

Wind energy is not the energy that immediately comes to mind when thinking about renewable energy in cities. Few cities have enough space within their area to build large wind farms. You may rather find small wind turbines on suitable locations within the city's' area or doing, very often after feasibility studies on this subject. Besides the erection of wind turbines, there are many other ways that cities can promote this renewable energy source. These include: applying procurement procedures that favour a certain technology, giving support to organisms that buy or run wind energy plants. The city of Dortmund a city that has developed a very innovative method to boost wind technology within its own territory.

GENERAL ASPECTS

Dortmund (597,000 inhabitants) is situated in the German Land of Nordrhein-Westfalen, being the eastern fringe of the Ruhr area. It lies on the Dortmund-Ems-Canal which makes it one of the important fluvial ports in the area. So it kept the merchant tradition developed in the 13th century when it became a member of the Hanseatic League, trading mostly with Scandinavian countries. In the 19th century, the city became important because of its coal mines and steel works. During World War II, it was widely destroyed and thus rebuilt afterwards.

Climatic data:

Mean wind speed: 5.1 m/s



CONTEXT

Wind energy projects are considered in the light of two sets of regulations: the Land Wind Energy legislation of 1996 which is a set of regulations with which new proposals must conform and an amendment to the zoning plan for Dortmund passed in 1995 which defines the locations within the municipality where wind energy projects are acceptable.

Dortmund has a municipal utility company (Stadtwerke), Dortmund Energie und Wasser (=DEW). The city, like many German cities, has a strong policy to promote environmental protection and has followed a policy of promoting wind energy to this end. Dortmund lies in the interior of Germany on low lying ground with no special wind energy potential.

The Stadtwerke asked the wind energy group at the Westphalian Wilhelms University at Münster to prepare a study of the potential of the city for wind energy which was published in 1995. This study identified the potential of the area within the city limits for wind energy and identified 7 individual sites suitable for 150 kW wind turbines taking into account factors such as visual impact and noise. However the technology progressed and the City determined to construct a 500 kW turbine on one of these sites between 'Steinsweg' and the dual carriageway A 45.

EXPERIENCE OF DORTMUND

The turbine chosen was an ENERCON-40 with a rated capacity of 500 kW. Since the site was in an inland area, a 65 m mast was used so that the rotor of 40 m diameter is rather small compared with the mast. The site itself lies on agricultural land on the edge of the town, near to a dual carriageway road and high tension pylons. The nearest habitations, a small group of four houses, lie at about 190 m from the turbine.

Technical data of the Turbine

Start of operation:	1. of August 1997
Height:	65 m
Rotor diameter:	40,3 m
Maximum rotor speed:	290 km/h
Maximum wind speed:	33 m/s
Calculated electricity generated:	730.000 kWh/a
Calculated CO ₂ savings:	400 t/a



Financing of the turbine

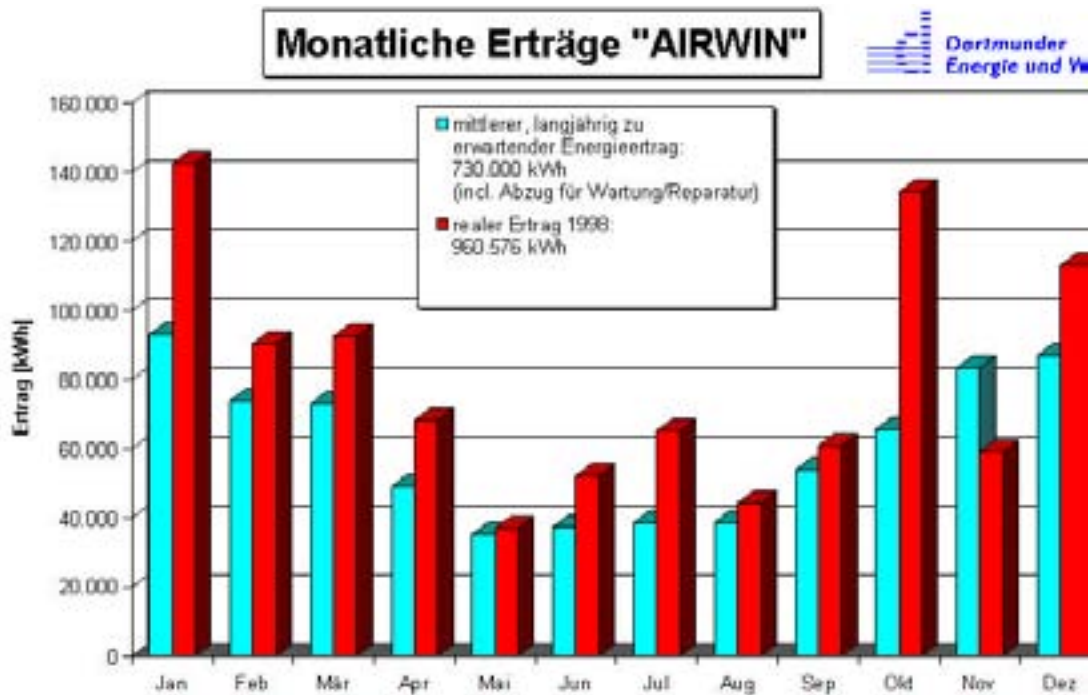
But it is the financing that is the most innovative aspect of the Dortmund wind energy plant. The project received a grant of nearly Eur 64,000 from the European Union. The balance of about Eur 447,000 had to be found by other sources. The DEW advanced this money needed to build the turbine and looked for means of getting a cheap loan afterwards, actually involving a large number of members of the local community in its funding but in an unusual way: DEW has offered bonds to members of the local community - effectively a loan over 10 years.

The bonds are in three denominations, Eur 153, Eur 256 and Eur 511. These are reimbursed at the nominal value after 10 years. They offer 3% interest guaranteed based on the turbine operating the equivalent of 1,000 hours at full output thus taking the risk of unfavourable weather conditions, maintenance costs and even damage or loss. This interest is reflected in the purchase price (e.g. Eur 114 for a Eur 153 certificate). If a higher output is obtained then the bonds pay a further dividend which is reimbursed as a terminal bonus. According to the preliminary study, the overall return over 10 years would be 5% for an output of 1,450 hours.

To advertise this unusual offer, the DEW published a brochure in which it described the turbine to be built and the environmental and financial advantages of buying such a bond. The citizens of Dortmund could either buy the bond or directly transfer the sum to a bank and then get the certificate in the DEW's office.



To get general public support and raise awareness about the issue, there was also a competition among the inhabitants of the City aimed at finding a name for the Wind turbine. This resulted in calling it 'Airwin', being phonetically very similar to the common German Christian name 'Erwin'.



In February 1999, all bonds - i.e. 1,830 altogether – had been sold, the Eur 447,000 to be funded by DEW had thus been raised publicly. However the turbine remains the ownership of the local authority who use it to feed into their local distribution network and help with peak lopping.

Management of the Turbine

The whole operation is run as part of DEW's normal electricity distribution operation. But there is a remote control operated by the producer ENERCON. At a wind speed of 33 km/h or more, the turbine stops operating for safety reasons and the personnel of ENERCON restart it when the stormy weather is over. Contact with the bond holders is maintained by means of a newsletter, Airwin News, 3,000 copies of which are circulated to "Friends of Dortmund Wind Plant" once a year to inform them about new developments, technical and production data and possible benefits.

Calculated and real output of the turbine

The production of the turbine varies considerably according to the season, generally producing between two and three times as much energy in winter as in Summer. In the first five months of operation, the turbine produced about 310,000 kWh with a calculated annual average of 730,000 kWh. This was seen as a satisfying result, considering the fact that the year 1997 was seen as generally unfavourable to wind energy in Germany. But the location of the 'Airwin' turbine turned out to be a good choice as it scored better than the average. In 1998, the energy production was 960,600 kWh, i.e. 30% above the estimated result. This remarkable



performance is due to favourable weather conditions (14% more wind than average), to a new rotor construction that maximises return, and also to better reliability than predicted.

EVALUATION AND PERSPECTIVES

The electricity is used directly by Dortmund Energie und Wasser and this enables the company to have wind generated electricity but to avoid paying the relatively expensive feed in tariff.

The project has the great advantage that it raises capital at a relatively low cost from enthusiastic members of the public who can see the physical result of their joint commitment to wind energy and to the saving of carbon dioxide emissions. However bond holders do not have a real direct involvement in the operation and management of the company so in practice this leaves the utility almost complete freedom of operation. This approach could be a useful model for local authorities which wish to develop a turbine without raising venture capital. The technique has the advantage of great simplicity for the investor, and given the small sums involved for each investor, the investment can be considered simply a gesture of good faith. However there are several constraints. In Germany a major advantage for the promoter is that the Stadtwerke is able to produce wind generated electricity without the obligation to buy in at a high feed in tariff. This might equally be an advantage for many municipally owned distributors and for municipalities wishing to use the electricity directly in their own establishments. In particular in these instances there is the advantage that the production of electricity in the local areas avoids transport charges and losses.

The liberalisation of the energy markets is likely to make such wind energy projects less attractive to municipal distributors since it involves a medium term investment with a pay back over ten years and whose profitability may change under changing market conditions. Nonetheless, DEW has made plans for another turbine and has publicised them. Although there were many people willing to join in (even though DEW wants to spread legal responsibility to all bond-holders which means less favourable conditions than before), a suitable location has not yet been found. The preferred solution is to place a second turbine on the same site the first turbine but there is opposition to this proposal on spatial planning grounds.

FOR FURTHER INFORMATION

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