

WIND ENERGY

TORTOSA (Spain)

Wind energy is not generally thought of as a source of renewable energy for cities. Very few towns have space within their city limits to build big wind power plants, so smaller facilities are much more common. In Southern Catalonia, specifically in the Ebro canal, there are very good environmental conditions for the exploitation of wind energy, and enough space for it. Municipalities can foster such installations in different ways, such as buying energy at preferential rates when they come from renewable energy sources; providing financial support and facilitating use of land and the search for locations.

GENERAL ASPECTS

Tortosa, with about 30,000 inhabitants, is the capital city of the Baix Ebre county. This county, which shows a physiography of strong contrasts from the coastal line to the mountainous areas of the Dels Ports range, predominantly features the Ebro River, which criss-crosses most of its territory.

Climatic data:

Annual mean wind speed: 7.3 m/s
Annual mean temperature: 17.2 °C



CONTEXT

The city of Tortosa is a major point of intersection for the counties in Southern Catalonia and their urban centre with a significant increase in the service sector although the agricultural sector plays a fundamental role for the local economy. Tortosa is currently developing an environmental section which, as of next year, will have the technical staff and the means necessary to work on a city project for sustainable development. Currently, initiatives for the protection of the environment include the separate collection of glass, paper and tins all over the Baix Ebre county by the County Council. In order to develop a programme for the Municipal Waste Management in Catalonia, pursuant to Law 6/1993, the city of Tortosa and the County Council are managing a county-wide programme for the separate collection and treatment of municipal wastes with a gradual incorporation of organic waste collection. Catalonia's government has recently built general collectors within the city limits to carry sewage waters to a waste-water treatment plant.

The first attempts to evaluate the feasibility of wind energy exploitation by constructing a wind power plant were made back in 1990. From the initial beginning, it was supported by the different administrations and in 1991 the THERMIE Programme of the General Directorate XVII of the European Commission gave it its support.

EXPERIENCE OF TORTOSA

The County Council of Baix Ebre's own choice to promote electricity production with wind energy as a renewable source had a specific weight on the convenience and timing to put this project in motion as a public initiative. The Ebro River criss-crosses the territory which



has an important impact on the wind intensity. The wind comes from the Northwest through the Ebro Valley and frequently reaches speeds of over 100 kilometers per hour.

The plant is located within the Tortosa city limits at Mount Buitaca, some 600 meters high and seven kilometres away from town. The space selected has scarce vegetation and a splendid panoramic view of the Ebro's delta. The geography and the orography of the area allows for some acceleration of the winds from the North-Northwest quadrant, and of local winds which have lower energy potential and different orientation. The wind power generators are adaptable to the orography of the site and are lined up on the mountain range. The novelty of putting the plant on complex topographical areas offers the possibility of disseminating the results of their proven energy efficiency. This is the first time that a local government has promoted the installation of a wind power plant in Spain which lead to the support by the Commission of the European Community through the THERMIE Programme by way of a non-repayable subsidy. Equally supportive from

the very beginning were the Catalanian government and the Ministry of Industry and Energy, which in turn boosted public interest.

Support was requested and obtained through different subsidies, on grounds of the reliability of the technology to be used, the originality of the initiative by a local government and the innovative nature of the project, due to the complexities of the site where it was to be installed. Once the energy potential and the institutional support were guaranteed, it became necessary to insure its economic viability because, although the project did not expect spectacular results, it demanded positive results.

The following factors were decisive:

- ⊖ Energy estimates supported by thorough wind energy surveys carried out by specialised companies.
- ⊖ An energy sales price assigned by regulations so as to avoid speculation. In addition, it was made mandatory for utility companies to buy the energy produced, which guaranteed sales of 100% of the generated energy.
- ⊖ Subsidies granted by different administrations which, along with capital stock, made up to 61% of the total investment.
- ⊖ A periodic review of each wind power generator means that the need to reinvest in equipment is zero during the plant's useful life. This factor was guaranteed through

maintenance operations with non-random values consolidated through the respective contracts, which guaranteed a total balance between earnings and expenses.

It was in May of 1992 when all these favourable parameters came together and the operating company was founded, with the unconditional support of the public sector and of a private company which was to be contractor and shareholder at the same time:

The city of Tortosa: Owner of the land, which it gave to the company; interested in participating in such a significant project; currently holds 10% of capital stock. Baix Ebre County Council: Promoter of the project; holds 14% of capital stock. ECOTECNIA, SCCL: This internationally-renowned co-operative responded favourably to the project from the very beginning; drafted the project and was the contractor and in charge of maintenance; holds 25.33% of capital stock. Eficiencia Energética, S.A.: This company, which is part of the Catalanian



Institute of Energy of the Catalanian Government (known as ICAEN) is the instrument for the autonomous region's participation in the project. It holds 25.33% of capital stock. Institute for Energy Diversification and Conservation: The state-owned company through which the Ministry of Industry and Energy participates in the project. It holds 25.33% of capital stock.

The plant has 27 wind power generators of the ECOTECNIA Model 20/159, with a 20 meter diameter propeller and 150 kW nominal power, which accounts for an aggregate power of 4.05 MW. There is a transformer station every five or six generators to transform voltage from 400 volts (generation) to 25,000 volts (mains supply line). In 1996, the first full production year, 7,385 MW of electricity was generated, which fell below the estimates since it was a year in which wind speeds were unusually lower than the average. Thorough wind measurements were taken to pinpoint the exact locations where energy values were figured to be around 980 kWh/m².

The plant is controlled by an automatic operating equipment which allows for remote operation by telephone. Two technicians conduct the supervision and maintenance work at the location itself. It should be also noted that, apart from these specific positions, the equivalent of 54 people a year (33,000 man-hours) have worked at the construction of the plant. Ten of them were people from the immediate vicinity. Several environmental measures were taken during the construction to reduce the impact, such as burying internal lines, designing external lines so as to avoid cutting trees, which are scarce in the area, and reforestation with local species.

Finally, on June 28, 1995, the wind power plant of Baix Ebre was connected to the 25 kV distribution network of the Fuerzas Eléctricas de Cataluña (FECSA) utility company.

The total cost of the plant was Eur 4,661.000, which were financed as follows:

Capital stock:	Eur 909,000
THERMIE Programme Subsidy:	Eur 1,285,000
Ministry of Industry and Energy Subsidy:	Eur 564,000
Catalonia Government Subsidy:	Eur 224,000
Caja de Madrid Loan:	Eur 2,120,000.

EVALUATION AND PERSPECTIVES

A review of the production figures reveals that, from the first year, the balance sheet was positive, and results were positive in the short term. This trend has consolidated as of the sixth year of operations. Balances, after repayment of the loan, were positive from the very first year of production, and the aggregate balance was considerable as of the third year.

This wind power plant avoids releasing into the atmosphere 8,300 tons of CO₂ and 50 tons of SO₂ every year, and substitutes 700 tons of petrol annually.

It provides electricity for 2,900 families and generates national industries and technological development.

Production data of the plant between 1996-1999 [MW/h]:

	1996	1997	1998	1999
January	579	566	858	997
February	1.247	610	347	1.435
March	627	523	645	936
April	548	673	776	838
May	362	334	406	516
June	296	427	281	323
July	269	531	397	293
August	284	207	395	309
September	622	120	627	257
October	924	504	1.019	323
November	1.008	763	1.119	956
December	619	1.080	818	1.121
total	7.385	6.338	7.688	8.304

The electricity produced equals one third of the city's demand.

FOR FURTHER INFORMATION

Consell Comarcal del Baix Ebre
Rosa Ma Solé
C/ Barcelona 152
ES – 43500 TORTOSA
Tel: +34 977 44 53 07
Fax: +34 977 44 53 08
E-mail: rmsole@baixebre.altanet.org

Ajuntament de Tortosa
Regidoria de medi Ambient
Jordi Bonilla
Plaça de Espanya s/n
ES – 43500 TORTOSA
Tel: +34 977 58 58 38
Fax: +34 977 58 58 52
E-mail: aj.tortosa@altanet.org
<http://www.tortosa.altanet.org>

This case study was prepared by Energie-Cités in co-operation with the municipality of Tortosa. It received funding from the ALTENER Programme of DG Transport and Energy of the European Commission.

