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# A Wind Farm Project Finance Deal

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*At this point they caught sight of thirty or forty windmills which were standing on the plain there, and no sooner had Don Quixote laid eyes upon them than he turned to his squire and said, "Fortune is guiding our affairs better than we could have wished; for you see there before you, friend Sancho Panza, some thirty or more lawless giants with whom I mean to do battle. I shall deprive them of their lives, and with the spoils from this encounter we shall begin to enrich ourselves (...)*

Miguel de Cervantes, *Don Quixote*

## Description of the Project

"Imagine that we put up the windmills. When the wind blows, the business is rolling."

At the beginning of 2002, Jakub Bujok, a finance analyst who was passionate about renewable energy, came up with an idea to develop and operate a wind farm in Pomerania, a seaside region in the north of Poland. Jakub was trying to convince his friend, Lukasz Dzienisz, to partner with him on the project. The two would make a perfect team to carry out the deal. Jakub and Lukasz had been friends since they met in college at the Warsaw School of Economics in Poland. Jakub had extensive knowledge of the energy industry, in particular renewables, and Lukasz had the entrepreneurial spirit. Their friends had even nicknamed the pair "Don Quixotes" because of their love of windmills.

The regulatory environment in Poland was favorable. New energy regulations published in December 2000 by the Minister of Economy required that 2.4% of the energy produced by each power plant would have to come from alternative sources in 2001 (either generated in-house or bought from independent power stations). This quota was set to increase year by year,

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reaching 7.5% by 2010. The European Commission was aiming for 12-15% of energy to be produced from alternative sources by 2020.

According to the Polish Energy Regulatory Office, renewables amounted to 1.91% of the total energy produced in 2000, most of which came from a single hydroelectric plant in Wloclawek (see Exhibit 1). There was a large disproportion between demand and supply of renewables. The government forecasted that alternative sources would reach 7.8% of the energy balance by 2010 and 14% by 2020, of which more than one-third would come from wind power.

Jakub and Lukasz wanted to seize the opportunity and decided to develop a farm with 10 wind turbines for a total of 20 Megawatts (MW) of nominal installed power in the Pomerania region, one of the most suitable places in Poland for this kind of venture (see Exhibit 2 for the map of wind zones).

The investment was a textbook example of project finance:

- Outlays were relatively high — above €20 million
- Most of the financing would come from long-term debt
- Debt repayments would be based on forecasted cash flows
- A special-purpose vehicle with limited recourse to shareholders would carry the project

## Development of Wind Power

The wind has been harnessed as a source of energy for centuries. First, windmills were used to grind grain and pump water. Wind energy was widely used until the end of 19th century, until the invention of the steam engine overshadowed its popularity.

The first wind power generator was built by Charles Brush in the winter of 1887-1888. It was a 17-meter-high rotor capable of producing 12 kilowatts (kW) of power. Some years later, Poul la Cour (1846-1908) discovered that rotors with fewer blades were more efficient for electricity generation. He used wind power in the process of electrolysis to produce hydrogen, which was then used to light the high school where he taught natural sciences.

The first commercial wind turbine was built on the Gedser Coast in Denmark in 1957 by Johannes Juul, who was one of Poul la Cour's students. His 200 kW turbine had three blades, a rotating hub, and many features similar to modern turbines.

During the 1960s, only eccentric amateurs were building wind farms. The most popular models were three-bladed turbines, which generated up to 15 kW. In the 1980s, wind turbines started to become an industry. A Danish power plant launched an initiative to build a 660 kW turbine. It was a difficult venture with a number of technical complexities (e.g., mechanical resistance, choice of materials) and economic problems (i.e., it had to be profitable). In the 1990s, efficient wind turbines were finally introduced. Modern wind turbines produce a few megawatts, the biggest being the Enercon E-112, which reaches 4.5 MW on a standard tower of 124 meters.

Modern wind turbines consist of a hub and a rotor mounted on a tower. The rotor is the most important part of the station: it converts wind energy into mechanical energy. It is placed on a special shaft made of reinforced fiberglass; this shaft drives the generator. The rotor generally runs at a speed of 15-20 revolutions per minute (rpm); however, a typical asynchronous generator works at 1,500 rpm. Therefore, a gearbox is used to increase rotational speed. Three-

bladed rotors are the most common. The blades are built of fiberglass that is reinforced with polyester. The system features microprocessors that rotate the blades around longitudinal axes, thus ensuring continuous adjustment to maintain optimal blade angles in relation to the prevailing wind. The hub must also be able to rotate 360 degrees on its axis in order to face the wind. As such, there is a special toothed-gear rotor for the hub at the top of the tower. The hub also contains a power transformer, bearings, and a brake to stop the turbine in case of a breakdown. Exhibit 5 shows the technical data for a Vestas V80-2.0 MW turbine.

Denmark had become the leading European country in wind energy production. 2002 marked the opening of a wind farm in southwestern Jutland with 80 turbines for a total of 160 MW. It was the largest in Europe. At that point, 12% of the energy produced in Denmark came from wind. The key factor for Danish success was a well-thought-out government strategy for the use of renewables. Denmark had more than 6,000 wind turbines, many of which were installed offshore on the seabed; offshore turbines were 50% more efficient than land turbines.

Germany had the largest wind power base — almost 6,000 MW in 2002. Other European countries with a large wind power base in their energy balance were: Great Britain (4,000 MW), Spain (2,000 MW), and the Netherlands (1,500 MW).

In Poland, the development of wind farms was taking off slowly. Most projects were carried by foreign investors and located in the north and northwest due to the suitability of wind conditions. According to experts, Poland has the conditions to become "a tiger of wind power." Exhibit 3 shows existing and planned wind farms as of 2002.

The largest wind turbine manufacturers were Vestas and NEG Micon, both from Denmark, along with the Spanish manufacturer Gamesa. These three companies controlled about 50% of the global wind turbine market, though Chinese companies were gaining market share. In Poland, there were two main wind turbine manufacturers: GTB Solaris from Warsaw and Nowomag from Nowy Sacz.

According to emission estimates, running a single 1 MW wind turbine could decrease the annual emissions of carbon dioxide ($CO_2$) by 714 tons, emissions of sulphur dioxide ($SO_2$) by 4.8 tons and emissions of nitric oxide ($NO_x$) by 1.6 tons. Nevertheless, some ecologists were against wind farms. They claimed that wind farms destroyed the landscape and caused noise pollution. The sound level produced by one Vestas V80 turbine was up to 92 dB(A) with a wind speed of 4 m/s and up to 109 dB(A) with a wind speed of 12 m/s (for the purpose of comparison, 100 dB(A) is similar to the noise made by a small airplane). The noise was bothersome to people living within a half kilometer radius from the turbine. According to ecologists, birds were the most adversely affected because their flight paths were disrupted. Due to these reasons, associations against wind farms had been established in some areas.

## Participants in the Project

The participants in the project were:

- Jakub Bujok and Lukasz Dzienisz as sponsors, i.e., managing shareholders of the project
- SPV (Special Purpose Vehicle), a company founded for the investment, i.e., to build, own, operate, and service debt from the cash generated by the wind farm
- Koszalin Power Plant as the buyer of energy from the wind farm