

Rotterdam, city of electric transport

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Abstract

Traffic and transport is an important cause of air-quality and noise pollution in Rotterdam. Solving these problems needs various measurements in our region; cycling, walking and improving public transport are part in that. But large scale use of clean, silent and energy efficient vehicle technologies is also a crucial part for a future sustainable transport system.

For the long term, Rotterdam regards the electric vehicle technology as the most promising solution for a real sustainable transport system. In the mean time, Rotterdam already started impulse-projects to create a market basis for large scale introduction of electric and hybrid-electric vehicles on the principle that seeing and trying is believing.

The energy company Eneco has originated from the Rotterdam municipal energy company GEB and is a very logical partner for the city of Rotterdam (still being a main shareholder in Eneco) when it comes to implementing projects where sustainable electricity is the most sound option.

Keywords: Environment, fleet, infrastructure, market, public transport

1 Introduction

1.1 City of Rotterdam

Rotterdam, with about 600.000 inhabitants itself and the centre of a region (Rotterdam city region) with about 1,2 million inhabitants, still has one the largest ports in the world and is the largest and central main-port for goods distribution in Europe. Rotterdam's transport policy aims at facilitating these economically very important distribution activities whilst reducing the environmental impact of traffic. To achieve this objective, goods transport is being shifted towards environmentally-friendly transport by rail and water. However, trains and ships mainly offer an alternative for long-distance transport,

most regional transport and urban distribution activities are and will be based on road transport. For trips shorter than 5 km, the majority of the population in Rotterdam uses a bicycle or walks, 24 % travels by car and only 5% uses public transport. For longer trips, the use of car and public transport increases to 65% and 23% respectively.

The high mobility needs in Rotterdam causes the city policy to aim for reduction of the negative impact on environment and public space, especially reducing noise and air pollution caused by mobility. The environmental mobility problems can be divided into 3 categories, contribution to world-wide emissions (green house gases), local air pollution emissions and effecting the quality of life (noise, vibration and the use of public space).

1.2 Eneco

Eneco has approximately 5500 employees. The head office, the core companies and the business units are located in Rotterdam: several offices are located in other parts of the country. In Belgium we have a branch-office in Mechelen. The shares of Eneco are held by 61 Dutch municipalities. Eneco applies an integrated distribution strategy and specializes in the production, transmission, trading, supply and metering of energy (electricity, gas and heat) and related products and services. Eneco is making a transition to a sustainable energy company and will make substantial investments in sustainable energy in the coming years. Some 2 million customers use the energy supplied by our company. Large companies, small and medium sized businesses and many households rely on our services.

Eneco considers increased sustainability, vertical integration in the production of electricity with clean fossil fuels and operational excellence to be the pillars of its strategy.

Eneco aims in playing a leading role in the transition towards a sustainable supply of energy in the Netherlands. Continuous innovation is an important ingredient for substantiating this.

For bridging the period to complete sustainability, Eneco wishes to further increase the generation of electricity from clean fossil fuels. Efficient gas-fuelled plants will enable us to absorb the imbalance inherent in renewable energy sources like wind and solar energy.

2 Background and objectives

2.1 Past experiences

In the past, Rotterdam and Eneco already have performed in several electric vehicle projects. Eneco took the lead in the period from 1995-1997 in the first EV project in the Netherlands by testing a small fleet of 5 Jeanneau Microcars for their own service vehicle fleet. The test proved to be technically feasible, but the small size of the vehicles in combination with a somewhat limited range, made it happen that the test did not lead to an prolongation in real for electric vehicles.

Later on, from 1998, the city of Rotterdam took part in two EU projects and one Dutch project, namely ELCIDIS, E-TOUR and PREVIEW.

2.1.1 ELCIDIS

In the ELCIDIS project, which ran from March 1998 till August 2002, the Rotterdam approach was adapted to the specific needs of the 3 largest transport companies for parcels and packages, operating from their own urban distribution centres. In practice 7 large electric vans with a payload of 1000-1500 kg and the relatively light weight ZEBRA batteries were tested.



Unfortunately there were a lot of technical problems, leading to a non-performance of the vans of around 40% in time. If the vans were working, drivers and transport managers were nevertheless very pleased with their performance, so potentially the use of large electric vans in this transport niche was viable.

In 2008, TNT started a sort-like new pilot with 2 electric Smith vehicles. They were also equipped with Zebra batteries and whether it was caused by those batteries or not, the vehicles also did not perform to the full satisfaction, so TNT is still looking for better solutions.

2.1.2 E-TOUR

In the E-TOUR project, Rotterdam promoted the use of electric two-wheelers as alternative for cars, conventional scooters and mopeds, focused on commuting and service trips. The first electric scooters came into operation in April 2000, the first electric bikes in October 2000. In order to get a young target group on electric bikes, it became very clear that products with high "emotional" value should be introduced. In the E-TOUR project, only the Swiss flyer bikes were meeting that expectation.



Although all operating electric scooters and bikes were well appreciated, performance could yet be disappointing, especially with regard to the “promised” driving-range. The recommendations from the project towards manufacturers, have been leading to much better products, especially with electric bicycles. Nowadays, electric bicycles are a great success in the Netherlands, last year almost 120.000 new electric bicycles were sold.

2.1.3 PREVIEW

In the PREVIEW project, started in 1999, the practical possibilities of using electric cars were being tested in the fleets of municipalities and private companies in the Rotterdam region. The objective was to prove the viability for electric vehicles in those niches and to set the right example where it concerns environmental friendly motorised transport. Furthermore it was expected that the results could be used to extend the number of clean vehicles in our fleet(s). After a long period of problematic procurement, 16 vehicles at municipal departments and private companies have been introduced, in principle all to the full satisfaction of the users.



Based on the positive experiences, it was concluded that the Rotterdam municipal fleet could, at the end of the project in 2004, be extended with at least 50 electric vehicles without sound objections. However, we could not get our hands on the desired vehicles at that moment.

2.2 New objectives

The Rotterdam Climate Initiative is the new, ambitious climate program in which the Municipality of Rotterdam, the Port of Rotterdam, DCMR Environmental Protection Agency Rijnmond and Deltalinqs (association of local industries) have joined forces to achieve a drastic reduction in Rotterdam’s CO₂ emissions. The growth of the city and the port in the coming years will significantly have to contribute to this goal. Rotterdam Climate Initiative combines all initiatives taken by Rotterdam – in the city and the port – to develop into a low-CO₂ city and energy port; “*the world capital of CO₂-free energy*”. With this initiative, Rotterdam expresses its ambition to reduce CO₂ emissions in Rotterdam territory by 50% in 2025 compared to 1990 and to create economic opportunities with respect to CO₂ for trade, industry and the port. The 4 parties involved agreed to devote their collective efforts to maximum innovation, maximum mobilization of people and organizations, and substantial investments in projects aimed at 50% reduction of CO₂ emission.

Rotterdam Climate Initiative and Sustainable Mobility

- For the transport sector the CO₂ reduction objective is 7% of the total effort.
- The approach is only focused on the modalities road transport (57%) en shipping (41%), because the modalities rail and air transport are only very marginal.
- For road transport a clear distinction between passenger transport and freight transport is essential (especially freight transport will be growing enormously. See figure 1).

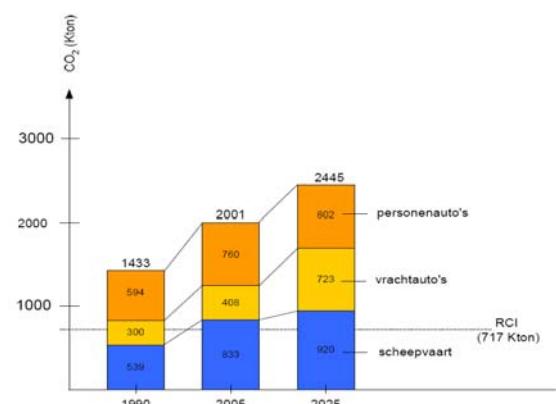


Figure 1: CO₂-emissions in 1990, 2005 and 2025 in the transport sector

In figure 2 the environmental burden of road transport is shown. For particulate matter and NOx it shows that there is a clear reduction achieved in the past years. However, for noise levels and in particular for CO₂ it doesn't count.

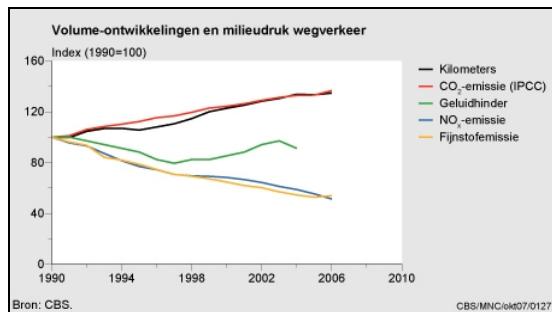


Figure 2: development environmental impact by growth of road transport

CO₂ emissions are still growing, because of the fact more kilometres have been driven. Our approach for Sustainable Mobility is aimed at the reduction of fossil fuels use in 3 ways:

1. Reduction of kilometres and changing transport behaviour (Clean **use**);
2. Deploying more efficient combustion engines and/or other drive train technologies (Clean **vehicles**);
3. Completely or partially replacing fossil fuels by cleaner, renewable fuels (Clean **fuels**).

In the current climate debate the urgent need for greenhouse gas reduction is accepted throughout the scientific community and policy makers. It is also becoming perfectly clear that the world's reliance on fossil fuels for transport is unsustainable. The days of cheap and easily available oil are numbered and fossil fuels are the main reason for global warming and we have to deal with that – not soon, not tomorrow, but now. It will be obvious that the traditional Dutch way of cycling is the most sustainable form of private transport, especially in our inner cities. However, we cannot solve all transport related environmental problems with bicycles or tricycles, so for motorised vehicles we need other technologies. Of course this also counts for water transport, a very important transport feature in our world port.

Fortunately there are alternatives, but only a few can start making a difference right away and for the coming years the main focus will have to be on the shift from fossil fuels to non-fossil fuels and the introduction of much more energy efficient drive lines.

Although in Rotterdam hydrogen is easily available as a (by) product from our chemical plants, we realise that it is now only a worth-while fuel to use for (medium to large scale) experiments, but not the short term and perhaps not even the long term solution for all motorised road- and water transport, since it is not the most efficient solution.

3 Solutions

In general, the policy in Rotterdam on transport and environment aims at reducing the growth of motor traffic, in order to improve both local accessibility and environment, by stimulating the use of public transport and cycling / walking for passenger transport and the use of rail and water for goods transport. Apart from this approach it is obvious that cars, vans, trucks and buses will keep an important role in urban traffic, especially for specific niche-applications. The following categories may be considered as such; public transport, urban distribution, municipal service vehicles, passenger cars for commercial use, taxi's and car-sharing. For these target groups, the introduction of clean, silent and energy efficient vehicles is absolutely necessary.

We focus on technologies, that provide reductions in the short term for both greenhouse gas and local air-quality emissions, like:

- Large scale and efficient use of bio-fuels
- Deployment of Intelligent Transport System (ITS) technologies
- Deployment of Hybrid technologies, especially for heavy duty applications
- Energy efficient hybrid and electric vehicle concepts (e.g. city car, urban delivery van etc.)
- Intelligent goods logistics

But we keep in mind that the future will need other solutions. When using bio-fuels, Rotterdam will of course keep a sharp eye on the origin, in order not to be confronted with other negative aspects that come with some of the bio-fuels.

New generations of bio-fuels are in that respect preferable, also because it is expected they can be produced at lower costs. The costs for the use of bio-fuels are not extremely high and will become more and more competitive with rising oil-prices. In our surrounding countries, taxation measures are already accounting for a cheaper use of bio-fuels in comparison with fossil-fuels.

However, we are convinced that the use of bio-fuels in future can only be feasible on a longer term if combined with energy saving technologies, like (plug-in) hybrid electric.

Especially the use of hybrid-electric drive lines for short distance heavy duty applications is a necessity in order to use less fuel as well, whatever (bio-)fuel is being used, because the less we use, the better it is. In this respect, Rotterdam is supporting the introduction of a Dutch patented electric in-wheel system (e-Traction), which may account for more than 50% of fuel savings, according to TNO measurements. The first market where this system will be introduced is the public bus transport, but the deployment in urban waste collection trucks and inner port area transportation is in view as well.

4 Electric vehicles development

With regard to electric vehicles, the development phase of a certain type of vehicle at this moment should be taken into consideration, see figure 3.

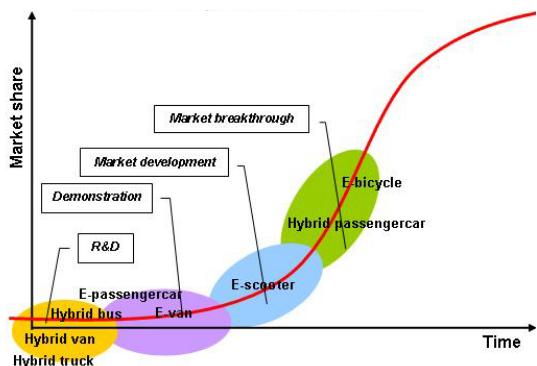


Figure 3: Market development electric vehicles

In our view, at this moment the development of electric bicycles and hybrid-electric (not plug-in) passenger cars are (far) ahead on the other electric road vehicles. It seems that electric scooters are taking a second place here and electric vans are coming in third place.

On the lower part of the development curve we have the still to be developed electric passenger cars and hybrid electric heavy vehicles and vans. Formula One racing and environment are perhaps not the best friends. Yet we are very hopeful that the now deployed Kinetic Energy Recovery System (KERS) in the electric version, could be very helpful for the development of electric vehicle components. There is no better testing facility than the Formula One Circuit.

5 Rotterdam electric transport

As described in our experiences from the past, zero-emission battery electric vehicles for specific niches in inner city use have been tested some time ago and were at that time not completely successful, especially with regard to investment costs and practical use, despite their superior energy efficiency. However, new promising (international) developments in this field have triggered renewed interest from different fleet-owners and our local energy company Eneco.

5.1 Present Rotterdam projects

For a start, it is good to mention that already more than 80% of the public transport in Rotterdam is running on electricity which is 100% green based on a contract between our public transport operator RET and Eneco. This part of the public transport concerns our fleet of trams and metro's, where also new energy recovering systems are being tested now, but with regard to electric road vehicles in Rotterdam, the following projects are now also running to the full satisfaction:

5.1.1 Piershuttle

The Piershuttle project started 4 years ago, it is an electric shuttle-bus on the Wilhelminapier, a newly developed area near the city centre. The electric shuttle bus is an existing product, produced in a co-operation between Spijkstaal Elektro BV; a Dutch firm specialized in electric utility vehicles and BredaMenarinibus, an Italian bus-builder. The design of this ZEUS-bus is from Pininfarina and the bus already proved its practical value also in several Italian cities.



In the first years the shuttle service was exploited by a special company, but it has now been taken over by our public transport operator RET. The success of this service also means that the RET is now looking for new sort-like services to be performed in the same way.

5.1.2 ParkShuttle

Also already in practice for a much longer time, but with more problems is the ParkShuttle near the P&R parking place at metro-station Kralingse Zoom. It's an up-scaled system of a pilot that ran from October 1997 till June 2001. The system uses autonomously operating electric vehicles that run on rubber tires and travel along a simple asphalt infrastructure using electronic guidance. With the use of an onboard navigation system, it will find its way automatically along a simple ground level asphalt track.



Despite some break-downs during the pilot, the automated vehicle operations have been widely accepted by the passengers.

Based on the positive experiences in the pilot, it was decided to up-scale the system to 6 new and larger automated vehicles on an expanded route structure. Despite more problems in the regular service, the system is still in operation.

5.1.3 Other projects

The city of Rotterdam now has electric sweeping machines for the pedestrian streets in the city centre and electric scooters in the municipal fleet. Also a new demonstration project with 30 electric bicycles for commuter transport has recently started. The kick off was done by our alderman for Traffic and Transport, see picture.



In co-operation with Eneco, recharging points for both e-bicycles and e-scooters have been realised in 5 parking places.

Segways are introduced for police and city guards. Something completely different is the start of a pilot project with the first hybrid electric shunt locomotive in Europe (or perhaps in the world), in close co-operation between our Rotterdam Port Authority, the shunt service company Rotterdam Rail Feeding (RRF) and Alstom.

5.2 Rotterdam short term projects

On a short term the following projects are planned: Renewed introduction of electric vehicles in the Rotterdam municipal fleet and municipal fleets of the surrounding regional municipalities.

Introduction of electric TukTuk cabs.

Introduction of electric public transport scooters, partially in co-operation with the Dutch railway company NS.

Introduction of electric cars for the car-sharing companies Greenwheels and StudentCar.

Introduction of a hybrid waste collection truck, one out of a pre-series from Volvo, see picture.



Introduction of a smaller electric waste collection truck, based on the chassis of the ZEUS-bus.

Introduction of 4 hybrid buses for our public transport company RET. Two buses will be the articulated Citaro Blue-tec hybrid, a pre-series from Mercedes-Benz. Two other buses will be from a Dutch consortium, called NEMS, using the direct drive in-wheel hub motor from e-Traction.



Finally, Rotterdam will use the start of the "Tour de France" in July 2010 as a very important moment for showing the possibilities of electric vehicles to a very large world-wide audience.

5.3 Present Eneco projects

After a thorough exploration of the future of sustainable mobility, Eneco is convinced that the large-scale use of electrical cars will become a reality in the near future. Eneco supports this development in various ways, they now have electric scooters in their service fleet and also a first in a series of service cars, see picture.



They also recently introduced the first public recharging station in the Netherlands for different types of electric vehicles, called NRGSPOT. The first two NRGSPOTS are big, see picture.



Although we realise that such a design will not be accepted as a solution for a great number of recharging stations in the city, it has been done on purpose. These examples are meant to be very striking, in order to show the people that electric transport is “coming”. So far the reactions from public and urban planners have proved our right.

5.4 Eneco short term projects

Within 4 years, Eneco will replace 500 of its current diesel fuelled company cars with electrically powered cars. At the same time, Eneco will work on installing more recharging spots for these cars, both at the homes of their employees and at their business premises, see picture.



In addition, a new generation of (public) recharging spots will be developed, designed for car parks, office locations, train stations and such, where cars and other electrically powered vehicles of all types and companies can recharge their batteries. Eneco will also, within a number of years, make compact NRGSPOTS available to the consumer, allowing them to recharge their electric vehicles at attractive rates, both at home and in the public space.

For these purposes, Eneco intends to primarily use electricity generated from wind, biomass and hydropower.

6 Programmatic approach

The municipality of Rotterdam and Eneco have taken the first steps to restart with electric vehicle projects in the Netherlands. Whilst other parties in the Netherlands only presented plans, we already started with them in reality. Since we have started a lot of separate initiatives, it will be obvious that we need a more programmatic approach in order to create a sound coherence in all those plans and projects. The programme, which still has to be politically accorded, will be set up on 4 pillars:

- Market development
- Infrastructure
- District approach
- Research activities

The force of the programme is in its coherence, but on the other hand, each pillar can still have its own dynamics and progress, so that they can also be executed independently from each other. The future will tell us the real results of this approach, but we feel to have established the right way of working in this field and aiming for the high (H)EV scenario's that are going round.

Acknowledgments

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Authors



Anthony Vermie is a key person in the field of traffic, transport and environment in the Rotterdam region. He was co-ordinator for the European projects ELCIDIS and E-TOUR. He was project-leader of "clean private and public fleets" in the European TELLUS project and TRUMP-trainer on the subject of clean vehicles and alternative fuels. He is now site co-ordinator in the European BEST project, this project will be running till January 2010.



Monique Blokpoel is innovation officer at Eneco headquarters in the staff business innovation. She is the responsible "inventor" and projectleader for the introduction of the NRGSPOTS in Rotterdam, the first public recharging stations in the Netherlands. She is also the main driver behind Eneco's corporate decision to replace a part of the own service fleet with electric vehicles in the coming years.