

## Biological Electricity

by Emmanuel Thevenon

In France, 60,000 people are supplied with electricity produced by power stations which run exclusively on biogas, a gas resulting from the decomposition of household waste. It is a first in Europe.

RUBBISH is no longer what it used to be. Waste, which is quite rightly criticised, could, in future, provide an important source of energy. Subsidiaries of the Vivendi group (Onyx, Dalkia and REP), recently provided proof of this by building what are, no doubt, the two largest power stations in the world running on biogas. Each of these plants (one in Plessis-Gassot in the Val d'Oise department, and the other in Claye-Souilly in Seine-et-Marne), produce 85 million kWh a year, enough to meet the electricity needs of more than 30,000 people. All of the electricity produced is bought up by the French electricity generating company, Electricité de France (EDF) in the framework of a twelve-year contract adapted to this very specific type of installation.

This gas results from the

anaerobic (without air) decomposition of the organic matter in buried waste. It consists mainly of methane (about 50%), carbon dioxide (35%) and nitrogen (15%) and also contains traces of hydrogen sulphide. Biogas, which is twenty-one times more active than carbon dioxide, also very actively contributes to the greenhouse effect. So, to avoid such problems, in the largest installations it has to be eliminated. It is usually burnt in flares but can also be used to produce electricity. A cubic metre of biogas is equivalent to half a cubic metre of natural gas, i.e. 5 kWh. Until now, this alternative was limited by the corrosive components of biogas and by its fluctuating composition. Indeed, the latter varies according to climatic conditions. Depending on humidity, temperature, atmospheric pressure and the

method used to gather it, its methane content, which gives biogas its calorific properties, varies between 30 and 60%. As a result, in addition to considerable corrosion and dirtying, the engines have to be very finely tuned. So the biogas is usually mixed with some natural gas before being used in power stations.

### Guaranteed profitability

So the two power stations of the Vivendi group are a spectacular innovation as they run exclusively on biogas. Each of them backs onto a rubbish dump in which 800,000 tonnes of waste are buried a year in an area of 200 hectares, representing the waste produced by two million people. The biogas is gathered by means of a network of horizontal and vertical conduits installed at the same time



An environment preserved thanks to a power station running on biogas.

as the rubbish is buried. A control and regulation unit, operating 24 hours a day, supplies a gas whose pressure and quality are constantly checked. When the gas reaches the production unit, it is burnt using burners especially developed by Dalkia which form part of boilers with stainless steel fireboxes. High pressure (40 bars), high-temperature (400°C) steam is thus produced and sent to a turbine driving an alternator. The latter converts mechanical energy into electrical energy which is

then delivered to an EDF station three kilometres away from the plant.

The two power stations are expected to go on operating for about twenty years. Income from the sale of electricity (at a price of 31 centimes a kWh or about 5 cents) helps to finance the investment made in the power station (110 million francs/17 million dollars) and its running and maintenance costs. According to the French Environment and Energy Agency (Agence de l'Environ-

nement et de la Maitrise de l'Energie (ADEME), the two French production units for valorising biogas will make it possible to save three million tonnes of CO<sub>2</sub> from being dispersed in the atmosphere in the next twelve years. There is also a saving of electricity as the biomass power stations supply the Paris area (where there is a shortage of it) and save the need to bring that extra amount into the region using high-voltage cables which lose some of the electricity that they carry.

## France's Foreign Policy

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**Humanitarian action**  
By designating a specific place for humanitarian action in its foreign policy, France is demonstrating at the highest level its determination to continue to uphold the values it has inspired. France has played a vital role in the development of humanitarian action and international humanitarian law.

France's humanitarian action provides technical and financial support for UN operations in partnership with French State agencies such as the Sécurité civile (emergency services dealing with natural disasters, bomb disposal, etc), Samu mondial (mobile emergency medical service — international branch) and the armed forces' health services.

In 1999, the Humanitarian Emergency Fund provided an initial appropriation of 57 million francs (8.69 million euros), subsequently adding a further 215 million francs (32.78 million euros) of special aid in the framework of the Balkans crisis. Over 40 million francs (6.10 million euros) were allocated to support French NGOs working abroad, reflecting the authorities' determination to contribute to their work in the international humanitarian arena where they play a leading role.

At the same time, France contributed a total of 404 million francs (61.59 million euros) to the programmes of international humanitarian organizations — ICRC, WHO and UN agencies with a humanitarian role (UNHCR — 44 million francs [7.1 million euros], UNICEF — 48 million francs [7.32 million euros], World Food Programme — 18 million francs [2.74 million euros] and UNRWA — 11 million francs [1.68 million euros]).

In addition, France contributed to European Union programmes through ECHO (European Community Humanitarian Office), to which it gave 688 million francs (104.88 million euros) 17.5% of ECHO's budget.

In all these ways, France directly or indirectly assists countries and peoples in need, suffering the effects of natural disasters or political crises.

The priorities in this sector are medical assistance and medicines, health and social care and nutrition. France attaches special importance to child protection and help for landmine clearance. 4.66 million francs (0.71 million euros) were allocated to this in 1999, including 2 million in special contributions for demining in Kosovo. Regions receiving the most aid were the former Yugoslavia, Africa, Asia and Latin America.

### Cultural, scientific and technical cooperation

French cultural and educational establishments abroad include:

- 270 French lycées and schools, with 160,000 pupils;
- 150 cultural centres and institutes;
- 220 Alliances Françaises in over 140 countries teach the French language to 370,000 students and also organize exhibits, show films, etc.
- 27 research centres and 130 archaeological digs spread over five continents.
- Every year 20,000 scholarships are awarded to foreign students and trainees in France, 115 million households have access by cable or satellite to the French-language TV channel TV5, and Radio France Internationale (RFI) has 30 million listeners.



## Culture and Leisure

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years, flocked to the 4,600 cinemas and new multiplex cinemas whose development has contributed to the rise in ticket sales.

### Music and dance

France is the home of some 11,300 dramatic artists and dancers, 16,200 musicians and singers, 250 music, opera and dance festivals, 8,700 variety performers; etc. In addition, amateur performers are increasing in number as teaching in these fields has grown apace (more than 4,300 institutions specialize in music alone).

### Theatre

Every year, some 50,000 performances put on by the national theatres, national drama centres, other subsidized playhouses and private theatres attract a total audience of eight million. In addition to the great theaters in Paris, its suburbs, in smaller cities and at world-renowned festivals such as Avignon, over a thousand independent theatre companies have sprung up.



### Museums and monuments

Around 1,200 museums draw tens of millions of visitors each year. The Louvre, Versailles and the Musée d'Orsay alone welcome nearly 15 million people annually. Most cities outside Paris have at least one museum. In addition, more than 1,500 monuments are open to the public (eight million visitors a year), with the Eiffel Tower the most popular attraction with 6



million visitors a year. Moreover, some 38,000 buildings are classified as historic monuments and as such are protected by the Ministry of Culture.

### Sport

Participation in sporting activities has grown rapidly in recent years. Almost 10 million people are enrolled in sports federations, with football and tennis the largest. Judo, pétanque, horse-riding, badminton and golf have recorded notable success in recent years. In addition, adventure and discovery activities such as mountain biking, hiking, climbing, hang-gliding and canoeing are winning increasing numbers of fans.

### Cultural festivals

Internet Festival, Heritage Days, Music Festival, the literature festival, Lire en Fête, and Science Week are all cultural and leisure events in which the French love to take part, and whose success is growing every year: on the Heritage Days, historic monuments (ministries, embassies, firms, banks) usually closed to the public open their doors. The aim of Science Week is to inform the public about developments in science and their implications for society. Focusing on books and reading, Lire en Fête organizes meetings with writers, writers' workshops and short story competitions and introduces visitors to trades within the book industry. Finally, the Internet Festival raises public awareness about the information society.

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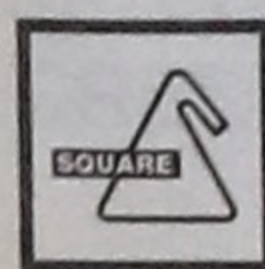
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