

BIOGAS - BIOFUEL

LILLE (France)

In the transport sector, municipal efforts to reduce local emissions imply carrying out a modal transfer away from private car towards public transport and at the same time limiting the emissions produced by urban public transport and captive fleets of vehicles. Several municipalities have started to investigate the possible energy uses as motor fuel of biogas, a renewable energy source produced from household refuse and/or agricultural waste on landfill or in sewage plants.

GENERAL ASPECTS

The CUDL (Urban Community of Lille) is a public intermunicipal co-operation body that gathers 87 communes from the Nord-Pas-de-Calais Region. Its scope of competencies includes the provision of services and amenities to the urban community in the following areas: town planning, road infrastructure, mobility and parking facilities, urban transport systems for passengers. The urban community is home to slightly over 1 million inhabitants and extends over an area of about 600 km².

Climatic data:

Degree days (Basis 18 °C): 2,470
Annual average temperature: 9.7 °C



CONTEXT

The specific features of the urban area explain the high number of travels registered in Greater Lille: more than 4 million travels are completed every day, 90% of them within the urban area limits. The future mobility policy of the urban community is determined by the objectives specified in the town planning and land use master plan. Priority is given to public transport under the following conditions:

- Development of existing transport facilities (train, underground, tramway),
- Preferential urban development in those areas serviced by such transport facilities.

The Law on Air and Rational Energy Use of 30th December 1996 made it compulsory to elaborate an Urban Mobility Plan for urban areas of more than 100,000 inhabitants, thus endowing the CUDL with a new responsibility area. The Urban Mobility Plan was adopted by the Urban Community Council on 14th March 1997. In this plan, the CUDL set the objective of promoting less polluting energy sources for private cars as well as for public and goods transport.

EXPERIENCE OF LILLE

The CUDL responsibilities include looking after the public urban transport network and managing several waste water treatment plants which, for some of them, produce a gas with a high methane content as a result of sludge treatment.

By the end of 1990, the CDUL launched a project, the first of its kind in Europe, to provide an energy use to this local renewable source. The aim of this experimental project was to use the biogas produced by the Marquette sewage plant, in the suburbs of Lille, to power urban transport buses.

The primary objectives of the project were to:

- Build a pilot site for the production of biogas,
- Convert a conventional diesel bus into a biogas-powered bus.

Up to 1990, 80% of the 15,000 m³ of biogas produced on a daily basis by the waste water treatment plant (i.e. the equivalent of 6,000 litres of petrol every day) were used internally to supply heat and power to the treatment plant and the rest was burnt off. It is not to waste the remaining 3,000 m³ that the CUDL decided to clean them to obtain a daily volume of 1,200 m³ of biogas usable as fuel for vehicles.

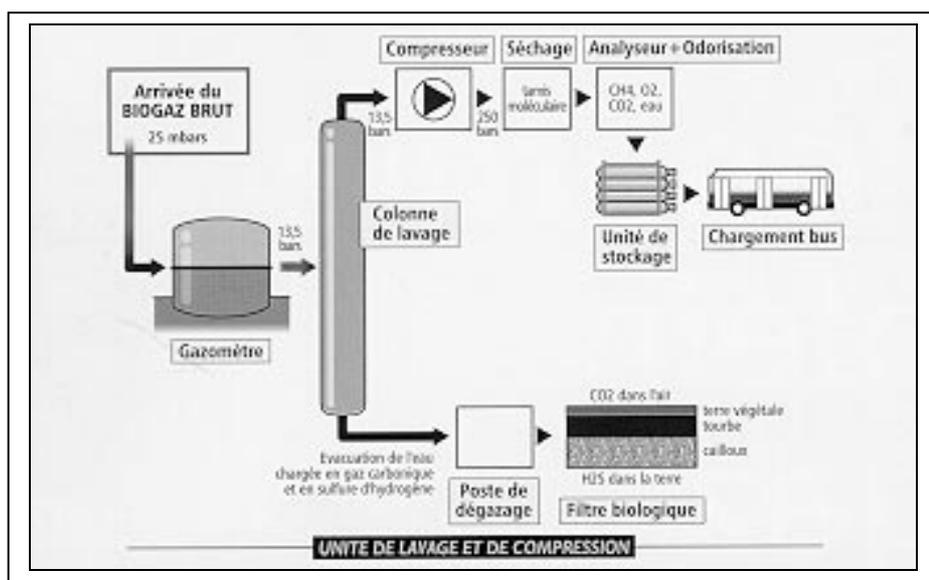
The biogas cleaning unit was commissioned in June 1995 and a distribution terminal was installed at the Marquette production site.

The cleaning method used is the absorption method. It consists in injecting compressed biogas at the bottom of a packed tower. The gas and the solvent

(in the present case, water) move along opposite directions. Cleaned gas is collected at the top of the tower. Water and the pollutant load come down at the bottom of the tower. The resulting liquid is then conveyed to a lagoon where it is cleaned of gas before being sent back to the tower.

The washing unit is designed to treat 100 m³ of biogas per hour, which means a production of 50 to 55 m³ of biogas fuel. The Marquette unit has demonstrated its capacity to produce high-quality biogas fuel at the designed nominal rate. This methane fuel has similar properties to the natural gas supplied by Gaz de France.

Eight buses are currently operating on biogas. The first one was introduced in March 1994, the second in September 1997, and the others at the end of 1998. All of them have, up to now, given complete satisfaction, either to the operator or the users.



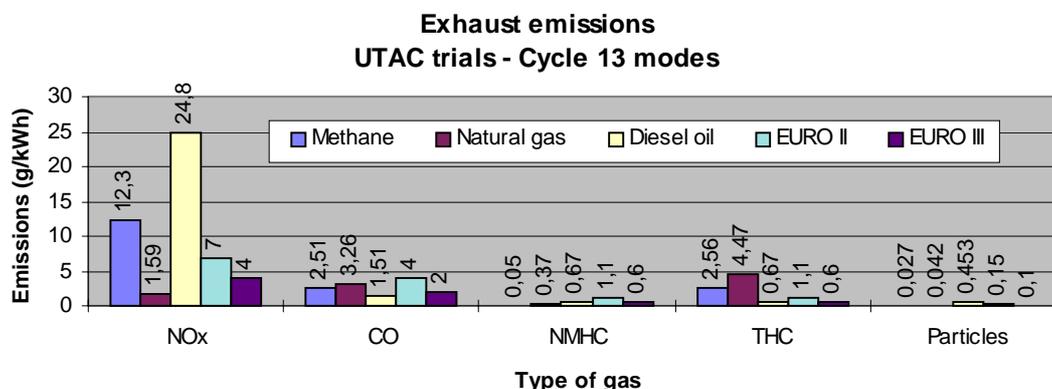
EVALUATION AND PERSPECTIVES

Operating results concerning biogas fuel

The first bus to be introduced performs as well as a conventional diesel bus. Drivers have even noted that acceleration and driveability are better. There is one problem however: the vehicle tends to slightly tilt when taking bends due to the weight of the gas tanks. This problem was solved before introducing the second bus.

Technical features of the Renault V.I. PR-100-2 biogas-fuelled experimental bus	
Introduction	March 1994
Type of fuel	Currently biogas fuel produced from the Marquette sewage plant
Gas quality	Good, between Gaz de France category B and category H
Tanks	6 aluminium tanks with a capacity of 127 litres each
Additional weight	1,500 kg
Range	220 km
Safety aspects	Biogas fuel is non toxic, weakly reactive, hardly inflammable and lighter than air
Consumption data	55 litres/100 km (diesel bus: 41 litres/100 km)
Performance	Improved acceleration and driveability
Pollutant emissions:	Complies with EURO II and EURO III standards. Higher results for NO _x due to a problem with engine tuning
Noise level:	Reduced by 60%

As far as users are concerned, they have noticed no difference as regard bus performances. They have however noted a reduction in noise and unpleasant smells.



NMHC = non methanic hydrocarbons / THC = total hydrocarbons

Economic aspects

The provisional cost of the operation is estimated at 900,000 Eur broken down as follows:

- 400,000 Eur for storage and distribution facilities,
- 110,000 Eur for building and civil works,
- 200,000 Eur for studies and costs of monitoring a pilot operation.

Because it is a pilot operation, the project has to bear additional operating costs partly linked to the distance between the biogas production site and the place where it used. This additional cost however is justified if one considers the interest of using biogas as vehicle

fuel. The extremely innovative dimension of the project allowed the CUDL to benefit from financial aid from the European Commission (150,000 Eur), the Regional Energy Conservation Fund (230,000 Eur) and ADEME (75,000 Eur). In spite of the extra costs in terms of labour and maintenance due to the small size of the pilot washing unit, the cost of producing biogas fuel is quite close to other fuel retail prices. The cost of producing one m³ of biogas from the sewage plant is indeed 0.75 Eur.

As regard the biogas processing plant, both technical and economic performances should increase. In the long run, price levels should match those of oil-derived fuels provided that biogas fuel is not subject to taxation.

As for the vehicles, various manufacturers have announced the imminent mass production of this type of buses. By the end of 1998, eight of these vehicles were in service in Greater Lille. With one tankful, the eight buses can run 150 kilometres daily and are operational all year round using this type of fuel only. This would mean an annual saving potential of 148,000 litres of diesel oil. By 2002, the Syndicat Mixte d'Exploitation des Transports en Commun de Lille (semi-public body in charge of operating public transport in Lille) should buy about 100 vehicles specifically designed to run on biogas.

The consumption of biogas-powered vehicles should drop in a near future due to:

- improved efficiency linked to the development of NGV techniques,
- reduced weight of vehicle-mounted fuel tanks (use of composite materials).

FOR FURTHER INFORMATION

Lille Métropole - Communauté Urbaine
M. Jean-Pierre DENYS
1, rue du Ballon - BP N° 749
F-59034 LILLE CEDEX
Tel: +33 3 20 21 37 84
Fax: +33 3 20 21 29 49
E-mail: jpdenis@cudl-lille.fr

SOLAGRO
M. Christian COUTURIER
219, Av. de Muret
F-31300 TOULOUSE
Tel: +33 5 61 59 56 16
Fax: +33 5 61 59 98 41
E-mail: solagro@compuserve.com

This case study was prepared by Energie-Cités in collaboration with the municipality of Lille. It received funding from the ALTENER Programme of DGXVII of the European Commission.

