

## WIND POWER DEVELOPMENT IN POLAND

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*The process of current and future wind power development in Poland is analysed. Analysis and assessment of wind power market in Poland in technical, economical and environmental aspects is made. Perspectives of wind power development up to 2020 in context of the implementation of the EU's "3 x 20%" climate package by Poland and national quantitative target for RES development by year 2020 are described. References 6, tables 2.*

**Key words:** wind power, development.

**Selected aspects of wind power development.** Up to 2005 period the wind power market in Poland was characterised by stagnation, caused primarily by the instability of the support scheme and poorly tailored legal regulations, resulting in risk levels unacceptable for the investors. Moreover, requirements applicable to balancing energy produced from wind turbines were very difficult to fulfilled in practice. Difficult and unstable legislative framework was key problem for development of wind power until 2005 and brought it to a halt.

Only from 2005, after the Poland's accession to the European Union and elimination of part of legal barriers, the number of realised investments started to rise. Government put favourable legal and economic regulations for renewable energy sources into practice and created good investment climate for them [4].

The national wind power sector has a phase of rapid development. It is a similar phenomenon like in the world, although at a much lesser scale. High relative growth rates after 2005 resulted from just a number of wind farms per year. In consideration of several dozen percent high dynamics of installed capacity growth in wind farms, Poland is currently making up for its historical backwardness and already getting ahead of a number of European countries. In the future Poland has a real chance to become one of the leading users of that form of renewable energy in Europe. Now, Poland are behind Germany, Spain, Italy, France, Great Britain, Portugal, Denmark, the Netherlands, Sweden, Ireland and Greece [3,6]. It is expected that the current installed capacity growth trend in the wind power sector will continue until 2020.

The national wind power sector has a very significant development potential. An important issue demonstrating the market potential of the wind power sector in Poland is the presence of leading European and world's energy groups and producers of wind turbines. Significant interest from foreign companies and their activity make the Polish wind power sector dynamic. The conditions and development perspectives of the wind power sector in Poland are very good.

Wind power succeeded in playing a significant role in National Electric Power System (NEPS) by strongly contributing to the implementation of the EU's "3 x 20%" climate package by Poland and the full implementation of the key element of the Package, i.e. Directive [1]. Worldwide action to reduce greenhouse gas emissions and high coal penetration in the Polish electricity generation sector (the share of coal in electricity production amounts to approximately 94%) lead to situation that wind power becomes a very cost-attractive option to reduce CO<sub>2</sub> emissions. The European Commission, estimating direct emissions in CO<sub>2</sub>/MWh assumed them to be zero for wind turbines [5].

Government established a political quantitative target for RES development by year 2020 - the share of RES in gross final energy consumption on level of 15% [2]. In connection with importance of wind power in national energy balances compared to its potential, also in the context of other RES technologies, wind power will play an important role in achieving this target.

Costs in the renewable sector are strongly correlated with local conditions, usually falling in quite a wide range, in particular when new technologies enter the market using various support schemes in different countries.

Comparison of the costs and efficiency of different energy production technologies, including renewables, in terms of economy and greenhouse gas emissions exhibits wind power is the inexpensiveest "green" electricity production technology in investment terms. Electricity production costs from wind in 2020 in the EU countries will be comparable to electricity production costs in nuclear power plants, but will be lower than in all other electricity production technologies basing on combustion of coal, gas and oil [5].

Wind farms are characterised by the shortest construction times, comparable only to waste gas installations. Wind farms are built twice considerable faster than: biomass systems, hydro plants, conventional thermal plants and nuclear plants [5].

Wind power is similarly advantageous in comparative assessment of greenhouse gas emission abatement costs, both in terms of avoided direct emissions and life cycle assessment cumulated emissions (cradle to cradle).

In case of energy technologies currently available and officially promoted in Poland as "climate-friendly" electricity sources, in the 2020 perspective wind power is the inexpensiveest available option [2].

Table 1 presents the planned dynamics of total installed capacity and energy production in the wind power sector in the 2012-2020 period.

In 2020, total wind installed capacity should amount to approximately 13 GW and total investment expenditures up to 2020 - approximately 15 billion Euro [5]. The total wind electricity production will amount to 33 TWh [5].

The scale and the required dynamics of necessary investments for a significant contribution of wind power to the achievement of the 2020 target for Poland (at least 15% of share of energy from renewable energy sources in final energy balance) are shown in Table 2.

**Table 1.** Selected planned parameters of wind power in years 2005-2010 in Poland [5]

	Wind turbine type	2012	2015	2018	2020
Nominal power [MW]	Onshore wind	2303	5000	9060	10893
Amount of produced electricity [TWh] in year	Onshore wind	5.16	11.90	22.76	27.85
Nominal power [MW]	Offshore wind	0	0	500	1500
Amount of produced electricity [TWh] in year	Offshore wind	0	0	1.50	4.50
Nominal power [MW]	Domestic wind turbines	10	190	369	600
Amount of produced electricity [TWh] in year	Domestic wind turbines	0.01	0.18	0.38	0.65

**Table 2.** Forecast of new wind capacity in Poland, in years 2012-2020, in MW [5].

Wind turbine type	2012	2013	2014	2015	2016	2017	2018	2019	2020
Onshore wind	899	899	899	899	1561	1537	962	947	885
Offshore wind	0	0	0	0	0	0	500	500	500
Domestic wind turbines	5	60	60	60	60	60	60	60	171

**Conclusions.** High technological level of wind power, market position and high credibility in the financial gained during the past years constitute strengths forming an actual base and perspectives for its further development in Poland.

In 2020 wind turbines will be the least expensive renewable electricity source, with costs comparable to electricity production costs in operating nuclear power plants. However, the costs will be lower than in the case of all other electricity production technologies related to the combustion of coal, gas and oil. It will cause dynamic increase and high share of installed capacity in the wind power sector. In Poland, share of installed capacity should amount 13 GW in 2020.

Implementation of the EU's „3 x 20%” climate package is a challenge and an opportunity for Poland to strengthen wind power development and the long-term modernization of the national power sector.

Wind power is one of the least expensive technological options to reduce CO<sub>2</sub> emissions and should significantly contribute to the implementation of Directive [1] in the 2020 perspective. Moreover, wind power sector should exploit its economic potential and contribute to the fulfillment of the Polish national 2020 target for renewable energy sources (15% share of energy generated from RES in the total primary energy) and CO<sub>2</sub> emissions abatement (reduction by 20%).

Greenhouse gas emission abatement is key positive environmental effect related to the development of wind power in Poland.

1. *Directive 2009/28/ec* of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC. – O.J.EC L 140 of 5.06.2009. (polish)

2. *Announcement of Ministry of Economy* from 21.12.2009 in a matter of the national energy policy up to 2030. – Monitor of Poland of 2010 No.2, Item 11. (polish)

3. *Wind energy in Poland.* Report - IDZP, TPA Horwath. – November 2010.

4. *Dolega W.* Analysis and review of support mechanisms for the promotion of renewable energy sources on example of Poland and different countries of the European Union // *Tekhnichna elektrodynamika. Tematychnyi vypusk "Problemy suchasnoi elektrotekhniki"*. – 2010. –Vol.1. – Pp. 49–52.

5. *Wisniewski G and others.* Wind power development in Poland by 2020 a vision. A report developed for Polish Wind Energy Association. – Warsaw: Institute for Renewable Energy, November 2009.

6. *Wind energy in Poland* – Polish Wind Energy Association – [www.visventi.org.pl](http://www.visventi.org.pl).

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*Проанализирован процесс нынешнего и будущего развития ветроэнергетики в Польше. Проведен анализ и оценка рынка ветроэнергетики в Польше учитывая технический, экономический факторы, а также фактор окружающей среды. Описаны перспективы развития ветроэнергетики до 2020 года в рамках реализации «3 x 20%» пакета по климатической политике Польшей и национальное количественное задание для развития RES до 2020 года. Библ. 6, табл. 2.*

**Ключевые слова:** ветроэнергетика, развитие.

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*Проаналізовано процес нинішнього та майбутнього розвитку вітроенергетики в Польщі. Проведено аналіз та оцінювання ринку вітроенергетики в Польщі, беручи до уваги технічний, економічний фактори, а також фактор навколишнього середовища. Описано перспективи розвитку вітроенергетики до 2020 року в рамках реалізації «3 x 20%» пакету з кліматичної політики Польщі та національне кількісне завдання для розвитку RES до 2020 року. Бібл. 6, табл. 2.*

**Ключові слова:** вітроенергетика, розвиток.

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