Clean vehicles in Stockholm

Historic retrospect 1994-2010

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MATS BÄCKER

Introduction

The Clean Vehicles in Stockholm programme has been run by the Environment and Health Administration in the City of Stockholm since 1994. The aim is to speed up the transition to clean vehicles and renewable fuels. This publication is about the history of the programme seen through the eyes of those who work with clean vehicles in the City today.

At the start, a central stumbling block for clean vehicle work was the classic dilemma: which comes first, the chicken or the egg? Many people raised the question of whether clean vehicles or refuelling stations for clean fuels should come first. Without cars running on clean fuels no one would open refuelling stations, and without refuelling facilities the car industry would not produce cars running on clean fuels. A major challenge at the outset was to do something about this deadlock. The way out of this dilemma was to focus work on both fuels and vehicles and to use the municipal fleet to facilitate the transition.

Much has happened during the more than 15 years since the first municipal cars in the City's fleet were exchanged for cars that could run on renewable fuels. Clean cars have now become just like normal cars and represented almost 40 per cent of new car sales in 2009. There are increasingly more models to choose from and knowledge about clean vehicles has increased. More and more people see the benefits of clean vehicles and fuels. During the early years, local air quality was an important driving force. Climate problems and carbon dioxide emissions from the transport sector have received increased attention over the years. The awareness that oil is running out has also meant that needs for finding alternatives to petrol are increasing.

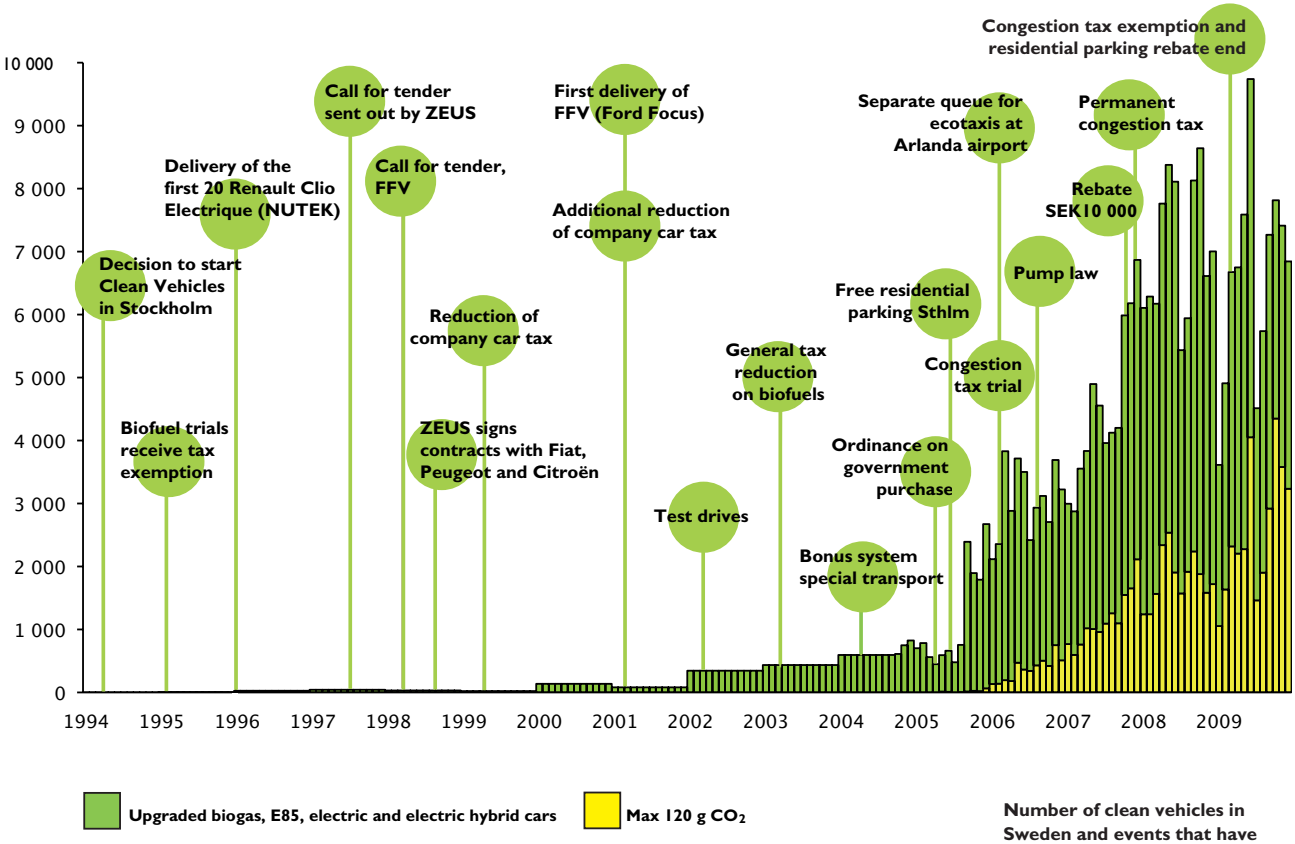
The overall strategy for work within Clean Vehicles in Stockholm has been to facilitate market introduction of clean vehicles and sustainable fuels. The guiding principle has therefore been to continuously collaborate with market players and to find ways of increasing the demand for clean vehicles and fuels. Since the start, work has developed in dialogue with companies and municipalities that have an interest in clean car initiatives, with vehicle manufacturers and fuel suppliers. The City's work has gone through three phases. The first phase was to remove barriers and pave the way for users of clean vehicles. When results were emerging, by way of the introduction of new models, work focused on broadening the market. Today, Sweden is seen as an important pilot country for clean vehicles. Motivating manufacturers to bring out new generation clean vehicles requires a bigger market. The third phase has therefore largely concentrated on increasing the market for clean vehicles outside Sweden, together with other European cities.

"At the event Nordisk Miljöbil in the mid-1990s, I had the opportunity to talk to a number of vehicle manufacturers. Of course, they all had concept models of various clean vehicles. Unfortunately, you couldn't find them on the street. When I asked why, the answer was that they would supply cars when there was a market, but that no one would buy a clean vehicle if there were no refuelling facilities. I then realised that our main task must be to remove the obstacles for a clean vehicle market. This has been a guiding principle for our work over the years."

Gustaf Landahl, Clean Vehicles in Stockholm.

Broadening the market meant that the three phases had a different focus, but the working methods remained largely the same. Although there is a link between time and phase, the introduction of various fuels has been carried out in parallel, reaching different levels of development. Passenger cars that can run on ethanol and upgraded biogas have now reached the third phase. Broadening the market for electric cars and clean trucks has been a much slower process. Work to increase the number of clean trucks and electric cars is still in the first phase. When Clean Vehicles in Stockholm started, the focus was on electric cars. However, the lack of new models and the lack of driving range improvement for existing cars meant that this focus disappeared. In early 2001, great hope was attached to an electric car with a small petrol engine to complement the battery. The technology was similar to today's plug-in hybrids, but this model never materialised. Instead, ethanol and biogas-powered cars were widely introduced. Now, entering the second decade of 2000, electric cars and clean trucks have come into focus again.

Monthly new registrations of clean cars, Sweden



Number of clean vehicles in Sweden and events that have influenced work within Clean Vehicles in Stockholm, 1994-2009, monthly figures.

Clean Vehicles in Stockholm – how it started

Clean Vehicles in Stockholm started in 1994, but even before this the City of Stockholm had decided to investigate the possibilities of introducing environmentally friendly vehicle technology. In 1989, the Stockholm Materials Supply Organisation (MFO), which at that time was responsible for procuring and maintaining the City's vehicles, carried out a survey of existing electric vehicle technology. As a result, the City purchased 10 electric cars of the make VW City Stromer; a converted VW Golf. The early activities were dominated by electric cars, partly due to the fact that there were no refuelling facilities for clean fuels at all.

The City of Stockholm's first clean vehicle was a battery-driven converted VW Golf.
PHOTO: CITY OF STOCKHOLM

In the early 1990s, electric cars were produced in small series by niche manufacturers around Europe. The electric cars had lead batteries and a driving range of around 50 kilometres per charge. The battery lifespan was also limited to an estimated three years. But compared to the electric cars that had been tested in the 1970s and that could come to an abrupt standstill, the cars of the 1990s were equipped with more reliable batteries. To increase the driving range, other battery technologies (sodium-sulphur, nickel-cadmium) were being tested, but the tests were not concluded.

In 1991, the Swedish Development Agency (Nutek) initiated the setting up of an electric vehicle collaboration group for Stockholm, Gothenburg and Malmö (STEG). STEG worked for the introduction of electric vehicles for environmental reasons. In 1992, Nutek started a national technology procurement. The City of Stockholm participated in the procurement through MFO. The aim was to bring out improved electric cars and coordinate demand from several buyers. As a result of Nutek's procurement, the first battery-driven Renault Clios were introduced in Sweden in 1995. The cars were equipped with nickel-cadmium batteries and could be driven for almost 80 kilometres per charge.

In 1993, the government commissioned the Swedish Transport and Communications Research Board (KFB) to run a development and demonstration programme on electric and hybrid cars. Simultaneously, extensive work was carried out to develop the infrastructure for charging electric cars. The main focus was on establishing public battery charging stations for both normal and fast charging.

The electric car initiatives were inspired by the Californian ''Zero Emission Vehicle'' programme. California had set up a goal of 10 per cent of new car sales being zero emission vehicles by 2003. In retrospect it may seem that there was too much blind faith in the Californian initiative. However, only a decade earlier California had spearheaded another impossible green mission: to fit all new petrol cars with catalytic converters. This initiative was successful and reached Sweden in the late 1980s.

Decision to start Clean Vehicles in Stockholm

The starting shot for Clean Vehicles in Stockholm can be dated to June 15 1994. This is when the municipal executive committee approved a proposed programme to introduce electric cars and other environmentally adapted vehicle technology. The overall aim of the programme was to reduce negative environmental impact from road traffic in Stockholm.

''The Municipal Executive Committee decided

1. that the City adopts the long-term goal that conventional vehicles in the City fleet, as far as possible, are replaced with electric cars and/or vehicles powered by alternative and environmentally friendly technology
2. to appoint a political reference group with representatives from the committees and boards concerned
3. to as a first interim goal, via the procurement group initiated by Nutek, replace 300 of the City's conventional vehicles with electric cars according to the above-mentioned programme
4. that financing is made as stated in the programme
5. to request the Environment and Health Committee to after consultation with the Real Estate, Streets and Traffic Committee, commission the Environment and Health Administration to appoint an inter-administrative project group for environmentally friendly transport with the main aim to
   - set up an implementation programme for increased use of environmentally friendly vehicle technology in Stockholm traffic
   - follow technological developments regarding environmental issues relating to transport vehicles, off road vehicles, energy carriers, etc.
   - to propose measures to the City's committees and boards aimed at introducing environmentally friendly vehicles and vehicle technology in the City
6. that the City applies for membership in CITELEC."

CITELEC is the Association of European Cities interested in Electric Vehicles, founded in 1990. CITILEC aims to disseminate information to its members, participate in research and demonstration projects, follow up and evaluate the development of vehicles and infrastructure and take part in international standardisation.

"The actual creation of Clean Vehicles in Stockholm was a sign of great foresight, a wise decision. Those who took the decision should be given the credit for having the courage!"

Hans Nyström 2009, Environmental Manager, Taxi Stockholm

How the work has been organised

The responsibility for carrying out the work within Clean Vehicles in Stockholm is thus with the Environment and Health Administration, and several administrations participate in the work. During the first years, an inter-administrative project group was in place comprising the Street and Real Estate Department, Stockholm Vatten, Stockholm Energi (now Fortum) and MFO. As clean vehicles became more common around 2001/2002, the inter-administrative group was dissolved and replaced by projects groups linked to specific issues or projects.

Since the start, Clean Vehicles in Stockholm has a political reference group (PRG). This has normally comprised three representatives from the majority in the municipal assembly and two from the opposition parties. The PRG has no formal political mandate and political decisions are taken as usual in committees and the City Council. However, the group has made it easier to reach political consensus regarding work relating to clean vehicles. This broad political support has been an important factor throughout. The PRG has played a particularly important role when it comes to speeding up Stockholm's work with EU projects. Short-notice decisions for entering as a partner in EU applications are often required, and the PRG has enabled a swifter handling of projects.

Clean Vehicles only.
PHOTO: FORTUM

The people behind Clean Vehicles in Stockholm. From left, Jonas Ericson, Eva Sunnerstedt, Helene Carlsson, Gustaf Landahl, Milla Sundström, Johan Seuffert and Björn Hugosson, all from the Environment and Health Administration in Stockholm, February 2010. PHOTO: LENNART JOHANSSON, CITY OF STOCKHOLM

Lack of market for clean vehicles and fuels

Despite the early initiatives, the supply of clean vehicles on the market was almost non-existent when Clean Vehicles in Stockholm started. Manufacturers and dealers were largely hesitant. This can be illustrated with a statement typical of the period:

"Clean vehicles are less reliable and have an uncertain second-hand value. Perseverance is required to place this product on the market. Unusual cars are not something that dealers long for, whether it's an electric car or another type of extreme car. They want vehicles that sell quickly, rather than something gathering dust. In addition, they are not qualified to sell this type of extreme car"

Interview with anonymous car dealer, basis for the report "Incentives for environmentally friendly vehicles" Report 1998:1, Environment and Health Administration in Stockholm.

The first task for Clean Vehicles in Stockholm was to replace conventional vehicles in the City's own fleet with clean vehicles. In order to achieve this, it was necessary to focus on technologies that were suitable for the City's fleet and that would be available in the near future. There must also be interest from vehicle manufacturers in developing the technology. Politicians required that the cars would be able to run on electricity or sustainable fuel.

There were already some electric cars on the market, whereas ethanol and biogas-powered cars came somewhat later. The first three ethanol cars in Sweden were introduced in Örnsköldsvik in 1994. During the 1990s there was only one available model: Ford Taurus Flexi-Fuel Vehicle (FFV). The cars were not for sale, but could be leased to large companies and authorities. In order to take advantage of the tax exemption on biofuels that applied to demonstrations, there was only one owner of the FFVs. However, the requirement that the vehicles were used in demonstration tests limited the total number of vehicles.

Ford Taurus Flexi-Fuel Vehicle (FFV) was the only E85-model in Sweden in the 1990s.
PHOTO: LENNART JOHANSSON, CITY OF STOCKHOLM

In the early 1990s it was difficult to find gas-powered cars (i.e. CNG vehicles) in Sweden, although these were common in a number of countries around the world, including Italy, Turkey, Russia and New Zealand. The first Swedish natural gas cars arrived in 1996, when Volvo launched the Volvo 850 bi-fuel. The same year, BMW introduced the 316g model in Sweden. These were the only two models that had been given European whole-vehicle type approval. There were many barriers, including a higher purchase price and a number of administrative difficulties. Swedish authorities stipulated that the gas tank should be able to withstand minus 40 degrees Celsius, something which the manufacturers did not accept. An exemption was needed to gain type approval for a new model. An additional problem was that gas cars required two vehicle tests; one for the vehicle and one for the gas tank.

The first filling stations for E85 and upgraded biogas became operational in 1996. Clean Vehicles in Stockholm has worked very actively to influence the large fuel suppliers OK (later OK/Q8), Shell and Statoil to supplement their stations with pumps for upgraded biogas, ethanol and battery charging.

The first filling stations for E85 and upgraded biogas opened in Stockholm in 1996.
PHOTO: PER WESTERGÅRD

From the start, the City of Stockholm has followed the line that clean vehicles are vehicles that can run on electricity or sustainable fuels. The renewable fuels that became commercially available a few years after the start of Clean Vehicles in Stockholm still dominate the Swedish market. RME was also available, but was mainly regarded as a fuel for heavy vehicles. One reason for this was that there were few light diesel cars, both in the City's fleet and in the general fleet. Another reason was the relatively large emissions of NOx, with high levels on, for example, the busy street Hornsgatan. The City of Stockholm has continuously monitored the development of fuels, and as new fuels with high environmental benefits became available they played a role in Stockholm's work. By venturing to invest in a number of technologies on a large scale, the initiative itself was pioneering.

Nothing ventured, nothing gained

The long-term ambition of the City of Stockholm was to create a functioning market for clean vehicles. The role of the City was to initiate development through collaboration with market players. However, contacts with the car industry were not encouraging. The following summarises the view of car manufacturers in 1996:

"Technology is not a problem when it comes to alternative fuels and biofuel. The problem is availability"... "Neither SAAB nor Volvo will invest in alternative fuels if there is not a market. There is also a sceptical attitude to "political solutions" and the use of biofuels built on an artificial basis. A viable long-term prospect is a prerequisite for introducing alternative fuels."...."To sum up, you could say that the introduction of a new fuel takes longer than to develop new engines."

Summary of survey among 23 car manufacturers: Olsson, Lars-Ola (1996) Cost influence on vehicles when using biofuels, commissioned by the Swedish Transport and Communications Research Board (KFB)

Work with clean vehicles soon engaged many people in the City of Stockholm: politicians and officials as well as fleet managers and individual drivers at the City's administration and companies.

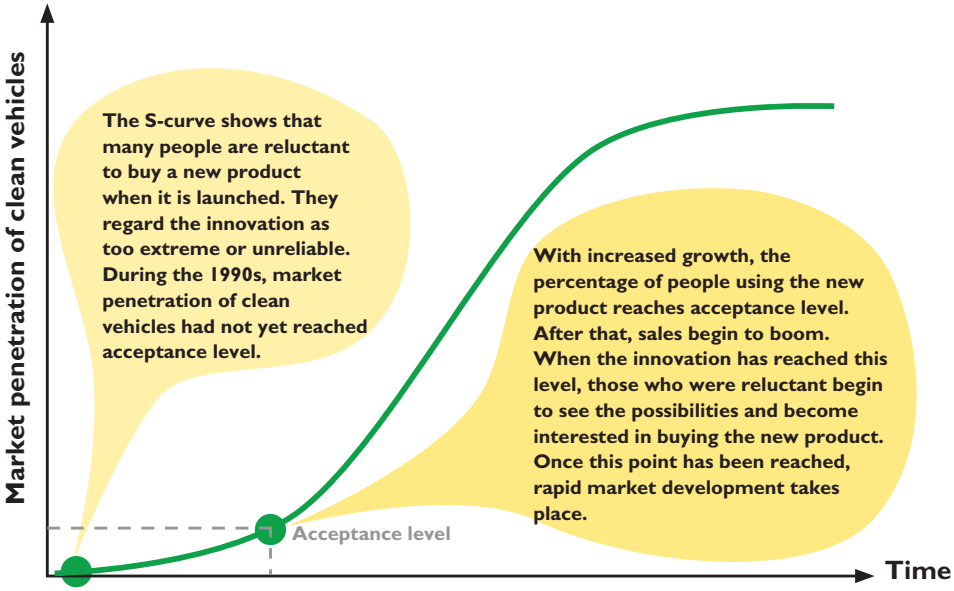
PHOTO: LENNART JOHANSSON, CITY OF STOCKHOLM

Without a market, no cars - and without cars you cannot create demand. This so called "chicken or egg" problem can often put a stop to new initiatives. By focusing on both fuels and vehicles, Clean Vehicles in Stockholm wanted to show that you can break the chicken-egg situation. But results take time. Clean Vehicles in Stockholm started using the so called S-curve to describe their work. The S-curve became a valuable tool for gaining approval internally as well as for external communication..

The S-curve shows that the introduction phase for new technology is slow, and this is also true for clean vehicles. There are several examples of market inertia related to new technology. Television existed for some decades before it became mainstream, and it took almost ten years for the Internet to make a breakthrough. Before an innovation becomes self-sustaining, it normally has to reach "critical mass". The introduction process over time can be illustrated with an S-curve, where the critical mass, or acceptance level, is the point where the sales start to boom.

MAGNUS KRISTENSON

The introduction of clean vehicles in the fleet follows an S-curve



Clean Vehicles in Stockholm saw their task as supporting market development until the growth of clean vehicles was self-sustaining. Several important factors contribute to a self-sustaining market: technological improvements, price reductions, knowledge about the product and service guarantees, to mention a few.

Market development can also be interpreted in terms of different adopter categories. The first individuals to use the new product are innovators who see new opportunities and are willing to take risks. They may venture to buy a car that no-one else has and are prepared to pay more. Others may hold back because of a perceived lack of information or support from the surrounding world for choosing a clean vehicle.

Marketing knowledge was used to gauge what volumes were required to reach a self-sustaining market. Initially the technology is adopted by a small group of "innovators". They normally constitute around 2.5 per cent of users. The second group to catch on is the early adopters. The majority follow when a penetration of around 13 per cent has been achieved and the technology has become more commonplace. The innovators are often seen as somewhat eccentric and adventurous, while the early adopters are those who "pave the way".

"Clean Vehicles in Stockholm has influenced the development! It's all about someone having the courage to dare."

Margareta Olofsson, Vice Mayor for Environment and Recreation (Left Party) 1994-1998, Opposition Vice Mayor 1998-2002

To speed up market development for clean vehicles, it was evident that the market needed support in order to get over the first level of 2.5 per cent. Support for clean vehicles also needed sufficient impetus to encourage early adopters. It was estimated that support was needed to influence around 5 per cent of either new car sales or the car fleet. In Stockholm, companies are responsible for around 70 per cent of all new car purchases. When it was time to start broadening the market, companies were thus a natural target groups. Although it has become more common for private individuals to buy clean cars, the dominance of companies on the new car market remains.

Looking back, you can see that more measures were required. One reason is that sales of vehicles and fuels are closely connected with other markets in a way that is much more complex than for some simpler products. Self-sustaining sales of clean vehicles require interplay with positive feedback between vehicle and fuel producers, retailers and dealers on the one hand, and consumer considerations on the other hand.

MATS BÄCKER

First phase – removing obstacles and creating demand

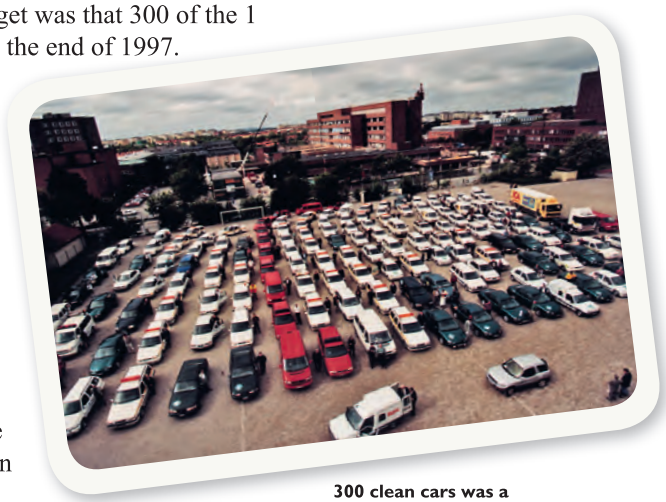
When work started there were, as we have described earlier, a number of bottlenecks stopping increased sales of clean vehicles. Obstacles included few car models, few refuelling facilities, and rules and regulations that were both complicated and made it more expensive to buy and run clean vehicles. The City of Stockholm started by removing barriers and by finding different ways of showing producers of vehicles and fuels that there was a market for clean cars.

The City's vehicles as a driving force

The overall aim of Clean Vehicles in Stockholm is to improve the environment by replacing conventional vehicles with vehicles with less environmental impact. A major task has been to influence the City's own fleet. The first interim target was that 300 of the 1 500 conventional cars should be replaced by clean vehicles by the end of 1997. This target was achieved. Most of the clean vehicles ran on upgraded biogas. Others were electric or ethanol cars.

The guiding principle has always been to hold up the City of Stockholm as a model. Living as you learn lends credibility, but the idea is more subtle than that. By leading the way and investing in clean vehicles, the City opens opportunities for followers. The ambition is to be at the leading edge and gradually demonstrate new vehicle technology as it becomes available.

One example is the Clean Urban Transport for Europe (CUTE) project, run in collaboration with Stockholm Public Transport (SL), Fortum, Busslink and the KTH Royal Institute of Technology, where three fuel cell buses and a pilot hydrogen plant were tested.



300 clean cars was a world record in 1997!
PHOTO: CITY OF STOCKHOLM

Work to replace some of the City's own vehicles with clean vehicles required a number of initiatives from Clean Vehicles in Stockholm. The City's administrations and companies had to be convinced why it was important to replace conventional cars with clean cars. A crucial problem was the higher purchase price of clean vehicles. It was not obvious who was to pay the additional cost; was it the administration using the car, or should all vehicle users share the cost? The chosen principle was that administrations and companies should not have to pay more for clean vehicles than for conventional vehicles. The additional purchase costs were actually met by grants from the EU, the government and from the City's own budget. To facilitate the transition to clean vehicles, it was decided that from 1997 the City administrations would rent their vehicles from the City's own fleet management. In this way, the City could control the vehicle fleet and assist with purchases. In the 1998 budget, City administrations were urged to choose only clean vehicles in the future, and the City companies were recommended to do the same. This speeded up the transition. By the turn of the century, the number of clean vehicles in the City fleet had increased to 500; mainly electric and biogas-powered cars. In 2000, the target was to have 600 clean vehicles operating in the City's fleets by the year end.

The same week that the City of Stockholm celebrated its 750th anniversary, the 750th clean vehicle rolled into the City's fleet. In recognition of this, Clean Vehicles in Stockholm organised a clean vehicle parade and a world record attempt.

World record attempt as the City's 750th clean vehicle rolls in, June 2002.
PHOTO: MIKAEL RÖHR

Even if the number of clean cars increased, it was difficult to get the drivers to fill up with clean fuels. Refuelling facilities were scarce, and many had to make a detour to refuel with ethanol or upgraded biogas. To increase the use of biofuels, the City of Stockholm set as a target that their own clean vehicles should run on 50 per cent upgraded biogas and 80 per cent ethanol respectively. As work in 2000-2001 focused on increasing biogas production, the requirement for using this fuel increased. The aims were gradually strengthened, and it was decided that by 2006, 60 per cent of the City's vehicles should be clean vehicles, running on biofuels to 80 per cent.

"Our first EU project came about almost by chance. I had replaced the head of administration on a trip to Brussels. In a meeting break in Brussels, I talked to a couple of people from other cities about starting a joint project on clean vehicles. 'As long as you prepare the application', was their reply. I took on the challenge, and six months later the ZEUS project was off the ground".

Gustaf Landahl,
Clean Vehicles in Stockholm

LENNART JOHANSSON, CITY OF STOCKHOLM

EU projects fund introduction of clean vehicles

When the decision was made in 1994 to replace the City's vehicles with clean vehicles, the Environment and Health Administration was asked to draw up a proposal for how the replacement programme would be financed. One of the proposals was to receive EU funding by participating in various EU projects. The aim of participating was not just purely financial, but also to create networks with other European cities and stakeholders and to strengthen Stockholm's position as a leading environmental city.

ZEUS put Stockholm on the European clean vehicle map

The first large EU project that the City of Stockholm participated in was ZEUS – Zero and Low Emission Vehicles in Urban Society. The project ran from 1996 to 2000. Stockholm was coordinator for the project, which was carried out in cooperation with seven other European cities.

The aim of the project was to overcome market barriers to a wider introduction of clean vehicles. Some examples of barriers that ZEUS focused on were the higher purchase price of clean vehicles and the lack of refuelling facilities, charging stations and servicing, as well as the lack of incentives to promote clean vehicles. The latter was vital for market growth. Within the framework of ZEUS, the goal was to introduce a total of 1200 clean vehicles in the cities, including cars, bicycles, buses and trucks. The City of Stockholm worked with the following sub-projects:

- responsibility for joint procurement of electric vehicles in ZEUS cities
- 300 clean vehicles (electric, ethanol and upgraded biogas) in the City's own fleet
- filling stations for upgraded biogas
- distribution of upgraded biogas to public filling stations with a biogas-powered truck
- two biogas-powered refuse collection trucks for the Old Town
- conversion of six of Stockholm Public Transport's petrol-electric hybrid buses to ethanol
- fast-charge station for electric cars
- promote the introduction of incentives to increase the use of clean vehicles

ZEUS gave the City of Stockholm scope to carry out a range of vital measures to increase the availability of refuelling stations and vehicles. It was important to demonstrate that clean vehicles worked. Stockholm gained position in Europe and was seen as a good example of how cities can work with clean vehicles. The City also gained prestige for being a good project administrator.

"We started running the two first biogas refuse trucks in the Old Town in 1998. The drivers liked the trucks, mainly because they were less noisy. When one of the trucks was temporarily out of use and replaced with a diesel truck, many residents phoned and complained about the increased noise! They had evidently become used to the lower noise level. This confirmed that our work was appreciated."

Nils Lundkvist, Traffic and Waste Management Administration

A whole range of EU-funded projects

As early as 1995, Stockholm together with cities around Europe applied to run the ELCIDIS (ELectric Vehicle CIty DIStribution) project. Due to the long approval time, the project did not start until 1998 and ran until 2002. In the project, Stockholm cooperated with e.g. Rotterdam, Stavanger and La Rochelle. Within the framework of ELCIDIS, six hybrid trucks (Mercedes Atego) and three electric vans (Citroën Berlingo) were tested for goods distribution in central Stockholm. The project was only planned for three years, but was extended by 12 months since it took more than a year for the trucks to arrive. Four transport companies were included in the project. ELCIDIS was also supported by the Swedish Energy Agency.

Since then, Stockholm has taken part in a range of EU projects and has been coordinator for several of them, e.g. ZEUS, Trendsetter and BEST. The City has used the EU projects to facilitate the introduction of new technology and to demonstrate how it works, (see table at the back for an overview of EU projects). Stockholm has also been consistent in its work with initiatives for ethanol and biogas, whilst at the same time testing new technologies. The City has not allowed EU calls for proposals to steer the direction of the work, but has used EU funding to implement existing action plans. Otherwise, there is a risk of jumping from one technology to another.

The refuse collection trucks introduced during the ZEUS project are still in use.
PHOTO: MAGNUS KRISTENSON

Emission and noise free transport with electric-hybrid truck tested in Stockholm within the framework of the ELCIDIS project.
PHOTO: MAGNUS KRISTENSON

Other funding of clean vehicle projects

Swedish funders have also contributed money to a great number of the City of Stockholm's clean vehicle projects. Different government authorities such as the Swedish Transport and Communications Research Board (KFB), the Swedish Delegation for Sustainable Transport and the Swedish Energy Agency have contributed funding to projects initiated by Clean Vehicles in Stockholm. The government's Local Investment Programmes (LIP) and Climate Investment Programmes (KLIMP) have also funded projects. The City of Stockholm's own environmental investment programme, the "Environmental Billion Fund" has also contributed money. In total, Clean Vehicles in Stockholm has distributed purchase grants to a great number of clean vehicles. During the first phase, focus was on the City's own fleet.

Through LIP, Stockholm received funding for several projects that aimed to increase the number of clean vehicles and the use of biofuels. In the first round of applications the City received support for two projects: "Alternative vehicles and fuels", which made it possible to subsidise the additional cost of 300 clean vehicles, and "Filling stations for ethanol fuel mix", which introduced seven E10 (10 per cent ethanol and 90 per cent petrol) filling stations in Stockholm. The latter project, however, was discontinued as a new requirement in the EU mineral oil directive, which governs the content of fuels, only allowed 5 per cent ethanol blend. At the same time, fuel companies volunteered to include 5 per cent ethanol in all petrol, starting in the Stockholm area, which made the project less worthwhile.

Collaboration with fuel companies

For sales of clean vehicles to gather momentum it was vital to increase the number of filling stations for biofuels. The strategy for Clean Vehicles in Stockholm was to collaborate with fuel companies to introduce pumps for upgraded biogas and ethanol at many sites around the city. Encouraging the market players to supply biofuels was a deliberate strategy. One advantage of working together with fuel companies was that existing payment systems and fuel cards could be used for refuelling. Also, pumps became available to the public and businesses.

Parallel with initiatives in Stockholm, the BioAlcohol Fuel Foundation (BAFF) in Örnsköldsvik decided to import ethanol cars in 1994. Stockholm joined the project and ordered five Ford Taurus FFV. In 1996, the first E85 pump was installed in Stockholm. OK (later OKQ8) promised to provide an E85 pump for every 10th ethanol car. The City of Stockholm ordered a further 35 Taurus FFV and OK provided another four ethanol pumps.

Stockholm worked mainly with OKQ8, Statoil and Shell to increase the number of filling stations. In 2000, there were four filling stations for upgraded biogas and eight E85 pumps. Birka Energi (later Fortum) invested in four fast-charge stations for electric cars, the first of which was installed at the Shell station at Norra Bantorget. Recharging facilities were also installed in some 20 multi-storey car parks in and around Stockholm. Since there were still relatively few refuelling stations, a map was published showing pumps and charge stations.

Refuelling and charging sites in Stockholm year 2000.

Lower taxes on clean vehicles and renewable fuels were two of the requests put forward to Finance Minister Bosse Ringholm by Alf T Samuelsson, Vice Mayor for the Environment, Stockholm, Bengt Sabel, member of the Traffic Committee, Gothenburg and Emmanuel Morfidakis, chair of the Technical Committee, Malmö in spring 2002.
PHOTO: MAGNUS KRISTENSON

Collaboration to remove obstacles

When work with clean vehicles started, there were many obstacles in legislation and taxation preventing a quick market introduction. Over the years, decisions within the Swedish Riksdag, Government and national authorities have been required to remove such barriers. The City of Stockholm has worked actively to facilitate changes in rules and regulations. To add strength to the arguments when dealing with decision makers at national level, Stockholm has collaborated with other active clean vehicle cities such as Gothenburg and Malmö. The cities have made joint representations to the finance and environment ministers over a number of years, starting in 1998.

The aim of the representations was to demonstrate the cities' commitment and to clarify the obstacles towards more clean vehicles. The cities gave a background for their requirements and what they themselves had done to drive developments forward. They put forward concrete proposals for measures that would facilitate a growing market for clean vehicles. Politicians from the cities worked together on such issues. A major issue when they lobbied the ministers in 1999 was to change the unfair tax rules for clean vehicles. In particular, this related to the rules for company car benefit, which were based on purchase price. Since clean vehicles were more expensive, the taxation on benefits was higher. Other issues which were raised in 1999 were that the environmental classification system should not discriminate against clean vehicles, tax rules for alternative fuels should be long-term, and approval and control of clean vehicles should be simplified. The representation gave quick results, and the benefit value for clean cars was equalised with conventional cars the same year.

Environment Minister Kjell Larsson makes an entrance on an electric scooter at the 1999 Clean Vehicles Conference.
PHOTO: CITY OF STOCKHOLM

In 2000, politicians in the cities wanted a national definition of clean vehicles. Another issue that was put forward was that blended fuels must be permitted and not opposed. This was shortly after E10 (10 per cent ethanol and 90 per cent petrol) had been prohibited. Again, politicians asked for clear and coordinated regulations for clean vehicles.

MAGNUS KRISTENSON

Technology procurements drive the market

A problem for the City of Stockholm was that there were so few clean vehicle models on the market. This made it difficult to find clean vehicles to meet customers' transport demands. The way of encouraging car manufacturers to invest in new models was to gather buyers in a joint call for tenders for larger volumes. The City of Stockholm initiated a number of technology procurements for vehicles over the years, which has made a significant contribution to increasing the number of models on the market.

Technology procurement within ZEUS

The technology procurement carried out within the EU project ZEUS was the first of its kind, as it gathered buyers from several different countries. This was more of a coordinated procurement than a technology procurement, but there were expectations on new battery technology for passenger cars and delivery vans included in the call.

The need for a joint procurement arose as the cities in ZEUS felt there were too few electric vehicles on the market. The project partners decided to work together to develop the market by sending out a joint call for tenders to vehicle manufacturers.

Stockholm led the procurement and formed a buyers' consortium together with four of the cities in ZEUS: Athens, Copenhagen, London/Coventry and Palermo. The electric vehicle procurement group drew up a list of required specifications for the vehicles. All known manufacturers of electric cars and light vans were contacted, and an advert was placed in the Official Journal of the EU in February 1997. The specifications formed the basis for the call for tenders. In total, the cities were interested in ordering 174 passenger cars and 37 light vans of the zero emission type. The agreement also had an opening for third party buyers.

Out of 20 manufacturers of electric vehicles, seven were prepared to meet the demand of all these cities. The lack of right-hand drive vehicles was a particular barrier for the British market. The tenders that were finally chosen were: Citroën Berlingo Electrique, Fiat 600 Elettra and, for the British market, Peugeot 106 Electric. Even if the procurement did not result in technological development, Citroën came up with a new concept by offering the purchase of a car without batteries combined with battery leasing. This proved a great success, since the leasing scheme meant that buyers could be assured that they would always have access to functioning batteries.

The five European cities bought a total of 200 electric cars and managed to cut prices substantially. Stockholm signed agreements with Citroën and Fiat. In addition to favourable prices, the market opened up in some countries where electric cars had not previously been available and battery leasing was introduced for the first time. Through the procurement, users outside ZEUS were also able to jointly buy more than 150 electric cars at the same advantageous price.

Technology procurement of ethanol cars

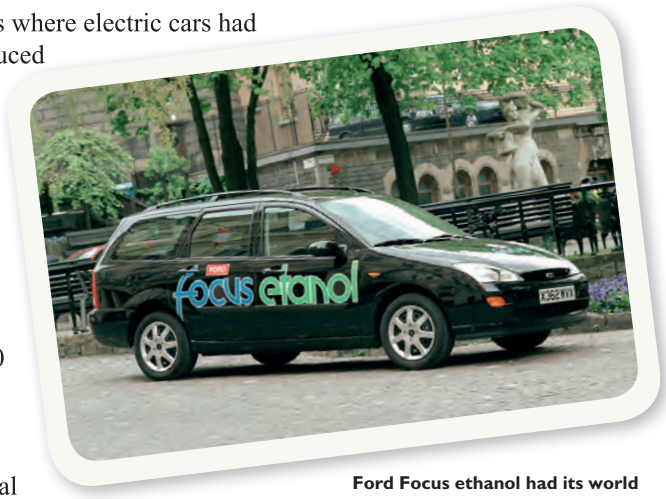
Clean Vehicles in Stockholm initiated and carried out a technology procurement of mid-size petrol/ethanol cars with financial support from the Swedish Delegation for Sustainable Technology. The procurement was carried out 1998-2000 and led to the world premiere of Ford Focus ethanol in Sweden in 2001.

Initially, a buyers' consortium was formed including the City of Stockholm, Swedish Meteorological and Hydrological Institute (SMHI), Växjö municipality, Borås technical services department, Malmö City traffic department, Helsingborg municipality, Haninge municipality, Örebro housing authority, Örebro municipality, Länsförsäkringar in Malmö, Halland county council and the Federation of Swedish Farmers (LRF).

The need for a procurement arose since there was only one E85 model available at the time (Ford Taurus FFV, see photo on page 7). Further reasons were that the car could only be leased, fuel consumption was high and the model was not well adapted to user requirements. Also, there were already more than 30 fuel stations for E85 in the country.

A pre-study was carried out to obtain information about potential buyers and their needs. Users were asked, for example, which of the three size models they preferred. Requirement specifications were drafted and the desired car was described in a brand-neutral way; a clean car of FFV type with emissions and energy efficiency comparable or better than a similar conventional car. Car dealers were asked similar questions. The pre-study showed that Volvo and Ford were interested. Volvo presented a V70 ethanol model and arranged test drives for members of the political reference groups outside the City Hall in Stockholm.

In May/June 1999, when it was evident that the only tender would come from Ford, since Volvo felt they lacked knowledge about the long-term performance of their car, a negotiated procedure took place. One condition for delivery from Ford was that the user group generated notification of interest for a total of 4 000 Focus FFV cars by the end of April 2000. On their part, Ford offered a discount of SEK5 000 below the price of a normal Focus. A marketing campaign was set up as part of the efforts to gather a sufficiently large user group. The campaign resulted in orders for 3 000 cars. Ford started delivering their vehicles in summer 2001, and by 2003 they had delivered 8 000 vehicles. Ford points out that without the technology procurement, the Focus FFV version would not have reached Sweden.



Ford Focus ethanol had its world premiere in Stockholm.
PHOTO: MAGNUS KRISTENSON

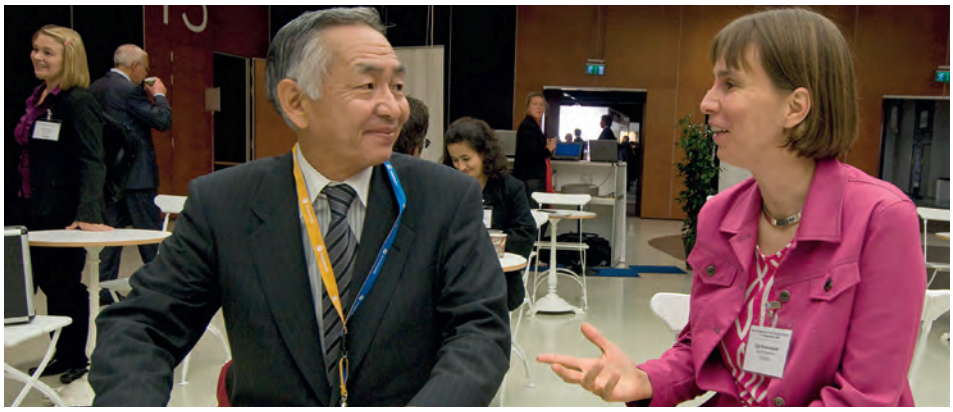
"One of the most crucial contributions by Clean Vehicles in Stockholm was the procurement of ethanol cars in 2001. This was an ingenious move, which showed that a proactive approach could solve the Catch 22 situation: there were no refuelling facilities because there were no cars and no cars because there were no refuelling facilities. Stockholm managed to undo this knot and they should take credit for this."

Jacob Lagercranz,
chair Green Motorists

Procurement of biogas-powered and electric hybrid vehicles

During 2001, Clean Vehicles in Stockholm initiated two new procurements. One was for biogas-powered vehicles and one for electric hybrids. These procurements were later amalgamated with a common municipal car procurement carried out by Kommentus. There was great interest, both from public administrations/companies and private companies. The final procurement was carried out on behalf of 46 municipalities, 15 municipal companies, 4 county councils, 42 units within the City of Stockholm, and 25 other companies and organisations.

The procurement resulted in a framework agreement with discounts of up to 14 per cent on existing clean vehicles on the Swedish market for the parties that took part. There were no specific incentives for clean vehicles in the agreements or the procurement, so it was up to each purchaser to set up their own principles for how many clean vehicles their fleet should contain, just as the City of Stockholm had done. The procurement resulted in the purchase of 400 electric and electric-hybrid vehicles and 650 gas-powered vehicles. At the request of the purchasers, the procurement was supplemented with ethanol vehicles. Within the agreement, 6 000 ethanol vehicles were ordered. One effect of the procurement was that Toyota Prius was introduced in Sweden earlier than in the rest of Europe.



The City of Stockholm has at all times collaborated with market players. Here, the engineer Takehisa Yaegashi, who led the development of the Toyota Prius, in conversation with Eva Sunnerstedt, Clean Vehicles in Stockholm.
FOTO: MAGNUS KRISTENSON

Technology procurement of ethanol transport vehicles

The range of clean passenger cars on the market increased substantially from 2005, but there were still few transport vehicles. Many municipalities and small businesses, e.g. carpenters, use such vehicles. In 2005-2007, the Environment and Health Administration carried out a technology procurement of ethanol-powered transport vehicles, supported by the City's Environmental Billion Fund. The procurement was initiated since the development of alternative fuel transport vehicles was slow and there was a lack of clean light truck and heavy vehicle models. The procurement was carried out in the following stages:

- survey of interest. A questionnaire was distributed to 5 020 legal entities that owned at least five transport vehicles; 200 responded
- information seminars for interested buyers
- limitation of the procurement to three vehicle classes
- drafting of specifications in cooperation with interested buyers
- meetings with manufacturers and ongoing information to them
- City of Stockholm signed an agreement with Kommentus, which assumed responsibility for carrying out the procurement and entering into a contract with the selected supplier
- one tender was accepted, contract awarded to Volkswagen, and the procurement was closed

The outcome of the procurement was an accepted tender for one of the three requested classes: a 2-5 m^3 van (VW Caddy). Volkswagen was awarded the general contract and 41 municipalities/municipal companies/county councils and 186 privately owned companies (a total of 227 units) were entitled to place orders under the agreement. Despite a big market, Volkswagen announced severe delays, just over a month before the first delivery. It turned out that the planned ethanol engine was not powerful enough for the delivery vans. The estimated delay was almost a year. As a sort of compensation, Volkswagen offered the buyer group a discount on a biogas-powered Caddy. This was only of interest for those who operated in parts of the country that had biogas. In the end, there were no deliveries of Volkswagen Caddy Ethanol. So despite great efforts from the City of Stockholm, the procurement did not increase the range of clean vehicles on the market.

City of Stockholm trains electric car drivers.

PHOTO: LENNART JOHANSSON, CITY OF STOCKHOLM

Internally focused information and communication

Information and communication have been vital for spreading knowledge about clean vehicles and fuels. This has been done through e.g. newsletters, seminars and conferences, with Clean Vehicles in Stockholm functioning as a resource centre for information.

In the start, when focus was on replacing part of the City's own fleet with clean vehicles, information and communication were largely aimed at the City's own organisation. Until Stockholm's politicians agreed on a central vehicle policy, it was up to the administrations and companies to decide whether they should acquire clean vehicles. They had to be convinced through training and information. External attention also helped strengthen the initiatives internally.

During 1998-2000, when the City had built up a fleet of clean vehicles, information and communication efforts intensified. The target group was mainly those who drove and managed the City's cars. Focus was on environmental benefits of clean vehicles, but also on technology. The aim was to interest, stimulate, motivate and encourage the early users, who at times had to live with technologies that were not always reliable. By the end of the first phase of this work, a semi-external newsletter was published and media gatherings were organised when new refuelling facilities opened.

Opening of the 1000th E85 filling station at OK/Q8 in Kista, October 2007.

PHOTO: LENNART JOHANSSON, CITY OF STOCKHOLM

Second phase – broadening the market

MAGNUS KRISTENSON

As efforts to adapt regulations and legislation and to increase the range of clean vehicles on the market started to show results, work entered the second phase. Now it was time to encourage more people to choose clean vehicles. Work increasingly focused on businesses and other organisations. At the same time, collaboration with market players intensified.

Incentives

When obstacles were reduced through simplified administrative regulations, the introduction of more models and refuelling facilities, clean vehicles became more equivalent to conventional cars. Clean Vehicles in Stockholm wanted to go further than just removing obstacles. The basis was that there should be a reward for environmentally sound vehicles. The City of Stockholm funded a study of various measures to stimulate the use of clean vehicles and show the effects of such incentives.

Work to introduce incentives for clean vehicles received an impetus during the 2000s. The collaboration between Stockholm, Gothenburg and Malmö continued, now with the focus on introducing mainly monetary incentives for clean vehicles. New representations were made to national politicians during 2002 with the aim of achieving:

- further tax relief for clean vehicles
- further tax relief for alternative fuels
- a long-term taxation strategy to stimulate clean vehicles and alternative fuels
- adaptation and supplementation of regulations for clean vehicles
- registration and labelling of clean vehicles (Road Traffic Registry)

As work focused increasingly on external users, Stockholm City Council agreed in 2003 on a target that 4 per cent of new car sales should be clean vehicles by 2006. For Clean Vehicles in Stockholm it became increasingly important to convince businesses of the advantages of clean vehicles. Many were still reluctant, not least due to the higher purchase cost.

In the second phase, the City of Stockholm introduced a purchase subsidy for transport companies. Around 800 clean vehicles were subsidised through the national climate investment programme KLIMP. Within the framework of the EU project Biogasmax, the City subsidised a further 100 vehicles, most of them external. For many of the companies receiving the subsidies, this incentive was a major factor for choosing clean vehicles. The subsidy has, for example, made it easier for taxi companies to change over to clean vehicles.

Free parking for clean electric cars was introduced in Stockholm as early as year 2000. Free parking for all clean vehicles used by residents and for commercial purposes was introduced in May 2005 and applied until the end of 2008. As permits were issued, the Traffic Administration checked that the vehicles met clean vehicle requirements. They were also authorised to ask for receipts or other proof showing that cars had been driven predominantly on clean fuels.

Clean Vehicles in Stockholm also works in other ways to increase the use of clean vehicles. As a large customer, the City has been able to use procurement specifications to further the development of environmentally adapted transport. Since 2004, all central

agreements within the City contain environmental requirements. A guide to environmentally adapted transport by way of travel tips and procurement has been jointly published by the Environment and Health Administration and the Traffic Administration. Requirements are made for the use of clean vehicles, as well as for biofuels and tyres.

The development of clean vehicles has also been speeded up by incentives from Stockholm County Council. In February 2004, the county council introduced an extra mileage allowance for special transport services carried out in taxis contracted by the council. To qualify for the bonus, the vehicles must drive on at least 80 per cent renewable fuels.

At Stockholm-Arlanda airport, ecotaxis have a separate queue, which gives precedence over conventional taxis. This has an effect on taxi companies, as the waiting time for ecotaxis is shorter. However, as an increasing number of taxis have been replaced by clean vehicles, the effects of the incentive have weakened. A decision has been made that only ecotaxis will be accepted at the airport from 1 July 2011.

At Stockholm-Arlanda, ecotaxis have a separate queue.
PHOTO: MAGNUS KRISTENSON

"It is extremely important that central players – vehicle operators, fuel companies, main customers, authorities, etc. – collaborate if you want long-term success. Clean Vehicles in Stockholm has been exemplary in its role as team leader and has facilitated collaboration and enabled all players in Stockholm to strive for the same goal."

Jonas Strömberg, Environmental Manager at SL, 2000-2006

PER WESTERGÅRD

Decentralised car purchasing

When the City of Stockholm's fleet management, MFO, was wound up in 2002, staff and resources were transferred to the Environment and Health Administration. However, a private leasing company took over the vehicles, which changed the situation. The number of clean vehicles in the City's fleet started to decline. Clean Vehicles in Stockholm stepped in as adviser to administrations and companies, with particular focus on purchasers. An additional person was appointed to support the administration's work with clean vehicles. A joint procurement of cars for the City was also carried out to secure favourable terms for City administrations and companies. To spread further knowledge about clean vehicles, seminars and test drives were organised.

The pro-active working methods gave results. After an initial decline, the number of clean vehicles in the City's fleet started to increase. Clean Vehicles in Stockholm has continued to act as adviser to the City's administrations regarding vehicles and fuels, and also funds the additional cost of clean vehicles with up to SEK30 000 per vehicle. The work of Clean Vehicles in Stockholm has also received political backing. Firstly, the City Council recommended that clean vehicles should be a priority when buying or leasing new cars. Later, the Council decided that all new vehicles should be clean vehicles, except for special vehicles and emergency vehicles. Clean Vehicles in Stockholm monitors how the City's administrations and companies comply with the decisions. Another important way of increasing the market for clean vehicles is that the City demands clean vehicles in procurements of all transport services, e.g. taxis, and that a certain percentage of renewable fuels is used. Clean Vehicles in Stockholm acts as adviser in City procurements of transport and transport-related services.

Trendsetter opens for external information and communication

During 2001-2005, when the market started taking shape and more clean vehicles became available, the direction changed towards more external information and communication. This was made possible by the EU project Trendsetter. Clean Vehicles in Stockholm acted more and more as an independent "supplier of facts" on clean vehicles and fuels, with the aim of increasing the number of clean vehicles in Stockholm as a whole. External information became an important tool for achieving a market breakthrough for clean vehicles. Since surveys at the time showed low interest for the environment as well as poor knowledge about clean vehicles, focus was put on conveying the message that price and performance of clean vehicles were no different from conventional cars. Information about available models and fuels was also important.

The website miljöfordon.se compiles product-neutral information on clean vehicles and fuels.

Companies and private individuals that had chosen clean vehicles were brought to light, and Clean Vehicles in Stockholm provided journalists with facts and contacts. In 2000, the first external newsletter was published and a communicator was appointed in 2002. This meant that there was more time and resources for strategic information and communication efforts. In 2004, www.miljofordon.se was launched in collaboration with Gothenburg and Malmö.

The aim of the website www.miljofordon.se is to spread product-neutral information on clean vehicles and fuels. The website presents all available information, and you can search for and compare clean vehicles and find filling stations for renewable fuels.

The portal is jointly run by Clean Vehicles in Stockholm, Clean Vehicles in Gothenburg and the Traffic Department in Malmö, and is partly financed through EU funds. The website developed from an Internet information site run by Clean Vehicles in Gothenburg since 1998.

The increased focus on external communication increased the need for facts. From 2001, Clean Vehicles in Stockholm started gathering statistics about the development of sales of clean vehicles and renewable fuels in the City of Stockholm and Stockholm County. Until the end of 2004 it was impossible to distinguish between conventional cars and clean cars in national statistics. Bi-fuel cars were registered as conventional cars. Basic documentation collected by the City of Stockholm has also been of great importance for understanding market development of clean vehicles.

Adverts in Stockholm for the campaign "Clean vehicles are better than normal cars".
PHOTO: HELENE CARLSSON

Campaign – "Clean vehicles are better than normal cars"

In 2003, Clean Vehicles in Stockholm carried out a big campaign together with car dealers (Ford, Toyota, Volkswagen, Mercedes and Nomaco/Melex) and fuel suppliers (Statoil, OKQ8, Stockholm Vatten, AGA Gas). The campaign was partly financed by EU funds through Trendsetter and partly by the participating players. The aim of the campaign was to increase knowledge about clean vehicles, influence attitudes and buying patterns, with increased sales as a result. The main message used in the campaign was: ''Clean vehicles are better than normal cars", i.e. they are comparable in price and better for the environment than petrol and diesel cars.

The main target groups for the campaign included media (national, local and specialist motor and environment media), clean vehicle manufacturers, business managers and environmental managers. The campaign was also aimed at vehicle purchasers in transport companies, companies with large fleets, companies with a strong environmental profile, vehicle purchasers in companies with environmental profiles, and car leasing firms.

The campaign included:

- tailor-made activities for specially invited decision-makers in target groups
- collaboration around the launch of ''At least one clean vehicle" – a network of " pioneering" companies. (The network was run by the companies involved and received great media attention as the initiators included Swedish Television and one of Sweden's major daily newspapers Dagens Nyheter.)
- new information on clean vehicles and fuels, collected and disseminated to the various target groups
- fact sheets on vehicles and fuels
- test driving of clean vehicles offered to companies and journalists
- information for companies about their experience of clean vehicles
- individual consultations
- press releases and other media contacts

The campaign was a success and resulted in a revised media picture. The concept of clean vehicles was established, and reporting on clean vehicles by the media increased by 700 per cent.

See and experience clean vehicles – test fleets and test driving

To make it easier for companies to choose clean cars, Clean Vehicles in Stockholm arranged test fleets. This meant that companies could borrow clean vehicles, free of charge, for a week. In return, they were asked to fill in a questionnaire. The aim was to give companies and drivers an idea of driving and refuelling a clean vehicle and find out how clean vehicles met their requirements for functionality, performance, safety, economy and the environment.

Test fleets were arranged during two periods:

- Test fleet within City of Stockholm's fleet management MFO
  The City funded the fleet, administered by MFO.
  Result: 100 drivers borrowed clean vehicles, 9 purchased, 39 planned to buy.
- Test fleet within the EU project Trendsetter
  Test fleet administered by car dealers, jointly financed by EU (33%), dealers (33%) and general agent (33%).
  Result: Out of the 99 people who borrowed clean cars, almost everyone was satisfied, and half of them said that they were prepared to pay a higher price for a clean vehicle.

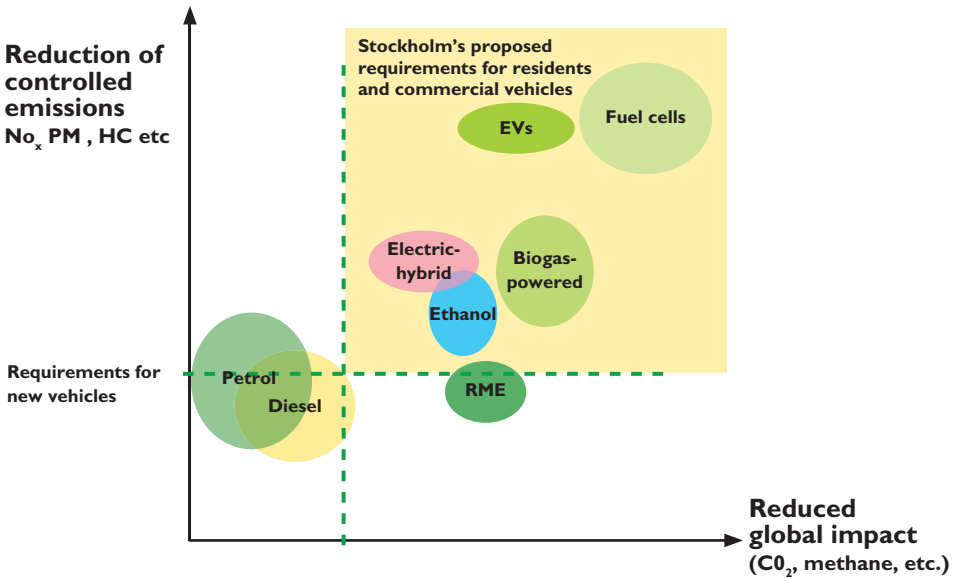
Test driving of clean vehicles has also been arranged at several fairs and conferences. Thanks to good collaboration with car dealers, who also wanted to demonstrate their vehicles, it has been possible to test drive biogas-powered, ethanol and hybrid vehicles. Fuel companies have also exhibited "demo stations" for biofuels.

Test driving of clean vehicles was offered at a company event at Haga Forum, autumn 2003.
PHOTO: MAGNUS KRISTENSON

Need for clean vehicle definition

From the start, Clean Vehicles in Stockholm followed the line that clean vehicles are vehicles that can run on electricity or biofuels. As work became more external, it became increasingly important to have a concrete definition of a clean vehicle. The City of Stockholm's first clean vehicle definition was based on a combination of local and global environmental benefit.

Diagram of environmental impact from different fuels



Stockholm's first clean vehicle definition was based on a combination of local and global environmental benefit according to documentation from 1996.

In May 2002, Stockholm's Real Estate, Streets and Traffic Committee agreed on a clean vehicle definition for the City. The definition was also used as a guideline for the decision on free parking for clean vehicles which was being drafted.

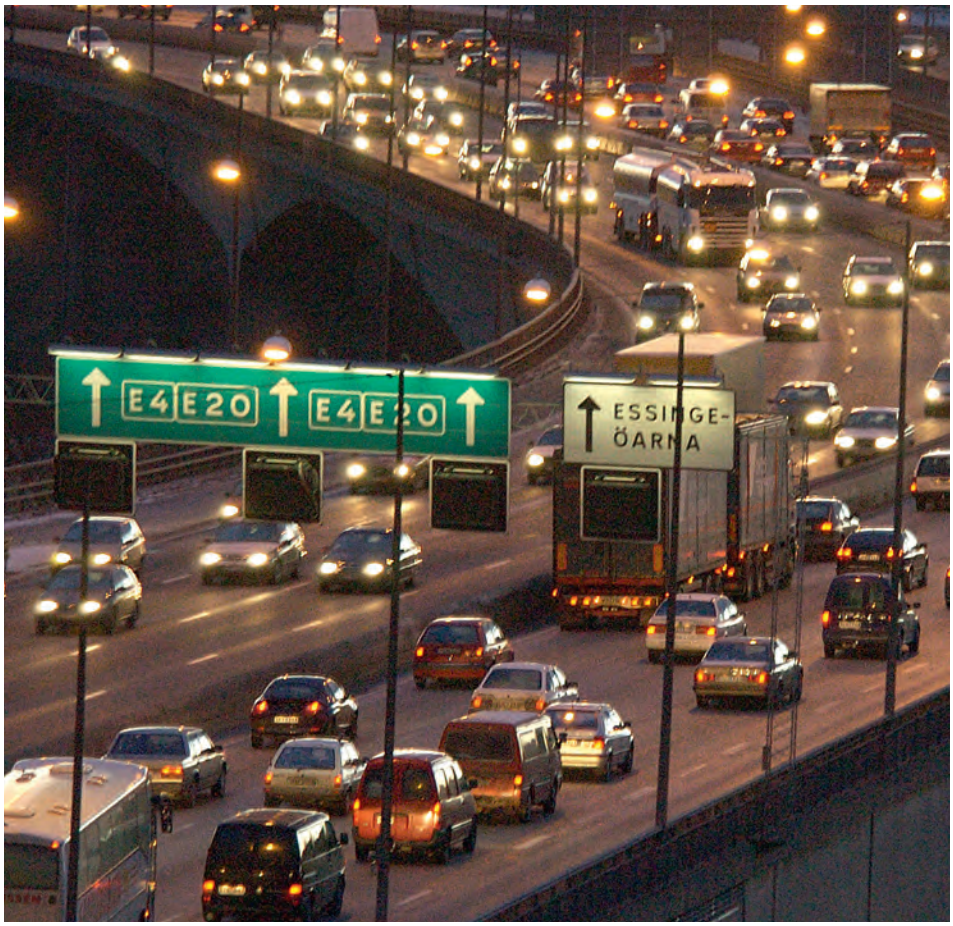
Stockholm's clean vehicle definition between 2002 and 2007

The definition of "clean vehicles" applies to vehicles with a total weight of less than 3 500 kilos:

- Electric vehicles, all model years
- Hybrid vehicles run on petrol/electricity, models from 2000
- Vehicles certified in environmental class 1, and bi-fuel types, run predominantly on upgraded biogas
- Flexi-fuel vehicles run predominantly on bioalcohol (e.g. E85)

The same definition was already used in the regulations for reduced taxation on company car benefit: electric, electric hybrid, gas-powered and ethanol vehicles. A number of towns and cities introduced clean vehicle definitions in order to offer free parking, like Stockholm. Gothenburg's definition also included cars with low petrol consumption. The range of definitions made it unclear for consumers, businesses, car manufacturers and fuel companies what actually constituted a clean vehicle. The metropolitan cities therefore, through their representations, demanded a national clean vehicle definition.

Finally, the Swedish Government adopted a definition of clean vehicles in January 2005. The definition was published in the Swedish Ordinance concerning the purchasing and leasing of clean vehicles by public authorities (2004:1364). Under the ordinance, at least half of new passenger cars bought or leased by an authority must be clean cars.



PER WESTERGÅRD

Requirements have gradually increased, and in the 2009:1 version, safety requirements were strengthened and the proportion of clean vehicles was increased to 100 per cent. For emergency vehicles, 50 per cent must be clean vehicles.

Under this definition, clean vehicles are "passenger cars equipped with technology to run partially or entirely on electricity, alcohol or other gas (except LPG) and that are of environmental class 2005, Electricity or Hybrid according to Appendix 1 of the Swedish Act on Motor Vehicle Emission Control and Motor Fuels (2001:1080)". Petrol and diesel vehicles are also defined as clean vehicles if the manufacturer can show that they emit a maximum of 120 g/ CO_2 per kilometre during mixed driving. Diesel vehicles must also be equipped with a particulate filter. For biogas-powered, ethanol and electric vehicles, there are also restrictions on fuel/electricity consumption.

State "pump law" initiative

As more models became available on the market, the lack of refuelling facilities for clean fuels was an increasing limitation. In 2005, the government proposed a new law requiring fuel stations to supply renewable fuels. The bill was based on the Government Official Report "Renewable vehicle fuels"(SOU 2004:4). The City of Stockholm was positive to speeding up the refuelleing infrastructure in this way, but felt that the new law would favour ethanol fuelling facilities, as they are cheaper to install than e.g. biogas pumps. The City therefore proposed that the law would be limited to refuelling stations selling more than 3 000 m^3 fuel per year, with an obligation to open both ethanol and upgraded biogas pumps (Reg.nr 2004-001176-217). However, Stockholm's ideas did not gain favour with the government, and the "pump law" came into force in April 2006.

"In the early 1990s, Gothenburg took a clear lead for clean vehicle activities. Malmö quite possibly acted as a locomotive for a period thereafter. During the past ten years, however, Stockholm has dominated the near-to-market clean vehicles activities in Sweden, not least through their leading role in a number of EU projects."

Hans Pohl,
motor industry analyst,
Vinnova

Third phase – from pilot country to a bigger market

HELENE CARLSSON

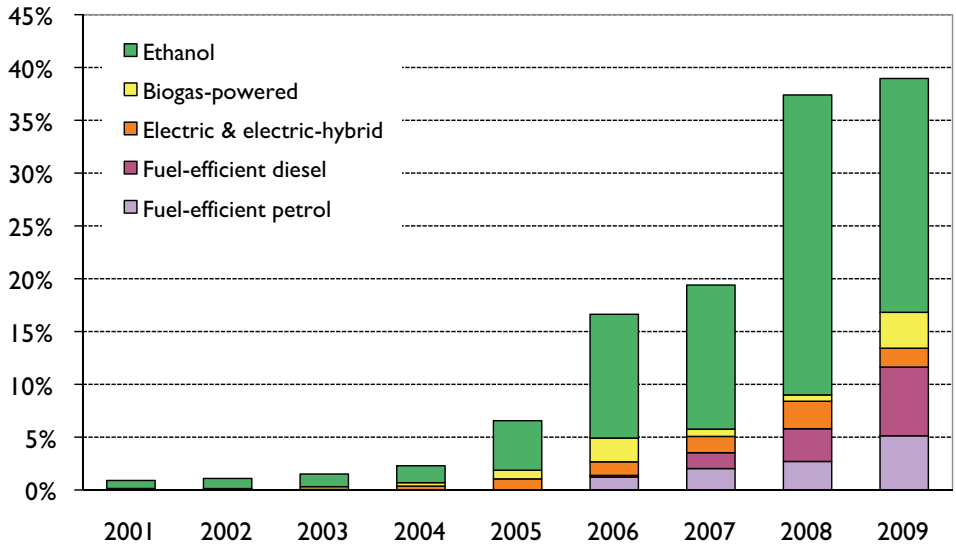
Cleans vehicles are now considered normal and in 2009, almost 40 per cent new car sales in Sweden were clean vehicles. Sweden is regarded as a major pilot country for clean vehicles, but car manufacturers require a bigger market in order to bring out new generations of clean vehicles. During the third phase, Stockholm has focused on increasing the demand for clean vehicles outside the country in collaboration with other European cities.

”We are manufacturers, and our job is to develop, produce, market and sell cars. Collaboration with different actors in society is a key factor for success when introducing new technology on the market. In this respect, the City of Stockholm is a good example. The way Clean Vehicles in Stockholm have inspired other European countries to work actively for clean vehicles has needless to say been a help to us.”

Anders Wahlén, Environmental Manager, Volvo Cars, Sweden

In Sweden, interest for clean vehicles really took off in 2006. Public awareness about climate issues increased, and many businesses that had been hesitant started to take environmental issues seriously. New models were launched and an increasing number of refuelling stations started to offer alternative fuels. At the same time, a range of significant incentives were introduced, such as the clean vehicle premium and exemption from congestion tax for clean vehicles.

Percentage of clean vehicles in new car sales, Stockholm County



Percentage of new registrations of clean vehicles (passenger cars) in Stockholm County 2001-2009.

The 4 per cent target was achieved already by 2005, and in 2006 more than 15 per cent of all new vehicles were clean, and the percentage has continued to increase. The City of Stockholm had, yet again, exceeded its expectations. In the Stockholm Environmental

Programme 2008-2011, the targets for 2010 are that 35 per cent of new car sales will be clean vehicles and that the proportion of renewable fuels used will grow to 8 per cent of total fuel consumption in Stockholm County. The 35 per cent target was already met by 2008, and Stockholm is well on the way to achieving the target for renewable fuels. For the City's own fleet, the target is that 100 percent will be clean vehicles fuelled with at least 85 per cent renewable fuels.

More local and national incentives

Lower benefit taxation, tax relief on biofuels, purchase grants to transport companies and free parking for clean vehicles were important driving forces for increasing the market. During the third phase, further initiatives that Clean Vehicles in Stockholm had worked for were realised.

Clean vehicles exempted from congestion taxes

During the congestion tax trial conducted from January to July 2006, clean vehicles were exempted from paying congestion tax when entering or leaving Stockholm's inner city. As the taxes were made permanent in August 2007, the exemption for clean vehicles remained. The original plan was that this incentive would end in July 2012. In 2008, however, the Swedish Riksdag decided that the exemption for clean vehicles under the provisions of the Congestion Tax Act (2004:629) would not apply to cars sold and registered after 31 December 2008. Clean vehicles registered before 1 January 2009, would be exempt until 1 August 2012.

Congestion taxes were introduced in Stockholm to reduce traffic in the inner city. Clean vehicles registered before the end of 2008 are exempted from the tax until 1 August 2012.
PHOTO: PER WESTERGÅRD

The clean vehicle premium was so popular, that the government ran out of funds earlier than expected.
PHOTO: LENNART JOHANSSON, CITY OF STOCKHOLM

Clean vehicle premium

The Swedish Government introduced a clean vehicle premium of SEK10 000, paid to private individuals who bought a clean vehicle. The cash rebate scheme applied from 1 April 2007, and was planned to last until 31 December 2009. The government had set aside a total of SEK815 million for the premiums: 50 million for 2007, 340 million for 2008 and 425 million for 2009. The aim was to encourage more individuals to purchase fuel-efficient cars and cars run on renewable fuels. The funds reserved for the premium were paid out faster than expected, and the rebate payments came to an end six months earlier than planned.

From reduced vehicle tax to tax exemption

Reduced vehicle tax for passenger cars complying with environmental requirements was introduced in 2006. The tax is based on the type of fuel used and CO2 emissions. Carbondifferentiated vehicle tax only applies to newer passenger cars. All other cars are taxed as before, based on weight and fuel type. In 2009, a new rule was introduced on tax exemption for new clean vehicles. As a compensation for the early withdrawal of the clean vehicle premium, all purchasers of new clean vehicles will be exempt from vehicle tax for five years, from 1 July 2009.

”I have followed vehicle manufacturers’ development of well functioning cars with harmless emissions and low energy consumption for almost 20 years. It is extremely important that these developments are put to common use. Stockholm has contributed not least through long-term influence at various levels. Seen in a wider context and an international perspective, the introduction phase has only just started, and continued incentives for users are urgently required.”

Karin Kvist, environmental expert BIL Sweden 1990-2008 (motor industry trade association), since 2009, Karin Kvist Environment Consulting

Congestion tax exemption and low price on clean fuels most important

In 2008, Clean Vehicles in Stockholm sent out a questionnaire to new clean vehicle owners. Replies showed that the most important incentives for choosing a clean vehicle were lower fuel costs and exemption from congestion tax. The new clean vehicle premium of SEK10 000 was of relatively low importance. Private individuals responded that the most important factor for choosing a clean vehicle was the wish to reduce their own negative impact on the environment. Company car drivers stated the lower benefit value as the most important factor, while free residential parking was of lesser importance.

Supplementary analyses showed that incentives that reduce running costs were stronger than incentives affecting purchase price. The exemption from congestion charges in Stockholm and lower fuel prices (the price of E85 in relation to petrol) showed the largest influence on the market between 2004 and 2008. Free parking also played a role, but to a lesser extent. It was also shown that incentives that introduce privileges for clean cars are stronger than incentives that attempt to ”even out” differences between clean cars and their conventional counterparts..

Round table initiative for biogas

The tax reduction on the employee benefit value of clean company cars is a powerful driving force behind the increase of gas-powered cars, as they receive a 40 per cent rebate on the assessment value. Biogas-powered (i.e. CNG) vehicles are also the preferred choice for many businesses within the taxi, delivery and transport sectors wanting to change to clean vehicles. Interest has increased dramatically since 2008, when the second generation, more efficient, biogas-powered vehicles appeared. The City of Stockholm has further facilitated developments by demanding biogas-powered vehicles in several procurements of waste collection services.

The increase in demand has led to temporary shortages of upgraded biogas in Stockholm. This has irritated many drivers, and Clean Vehicles in Stockholm has on occasions talked to drivers at refuelling stations about plans for expansion of production and infrastructure. This has been appreciated and has helped drivers remain positive to biogas.

To meet increases in demand, local distributors buy biogas from all nearby producers, e.g. in Västerås, Örebro and Linköping, and to a lesser extent in Trollhättan. To avoid running dry, refuelling stations use natural gas as a back-up. In 2007, the percentage of biogas was 94 per cent and in 2008 it was 82 per cent. The reason for the increased use of natural gas was that the market grew by 30 per cent without any new production of biogas. The aim is to use 100 per cent biogas. In 2009, biogas production started at Himmerfjärdsverket in Södertälje. Previously there were two biogas plants, in Bromma, established in 1996, and in Henriksdal, established in 2004.

To achieve a long-term solution for the supply of biogas in Stockholm, Clean Vehicles in Stockholm has initiated a round table group. The group consists of users, suppliers and producers, and in 2007 an action plan was agreed. This includes new production facilities and refuelling stations.

The sale of upgraded biogas has increased dramatically since the mid-2000s, see table.

Volumes of upgraded biogas and natural gas as vehicle fuel supplied in Stockholm County (1000 Nm³), and annual percentage increase

År	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Volume upgraded biogas (1000 Nm³)	180	200	300	367	527	1 096	2 192	4 010	5 970	6 445	7 587
Volume natural gas (1000 Nm³)	0	0	0	0	0	0	0	410	320	984	3 000
Annual percentage increase		11%	50%	22%	44%	108%	100%	102%	42%	18%	43%

Data sources: Försäljning av miljöbilar och förnybara drivmedel i Stockholm (2008) [Sales of clean vehicles and renewable fuels in Stockholm] and ZEUS Final Report (1999).

Regional – national collaboration ties up the market

Together with Linköping and Västerås, Clean Vehicles in Stockholm and AGA Gas are running a project to promote upgraded biogas as a vehicle fuel in the Stockholm-Mälardalen region. As a result, Mälardalen Energy Agency has taken the initiative to create the network organisation Biogas East, gathering biogas producers, suppliers and users in a project aimed at creating the best possible regional conditions for increased production, distribution and consumption of upgraded biogas in Mälardalen, Östergötland and on Gotland. Biogas East follows the example of the Biogas West project in western Sweden. Increased production and more refueling stations along the ”Biogas Highway” between Stockholm and Gothenburg, and a drive for more biogas-powered vehicles were part of the EU project Biogasmax.

LENNART JOHANNSON, STOCKHOLMS STAD

“For many years, Rotterdam and Stockholm have enjoyed successful cooperation on climate, environmental and transport issues in projects such as BEST and ELCIDIS. Stockholm is a world-class city: ambitious, committed and always a source of inspiration! We are looking forward to taking the next steps in our cooperation.”

Wiert-Jan de Raaf, Programme Director, Rotterdam Climate Initiative

Participants from eight countries gathered in Stockholm for the kick-off of the EU project BEST in January 2006.
PHOTO: LENNART JOHANSSON, CITY OF STOCKHOLM

International network

Participation in EU projects has provided Stockholm with a large European network, which is one of the factors enabling the City to work with clean vehicles to such a great extent. Experience from Stockholm has been shared and has inspired a number of other cities; Stockholm participated in both Niches and Catalist due to long experience of working with clean vehicles. A number of projects have focused on the production and supply of biogas and the use of biogas as a vehicle fuel in order to establish more refuelling stations and increase the use of upgraded biogas in vehicles.

Stockholm adopts government definition – with additions

In May 2007, Stockholm City Council decided to adopt the government definition of clean vehicles. This definition was broader than the definition Stockholm had worked with, as it also included energy-efficient diesel and petrol cars. Stockholm added a user requirement: that bi-fuel vehicles predominantly (more than 50 per cent) use clean fuels. Stockholm also adopted a definition for light transport vehicles and mini-buses.

Clean vehicles are:

- Ethanol vehicles E85
- Natural gas and biogas-powered vehicles
- Electric vehicles
- Petrol and diesel powered vehicles including hybrid models with carbon dioxide emissions below 120 g/km (equivalent to around 5.0 litres of petrol or 4.5 litres of diesel/100 km)

The energy consumption for an alternative fuel vehicle may not exceed the energy equivalent of 9.2 litres petrol, 8.4 litres of diesel or 9.7 cubic metres of CNG on mixed driving (according to type approval). Electric cars may not exceed 37 kWh/100 km.

All vehicles must be classified for environmental class 2005. Vehicles run on diesel must be equipped with a particulate filter or other comparable purification device that meets requirements for environmental class 2005PM.

There was an addition for mini-buses (passenger car with a minimum of 5 seats in addition to the driver's seat) and light transport vehicles. These are considered clean by the City of Stockholm if they can be run on:

- Electricity or electric hybrid engine
- Fuels other than petrol, diesel or LPG

All vehicles must be classified for environmental class 2005. Vehicles with diesel engines must also meet requirements for environment class 2005PM. The vehicles must be registered as light transport vehicles or light buses. In order to qualify for parking benefits which were still valid, there was also a user requirement that ethanol and gas-powered vehicles must be run with predominantly biofuels.

Active information and communication

During 2006-2009, the trend for clean vehicles growing, the interest for climate issues increased among the public, and environmental arguments regained their importance in communication. At the same time, criticism increased, mainly towards ‘‘thirsty” ethanol cars and the incongruous use of “food for fuel”. Criticism was strongest in 2007 and 2008, but became more modified and balanced during 2009. Important messages for Clean Vehicles in Stockholm were that clean vehicles are part of a sustainable transport system, and also that the total volume of transport must decrease. The City emphasised the importance of choosing ethanol produced in a sustainable way. The negative criticism intensified efforts to communicate what was true and false in the debate. For example, FAQ and other information was published on the web and contacts with media increased. Clean Vehicles in Stockholm has also worked with scientists to clarify the situation. During the period, 20 different press releases were sent out and a number of journalists were informed individually. The number of gas-powered vehicles on the market started to grow, as did production of biogas. This also led to an increase in information about biogas-powered models, refuelling stations and the advantages of using upgraded biogas over petrol or diesel.


LÖRDAG 15 DECEMBER 2007

DN.

Mat för 273 dagar i tanken

I framtiden kanske vi kör elbilar

240 LIMPOR = EN TANK ETANOL

Media portrayal in 2008 of ethanol use in Sweden as a cause of hunger in the world started a heated debate.

Debate on the future of biofuels at the Clean Vehicles in Stockholm seminar on sustainability at Berns in spring 2008. From left, Ulf Svahn, the Swedish Petroleum Institute (SPI); Svante Axelsson, the Swedish Society for Nature Conservation; Helena Fornstedt, Statoil; Mattias Goldmann, Green Motorists and Peter Roberntz, WWF.
PHOTO: MAGNUS KRISTENSON

Newsletter

Clean Vehicles in Stockholm publishes a newsletter five times a year, printed and circulated both via post and e-mail. It is also available on the web and handed out at various events. In total, the newsletter has around 3 500 subscribers. It contains in-depth articles on various topics, practical advice and interviews with companies and organisations that may serve to inspire others. To a certain extent, the newsletter also covers news regarding vehicle models and incentives.

Conferences and study visits

Each year, staff from Clean Vehicles in Stockholm give between 30 and 40 presentations at national and international conferences. Vehicle manufacturers and fuel companies have also participated at fairs and exhibitions and given talks at seminars held by Clean Vehicles in Stockholm.

For a number of years, latterly in 2007 and 2009, Clean Vehicles in Stockholm has been responsible for organising the international conference CVF (Clean Vehicles and Fuels). CVF is carried out with players from the vehicle industry, fuel companies and stakeholder organisations, e.g. BIL Sweden, BAFF and the Swedish Gas Association, the Swedish Electric & Hybrid Vehicle Association (Sweva) and Hydrogen Sweden. The aim of the conferences was to demonstrate vehicles, hold seminars and capture issues for discussion. On several occasions, government ministers were lobbied in connection with the conference.

Clean Vehicles in Stockholm receives around 25-40 study visits every year, most of them international, each with 2-50 participants. They are offered talks on how work with clean vehicles is carried out in Stockholm, viewing and test driving different types of clean vehicles, and visits to refuelling stations and production plants for biogas. Many are also interested in seeing SL's ethanol and biogas-powered buses and visiting bus depots to look at refuelling facilities. Welcoming groups has been an important part of efforts to disseminate experience from Stockholm and to inspire others to invest in clean vehicles, as well as finding and getting to know future cooperation partners.

Clean Vehicles in Stockholm receives a great number of study visits every year.
PHOTO: LENNART JOHANSSON, CITY OF STOCKHOLM

Clean Vehicles in Stockholm took the initiative to organise the conference Clean Vehicles and Fuels 2007.
PHOTO: BILSWEDEN

Clean Vehicles in Stockholm has received many prizes and awards for their initiatives.
PHOTO: MAGNUS KRISTENSON

Clean Vehicles in Stockholm – award-winning environmental work

Work carried out within and through Clean Vehicles in Stockholm has been successful in many ways. The greatest success factors include …

- political support
- clear strategy behind the work (support in technology introduction)
- funding through EU, national and local funds
- cooperation with other cities, vehicle manufacturers, fuel companies
- large-scale perspective
- changes to own fleet, and own production of fuels to show the way
- direct dialogue with national politicians
- fuel and technology-neutral initiatives
- work to increase availability of fuels
- commercial thinking

Stockholm's work with clean vehicles has received attention from all around Europe, which was also one of the objectives. The City has received many prizes and awards for its work, including the Civitas Award, Niches Award and Green Fleet Europe. The jury's motivation for the Civitas Award mentions that Stockholm has converted political goals into practical action. The work with clean vehicles and the City's good reputation were also important factors for Stockholm being selected as the European Green Capital 2010.

STOCKHOLM winner 2010
EUROPEAN GREEN CAPITAL

EU projects that Clean vehicles in Stockholm have coordinated or participated in

Project/year	Project aim	Sthlm's role	Cooperation partners	EU fund
ZEUS 1996-2000	Increase share of clean vehicles in Stockholm through technology procurement of electric cars, production and distribution of upgraded biogas.	Coordinator	Copenhagen, Athens, Helsinki, London/Coventry, Luxemburg, Palermo and Bremen	5th Framework Programme
ELCIDIS 1998-2002	Electric-hybrid trucks for local distribution.	Projektpartner	Rotterdam, La Rochelle, Erlangen, Region Lombardia/Milano och Stavanger	5th Framework Programme
E-tour 2000-2002	Introduce electric two-wheelers, e.g. bicycles and mopeds.	Project partner	Rotterdam, Barcelona, Brussels, Capri/Mykonos, Erlangen, Basel/ Mendrisio, Rome	
Moses 2000-2003	Car pool project – starting car pools with a total of 20 clean vehicles and developing methods for smart bookings.	Project partner	Bremen, London, Palermo, Turin, Genua, Brussels, Prague	
Cute 2002-2006	Field testing of 27 fuel cell buses, three in Stockholm traffic. Production of hydrogen gas at depot.	Project partner	London, Amsterdam, Madrid, Hamburg, Luxemburg, Barcelona, Porto, Stuttgart	5th Framework Programme
Plume 2003-2005	Planning Urban Mobility in Europe, knowledge/research on transfer of sustainable mobility to end users, i.e. cities.	Project partner	Stockholm was one of several cities participating in workshops on the results	5th Framework Programme
Trendsetter 2002-2006	Project for sustainable transport (clean vehicles, fuel production, smart traffic information, environmental zone…).	Coordinator	Lille, Prague, Graz, Pecs	5th Framework Programme
BEST 2005-2009	Market introduction of ethanol vehicles.	Coordinator	Rotterdam, BioFuel Region, Madrid, La Spezia, Basque Country, Somerset, Nanyang, Sao Paolo	6th Framework Programme
Biogasmax 2005-2010	Promote production of upgraded biogas and use of upgraded biogas in vehicles.	Project partner	Lille, Berne, Gothenburg, Lombardy, Rome, Stockholm, Torun and Zielona Gora	6th Framework Programme
Niches 2004-2007	Promote the development of sustainable transport solutions from niche to large-scale.	Project partner	POLIS (European Cities and Regions for Innovative Transport Solutions), Eurocity (nätverk för EU:s storstäder), Stockholm	6th Framework Programme
Catalist	Disseminate experience and arguments from work with sustainable transport to cities in new Member States. Inspire them to work in similar ways. Stockholm responsible for clean vehicles and financial control instruments.	Project partner	Berlin, Bremen, Bukarest, Genova, Göteborg, Graz, Kaunas, Krakow, Nantes, Rom, Rotterdam, Tolouse	7th Framework Programme
CleanTruck 2010-2013	Increase use of biofuels in heavy vehicles, setting up two refuelling stations for heavy vehicles; one for biogas and one for ED95. Subsidies of ethanol, biogas and hybrid trucks.	Coordinator	OKQ8, IDS, AGA Gas AB	LIFE+

Selected brochures and reports from Clean Vehicles in Stockholm

Bioethanol for Sustainable Transport – Final report
Demonstration and evaluation of bioethanol vehicles and fuels within the framework of an EU project, (2010).

Sales of clean vehicles and renewable fuels in Stockholm
Compilation of statistics for 2009, (2010).

Promoting Clean Cars - Case study of Stockholm and Sweden
Report, in English with Swedish summary, (2009).

FAQ about Ethanol
Fact sheet, (2009).

FAQ about Biogas
Fact sheet, (2009).

Trendsetter – Policy report
Demonstration and evaluation of different initiatives for sustainable transport within the framework of an EU project, (2006).

CUTE – Clean Urban Transport for Europe – Final report
Demonstration and evaluation of fuel cell busses in regular traffic within the framework of an EU project, (2006).

ELCIDIS – Electric Vehicle City Distribution – Final Report
Distribution with electric hybrids within the framework of an EU project, (2002).

E-TOUR – Electric Two Wheelers On Urban Reads – Final Report
Demonstration and evaluation of electric bicycles and mopeds within the framework of an EU project, (2002).

ZEUS Final Report
Procurement and demonstration of clean vehicles within the framework of an EU project, (2000).

www.stockholm.se/cleanvehicles

Clean Vehicles in Stockholm has been run by the Environment and Health Administration in the City of Stockholm since 1994. The aim is to speed up the transition to clean vehicles and renewable fuels.

Since the start in 1994, the share of clean vehicles has risen from none at all to more than eleven per cent in the County of Stockholm. In 2009, more than one in three vehicles sold in the County of Stockholm was a clean vehicle. More than seven per cent of vehicle fuels in the region were renewable in 2009.

This publication describes how the work with clean vehicles has been organised to reach these results, which actors have been involved, what has happened in the surrounding world, and which strategic choices that have been made during the journey.

BEST
BioEthanol for Sustainable Transport

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