

Wind energy in Poland – History, current state, surveys, Renewable Energy Sources Act, SWOT analysis



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ABSTRACT

The history, current state and prospects for the development of the wind power sector in Poland have been presented. Poland has a long tradition of using wooden windmills, mainly post mills for economic purposes. Basing on the data of the Institute of Meteorology and Water Management, the speed of wind was calculated in Poland at a height of 100 m. The highest wind speed in Poland is noted in the northern part, the central part and, most of all, in the south-western part. In the December 2015 there were 1016 wind installations in Poland of total power of 5100 MW in Poland. There are also 37 wind farms. At the largest farm – Margonin – there are 60 wind turbines in operation, each of power of 2 MW. The new formal and legal framework for the wind power sector in Poland was described in relation to the new Renewable Energy Sources Act (RES Act). The new regulations on funding the wind power sector; that is, an auction system, were presented. The outcomes of the sociometric surveys conducted among investors were described. The SWOT analysis of the wind power sector in Poland was presented. The three scenarios of the development of the wind power sector in Poland were described.

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1. Introduction

Since the Digital Revolution, which commenced in the middle of the 20th century, there has been a systematic global increase in demand for energy. This growth is exponential and, according to various forecasts for the near future, energy demand will reach 599 EJ in 2020 and 657 EJ in 2025 [1].

Wind power has been used by people since a long time ago. Along with the Sun, wind has been used to dry among others agricultural crops. The immense force of wind inspired our ancestors to harness it for economic purposes. Not many people realise that the great geographical exploration was possible due to wind energy that powered the sailing ships. Wooden windmills were used to grind grain, water or dry the fields [2,3].

The first description of a windmill used to transport water was created in India 400 BC; in China windmills in the shape of a windlass were used to water the fields 200 BC. At the beginning of the AD era windmills appeared in China and in the Mediterranean countries. The year 644 AD is considered to be the date of the first documented reference to windmills. The Persians ground grain by means of windmills since the 6th century AD. Unlike the construction design that became widespread in Europe, the Persian windmills had sails moving on a horizontal plane on a vertical cylinder. In the 8th century in the whole of Europe windmills with four sails appeared. The Dutch specialised in this type of construction [2,3].

The industrial development meant that new sources of electricity were sought. At the turn of 1887/1888 Charles F. Brush built the first automatic wind turbine that produced electricity. The power plant was constructed from cedar wood and consisted of 144 blades, had 17 m diameter and weighed 80 tonnes. Brush's power plant operated for 20 years and powered accumulators. Despite its large size, the power plant had the power of 12 kW, which was due to using a multi-turn and multi-blade rotor [4].

The wind energy sector plays an increasingly more important part in the global economy. Low fossil fuel prices had no negative impact on the wind sector. Wind power leads the way among environmentally-friendly methods of power generation in the world [5–8]. The global growth rate was 16.4% in 2014 and 17.2% in 2015. Poland, Brazil, China and Turkey were the most dynamic countries and saw the strongest growth rates (Table 1). China is a world leader in wind power generation – in adding 33 GW of new capacity. This represents a market share of 51.8%. The US market

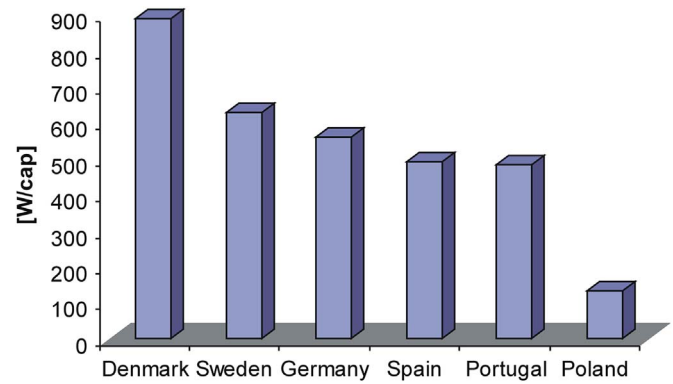


Fig. 1. Installed capacity per capita in 2015 in top five countries and in Poland [W/cap] (own calculations).

saw good performance with 8.6 GW of added capacity. Germany, in anticipation of changes in legislation, installed 4.9 GW. Wind power contributed a new record of 13% of the country's power demand in 2015. Brazil was the fourth largest market for new turbines with a market volume of 2.8 GW. India saw 2.3 GW of new installations by November 2015, enough to bypass Spain as fourth largest market in terms of total capacity [9].

Fig. 1 represents the installed power of wind farms per person. The unquestionable leader is Denmark (888 W/cap). According to our calculations, Poland had the power of 132 W per person.

It is also worth mentioning that the global market of small wind turbines is developing very well. It is estimated [10] that there are at least 870,000 of small wind turbines in the world, with an annual increase of 8–10%. Around 625,000 turbines operate in China, 157,700 in the USA, 24,000 in Great Britain, 14,500 in Germany, 11,000 in Canada, and about 3,200 turbines in Poland [10–12].

The aim of this paper is to examine the history, current state and prospects for the development of the wind power sector in Poland. Included is the description of sociometric surveys sent to both the companies [13] and the owners of wind turbines [14]. The research presented in the paper is the continuation of further investigations into bioenergy in Poland [15], geothermal energy in Poland [16] and solar power in Poland [17] carried out by our research team.

The wind power sector already plays a huge part in power generation in Poland. Along with hydropower, solar energy and biomass energy, wind power is a part of the energy mix in Poland. The high price of Polish coal and its negative environmental impact result in ever growing support for the renewable energy in the Polish society. As the new Act on Renewable Energy Sources in Poland came into force, a new SWOT analysis new bill on wind power investment in Poland were also presented. The strategy for the development of wind power sector in Poland for the coming years was presented.

2. Use of wind energy in windmills in Poland

Wind turbines used to harness renewable energy are becoming more frequent in Poland. It is worth mentioning that wooden windmills have been known in Poland for a few hundred years. According to Gloger [18], windmills were introduced to Poland from the west whilst Małyszczycy [19], Sackiewicz [20] and Klaczyński [21] see their origin in the east. The 15th century images of windmills that were found in Poland unequivocally indicate the type of a windmill with a horizontal axis, which is a western type.

Table 1
Top 15 countries by total wind installations [9].

Position	Country	Total capacity 2015 [MW]	Added capacity [MW]	Growth rate 2015 [%]
1.	China	148,000	32,970	29.0
2.	United States	74,347	8598	13.1
3.	Germany	45,192	4919	11.7
4.	India	24,759	2294	10.2
5.	Spain	22,987	0	0.0
6.	United Kingdom	13,614	1174	9.4
7.	Canada	11,205	1511	15.6
8.	France	10,293	997	10.7
9.	Italy	8958	295	3.4
10.	Brazil	8715	2754	46.2
11.	Sweden	6025	615	11.1
12.	Poland	5100	1266	33.0
13.	Portugal	5079	126	2.5
14.	Denmark	5064	217	3.7
15.	Turkey	4718	955	25.4
	Rest of the World	40,800	5000	14.0
	TOTAL	434,856	63,690	17.2

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