

BIOGAS

VIENNE (France)

Biogas is produced by the anaerobic decomposition of organic matter (wood and agricultural waste). It has become a cost effective alternative to conventional energy sources and one of the cheapest sources of renewable energy. In Vienne, in the Rhone-Alpes Region, the biogas generated by the engineered landfill site is used to fuel a power generating equipment at the wastewater treatment plant and in the processes of an industrial company.

THE CITY

Formerly the capital city of the Allobroges, Vienne was conquered by the Romans in the 1st century B.C. and became the seat of a powerful archdiocese as soon as the 5th century. The establishment in the 18th century of the Charvet royal works specialised in the manufacture of draperies marked the beginning of the industrial era. Its economic growth in the 19th century is closely related to the development of the textile, leather and paper industries on the banks of the River Gère. With 30,000 inhabitants, Vienne has become a diversified industrial centre as well as a small administrative capital as Sub-Prefecture of the Isère Department. The industrial wastelands of the textile industry are being progressively reclaimed.



CONTEXT

An engineered landfill site was opened in 1968 by the City of Vienne at the locality of St Alban les Vignes on the thalweg that marks the border between Vienne and the neighbouring commune of Reventin Vaugris. An association of local authorities responsible for household waste management – Syndicat de Vienne et sa Région pour les Ordures Ménagères (SYVROM) – was created in 1984. In 2001 the association gathered 23 communes and served 65,000 inhabitants. The amount of domestic waste and non-hazardous industrial waste entering the landfill is estimated at around 50,000 tonnes/year. In 1993 a network of wells for capturing biogas was installed and the biogas collected was initially flared on site. However, quantitative and qualitative measurements were made that revealed an availability of around 500 Nm³/hr with a 40% methane content. It is on the basis of these measurements that a waste-to-energy scheme was devised.

An economic evaluation of this source of energy rapidly identified the local wastewater treatment plant as a potential outlet. The wastewater treatment plant has indeed a steady electricity demand and a project for drying sewage sludge was under investigation. Nearby the wastewater treatment plant is a large dyeing plant with an annual natural gas demand of 26,000 MWh which accepted to envisage fuel substitution.

The relations between the wastewater treatment plant operator - Syndicat Mixte pour l'Exploitation de la Station d'Épuration de l'Agglomération Viennoise (SYSTEPUR) - and

SYVROM were made easier by the fact that the communes belonging to the first organisation are also members of the second, both organisations being under direct local government control and having the same president.

EXPERIENCE OF VIENNE

SYVROM entrusted the Rhonalpennergie-Environnement Agency with a study that was initiated in 1995. The mission of the Agency is to assist local authorities of the Rhône-Alpes region in investigating solutions and mounting projects promoting the use of renewable energy and help them in their contacts with site owners. The entrusted study concerned on-



Picture 1: St Alban les Vignes landfill site

site utilisation of biogas to produce electrical power and provide heating to nearby workshops belonging to the municipality. In the meanwhile SYSTEPUR investigated several possible uses for the sewage sludge produced by the wastewater treatment plant, including a drying option as already mentioned. A connection was rapidly made between the two studies and a multi-purpose biogas utilisation scheme was designed at the wastewater treatment plant for the urban area of Vienne. Another potential user, the SVTA dyeing plant, expressed its interest in using biogas in its steam generation process. A first preliminary study was submitted in 1996 to potential

partners, namely the Rhône-Alpes regional council and the regional branch of Ademe (French Energy Management and Environmental Agency). The technical staff of the municipality of Vienne collaborated with specialised consultant firms on this pilot study.

A consultation process was launched in 1998 concerning different works aimed at implementing the biogas utilisation scheme. The objective was to:

- optimise biogas collection from long buried waste in a landfill cell. This is done by installing valves to achieve accurate pressure relief setting and by analysing the output from each collection trench on a regular basis. Final capping works on the excavated cell should further improve biogas capture by avoiding dispersions into the air,
- install a biogas compression and dewatering unit to facilitate transportation towards utilisation sites (picture 1 represents the unit with its regulation flaring systems),
- build a 3.7 km long pipe work running under national, communal and private roads and supplying biogas to the dyeing plant,
- install in SVTA dyeing plant a 2.09 MW biogas-fuelled boiler capable of producing 3 tonnes of steam per hour,
- install a 469 kW generating set at the wastewater treatment plant,
- install a centralised management system for monitoring biogas quantity and composition.



The size of the installations has been calculated so as to optimise biogas utilisation:

- the generating set must only operate in winter as in summer the price of the electrical power generated equals operating costs,

- when the generating set is operating, excess power is sold to EDF, the national electricity company
- in summer, the boiler uses up nearly all the biogas produced,
- it is planned to dry the sludge from the wastewater treatment plant in a biogas-fired kiln,
- the generating set is dimensioned so as to be able to supply power to a sludge drying unit (engine),
- in case of failure or no-consumption period, the existing flaring system will burn biogas and a small additional flare will be used to regulate biogas flow in the network.



Financial results

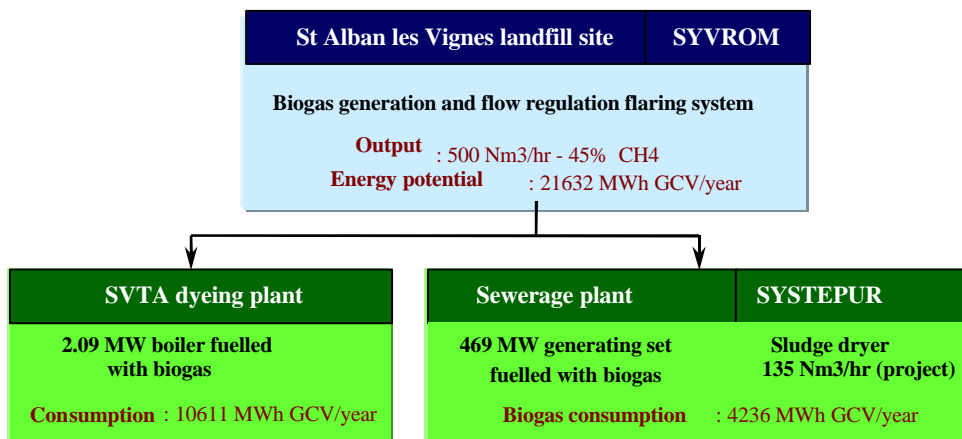
Total capital investment (including boiler at the dyeing plant) for biogas utilisation systems amounts to €1.3 million, VAT excluded, the total sum being broken down between the two associations as follows:

- SYVROM for capturing, treating, transporting and selling biogas: 68%
- SYSTEPUR for converting biogas to electricity: 32%.

The project received the following funding:

The Rhône-Alpes Region supported the project up to 30%, a grant from Ademe covered 43% of project costs and the remaining 27% were covered by a loan. Break even point is reached during the loan redemption period (10 years) and the project should yield benefits afterwards.

Biogas is sold at a price of 0.00732 €/kWh.



Environmental assessment

Biogas has a complex and variable composition. In 1998, analyses revealed a H₂S content of about 2,100 ppm and it was decided to desulfurise the product. As project progressed, H₂S content continued to decrease to reach 800 ppm in 2000, a concentration that allows biogas to be used without pre-treatment. As far as the generating set is concerned, the contractor committed to accept H₂S contents of up to 1,500 ppm. The installations are listed as registered installations for the protection of the environment. This decision was notified together with the planning permission that was issued further to the application for a new cell excavation at the landfill site.

EVALUATION AND OUTLOOK

Trials and progressive commissioning of the installation started early in 2001. Biogas utilisation rate is estimated at 69%. By the end of September 2001, all the installations – treatment plant, generating set and boiler - were operational. The operator is now installing an automated centralised system for managing and monitoring the equipment so as to optimise utilisation rate and comply with right-of-use priorities.

The multi-purpose biogas utilisation scheme as designed at the St Alban les Vignes landfill site combines economic and environmental benefits:

- Biogas fuel being twice cheaper as natural gas, it offers to those industries that are still using natural gas in their production processes, the possibility to achieve significant savings on their energy bill,
- By saving methane from entering the atmosphere, the combustion of methane contributes to reducing greenhouse gas emissions while saving on fossil energy sources.

The exploitation of biogas in Vienne involves innovative technologies that make use of a local and renewable energy source and is economically viable if grants are taken into account. An overall approach to the problem and the consultation process with the different stakeholders involved in project mounting contributed to finding, in a relatively short space of time, a common solution that brings benefits to all.

Despite the advantages described above, the exploitation of biogas energy potential is not fully developed in France if compared with the situation in Scandinavian countries, Germany or Austria. The recent obligation to collect biogas in landfill sites and the incentive to use it as a source of energy may contribute to developing a truly biogas dedicated industrial sector.

The choice made by Vienne may set an example and inspire other local authorities anxious to give practical expression to their sustainable development policy. This is all the more topical as the potential for biogas generation in engineered landfill sites in the Rhône-Alpes Region alone is estimated at around 10.000 m³ of CH₄/hr.

FURTHER INFORMATION

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