

# Paderborn

## 1.1. GEOGRAPHICAL SITUATION, CONTEXT AND ORIGIN OF THE PROJECT



● Wind Farm Paderborn	
Turbine typ	: VESTAS V-66
Rated power	: 1,650 kW
Hub height	: 76 m
Number of installed turbines	: 11
Installed capacity	: 18.2 MW
<u>Commissioning</u>	: Nov. 2000
Total investment	: 18,838,300 €
Yearly energy production	: 31,350 MWh
Specific investment coefficient	: 0.60 € / (kWh a)
Number of shareholders	: 91

The Paderborn Windfarm has a rated power capacity of about 18.2 MW. The project consisting of 11 wind turbines of VESTAS V-66 at each 1.65 MW rated power is sited near Paderborn in North-Rhein-Westfalia. The wind farm was initiated locally by a group of developers and is owned by 91 shareholders. The structure and organisation of ownership is described in section 4. Commissioning was in November 2000, therefore the economical background of the project is based on the actual German Renewable Energy Sources Act (REL).

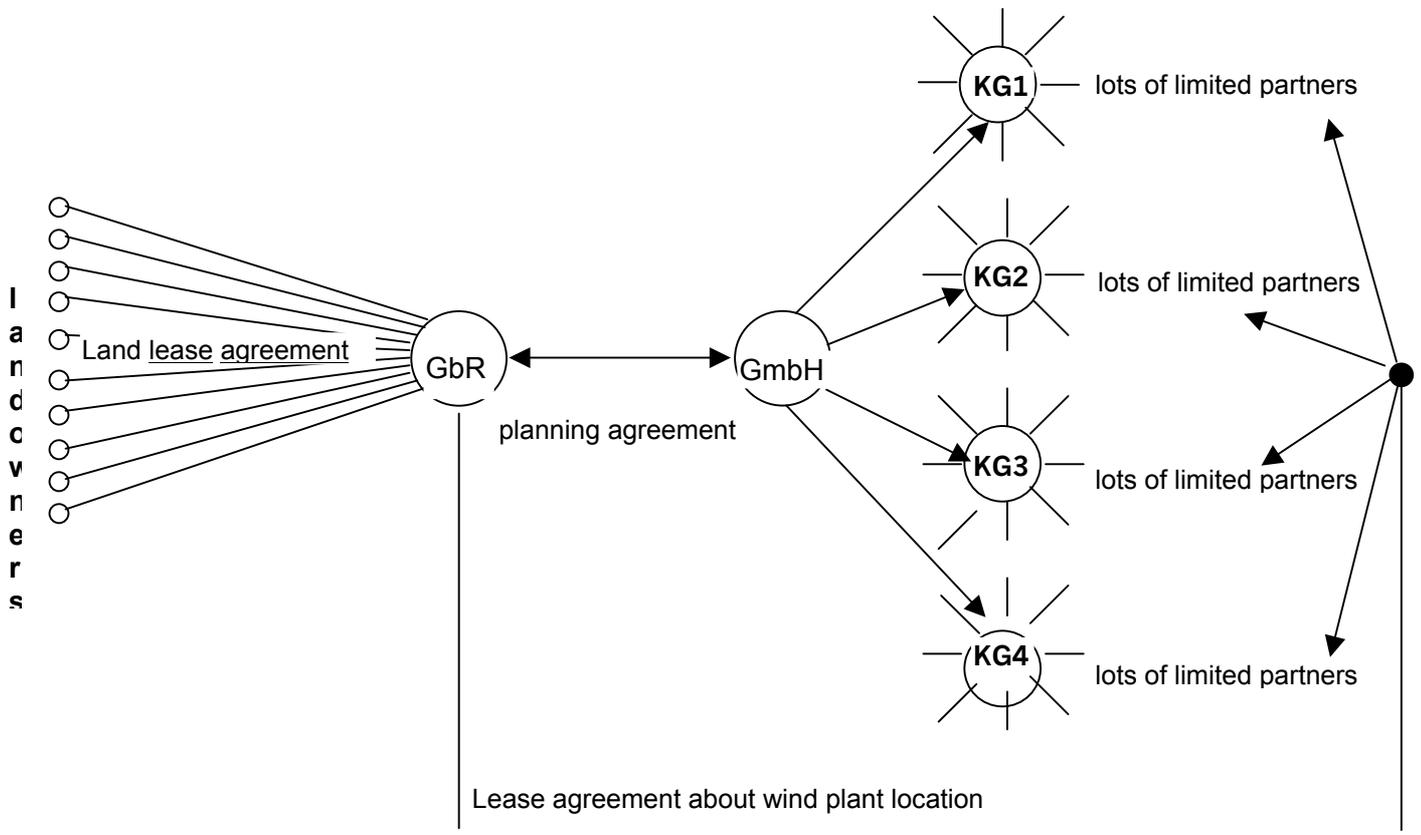
The area of Paderborn is one of the windiest inland sites in North-Rhein-Westfalia. A high concentration of wind turbines can be found in that region. Local inhabitants are well informed about wind energy, the local acceptance is high. Most of the wind turbines and wind farms in the region of Paderborn are developed by local planning consultancies. Wind energy became an economical factor, local employment was initiated. Local authorities are used to handle the planning procedure of wind farms.

## 1.2. LEGAL FRAME AND INVESTMENT SCHEMES

### 1.2.1. Legal Frame

To make a peaceful course possible, the actors of the wind park in Paderborn founded first a co-operative of land owners and created themselves a few rules to consider the matters of everybody who is involved in their project. An important step was to organise a fair distribution of the land lease among the different landowners rated to the square meters of their ownership (see left part GbR in figure 1). In that way every landowner in the designated area of the wind farm can participate in the income from land lease independently of the fact on whose specific ground the wind turbines are erected. Neighbourhood fighting was avoided. The process of landowner organisation was a self-defined procedure. The so formed land owner company made a planning agreement with the project developer. Planning procedure was running on a

professional basis. For establishing of the operational period a limited company (GmbH) was founded. This company realised the investment by collecting equity of private investors (groups of Kommanditisten KG, see right part of figure 1). Most of the private investors are based locally. The land owners got a second chance to participate in the income of the wind farm by becoming members of a KG-group or by erecting a wind turbine by their own in the planned area.



- GbR** : civil law association which adjust the net rent and consist of the landowners
- GmbH** : limited company which deals with the planning (complementary) and the operation of the wind farm
- KG** : limited partnership where lots of limited partners buy parts of the wind park

Figure 1: Structure of the wind farm organisation

The limited company is the complementary part in the structure of the organisation, it supervises the building period and organises the technical and administrative operation of the wind farm. In total there are 91 private investors (Kommanditisten) with different shares who take part in the operation of the wind farm.

### 1.2.2. Economy

**Table 8:** The total investment costs of the project in Paderborn

<b>Investment costs</b>		
Wind turbines (11 VESTAS V-66)	86.6 %	16,310,200 €
Foundations	3.2 %	590,600 €
Transmission station	0.3 %	55,000 €
Grid connection, incl. tranformer station	4.3 %	815,500 €
Streets	0.9 %	165,000 €
Planning and building supervising	3.0 %	550,000 €
Company founding, tax consulting, legal advisering	1.0 %	187,000 €
Environmental impact payment	0.9 %	165,000 €
<b>Total investment costs</b>	<b>100 %</b>	<b>18,838,300 €</b>
Specific investment costs		<b>1,035 € / kW</b>

**Table 8** shows the spread of the total investment in Paderborn. Additional investment costs like grid connection and streets cover lower shares beside the wind turbines in bigger sized projects. Planning procedure and administrative work for company founding etc. become more expensive in comparison to privately organised projects of the early 90ties.

### 1.2.3. Financing

When the Paderborn wind farm was financed subsidies of the Federal State were not any more available. This incentive existed only in the start up of the German market. The necessary equity of 20 % was financed by the groups of Kommanditisten (KG) (see **table 9**).

**Table 9:** The financing of the project in Paderborn

<b>Financing</b>		
Equity (from private investors)	20 %	3,767,800 €
ERP-loan	50 %	9,419,150 €
DTA-loan	30 %	5,651,500 €
<b>Total financing</b>	<b>100 %</b>	<b>18,838,300 €</b>

The economy of the Paderborn wind farm is based on the German Renewable Energy Sources Act (REL) which is in force since April of 2000. Tariffs are regulated in two steps, in the first phase of operation a high tariff with 0.091 € / kWh is guaranteed. In the second phase which starts after a certain period of time which is related to the wind quality of the site the tariff is lowered to 0.062 € / kWh. For later projects with a start-up after 2002 both tariffs are reduced by 1.5 % per year.

The wind conditions in Paderborn lead to an energy production of 31,350 MWh per year. This energy yield includes all losses of technical availability, grid availability and wind farm efficiency. Under these conditions the lower tariff will be relevant after 15 years of operation. Average electricity price for 20 years lifetime comes to 0.084 € / kWh. The yearly income can be calculated to 2,852,850 € for the first 15 years (see **table 10**)

**Table 10:** Yearly income of the project in Paderborn

Energy generation per year	31,350 MWh
Refunding	0.091 € / kWh
Yearly income	2,852,850 €

**Table 11** gives an overview about yearly expenses. Most of the yearly income has to be paid during the period of 12 years loan for pay back and interests. After 12 years payments to the bank are done. In the case of Paderborn wind farm most of operation and maintenance costs (O & M) are put into reserves because of safety reasons. On one hand liquidity has to be sufficient in years with lower wind speeds and on the other hand reserves are necessary to cover higher costs for spare parts during the second decade of operation. Reserves are calculated constantly for the whole lifetime, therefore there is only a marginal increase to be foreseen for the second decade. Specific O & M costs can be defined as constant on the level of 0.030 € / kWh and are typically more or less double of those at coastal sites.

**Table 11:** Yearly expenses of the project in Paderborn

<b>Yearly expenses</b>	
Maintenance	88,000 €
Insurance	53,900 €
Land lease	142,650 €
Electricity and telephone	15,455 €
Management	165,000 €
Reserves	330,000 €
Others	132,000 €
<b>Total yearly O &amp; M costs</b>	<b>927,005 €</b>
Specific yearly O & M costs (first 10 years)	0.030 € / kWh
Specific yearly O & M costs (second 10 years)	0.030 € / kWh
Capital costs (average first 12 years)	1,534,500 €
<b>Total yearly expenses</b>	<b>2,461,505 €</b>

The production price per kWh electricity can be estimated as follows (see **table 12**): Assuming a 20 years life time period the specific investment costs run to 0.030 € / kWh. The O & M costs are estimated to stay constant at a level of 0.030 € / kWh because of constantly cumulated reserves which cover all technical risks (see above). Total interests cumulate to 3,343,350 € during the pay back period of the loans. Electricity production costs of 0.065 € / kWh are resulting.

**Table 12:** Key figures after budget of the project in Paderborn

Specific investment costs for 20 years	0.030 € / kWh
Specific O & M costs (20 years average)	0.030 € / kWh
Average capital costs for interests of bank loans	0.005 € / kWh
<b>Electricity production costs</b>	<b>0.065 € / kWh</b>

A financial result by shareholder can not be estimated easily because benefits are depending on tax conditions which are linked to the individual income situation of each shareholder.

### **1.3. CONSULTATION PROCESS**

The consultation process was more or less identical with the founding of the landowners company. All neighbours are members of this company. Therefore no complains from outside public had to be solved. Public hearings were not necessary.

### **1.4. DIFFICULTIES ENCOUNTERED**

The strategy of creating the land owners company avoided any claim or negative discussion. Dialogue with local authorities was in favour to realise the project.

### **1.5. SOLUTION IDENTIFIED**

The discussion concerning the founding of the land owners company was a self-defined process. Participation of all neighbours was the solution which gives guarantee for the success of the project.