cars and testing of plug-in hybrids that can be both charged and driven on various fuels.





Vi kör på  
biogas

URR 411

A3

# Congestion tax reduces greenhouse gas emissions

To deal with congestion and traffic disturbances, a congestion tax was implemented in Stockholm in 2007. Since then, traffic to and from the city centre has declined by an average of approximately 20 per cent, and queuing times in and around the city centre have decreased by 30 to 50 per cent. Greenhouse gas emissions have declined by up to 14 per cent in the city centre and by approximately 3 per cent in the entire Stockholm region.

Before the congestion tax was introduced, many people opposed it. Accordingly, a trial of the congestion tax was carried out in 2006. The trial resulted in an increase in popular support for the tax because the number of cars

in the city centre decreased and because the system worked well. The outcome was that the majority of Stockholmers now have a positive view of the congestion tax.

The congestion tax is national and applicable to Swedish-registered cars that drive in and out of the Stockholm city centre between 6:00 a.m. and 6:30 p.m. on regular working days. Each passage costs € 1 to € 2 depending on the time of day, with a maximum amount of € 6 per day. Cars are automatically registered at payment stations, and the tax is paid monthly through a notice sent to the vehicle owner.

## Better air and reduced congestion

Surveys commissioned by the City of Stockholm after the congestion tax was implemented indicate that...

- Nearly 75 per cent of Stockholmers now experience reduced congestion at entrances and exits and in the city centre.
- More than 70 per cent feel that the air has improved.
- 65 per cent say that traffic noise has declined.
- More than 50 per cent believe that traffic safety has increased.



Map of payment stations surrounding Stockholm city centre.



20 Kr

# Stockholmers are becoming increasingly climate-smart

The City of Stockholm has carried out several communications projects pertaining to the climate. The goal is to increase awareness of what people and companies can do themselves to reduce greenhouse gas emissions and total energy consumption.

From 2008-2010, several campaigns will inform those who live and work in Stockholm about what the City does to reduce emissions, the City's goal of being fossil fuel-free by 2050, and alternatives for reducing their own emissions. The campaign themes are housing, the workplace, travel and shopping.

The City runs a network for companies engaged in climate issues. Companies from various industries inspire others by presenting specific decisions and actions that reduce greenhouse gas emissions.

The City also works to provide support and knowledge for teachers to facilitate their work with the climate issue. Stockholm's schools have received teaching mate-

rial in the form of teacher guidance and facts about the climate issue. They have also received support to reduce the climate impact of schools.

Households are responsible for more than half of all carbon dioxide emissions. One project has focused on households' total energy consumption. During the course of a year, selected households received tips on how they could reduce their climate impact, while Stockholmers were able to follow them in the media. The households succeeded in reducing their climate impact by an average of 20 per cent.

To reduce fuel consumption, Stockholm's motorists were encouraged to check their tyre pressure in a series of campaigns. Nearly 25 per cent of Stockholmers noticed the campaigns, which are estimated to have reduced greenhouse gas emissions by approximately 4,300 tonnes.

## The Stockholm Climate Pact

The City of Stockholm has taken the initiative to the Climate Pact. It is open to companies operating within the city. The companies commit to work for the same goals as the City, for instance a 10-per cent reduction of energy usage between 2008 and 2010.

The Climate Pact provides a platform for the companies to report on their environmental work. It is also an opportunity to share best practices and become inspired. The Climate Pact started in September 2007 and in May 2009 more than 60 companies have signed it.





Stockholmers are well-equipped to meet the future with ambitious established climate targets. The City's long tradition of focusing on environmental issues lays the foundation for Stockholm's ability to perform in line with *the European Green Capital 2010* title for many years to come.





**[www.stockholm.se/klimat](http://www.stockholm.se/klimat)**

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