

## 8 Case studies

### 8.1 Entire

The EU project ENTIRE – funded by the THERMIE programme of DG TREN – demonstrates how commercial and public transport in urban areas can become more energy efficient while emissions are reduced. ENTIRE involves seven European partner cities and regions and a total of 12 applications and integrates the key technologies for a sustainable urban transport system. The exchange of know-how and technologies between the regions and cities thereby has the effect of a catalyst.

One of the project partners is the city of Cologne. In Cologne, various alternatives are presently being examined with regard to their potential as a substitute for traditional fossil fuels. Of these, compressed natural gas (CNG) is among the most mature technologies to date. A mass introduction of this promising technology in the competitive fuel market, however, is hampered by a commercial disadvantage due to the low number of vehicles presently in use. Demonstrations of NGVs are means for establishing local markets to facilitate the further deployment of this technology.

The Cologne demonstration is carried out in close co-operation with the neighbouring cities of Brühl and Hürth and the commercial operator United Parcel Service. Hürth has introduced one and Brühl two monofuel CNG refuse trucks respectively in their waste collection scheme. The lorries are fuelled at two fast fill natural gas stations owned by the local utility companies.

UPS converted four of its Citroën-based P-36 courier vans from diesel to monofuel natural gas. The converted vehicles operate on express deliveries and make use of a new public filling station for NGVs. All vehicles are operated under regular conditions in order to allow comparison with their diesel counterparts.

The objective of this application is to establish a comprehensive information infrastructure on local energy consumers and emission sources providing details that are to be taken into account in the context of urban planning schemes aimed at increased energy efficiency and the reduction of air pollution. The user community comprises local and regional authorities as well as utility companies. Besides plain environmental monitoring, this concept comprises the development and implementation of a suitable platform to establish energy balances and a reliable simulation of environmental changes, as well as the provi-

sion of decision making tools for preventive action against energy consumers and emission sources that pose a threat to the urban environment and public health.

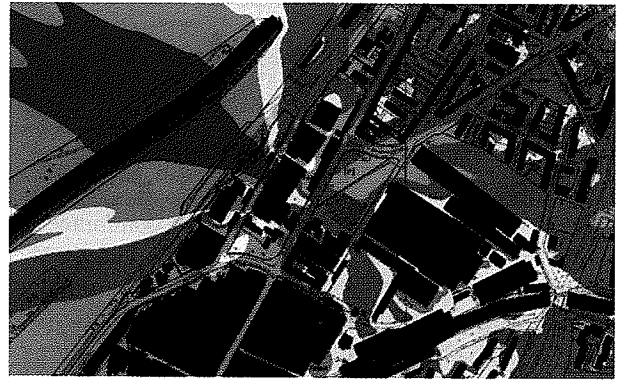


Fig. 8-1: Screenshot of microscale immission simulation

For this purpose a variety of user-specific applications are integrated in a heterogeneous data network, the Integrated Environmental Information and Management System, which provides a common virtual platform for the various services and procedures required by the respective users. A key task in this respect is the interactive connection of previously isolated data sources and simulation modules for energy-use and pollutant dispersion in different environmental domains. More information can be obtained from the project's home page <http://www.entire.org>.

### 8.2 Natural Gas Vehicles for European Cities and their Integration with Urban Traffic Management

The NGVeuropa project demonstrates over 300 different types of natural gas vehicles such as conventional and articulated buses, taxis, waste collection vehicles, delivery vans, cars, service cars and trucks in fourteen municipalities in seven European Union Member States. This project is co-financed by the European Commission, DG XVII.

All 300 vehicles, primarily from European original equipment manufacturers (OEMs), are state-of-the-art natural gas vehicle technologies now on the verge of entering the market or at the early adoption phase. The NGVs use the latest lean burn heavy duty engine technology as well as self-adapting heavy and light duty systems which are designed to accommo-

date a wide range of European natural gas compositions.

NGVEurope includes the first 'major' European demonstration of biogas in light and heavy duty OEM vehicles, in Göteborg and Eslöv, Sweden. It is important to demonstrate that both agricultural and urban waste can be used to create natural gas for application as a clean burning vehicle fuel. This 'environmentally closed loop' using converted waste products to fuel a low polluting waste collection vehicle represents a future solution to waste management in urban and rural areas.

Other partners are demonstrating the multi-faceted use of NGVs, focusing on:

- The use of clean, quieter public transportation vehicles in Augsburg, Germany; Colmar and Poitiers, France; Dublin, Ireland and Rome, Italy.
- The demonstration of the cost-benefits of NGVs in private fleets in Koblenz, Germany; Göteborg, Sweden; Mechelen, Belgium; Haarlem, Amstelveen and Velsen, the Netherlands.
- The evaluation of the best transport solution for waste collection vehicles in Ixelles, Gent and Mechelen, Belgium; and Velsen, the Netherlands.

NGVEurope provides practical long-term experience with natural gas technology to demonstrate passenger and user acceptance as well as knowledge of operation and maintenance experience. The economic viability of NGVs is carefully evaluated.

The comprehensive NGVEurope EMISSIONS TESTING PROGRAMME is designed to obtain *reliable* data on emission reduction potential. Its aim is to supply authorities with emission data that can be used to demonstrate the cost/benefits of various fuels and particularly NGVs and natural gas. Comparable emissions data for a wide range of vehicles, including cars, taxis, vans, public transport buses and waste disposal vehicles will be collected. The project results determine and quantify the environmental advantages of NGVs in comparison with conventional gasoline and diesel vehicles. The emissions data of the vehicle manufacturers is also taken into consideration for the evaluation. The project allows a comparison of the natural gas lean burn engine technology with natural gas engine technology working with  $\lambda = 1$ . In addition, the use of the Life-Cycle-Analysis ensures the measurement of up-stream environmental impacts and ensuing transport system costs ("cradle to grave approach").

Finally, this project results in recommendations about which natural gas vehicles and testing technologies and which kind of operation systems are the most

appropriate under different circumstances, depending on transport structures and mobility requirements.

Detailed and regularly updated information on the NGVEurope project can be obtained from the project's home page: <http://www.euweb.de/NGVEurope>.

### 8.3 ZEUS – Zero and Low Emission Vehicles in Urban Society

The inspiration for ZEUS was a desire to utilise energy for transport more efficiently and reduce transport related pollutant emissions. This requires a broad approach – the implementation of a variety of alternatively fuelled vehicles, urban mobility planning, and public awareness-raising, all working in synergy.

The ZEUS partners are Stockholm (coordinator), Athens, Amaroussion, Bremen, Coventry, Copenhagen, Helsinki, Luxembourg, Palermo, and the London Boroughs of Camden, Merton, Southwark and Sutton. The project began in late 1996 and continued until June 2000.

ZEUS focuses on *removing market obstacles* to zero and low-emission vehicles. These include the high cost of vehicles, a lack of infrastructure for fuel and maintenance, insufficient technology development, and a lack of market incentives. Cities that implement these vehicles together with progressive urban mobility measures can provide better mobility which has the potential to be cleaner, more effective, and in the long run, maybe even cheaper.

#### CNG and biogas in ZEUS

ZEUS included over 350 CNG and biogas<sup>3</sup> vehicles: passenger cars, vans, buses, and garbage trucks, used as city fleet, public transit, and car sharing vehicles. Together, they saved at least 600,000 litres of petrol and diesel and reduced CO<sub>2</sub> emissions by over 400 tonnes. Purchase volumes helped municipalities convince some CNG providers to contribute to the cost of infrastructure provision, lowering this cost for municipalities. In Palermo, the construction of the CNG station convinced the local transportation authority to purchase another 27 buses. ZEUS was also responsible for the addition of several new refuelling facilities. During ZEUS, consumption of CNG almost doubled in Bremen. In Stockholm, the amount of biogas sold more than tripled, to over 180,000 Nm<sup>3</sup>

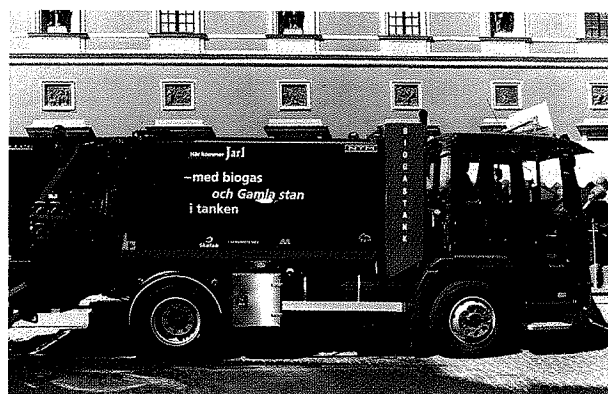
<sup>3</sup> Biogas is used in Stockholm and is produced locally from sewage. A biogas-fuelled distribution truck delivers the gas to several local refuelling facilities for cars and garbage trucks. The positive experience with biogas in ZEUS has prompted the planning of several new biogas facilities.

annually. The ZEUS experience has generated a number of recommendations for cities interested in using CNG and other alternative fuels:

- 1. Reduce and manage the high marginal cost** of zero and low emission vehicles by buying in volume. Take advantage of any available purchase subsidies, and factor both long and short term costs into the equation.
- 2. Take an active role in providing fuel refueling and recharging opportunities** by financing infrastructure directly or partially, planning sites, and monitoring use.
- 3. When monitoring vehicles**, test vehicles in "real world" situations and complement automatic systems with manual log-book systems.
- 4. Use fairly mature alternative fuel technologies** when implementing vehicles in urban service or car sharing. Bi-fuelled vehicles should be considered transition vehicles; they are often inefficient but can build a market for dedicated gas vehicles.
- 5. Implement one type of fuel at a time** to avoid confusion and complexity in the transition to cleaner vehicles. Consider single-supplier contracts to simplify service and maintenance planning.
- 6. Plan for service and maintenance** of alternatively fuelled vehicles. At the procurement stage, ensure that maintenance, training support, and spare parts accessibility issues are adequately dealt with. Allow for extra time during the transition period, and train all technicians, drivers, and safety personnel.

- 7. Increase user acceptance** for new vehicle technologies by conducting market surveys, marking demonstration vehicles and infrastructure with clear signage, and providing direct experience with vehicles using loaner or demonstration vehicles.

ZEUS has produced a guide for cities interested in implementing alternatively fuelled vehicles, as well as a series of special issue reports that cover many of these topics in greater depth. Contact THERMIE or ZEUS project leaders via the project's homepage: <http://www.zeus-europe.org>. For further contact details, please refer to section 9.



*Fig. 8-2: The ZEUS project procured and put into use more than 1,000 zero and low emission motor vehicles and 600 cycles. ZEUS used cars, vans, buses and trucks and a wide range of alternative fuels.*

## 9 Sources of information

### Clean Fuels Foundation

The Clean Fuels Foundation is the world's first, and only charitable, public membership-based organisation dedicated solely to the advancement of cleaner-burning alternative transportation fuels produced in America: 1730 K Street, Suite 304, NW Washington D.C., Tel: +1-202-508-3887; Fax: +1-202-337-3759, E-mail: [all@cleanfuels.org](mailto:all@cleanfuels.org)

### Clean Fuels Network

The Clean Fuels Network combines information on energy industry news, weather, stock quotes and pricing data on its website. Links to an expanding number of online industry publications, as well as to the websites of a large and growing number of energy

industry participants are provided. Future content and features will target the end-use customer, and enable industry participants to conduct electronic commerce with those customers who are drawn to the web-based energy communities: Website: <http://www.naturalgas.com/>

### European Committee for Standardization (CEN)

CEN's mission is to promote voluntary technical harmonisation in Europe in conjunction with world-wide bodies and its partners in Europe. Harmonisation diminishes trade barriers, promotes safety, allows interoperability of products, systems and services and promotes common technical understanding. Where-

ever possible CEN works with other European bodies and the International Organization for Standardization (ISO). Website: <http://www.cenorm.be>

### **Erdgas Mobil**

Home page organised by the BGW, Bundesverband der deutschen Gas- und Wasserwirtschaft e.V., Germany. The BGW is the representative of the German gas utilities, water works and sewage treatment plants for political, economic, economic-technical and legal questions. The addresses of the filling stations in Germany are available on the following website: <http://www.erdgasmobil.de>, E-mail: [info@erdgasfahrzeuge.de](mailto:info@erdgasfahrzeuge.de)

### **European Automobile Manufacturers Association (ACEA)**

Established in 1991, ACEA is the professional body defending and representing the interests of 13 members of the European automotive industry before the EU and other international institutions. Rue du Noyer 211, B-1000 Brussels, Tel.: +32-2-7325550, Fax: +32-2-7387310, Website: <http://www.acea.be>

### **European Natural Gas Vehicle Association (ENGVA)**

The European Natural Gas Vehicle Association (ENGVA) is a non-profit organisation whose mission is to develop a sustainable and profitable market for natural gas vehicles (NGVs) throughout Europe by creating a favourable political and economic environment that encourages the development of NGV technology as well as European fuelling infrastructure for natural gas. Spaklerweg 28, NL-1096 BA Amsterdam, Tel.: +31-20-5973100, Fax: +31-20-5973000, E-mail: [info@engva.org](mailto:info@engva.org), Website: <http://www.engva.org>

### **FordonsGas**

The home page of FordonsGas provides information on the location of natural gas filling stations in Sweden: <http://www.fordonsgas.o.se>

### **The Gas Research Institute**

GRI manages a comprehensive research, development and commercialisation (RD&C) programme for the natural gas industry. GRI's mission is to deliver high-value technology, information, and technical services to gas and related energy markets. Website: <http://www.gri.org>

### **International Association for Natural Gas Vehicles (IANGV)**

The Association was established in 1986 to provide the NGV industry with an international forum and an advocate for NGVs. It now has 200 corporate and individual members in 35 countries. IANGV provides information to members and non-members. Website: <http://www.iangv.org.nz>

### **International Gas Union (IGU)**

The IGU supports the development and promotes the dissemination of gas technology which will further improve efficiency and the relative (to other fuels) improvement of the environment. The IGU encourages policies in support of natural gas vehicles, which offer a promising solution to combat air pollution by urban traffic: Office of the Secretary General, c/o N V Nederlandse Gasunie, P.O. Box 19, NL-9700 MA Groningen, The Netherlands, Tel.: +31-50-5212999, Fax: +31-50-5255951, E-mail: [Secr.IGU@Gasunie.nl](mailto:Secr.IGU@Gasunie.nl), Website: <http://www.igu.org>

### **International Organization for Standardization (ISO)**

The International Organization for Standardization (ISO) is a world-wide federation of national standards bodies from some 130 countries. The mission of ISO is to promote the development of standardisation and related activities in the world with a view to facilitating the international exchange of goods and services, and to developing co-operation in the spheres of intellectual, scientific, technological and economic activity. ISO's work results in international agreements which are published as International Standards. 1, rue de Varembé, Case postale 56, CH-1211 Genève 20, Switzerland, Tel.: +41-22-7490111, Fax: +41-22-7333430, E-mail: [central@iso.ch](mailto:central@iso.ch), Website: <http://www.iso.ch>

### **International Union of Public Transport (UITP)**

Founded in 1885, UITP is a world-wide association of urban and regional passenger transport operators, their authorities and their suppliers with over 2,000 members from nearly 80 countries, UITP seeks to promote a better understanding of the potential of public transport. Ave Herrmann-Debroux 17, B-1160 Brussels, Tel.: +32-2-6736100, Fax: +32-2-6601072, E-mail: [administration@uitp.com](mailto:administration@uitp.com), Website: <http://www.uitp.com>

**Natural Gas Vehicle Coalition**

The NGVC is a national organisation dedicated to the co-operative development of a growing, sustainable and profitable natural gas vehicle market. The NGVC represents more than 200 natural gas companies, engine, vehicle and equipment manufacturers, and service providers, as well as environmental groups and government organisations interested in the promotion and use of natural gas as a transportation fuel. 1515 Wilson Boulevard, Arlington, VA 22209, USA, Tel: +1-703-5273022; Fax: +1-703-5273025, Website: <http://www.ngvc.org>

**SNAM**

SNAM is the Eni Group company concerned with supply, transportation and long-distance distribution of natural gas in Italy. The addresses of the filling

stations in Italy are available on the following website: <http://www.eni.it/snam/italiano/target/automobilista/automobilista.html>

**Zeus Europe**

Contact: Gustaf Landahl, Tel: +46-8-50828916, Mats Svensson, Tel: +46-8-50828915, Environmental and Health Protection Administration Stockholm, Box 38024, S-10064 Stockholm, Sweden, Fax: +46-8-50828993, Website: <http://www.zeus-europe.org>

For further information on Zeus Europe, please refer to Section 8.3

**1998 OEM Alternative Fuel Vehicles**

Information on the 1998 Original Equipment Manufacturers Alternative Fuel Vehicles from the United States. Website: <http://www.afdc.doe.gov>

## 10 References

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- BGW: Wirtschaftlichkeit erdgasbetriebener PKW und Kleintransporter aus Sicht der Flottenbetreiber, 1997
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- Naturalgas home page: <http://www.naturalgas.org/NGVBASIC.HTM>
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- Stadtwerke Augsburg, Roland Bartosch: Erdgas für Kraftfahrzeuge, Augsburg, Germany, 2000
- Stäubli: NGV: Refuelling connections - NGV 1 design, 1998

## Notice to the reader

Extensive information on the European Union is available through the EUROPA service at internet website address <http://europa.eu.int/>

The internet website address for the Fifth Framework Programme is  
<http://www.cordis.lu/fp5/home.html>

Further information on DG Energy and Transport activities is available at the internet website address  
<http://europa.eu.int/en/comm/dg17/dg17home.htm>

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