CARBON ENGINEERING

Track One

Joint Implementation

Project Design Document

Project of Renewable Energy Group PWB I

PWB Spółka z ograniczoną odpowiedzialnością
Spółka komandytowa (2)
ul. Garbary 56/12
61-758 Poznań
NIP 7831664640 REGON 301538385

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Prezes Zarządu
Komplementariusza
Przemysław Kowalski

Potwierdzam zgodność z oryginałem
od strony 1 do strony 133
21-11-2012
podpis...............................

str. 1

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i) International

(1) United Nations Framework Convention on Climate Change, adopted in New York on 9th of May 1992.

ii) European

(1) DIRECTIVE 2003/87/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC.

(2) DIRECTIVE 2004/101/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 October 2004 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms.

(3) 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.

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(5) COMMISSION DECISION of 13 November 2006 on avoiding double counting of greenhouse gas emission reductions under the Community emissions trading scheme for project activities under the Kyoto Protocol pursuant to Directive 2003/87/EC of the European Parliament and of the Council.

(6) COMMISSION DECISION of 18 July 2007 establishing guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council.

iii) National

(1) Environmental Law (act) of 27 April 2001 (Polish Journal of Laws no. 62 item 627).

(2) Act on the system of managing emissions of greenhouse gases and other substances of 17 July 2009 (Polish Journal of Laws no. 130, item 1070).

(3) Act on the greenhouse gas emission allowance trading scheme of 28 April 2011 (Polish Journal of Laws no. 122, item 695).

(4) Regulation of the Ministry of the Environment on the types of projects that may significantly affect the environment and detailed conditions for qualifying projects to draw up a report on environmental impact of 9 November 2004 (Polish Journal of Law no.257, item 2573) – repealed as of 15 November 2011.

(5) Regulation of the Ministry of Environment on the types of projects which may be implemented as Joint Implementation projects in Poland of 26 August 2010 (Polish Journal of Laws no.167, item 1132).

(6) Regulation of the Ministry of Environment on the detailed scope of information contained in project documentatio of 3 December 2010 (Polish Journal of Laws no.240, item 1608).

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2) Stategies and policies

a) STATE ECOLOGICAL POLICY 2009-2012 wit the prospect of the 2016 (document adopted on 22 May 2009).
b) STATE CLIMATE CHANGE POLICY – Strategies aiming at greenhouse gases reduction in Poland up to 2020 (document adopted on 4 November 2003).
c) STATE ENERGY POLICY 2025 (document adopted on 4 January 2005).
d) DEVELOPMENT STRATEGY ON RENEWABLE ENERGY SECTOR (document adopted on 5 September 2000).
e) POLAND SUSTAINABLE DEVELOPMENT STRATEGY 2025 (document adopted on 25 July 2000).
f) NATIONAL DEVELOPMENT PLAN 2007-2013 (document adopted on 11 January 2005).

3) Raportes and analysis

a) The „Wind power development in Poland by 2020 – a vision" report – Polish Wind Energy Association, January 2010.
b) The „Wind energy in Poland 2010" report - Raport Energetyka Wiatrowa w Polsce 2010" - TPA Horwath, Domański Zakrzewski Palinka, November 2011.
c) The "Barriers for energy sector" report - Polish Confederation of Private Employers in Energy Sector, Polish Confederation of "Renewable Energy Forum", May 2011.

4) Project reference documents

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ABBREVIATIONS

Units of measurement:

CO_2	Carbon dioxide
GWh	Gigawatt hour
km	Kilometer
kV	Kilovolt
kW	Kilowatt
m	Meter
Mtoe	Metric ton
MW	Megawatt
MWh	Megawatt hour
t	Ton

Names:

EU ETS	European Union Emission Trading System
WF Korsze	Wind farm Korsze
GPZ	Main Power Supply station
JISC	Joint Implementation Supervisory Committee
KOBiZE	National Centre for Emission Balancing and Management / Krajowy Ośrodek Bilansowania i Zarządzaniania Emisjami
NFOŚiGW	National Fund for Environmental Protection and Water Management / Narodowy Fundusz Ochrony Środowiska i Gospodarki Wodnej
MŚ	Ministry of Environment / Ministerstwo Środowiska
PSE	Polish Power Grid Company / Polskie Sieci Elektroenergetyczne S.A.
PSEW	Polish Wind Energy Association / Polskie Stowarzyszenie Energetyki Wiatrowej
EU	European Union
URE	Energy Regulatory Office / Urząd Regulacji Energetyki
UNFCCC	United Nations Framework Convention on Climate Change

Definitions:

AAU	Assigned Amount Units
AIE	Accredited Independent Entity
BAT	Best Available Technology
ERU	Emission Reduction Unit
GHG	Greenhouse Gases
JI	Joint Implementation
NAP	National (Emission) Allocation Plan
RES	Renewable Energy Sources
PDD	**PROJECT DESIGN DOCUMENT**

Prezes Zarządu Komplex Energia Przemysław Kowalski

1. GENERAL AND TECHNICAL DESCRIPTON OF THE PROJECT

Name/Title of the project:

Title of the project: **"Joint Implementation Track One Project of – Renewable Energy Group PWB I "**

Sectoral scope(s): (1) Energy industries (renewable/non-renewable sources)

1.2. Location of the project – voivodeship, commune, city/town, address, property parcel number.

1.2.1. Group of Wind Parks CZYŻEWO

„Group of Wind Parks Czyżewo", hereinafter reffered to as „ZEW Czyżewo" is located in Poland, at a distance of over 500m to the nort-west of the village Czyżewo, in the community Strzelce Krajeńskie, in the north part of strzelecko-drezdenecki district, in lubuskie voivodeship. This investment is about 150 km to the south-east from Szczecinek and about 140 km north from Zielona Góra.

Figure 1.2.1 **Localization of Wind Park** *Czyżewo (Źródło: © Google Maps)*

Localization of Wind Park Czyżewo according to the administrative division:

- Lipie Góry: 228, 238, 239, 249 i 251 (municipal roads),
- Lipie Góry: 239, 246, 247; Licheń: 3, 5/120, 6, 1/112, 1/116, 1/122; Strzelce Krajeńskie: 327, 332/5, 336, 410, 411, 413/1, 421/21, 421/22, 421/23, 421/63, 422, 445/1, 445/91, 457/24, 457/30, 491, 541/29, 543,

639, 360, 357, 359/2, 541/33, 577/1, 528/1, 588/1, 588/2, 541/28; Sławno: 4, 130/1 (Power cable lines SN-15kV and fiber-optic cable lines),

- Licheń: 5/144 (EW1: Wind Park with the necessary technical infrastructure),
- Lipie Góry: 124/5 (EW2: Wind Park with the necessary technical infrastructure),
- Lipie Góry: 124/6 (EW3: Wind Park with the necessary technical infrastructure).

1.2.2a Wind Park DZIAŁOSZYN

Wind Park DZIAŁOSZYN is located in Poland, in the Działoszyn village, in Działoszyn commune, in the pajęczański district, in łódzkie voivodeship. The investment is about 250 km south-west from Warszawa and about 100 km north from Katowice.

***Figure 1.2.2. Localization of Wind Park DZIAŁOSZYN** (Source: © Google Maps)*

Localization of Wind Park DZIAŁOSZYN according to the administrative division:

- Działoszyn: plot No 858 (Power station);
- Działoszyn: plot No 1999 (the slope of the wing);
- Działoszyn : plot No 880, 881, 9193, 1019,936,937,938 (course of the power cable);
- Działoszyn: plot No 709, 771, 791, 937 (rebuilding of the roads and cure);
- Działoszyn: plot No 880 (Power station);
- Działoszyn: plot No 881 and 937 (elements associated with the investment cable line, metering station, road squares, parking bays).

1.2.3. Wind Park EKO – Energia

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Wind Park EKO-Energia is located in Poland, in villages:Płużnica, Bartoszewice i Nowa Wieś Królewska, in Płużnica commune, w wąbrzeski district, in kujawsko-pomorskie voivodeship. The investment id located about 200 km to the north-west from Warsaw and zbout 20 km to the south from Grudziądz.

***Figure 1.2.3. .* Localization of Wind Park** *EKO-Energia (Źródło: © Google Maps)*

Localization of Wind Park according to the administrative division:

- Płużnica: plot No 244/8, 237/3 (2 Wind Parks),
- Bartoszewice: plot No 154/3 (1 Wind Park),
- Nowa Wieś Królewska: plot No 5/3 (1 Wind Park).

1.2.4. Wind Park GRABOSZEWO

Wind Park GRABOSZEWO is located In Poland, in Graboszewo village, in Strzałkowo commune, in słupecki district, in wielkopolskie voivodeship. The investment is about 260 km to the West from Warsaw and about 70 km to the east from Poznań.

***Figure 1.2.4.*. Localization of Wind Park** *GRABOSZEWO (Źródło: © Google Maps)*

Localization of Wind Park according to the administrative division:

- Graboszewo: plot No 58 (elektrownia wiatrowa) , 59, 60, 84, 91;
- Paruszewo: plot No 79, 86, 90, 91, 102, 108, 109, 110;
- Skarboszewo: plot No 40, 41, 60, 146, 175/1, 175/2, 175/3;
- Strzałkowo: plot No 183; 191;
- Kotunia: plot No 670, 669/2, 683/2, 667, 682, 665, 664, 663;
- Słupca: plot No 1199, 1200, 2323/2, 1213, 1219/4, 1220/2, 1236, 1227/1. 12227/11;

1.2.5. Wind Park JAROGNIEW – MOŁTOWO

Wind Park JAROGNIEW – MOŁTOWO is located in Poland, close to the villages: Jarogniew, Gościno, Mołtowo and Skronie, in the Gościno commune, in kołobrzeski district, in zachodniopomorskie voivodeship. The investment is about 250 km to the West from Gdańsk and about 120 km to the north-east from Szczecin.

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***Figure 1.2.5.*. Localization of Wind Park** *JAROGNIEW-MOŁTOWO (Źródło: © Google Maps)*

Localization of Wind Park according to the administrative division:

- Gościno: plot No 36; 37; 53/1 and part of plots No 32; 38; 39;
- Mołtowo: plot No 13/44
- Skronie: plot No 109/19; 109/20; 109/24; 109/27; 109/29;

1.2.6. Wind Park KALNIKÓW

Wind Park KALNIKÓW is located in Polsce, in the Kalników village, in Stubno commune, in przemyski district, in podkarpackie voivodeship. The investment is about 250 km to the west from Kraków and about 10 km to the west from the Polish-Ukrainian Border.

Figure 1.2.6. . **Localization of Wind Park** *KALNIKÓW (Źródło: © Google Maps)*

Localization of Wind Park according to the administrative division:

- Hruszowice: Plot No 261/1, 280, 288, 510/2;

1.2.7. KRZEMIEŃ I WSPÓLNICY company wind park

Krzemień i Wspólnicy company wind park is located in Poland, In villages:
- Broniewice, in Janikowo commune, in inowrocławski district, in kujawsko-pomorskie voivodeship, and
- Kruśliwiec, in Inowrocław commune, in inowrocławski district, in kujawsko-pomorskie voivodeship.

The investment is about 250 km West from Warsaw and about 200 km to the south from Gdańsk.

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Figure 1.2.7. **. Localization of Wind Park** *KRZEMIEŃ I WSPÓLNICY (Źródło: © Google Maps)*

Localization of Wind Park according to the administrative division:

- Kruśliwiec: plot No 208/2, 211 (Inowrocław commune) (2 wind parks);
- Broniewice: plot No 50 (gm. Janikowo) (2 wind parks).

1.2.8. Wind Park SANNIKI

Wind Park SANNIKI is located in Poland, In the villages: Szkarada and Sanniki, In the Sanniki commune, in gostyniński district, in mazowieckie voivodeship. The investment is about 80 km to the West from Warsaw and about 350 km to the north from Kraków.

Figure 1.2.8. . **Localization of Wind Park** *SANNIKI (Źródło: © Google Maps)*

Localization of Wind Park according to the administrative division:

- Szkarada: Plot No 55, 56, 990, 930, 929 i 57/5 (wind turbines and associated faciliteies);
- Szkarada: Plot No 970, 892 (exit of the way);
- Sanniki: Plot No 909, 910, 911, 912, 913, 892 (exit of the way);
- Sanniki: Plot No 982, 983, 984, 970 (exit of the way).

1.2.9. Water Power Plant BOBROWICE IV (TAURON)

Water Power Plant BOBROWICE IV is located on the Bolesława Krzywoustego 5St., 58-500 Jelenia Góra In Poland, In dolnośląskie voivodeship. The investment is about 100 km to the south-west from Wrocław and about 300 km west from Częstochowa.

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Figure ***1.2.9.*** . Localization of Water-Power Plant *Bobrowice IV (Źródło: © Google Maps)*

1.2.10. Wind Park LIPNIKI (TAURON)

Wind Park LIPNIKI is located in Poland, In the villages: Lipniki, Goworowice, Cieszanowice and Szklary, in Kamienik commune, nyski district, ine the south-west part of the opolskie voivodeship. The investment is about 80 km south from Wrocław and about 20 km north from the Polish-Czech border.

Figure 10. . Localization of Wind Park *LIPNIKI (Źródło: © Google Maps)*

Localization of Wind Park according to the administrative division:

- Szklary: Plot No 844/5, 844/3, 925, 842
- Ciechanowice: Plot No 325, 126/1, 320, 8/1, 308, 319, 162, 146, 11/2, 317
- Kamiennik: Plot No 89, 92, 93/1. 479, 476, 94/1, 460, 99, 459, 123/1. 490/1, 492, 130, 131/1. 131/2, 140, 141/1, 458, 208, 207, 498/2, 200/4, 200/3, 506, 227
- Goworowice: Plot No 374, 353
- Chociebórz: Plot No 34/15, 208, 34/5, 34.6, 34/7, 34/8, 34/9, 34/10, 207/1, 207/2, 19, 156, 59, 147, 152/2, 24, 76/1.

1.2.11. Wind Park WARTKOWO

Wind Park WARTKOWO is located in Poland, in Wartkowo village, in kołobrzeski district, Gościno commune, in zachodniopomorskie voivodeship. The investment is about 120 km to the North-east from Szczecina and about 40 km south- west from Koszalin.

Figure ***1.2.11.*** . Localization of Wind Park *WARTKOWO (Źródło: © Google Maps)*

Localization of Wind Park according to the administrative division:

- Wartkowo: Plot No 8/4, 9, 10, 11, 12, 13, 29, 113, 114, 115, 116, 123/39;
- Wierzbka Dolna: Plot No 15/2, 29, 114;
- Pobłocie Wielkie: Plot No 2, 24/1, 3/2, 76, 146/1. 167/1, 15, 46;
- Karkowo: Plot No 21, 23, 27;
- Myślino: Plot No 16/21, 16/27, 12/6, 4, 8/1, 16/36, 10, 16/2;

1.2.12. Wind Park WOLBÓRZ

Wind Park Wolbórz is located in Poland, in the villages Wolbórz and Żarnowica, in Wolbórz commune, in piotrowskim district, in łódzkie voivodeship. The investment is located about 50 km south-east from Łódź and about 120 km na south-west from Warsaw.

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Figure 1.2.12. **. Localization of Wind Park** *WOLBÓRZ (Źródło: © Google Maps)*

Localization of Wind Park according to the administrative division:
- Wolbórz: Plot No 1646, 1647, 1628 (1 wind park),
- Wolbórz: Plot No 1726, 1743 (associated developments),
- *Żarnowica* Plot No *nr 61/6 (1wind park).*

1.2.13. Group of the wind parks ŻEŃSKO

Group of the wind parks Żeńsko is located in Poland, close to the Żeńsko village, in the Krzęcin commune, in the choszczeński district, in zachodniopomorskie voivodeship. The investment is about 200 km north-west from Poznań and about 100 km east from the Polish-German border.

Figure 1.2.13. **. Localization of Group of Wind Park** *ŻEŃSKO (Źródło: © Google Maps)*

Localization of Wind Park according to the administrative division:

- Żeńsko: Plot No 103, 106, 127 (wind parks), 126, 101, 118 (Krzęcin commune);
- Nowe Żeńsko: Plot No 19; 20; 45/1; 46/1; 55; 60; 75; 100 (Choszczno commune);
- Wysokie: Plot No 1, 3, 13 (Choszczno commune);
- Rudniki: Plot No 2, 71 (Choszczno commune);
- Choszczno (city): Plot No 79, 82/2; 83.

1.3. Aim, type and realization period of the project

The essence of the project is the construction of wind parks and water-power plant . Total aggregate nominal installed capacity of all instalations is approximately 117MW. In addition to the turbines themselves associated infrastructure has been built, which consists of medium voltage measuring station equipped with a medium-voltage switchgear with two fields and the measuring linear lines connecting the power cable between them, power measuring station and measuring station of the point of connection and fiber optic lines connecting power with each other and a common surveillance system.

PWB spółka z ograniczoną odpowiedzialnością sp.k. is responsible for the coordination, preparation and approval process of the project under the Joint Implementation mechanism for all installations involved (entities).

The aim of the project is the production of electricity using wind turbines work and its transfer to the national energy system through the use of the 110 kV line, on the basis of the contract of sale of electricity generated from renewable energy sources.

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The effect of the plant is the production of electricity using renewable sources - wind and water, and replace the power grid supplied electricity derived from conventional sources, using mainly coal mine. In so doing helps to prevent the emission of carbon dioxide - in this case, there is the so-called. double indirect emission reduction in installations covered by the EU ETS.

The project belongs to the category of the measures adopted for the implementation of the JI in Poland and is one of the types of activities (paragraph. 2 pts. 1 - Use of renewable energy sources), as listed in Regulation of the Ministry of Environment on the types of projects which may be implemented as Joint Implementation projects in Poland of 26 August 2010 (Polish Journal of Laws no.167, item 1132).

The project refers to a fully implemented and finalized investment.

This project, by replacing electricity in the Polish national network, leads to a reduction or avoidance of greenhouse gas emissions from installations covered by the EU ETS (Article 38, para. 1a Act management system for greenhouse gas emissions and other substances). According to the Act, such action may acquire the status of JI, even if at the time of the request for LoA have already been implemented and operated.

This project is not the way to meet compliance with the obligations arising from the EU or national law.

Estimated annual energy production amounts to 281 GWh and the expected life of the investment loan is 20 years.

Implementation of the project is consistent with the objectives of sustainable development and Polish environmental policy, climate and energy. In addition, contributes to the achievement of Poland's indicative target for 2020, which is the share of energy from renewable sources to 15% of the total energy consumed in Poland, and thus to fulfill the commitments made by the EU member states in the energy and climate package 3x20 % (compared to the share of RES in the energy balance ratio of the country in 2009. 7%).

Among the commonly encountered types of renewable energy sources (hydro, biogas, wind, solar), according to many industry experts, only the wind turbines can significantly contribute to the environmental objectives of the pro-EU policies. The experience of other countries (eg Germany) clearly show that the leading position among the various types of renewable energy technologies in countries with similar geographical features to Polish, is wind energy and wind power. **Also in Poland, wind power is now the fastest growing sector of renewable energy.**

1.4. Name and address of the developer and owner of the project.

Poland:

PWB spółka z ograniczoną odpowiedzialnością sp.k.
Garbary 56/12 St.
61-758 Poznań

REGON: 301638385
KRS: 0000374570
VAT: 7831664640

Prezes Zarządu Komplementariusza Przemysław Kozłowski

<u>Project Developer and owner:</u>

PWB spółka z ograniczoną odpowiedzialnością sp.k.
Garbary 56/12 St.
61-758 Poznań
Poland

REGON: 301638385
KRS: 0000374570
VAT: 7831664640

The sponsor has not yet been selected and will be originated after the development of this document.

1.5 Project developer's and project owner's experience in projects realization, including projects that are being developed and not operating yet and description of authors and co-authors of technologies and solutions applied in the project

1.5.1. Group of Wind Parks CZYŻEWO

<u>Company Structure:</u>

The owner of the ZEW Czyżewo is fully DOMREL Biuro Usług Inwestycyjnych Sp. z o. o. based in Szczecin. The technical viability Gamesa G90 wind turbine has been determined for a period of 30 years after launch. In addition to periodic power control is maintenance-free.

<u>Experience:</u>

DOMREL Biuro Usług Inwestycyjnych Sp. z o. o. engaged in carrying out the project of wind farm Czyżewo for the company he founded EW Czyżewo Sp. Z o. o., and then submitted a draft report for further surveillance by EW Czyżewo Sp. z o. o.
The design portfolio of DOMREL Biuro Usług Inwestycyjnych Sp. z o. o. include investment Group of Wind Parks Słupca Pilot and Wind Park Graboszewo, realized by the Company Wielkopolskie Elektrownie Wiatrowe Sp. z o. o., a company owned in 20 % is DOMREL. In addition, the company conducts Domrel projects for foreign investors such as E.ON, RWE, Eolfi.

<u>Authors of technologies applied in the project:</u>

Technology applied in the project – converting wind energy into electricity by the use of wind turbines – is very common and it is also one of the best available techniques (BAT) and is being applied successfully in many countries worldwide. Wind farms are zero-emission, their development and operation contributes to GHG emission reduction.

The discussed wind farm consists of three wind turbines Gamesa Eolica type G90 2 MW each.

Used wind turbines are manufactured by the Spanish company Gamesa Eolica S.A. and are one of the most modern technology available in the world market.
The main purpose of the present wind farm is the production of electricity by making use of wind energy for rotation of the rotor. Produced in this way electricity is sold to companies engaged in the distribution of energy and forwarded to the national electricity grids by GPZ 110/15 kV in Strzelce Krajeńskie.

The scope of the project includes the following technology:

- **3 wind turbines GAMESA Eolica G90—2.0 MW**. They have a tower of 100 m altitudes, the rotor with a diameter of 90 m and 2000 kW electrical power. G90 turbine generates electricity with a voltage of 690 V, 50/60 Hz;
- Cut-off wind speed for the generator is v = 21 m/s. Towers with a height of up to 100 m are made of high-strength structural steel S355J2 + N.
- The rotor consists of three blades with variable angle, made of fiberglass reinforced plastic.
- Each generator is equipped with a lightning protection and obstruction marking in-forming the object location warning aircraft before impact. Gondola generator automatically follows the direction of the wind. Each propeller was painted in accordance with applicable regulations.
- Electricity produced by wind turbine electricity is sent through the cable line SN-15 kV to the national energy system under the conditions and in agreement with ENEA S.A. Branch in Gorzow Wielkopolski.

The rotor of the generator will rotate depending on the wind speed at a speed of from 9.0 to 19.0 rev/min. Minimum necessary to rotate the wind in the movement of the rotor is 3.0 m/s, while the optimum wind power plant which is obtained at its maximum power output of 15.0 m/s In the event of a wind blowing at a speed of more than 21m/s, for safety reasons the rotor power is automatically stopped.
"ZEW Czyżewo" is connected to the system of roads, power lines and sewage fiber optic cable.

- Road system consists of:
  - the county road connecting Strzelce Krajeńskie from Bierzwniki,
  - access roads completed by mounting squares.

- Manoeuvring (mounting platform) of paved roads to gravel multilayer geotextile (or on the foundation of the stabilized soil preparation UPD 2000) are located in the immediate vicinity of the wind generators. They were used for the purpose of maneuvering trucks and cranes during installation work.
- The width of the access road is 5.0 m square mounting dimensions near the wind turbine 35.0 x25,0m, on site construction time dimensions temporarily expanded to the dimensions of 44.0 x44,0m.
- Wind turbines and accompanying devices do not require constant maintenance and periodic maintenance only. They do not need water and sewage connections. The area around the power plant and the foundation was covered with a layer of soil, and to further its agricultural use.

1.5.2. Wind Park DZIAŁOSZYN

Company Structure:

Wind power contractor of the first turbine in DZIAŁOSZYN is Bella Enterprise Sp. z o.o. and of the second turbine Flower Enterprise Sp. z o.o. The companies were established solely for the implementation of the present plant.

Experience:

So far Bella Enterprise Sp. z o.o. and Flower Enterprise Sp. z o.o. did not conduct any other business activity, and their activity is mainly focused on the preparation for the commencement of the investment, in particular in obtaining the necessary permits and documentation and execution of that investment.

Authors of technologies applied in the project:

The technology used in wind park DZIAŁOSZYN - V90 2MW is characterized by a high degree of two potential sources of renewable energy - wind power and solar energy (carbon-free sources). Photovoltaic cells produce electricity for supply of equipment necessary for the operation of the wind power plant in the amount of 2.9 MWh/year. Also allows the use of solar panels to reduce energy consumption of conventional sources and reduce air emissions.

The scope of the project includes the following technology:

- **2 wind turbines Vestas V90-2.0 MW.** The turbine has a tower with altitudes 105 m rotor diameter of 90m and 2000kW electric power. V90 turbine generates electricity with a voltage of 690 V, frequency 50 Hz;
- Cut-off wind speed for the generator is v = 25m/s Towers with a height of up to 105 m are made of high-strength structural steel S355.
- Each generator is equipped with a lightning protection. Gondola generator automatically follows the direction of the wind.
- Electricity produced by wind turbine is sent 15kV line (medium voltage) to Polska Grupa Energetycza.

- All types V90-1.8/2.0 MW turbines are equipped with OptiTip ®, developed by VESTAS blade pitch control system (pitch). OptiTip ® monitors the angle of the blades so that they are optimally positioned for the current wind conditions. This allows you to optimize the size of the energy produced and the level of noise. For all wind speeds OptiTip ® systems and OptiSpeedTM provide maximum nominal power gain, regardless of the temperature and density of air. At high wind speeds the wind electric power production is maintained at the nominal output. The turbine is equipped with a braking system that stops the rotation when the stop is required.
All functions of the turbines are monitored by microprocessor controllers. The control system is equipped with a number of sensors to ensure safe and optimal operation of the wind turbine.

- The road system of each turbine consists of a paved access road (with stone aggregate) for a wind tower to 4.5m wide and the exit of the highways No. 937 and 771.
- Maneuvering area measuring approximately 25x40 dimension, and bay idle 4.5 x18,5m are located in the immediate vicinity of each plant.

Access roads to the square and arches are made of stone with different grain size and thickness dependent on ground conditions and in accordance thickened.

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Działoszyn wind plant is the first in Poland this type of installation, which is characterized by a high degree of potential for alternative energy sources because of the simultaneous use of wind energy and solar energy.

1.5.4. Wind Park EKO – Energia

Company Structure:

EKO–Energia Sp. z o.o. is a commercial company and was founded in 2007 to carry out the project. As part of the organizational structure of the company in question was co-ordinated investment in its implementation and is supervised during the operation. The main shareholder of the company is the companyLD Energia Sp. z o.o., which owns 100% of the shares in the company.

Authors of technologies applied in the project:

The scope of the project includes the following technology:

- **4 ENERCON wind turbines - 0.8 MW**. In Bartoszewice (1 turbine) and Płużnica (2 turbines) wind turbines are equipped with a type Enercon E-53, while the plant in Nowa Wies Królewska in one turbine-type E-48.
- The turbine has a tower with a height of 63.7 m (Nowa Wieś Królewska) or 72.2 m (Bartoszewice, Płużnica), rotor diameter of 53m, 800kW electric power.
- Wind speed to cut the generator is v = 28 m/s. Towers made of prefabricated steel pipe technology.
- Each generator is equipped with a lightning protection. Gondola generator automatically follows the direction of the wind.
- Rotary gondola placed on top of the tower is set depending on the direction of the wind rotor using technology OptiSpeed™

- Wind generators work without supervision. They do not need water supply or sewage disposal.
- Square and the access road are made in GEOSTARK K1 technology which means: mixing soil with special bonding with cement or aggregates of varying degrees of fineness, respectively concentrated.

- According to the connection conditions, wind turbines will be connected to the grid with a rated voltage of 15 kV.

- In case of 2 wind parks in Płużnica (plots No. 244/8, 237/3), point of attachment is: GPZ LISEWO-WĄBRZEŹNO (SN 2-0021-06), NAPO. – LISEWO-WĄBRZEŹNO (221060000N), existing overhead line AFL 3 x 70 mm^2. Total connected load placed on the network – 1 600,00 kW, taken from the network 100 kW. Place of supply of electricity to screw terminals on the disconnector 15 kV from the manufacturer's installation.
- In casae of 1 wind park in Bartoszewice (plot No. 154/3), point of attachment is: GPZ WĄBRZEŹNO-LISEWO (SN 2-0017-18), NAPO. – BARTOSZEWICE 2 (217182600N), existing overhead line AFL 3 x 35 mm^2. Total connected load placed on the network 800 kW, taken from the network 50 kW. Place of supply of electricity to screw terminals on the disconnector 15 kV from the manufacturer's installation.

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- In casae of 1 wind park in Nowa Wieś Królewskia (plot No. 5/3), point of attachment is: GPZ WĄBRZEŹNO-LISEWO (SN 2-0017-18), NAPO. – WĄBRZEŹNO-LISEWO (217180000N), existing overhead line AFL 3 x 35 mm^2. Total connected load placed on the network 800 kW, taken from the network 50 kW. Place of supply of electricity to screw terminals on the disconnector 15 kV from the manufacturer's installation.

1.5.5. Wind Park GRABOSZEWO

Company Structure

Wielkopolskie Elektrownie Wiatrowe Sp. z o. o. is a deliberately set up by the company DOMREL Biuro Usług Inwestycyjnych Sp. z o. o. to realize project involving the construction and operation of a wind farm near the village Strzałkowo in wielkopolskie voivodeship - Group of Wind Parks Słupca Pilot, to which the system belongs.

Experience:

Design portfolio of DOMREL Biuro Usług Inwestycyjnych Sp. z o. o. includes the investment of Group of Wind Parks Czyżewo, Group of Wind Parks Słupca Pilot and other projects conducted for foreign investors such as E.ON, RWE, Eolfi.

Authors of technologies applied in the project:

Wind Park GRABOSZEWO with total power output of 2 MW is part of the Group of Wind Parks SŁUPCA, with a total capacity of 6 MW.

The scope of the project includes the following technology:

- One wind turbine Enercon E-82 type, 2 MW with the following parameters: electric-power 2000 kW, the height of the tower - 108 m and a diameter rotor - 82 m. This turbine produces electricity with a voltage of 690V and a frequency of 50 Hz.
- Wind speed to cut off the generator is v=25 m/s. Tubular towers with a height of up to 108 m made of stainless.
- Each generator is equipped with a lightning protection. Gondola generator automatically follows the direction of the wind.
- Electricity produced by wind turbine is sent to 15kV line..

- The road consists of roads with stone aggregate width - up to 5m.
- Maneuver square(mounting platform) is located in the immediate vicinity of the wind generator.
- Wind generators work without supervision. They do not need water supply or sewage disposal.

E82 2 MW turbine was launched in mid-2006 and is the successor to the E66 turbines and the land version of the E70. Enercon E82 turbine is designed for locations with low / medium wind speeds.

1.5.6. Wind Park JAROGNIEW - MOŁTOWO

Company Structure:
Owner of the farm is Beta Sp. z o.o., whose sole shareholder is GDF Suez Energia Polska S.A.

Experience:
Experience at least 2 - years of electricity generation have among others the following companies within the Group GDF SUEZ:

a. Electrabel in relation to wind farm „Bullingen" with a capacity of 12 MW, located in Bullingen (Belgium), which was put into operation on February 3, 2009 ;
b. Compagnie du Vent in relation to wind farm „Picoterie 1" with a capacity of 12 MW, located in miejscowości Charly (France), which was put into operation on July 1 2009 ;
c. Generg SGPS in relation to wind farm „Pinhal" with a capacity of 144 MW, located in Pinhal (Portugal), which was put into operation on December 1 2005.;
d. Erelia in relation to wind farm „La Haute Lys" with a capacity of 12 MW, located in Fauquembergues (France), which was put into operation on November 1 2004.;

Authors of technologies applied in the project:
The technology used in this band of wind power plants is characterized by a high degree of wind energy.

The scope of the project includes the following technology:

- **10 wind turbines type REpower MM92– 2.0 MW**. Each tower has a height of 100 m and a diameter of approximately 4m. and propellers with a maximum length of 44m, a rotor with a diameter of 92.5m and 2000 kW electrical power. One turbine generates electricity with a voltage of 690 V and frequency of 50 Hz (or 575 V (60 Hz));
- Cut-off wind speed for the generator is v = 24 m/s. Towers and claw habit of reaching 100 m made of steel.
- Each generator is equipped with a lightning protection. Gondola generator automatically follows the direction of the wind.
- Electric power generated in each wind turbine is transmitted to the power grid, 110kVby underground cable by connection point GPZ (Main feed point), in which by means of transformers, high-voltage conversion is at low voltage (230 V).

- Road system consists of:
  - a network of roads partially paved and roads of district,
  - specially constructed internal roads.

Road due to the operating conditions, the manufacturer's guidelines and the guidelines of wind turbines have a fire lane width of 5.0m and a reinforced shoulder with dimensions 2x1m.

- Wind generators work without supervision. They do not need water supply or sewage disposal. Each turbine is equipped with a dual band asynchronous generator:50 Hz and 60 Hz, rated voltage: 690 V (50 Hz) and 575 V (60 Hz), rated speed: 900 -1 800 (50 Hz) and 720 – 1 440 rotation/min (60 Hz);
- Each of the wind turbines is set on a foundation of reinforced concrete (fixed depending on ground conditions).
- The combination of the wind farm with the electricity network, the underground cable 110kV, through the connection point GPZ (Główny Punkt Zasilający).

1.5.7. *Wind Park KALNIKÓW*

Company Structure

Owner of the wind park KALNIKÓW is GA ETON Andrzej Gądek company with the seat in Wieliczka.

Authors of technologies applied in the project:

Technology applied in the project – converting wind energy into electricity by the use of wind turbines – is very common and it is also one of the best available techniques (BAT) and is being applied successfully in many countries worldwide. Wind farms are zero-emission, their development and operation contributes to GHG emission reduction.

The scope of the project includes the following technology:

- **4 wind turbines Fuhrländer FL 77/1500 type** rated at 1,5 MW, located at altitudes 102,5 m. n. p.g., with symbols: EW-1, EW-2, EW-3, EW-4. Each turbine has a tower with a height of 100m rotor diameter of 77m and 1500kW electric power. Each turbine generates electricity with a voltage of 690 V and frequency 50Hz;
- Wind speed is the cutoff enerator is v = 20m/s. Towers made of prefabricated steel pipe technology with a height of up to 100 m;
- The transformer station type STSRU-20/250-KK2 for the purposes of the undertaking's own,
- Coupling station, Indoor, container - measuring power medium voltage distribution,

- The road consists of access roads to the stations made of reinforced concrete panels on the sand bed with a width of about 3.5 m and a length of approximately 600 m for the construction and cranes maneuvering;
- Manoeuvring, hardened reinforced concrete slabs around 1500 m2. They have been used for shunting trucks and cranes during assembly.
- Power lines, ground dug up 15 kW conducted within and outside the power plant to the condensation transforamtorowej coupling;;
- Wind generators work without supervision. They do not need water supply or sewage disposal.
-

1.5.8. Wind Park of *KRZEMIEŃ I WSPÓLNICY company*

Company Structure:

Owner of the Wind Park is company KRZEMIEŃ i WSPÓLNICY Sp. z o.o.

Experience:

It is the first and so far only completed project in the field of renewable energy for all participants of a partnership KRZEMIEŃ I WSPÓLNICY Sp. z.o.o.

Authors of technologies applied in the project:

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The scope of the project includes the following technology:

- **4 wind turbines** TACKE TW type – 600 (600 kW) with asynchronous generators with a capacity 600 kW each and distributed on 2 turbines in villages Kruśliwiec i Broniewice. Each turbine has steel tower with a height of 50 m and 43m rotor diameter and produces electricity with a voltage of 690V and frequency 50Hz;
- Each generator is equipped with a lightning protection. Gondola generator automatically follows the direction of the wind.
- Electricity produced by wind turbine is sent to the central station of 110/15 V and then to the network.

Wind Park TRACE TW 600 is equipped with a security system control via microprocessor controller which protects against the effects of interference that may occur in the power system. Securing proper operation of the generator to the network owned by Vocational Energy ENEA- Operator sp. z.o.o. Branch in Bydgoszcz is implemented using a microprocessor controller.

- Access roads are made of stone aggregate.
- Wind generators work without supervision. They do not need water supply or sewage disposal.

1.5.9. Wind Park SANNIKI

Company Structure:

The owner of Wind Park Sanniki is WS Sanniki Sp. z.o.o. The shareholders of the Company are the four entities:
- Skraem Holding ApS,
- Strabo Holding ApS,
- Visby A Holding ApS,
- Torben Husted Holding ApS.

Experience:

The purpose of the creation of WS Sanniki Sp. Z o.o. was the start of operations in the production of renewable energy by building wind of fame present a complex of 3 wind turbines with a total capacity of 6 MW.

Authors of technologies applied in the project:

Technology applied in the project – converting wind energy into electricity by the use of wind turbines – is very common and it is also one of the best available techniques (BAT) and is being applied successfully in many countries worldwide. Wind farms are zero-emission, their development and operation contributes to GHG emission reduction.

The scope of the project includes the following technology:

- **3 wind turbines VESTAS V90 type—2.0 MW**. Each turbine has a tower with a height of 105 m, a rotor with a diameter of 90m and 2000kW electric power. V90 turbine generates electricity with a voltage of 690V and frequency 50Hz;
- Wind speed generator to cut the v = 25 m/s. Towers with a height of up to 105 m are made of structural steel.

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- Each generator is equipped with a lightning protection. Gondola generator automatically follows the direction of the wind.
- Electricity from wind turbines is transmitted field rope SN-15 kV to GPZ Szkarada.

VESTAS V-90-2.0 MW turbine is prevailing torque locking system and a rotating gondola with variable pitch blades. Turbine Vestas V90-2.0 is equipped with a rotor diameter of 90 m using OptiSpeedTM technology. This technology enables the differentiation of rotor speed (RPM), and thus the optimal use of the rotor aerodynamic efficiency. All turbine type V90-2.0 MW have OptiTip ®, developed by VESTAS blade pitch control system (pitch) OptiTip ® monitors the angle of the blades so that they are optimally positioned for the current wind conditions. This allows you to optimize the size of the energy produced and the level of noise.
The rotor blades are made of fiberglass-reinforced epoxy resin. Each blade consists of two shells connected by beams supporting them. Special steel blades combine the anchor in with a four ball bearing mounted rotor hub. Main shaft via a gear puts the power to the generator. Transmission is a combined plan tern-screw. Power is transmitted from the transmission to the 4-pole, asynchronous generator rotor uzwojonym with maintenance-free, made the clutch.
Step-up transformer secondary voltage is located at the rear of the nacelle in a separate compartment. In the construction of a dry transformer insulator used - synthetic resin, specially manufactured for use in Turbiach wind. For all wind speeds OptiTip ® systems and OptiSpeedTM provide maximum nominal power gain, regardless of the temperature and density of air. At high wind speeds, the electrical power output is maintained at the nominal output.
The turbine is equipped with a braking system that stops the rotation when the stop is required. System sets the blades in the flag and turn on the parking brake, hydraulic controlled. The parking brake is mounted on a high-speed shaft of the gearbox. The brake is activated manually by pressing a button inside the wind turbine. All functions are turbine monitor with microprocessor controllers. Control system is equipped with a number of sensors to ensure safe and optimal operation of the wind turbine.

- OptiSpeedTM system ensures the continuity and stability of the energy produced by the turbine. OptiSpeed system consists of an efficient asynchronous generator with assemblied rotor and slip ring, the power converter to switch IDBT and protective system, which provide the turbine with variable speed. OptiTip OptiSpeed systems and provide energy optimization, low noise and reduced transmission charges and other important elements. System controls the voltage in the circuit in the generator rotor.
This allows precise control of reactive power and connecting the generator to the axis.

-The road consists of:
• access roads to wind towers - up to 4.5m wide, connected to local roads.

- Maneuvering area with dimensions 24x40 maneuvering my bay idle 4.5 x18, 6 m are made of stone with different grain size and layer thickness-dependent ground conditions and in accordance thickened. Maneuvering is located in the immediate vicinity of the wind generators. It has been used for shunting trucks and cranes during installation work.
- Roads made of stone aggregate.
- Wind generators work without supervision. They do not need water supply or sewage disposal..

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1.5.10. Water – Power Plant BOBROWICE IV (TAURON)

Company Structure

Owner of the water-power plant is TAURON Ekoenergia Sp. z o.o.

Experience:
Bobrowice IV is first water-power plant built by TAURON Ekoenergia Sp. z o.o., and has the latest. It was built entirely from the ground in the immediate vicinity of the power plant „Bobrowice III".

Authors of technologies applied in the project:
This is a power plant built from the ground in the vicinity of existing power Bobrowice III, in order to take full advantage of Bóbr River flows.
Power Bobrowice IV is equipped with two turbine-type RTKs-1200, company GAJEK ENGINEERING sp. z o.o. from Gdańsk, are vertical pipe, high-speed Kaplan turbines with vertical transmission gear, brake and hydraulic controlled four-splenius rotor and angled steering apparatus with 16 blades. The turbines, with a flexible coupling gear, working two asynchronous generators Siemens 1LA8405 a power of 500 kVA each. The turbines are powered by energy channel, the water intake structure and piping turbine with a diameter of 1600 mm and a length of 15 m nominal Bleed the power is 8.4 m.
On the construction of the water intake grilles mounted sweeper production Gajek Engineering, type CzK-3. It is a construction sweeper cranberry, designed to clean water turbine inlet grilles. It consists of a stationary base and two movable arms, where one of them is fixed rake arm of length equal to the width of the bars.
On the proper operation of the power plants controlled by the computer system to collect and display data, consisting of the parent plant regulator, computer visualization program is running on the axed and communication links between hydro and computer controllers.
Power operation is automated and controlled work is done remotely from power Bobrowice I.

1.5.11. Wind Park LIPNIKI (TAURON)

Company Structure:

The investor was originally a Spanish company GAMESA ENERGIA POLSKA Sp. z o.o., has signed a lease agreement with the owners of the land, developed design documentation and received all necessary decisions, agreements and permits for investment (2008). In 2009, the entire project of Wind Farm Lipniki was sold to WSB Parki Wiatrowe. WSB Parki WiatroweCompany is Polish branch of WSB Neue Energien GmbH from Drezno, which specializes in the production of electricity from renewable energy sources and since 1996 has set more than 300 wind turbines with a total capacity of 465 MW. Lipniki project was for the company's first venture in Poland. Owner of the wind park is TAURON Ekoenergia Sp. z o.o.

Experience:
TAURON Ekoenergia sp. z o.o. acquired 100% of shares Lipniki 28 September 2011. On 1 June 2012 the companies TAURON Ekoenergia sp. z o.o. and Lipniki sp. z o.o. merged through the transfer of capital Lipniki sp. z o.o. for TAURON Ekoenergia sp. z o.o.

Wind Park LIPNIKI is first Wind Farm in TAURON Ekoenergia portfolio.

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Authors of technologies applied in the project:

The technology used in wind farm Lipniki characterized by a high degree of wind energy.

The scope of the project includes the following technology:

- **15 wind turbines MM92 type REPower company** with a max power 2,05 MW. Each turbine has a tower with a height of 80 m rotor diameter of 92.5 m and produces an electric current with a voltage of 690V and frequency 50Hz. Electrical controls are located on the bottom of the tower, and the voltage transformers are located 0.69 kV/20kV next to the towers.
- Wind speed generator to cut the v = 24 m / s Towers with a height of up to 80 m are made of steel.
- Each generator is equipped with a lightning protection. Gondola generator automatically follows the direction of the wind.
- Wind turbines are connected in two groups: 1-7 and 8-15, with the two power cables to the sub-scriber is output transformer station (GPZ) 110/20kV power of 31.5 MVA, located approximately 7.5km from the farm in Cieszanowice.

1.5.12. Wind Park WARTKOWO

Company Structure:

Under agreements between the PEP S.A., GDF Suez Energia Polska S.A. and Gamma Sp. z o.o. , target company for wind farm project Wartkowo, GDF Suez Energia Polska S.A. became the owner of 100% shares of the company. The transaction took place on 8 June 2010.

Experience:

Near Wartkowo Wind Park, also in the community Gościno, operates a wind farm Jarogniew-Mołtowo 20 MW, which also belongs to the group of companies of GDF Suez Energia Polska.

GDF Suez also bought the wind farm project on the Polish Energy Partners and is preparing for the implementation of wind farm power Pągów 51 MW. The farm will be commissioned in early 2013. .

In 2010, the share of renewables in energy production in the GDF SUEZ Energy Poland SA amounted to a total of 10%, while the national average remained at a level of about 6%.

Investments listed here is not the end of the action GDF SUEZ Energy Poland SA to increase participation in the national production of electricity from wind. The company is also working on many other projects. Actively looking for new places to invest. For example, the company acquired in December 2011 Klukowo Wind Farm project - a planned Samborsko of thecapacity 105 MW.

Authors of technologies applied in the project:

The scope of the project includes the following technology:

- **15 wind turbines Gamesa G-90.** Each turbine has a tower with a height of 100m, 92m rotor diameter and electrical power 2000kW. Each turbine generates electricity with a voltage of 690V and frequency 50Hz;
- Wind speed generator to cut the v = 21 m / s Towers with a height of up to 100 m are made of steel.

- Gamesa G90 wind turbine is a variable speed of rotation of the rotor diameter of 90 m power control is done by changing the angle of attack of individual blades. The rotor blades are equipped with a safety system to prevent lightning.
- Each generator is equipped with a lightning protection. Gondola generator automatically follows the direction of the wind..
- Electricity from wind turbines is sent by 15 kV power cables that connect individual energy power station SN 15/110 kV - for the change in voltage and connect the power unit to the power grid.

Wind turbines Gamesa G-90 continues its long-standing reputation for reliability. These turbines are particularly suited for places where high wind speeds. G-90 has been designed to ensure maximum efficiency in the upper power range. This turbine is ideal for wind conditions and types of terrain in Poland. G-90 turbine units are top notch and are characterized by low noisiness, high performance and reliability, which is based on many years of research and experience of the manufacturer. Are optimized for installation within the land and can be used even in light winds. Gamesa turbines brand went through a lot of detailed research, it has been put into operation, allowing to meet the high requirements for energy production, reliability, power quality and noise levels.

Gamesa G90 turbines are based on modern technological solutions in the field of onshore wind energy - the wind turbines located on land beyond the sea. Gamesa G90 turbine technology is modern and meets European quality standards ISO 9001:2000.

- The road consists of:
• Internal roads of width 5 m;
• External road of width 5 m;

- Manoeuvring (platform installation) are located in the immediate vicinity of the wind generators. They have been used for shunting trucks and cranes during installation work. For the purposes of assembly have dimensions 25x45m, for the purposes of exploitation of their size decreased to 22.4 x39. In order to harden the surface as the material used for internal roads.
- Internal roads made of crushed aggregate, lined the entire length of geotextile separacyjno-reinforcing. Macrolevelling made surfaces.
- Wind generators work without supervision. They do not need water supply or sewage disposal..

- Accompanying infrastructure associated with Wind Park WARTKOWO:
    - 15 kV power cables and control and automation cables;
    - Medium voltage substation 110kV in Wartkowie SN (main supply point - GPZ) and a possible opportunity to rebuild the existing station in Karścinie;
    - system leakage, high-voltage power line - 110kV high voltage - approximately 11.2 km connecting GPZ Wartkowo station in Karścinie.

1.5.13. Wind Park WOLBÓRZ

Company Structure:

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Company TRASKO ENERGY 2 Sp. Z o.o. purchased in June 2010 from the company WIBDPROJEKT Sp. z o.o. two projects with the final building permit wind turbines Vestas V90 2MW type and applied for a grant from the ROP WŁ, action II.9 – renewable energy sources. This company is a target group "TRASKO", which deals with the construction and operation of wind turbines and selling electricity.

Experience:

Wolbórz Wind Park is the first but not the last investment in the renewable energy field carried by SPVs TRASKO group. At the turn of 2011/2012 launched another investment, this time in the province Mazowieckie, with the power 4MW.

Authors of technologies applied in the project:

Technology applied in the project – converting wind energy into electricity by the use of wind turbines – is very common and it is also one of the best available techniques (BAT) and is being applied successfully in many countries worldwide. Wind farms are zero-emission, their development and operation contributes to GHG emission reduction.

- The scope of the project includes the following technology:

- **2 wind turbines VESTAS V90 - 2,0 MW**. Each turbine has a tower with a height of 100m, 90m rotor diameter and electrical power 2000kW. Each turbine generates electricity with a voltage of 690V and frequency 50Hz;
- Wind Speed for cutting eneratora is v = 25 m/s. Towers made of prefabricated steel pipe technology with a height of up to 100 m.
- Each generator is equipped with a lightning protection. Gondola generator automatically follows the direction of the wind.
- Electricity from wind turbines is transferred to line 15 kV distribution of PGE Dystrybucja Łódź-Teren S.A.

The transformer is located in the nacelle. The transformer is a three-phase dry transformer, which is self-extinguishing.

Each turbine of this type utilizes OptiSpeed, which allows differentiation of the rotor speed and the optimum use of the aerodynamic efficiency of the rotor. The present plant is also equipped with modern technology OptiTip - blade pitch control system (pitch). OptiTip monitors the angle of the blades so that they are optimally positioned for the current wind conditions. This allows you to optimize the size of the energy produced and the level of noise.
The wind turbine is in full automatic mode, the controller VMP (driver Vestas Multi Processor). This controller consists of a gondola driver, driver, driver hub and grounding. It performs the following functions:

• Before connecting the generator to the network is synchronized to the network in order to reduce the current wyłączeniowego,
• switching current is lower than the nominal current,
• Automatic gondola deviation in the direction of the wind,
• network monitoring utility,
• monitoring float,
• stop the turbine in the event of damage.

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- VESTAS wind turbine type 2.0 is regulated wind turbine blade angles, resulting in the blades are always positioned at the optimum angle during production breaks and situations. Generator is a special rotor asynchronous assemblied generator, slip ring and Vestas Transducer System (VCS), which allows operation of the wind turbine at variable speeds.
  The advantages of a wind turbine with adjustable blade angle findings working with variable speed include, among others:
- Optimal production of electrical power at any wind condition,
- the output power is limited to 2.0 MW,
- Output power is compensated resulting in high power quality and low flicker
- Lack of starting,
- turbine can be stopped without the use of mechanical brake,
- minimize fluctuations in the mechanical transmission system,
- There are two different sound levels.

- Roads were made of stone aggregate.
- Wind generators work without supervision. They do not need water supply or sewage disposal.

1.5.14. Group of Wind Parks ŻEŃSKO

Company Structure:

The owner of ZEW Żeńsko is KSM Energia Sp. z o.o headquartered in Szczecinm. It is a company set up in October 2009, purposely to carry out this project.

Experience:

It does not have experience in project implementation, but its partners - Renpro Sp. Z o.o. (70% of shares) and Mr. Adam Stadnik (30%) are among the leading companies renewable energy market in Western Pomerania.
For reference projects to be developed under the direction of Renpro Sp. Z o.o. include:
- Wind Park Karścino, Mołtowo, Kurkowo in commune Karlino with power 90 MW,
- Wind Park Zajączkowo in commune Kobylnica with power 48 MW,
- Wind Park Wałcz in commune Wałcz with power 4,5 MW,
- Wind Park Koczewo in commune Kobylnica with power 42 MW,
- Wind Park Tychowo in commune Sławno with power 50 MW,
- Wind Park Krzęcin in commune Krzęcin with power 6 MW.

Authors of technologies applied in the project:

The scope of the project includes the following technology:

- **3 wind turbines GE 2,5 xl**. Each turbine has a tower with a height of 100 meters, the rotor with a diameter of 100 m and electric power 2500kW. Each turbine generates electricity with a voltage of 690V and frequency 50Hz;
- Wind Speed for cutting eneratora is v = 25 m / s Towers made of prefabricated steel technology.

• Each generator is equipped with a lightning protection. Gondola generator automatically follows the direction of the wind.

Model 2.5xl GE Energy offers 5% improve gross capacity utilization rate and a 12-percent increase in annual energy production compared to the previous model with a capacity of 2.5 MW (introduced in 2004). Used turbine can operate at power plants, where the average wind speed reaches up to 8.5 m / s Rotor diameter 2.5xl model is 100 m and is the largest GE wind turbine for use on land. The turbine is designed to meet the current needs of the European Union, where there is no free land area limits the size of projects.

2.5xl model was introduced as a technological extension of the model 2.5. 2.5xl turbines were manufactured at GE Energy's wind turbines in Salzbergen in Germany.
Wind turbine technology, GE Energy is an important element of the initiative called ecomagination GE. As part of GE's ecomagination creates and markets technologies that help customers solve problems related to environmental protection.

- Roads made of stone aggregate.
- Wind generators work without supervision. They do not need water supply or sewage disposal..

1.6. Project development phase – at the date of application

1.6.1. Group of Wind Parks CZYŻEWO

The project, which is the subject of an application for a letter of approval has been completed and the date the application is under full operation.

As a project start date adopted was 08.11.2010, when the decision has been taken on the permit for use by the District Superintendent.

Final commissioning and start the installation of renewable energy production took place on 14.09.2011 (date of start monitoring energy produced).

In the period from the acquisition of wind power by the owner (mid-November 2011) until 07/23/2012, there were no production downtime due to failure lasting longer than 5 days.

__Stages of preparation and implementation of the project:__

The table below shows the process of obtaining key administrative decisions issued during the preparation and realization of investment.

Table 1.6.1 History of the process of obtaining the administrative decisions during the preparation and realization of the wind farm

Type of document	Date
Application for building permit	02.12.2008
Obtaining a building permit decision	05.02.2009 07.01.2010

1.6.2. Wind Park DZIAŁOSZYN

The project, which is the subject of an application for a letter of approval has been completed and the date the application is under full operation.

The date of commencement of the project adopted 02.01.2011, when the construction of 2x2MW wind plant in town Działoszyn by Bella Enterprise Sp. z o.o and Flower Enterprise Sp. z o.o. started.
Final commissioning and start the installation of renewable energy production took place on 30.01.2012, when the electricity meter registered a first amount of energy flowing into the network PGE Dystrybucja S.A. Oddział Łódź – Teren.

The installation works without any failures since its launch, generating renewable energy and bringing it to the national grid. Wind turbine failures are very rare, due to the constant remotely monitoring.

Stages of preparation and implementation of the project:

The table below shows the process of obtaining key administrative decisions issued during the preparation and realization of investment.

Table 2.6.2.a *History of the process of obtaining the administrative decisions during the preparation and realization of the wind farm - Bella Enterprise Sp. z o.o.*

Type of document	Date
Issue terms of connection to the grid	22.02.2008 09.07.2008
Signing a contract to join by received terms of connection to the grid	01.10.2009
Application for building permit	11.09.2009
Issuance of building permit	12.11.2009
Issuance of the commune Mayor's decision, defining environmental determinants of consent for the project	09.09.2008 21.01.2009
A license for electricity generation	20.03.2012

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Table 3.6.3.b *History of the process of obtaining the administrative decisions during the preparation and realization of the wind farm- Flower Enterprise Sp. z o.o.*

Type of document	Date
Issue terms of connection to the grid	20.04.2010
Signing a contract to join by received terms of connection to the grid	06.05.2010
Issuance of building permit	07.01.2010
Issuance of the commune Mayor's decision, defining environmental determinants of consent for the project	01.09.2009

1.6.3. Wind Park EKO - Energia

The project, which is the subject of an application for a letter of approval has been completed and the date the application is under full operation.

Project start date is 06/18/2008, when preparations were purchased (prepared necessary documentation).

Turbines in Płużnica and Nowa Wieś Królewska Has started production from 10.12.2010, and in Bartoszewice from 17.12.2010

Final commissioning and start the installation of renewable energy production took place on 31.12.2010.

<u>Stages of preparation and implementation of the project:</u>

The table below shows the process of obtaining key administrative decisions issued during the preparation and realization of investment.

Table 4.6.3. ***History of the process of obtaining the administrative decisions during the preparation and realization of the wind farm***

Type of document	Date
Issue terms of connection to the grid	21.06.2007 (Płużnica, Bartosozwice) 21.04.2007 (Nowa Wieś Królewska)
Signing a contract to join by received terms of connection to the grid	21.06.2007 (Płużnica, Bartoszewice) 05.07.2007 (Nowa Wieś Królewska)
Granting concessions promise for electricity generation	27.04.2009
Application for building permit	24.03.2009
Issuance of building permit	09.04.2009 (Nowa Wieś Królewska, Płużnica,

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	Bartoszewice)
Issuance of the commune Mayor's decision, defining environmental determinants of consent for the project	06.07.2007 (Płużnica) 17.07.2007 (Bartoszewice) 22.11.2007 (Nowa Wieś Królewska)
Application for a license to use	20.12.2010 (Bartoszewice) 20.12.2010 (Nowa Wieś Królewska) 20.12.2010 (Płużnica)
Receipt of the decision to permit the use of	28.12.2010 (Nowa Wieś Królewska) 29.12.2010 (Bartoszewice) 29.12.2010 (Płużnica)

1.6.4. Wind Park GRABOSZEWO

The project, which is the subject of an application for a letter of approval has been completed and the date the application is under full operation.

Starting date of the project is 19.10.2011, when was received the decision on granting a permit for use issued by the District Inspector of Building Control in Słupca.

The start-up of the wind farm, defined as first delivery of electrical energy to the delivery point, took place on 31.08.2011, when startaed monitoring system.

On 26/02/2012 an error of the Power marketing motor blades occurred, and lasted for 197 h 13 min. During the operation no other failures occurred and / or the length of downtime equal to or greater than 5 days.

Stages of preparation and implementation of the project:

The table below shows the process of obtaining key administrative decisions issued during the preparation and realization of investment.

Table 5.6.4. ***History of the process of obtaining the administrative decisions during the preparation and realization of the wind farm***

Type of document	Date
Application for building permit	26.08.2009 (wpłynęło 20.01.2010)
Issuance of building permit	18.03.2010
Issuance of the commune Mayor's decision, defining environmental determinants of consent for the project	10.07.2009

1.6.5. Wind Park JAROGNIEW - MOŁTOWO

The project, which is the subject of an application for a letter of approval has been completed and the date the application is under full operation.

Starting date of the project is 09.2008, when the Building Permit was prepared: Land Development Project for Wind Farm Jarogniew - Mołtowo.

Final commissioning and start the installation of renewable energy production took place on 01.11.2010, when commisioning of the wind farm Jarogniew – Mołtowo started (27.12.2010 r- end of starting of the group of wind parks).

Wind turbine failures are very rare, due to the constant monitoring conducted remotely. For the installation there were not received any information about possible failures or outages.

Stages of preparation and implementation of the project:

The table below shows the process of obtaining key administrative decisions issued during the preparation and realization of investment.

Table 6.6.5. ***History of the process of obtaining the administrative decisions during the preparation and realization of the wind farm***

Type of document	Date
Application for a promise of concessions for electricity generation	**06.12.2010 (received 07.12.2010)** **30.03.2012**
Granting concessions promise for electricity generation	**31.12.2010** **05.04.2012**
Issuance of the commune Mayor's decision, defining environmental determinants of consent for the project	**24.10.2008**

1.6.6. Wind Park KALNIKÓW

The project, which is the subject of an application for a letter of approval has been completed and the date the application is under full operation.

Starting date of the project is from the second quarter of 2008 after obtaining the necessary permits, decisions and opinions.

Commissioning and start the installation of renewable energy production took place on 29 September 2011.

Wind turbine failures are very rare, due to the constant monitoring conducted remotely. For the installation there were not received any information about possible failures or outages.

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Stages of preparation and implementation of the project:

The table below shows the process of obtaining key administrative decisions issued during the preparation and realization of investment.

Table 7.6.6. History of the process of obtaining the administrative decisions during the preparation and realization of the wind farm

Type of document	Date
Issuance of the commune Mayor's decision, defining environmental determinants of consent for the project	07.07.2008 08.07.2009
Issuance of the promise of licence for electricity production	30.09.2011

1.6.7. Wind park company KRZEMIEŃ I WSPÓLNICY

The project, which is the subject of an application for a letter of approval has been completed and the date the application is under full operation.

Starting date of the project is 5.03.2007, when there were purchased projects from WINDBUD company, engaged in the acquisition areas and projecting wind farms.

Final commissioning and start the installation of renewable energy production took place on 20 June 2008.

Throughout the production of energy from renewable sources, there were 3 short, most 3-day periods of downtime due to failures (sensor, anemometer).

Stages of preparation and implementation of the project:

The table below shows the process of obtaining key administrative decisions issued during the preparation and realization of investment.

Table 8.6.7. History of the process of obtaining the administrative decisions during the preparation and realization of the wind farm

Type of document	Date
Issue terms of connection to the grid	23.07.2007 (Broniewice) 30.08.2007 (Kruśliwiec I & II)
Issuance of building permit	29.10.2007 (Broniewice) 05.07.2007 (Kruśliwiec I & II)

Application for a license to use	03.06.2008 (Broniwice) 03.06.2008 (Kruśliwiec).
A license for electricity generation	**b.d.**

1.6.8 Wind Park SANNIKI

The project, which is the subject of an application for a letter of approval has been completed and the date the application is under full operation.

Starting date of the project is 24.08.2008, when was received the decision on environmental conditions of approval for the investment (for a stand-alone wind power plant with associated components).

Final commissioning and start the installation of renewable energy production took place on December 2011

Wind turbine failures are very rare, due to the constant monitoring conducted remotely. During start-up wind farm Sanniki had some downtime for various reasons. After completion of the project start-up works flawlessly.

Stages of preparation and implementation of the project:

The table below shows the process of obtaining key administrative decisions issued during the preparation and realization of investment.

Table 1.6.8 History of the process of obtaining the administrative decisions during the preparation and realization of the wind farm

Type of document	Date
Issuance terms of connection to the grid	09.07.2008 23.04.2009
Application for building permit	15.05.2009 05.06.2009
Issuance of building permit	30.06.2009 28.08.2009
Issuance of the commune Mayor's decision, defining environmental determinants of consent for the project	04.08.2008 06.10.2009

b.d. – brak danyc

1.6.9. Water- Power Plant BOBROWICE IV (TAURON)

The project, which is the subject of an application for a letter of approval has been completed and the date the application is under full operation.

Starting date of the project is 6 December 2008, when the plant was put into operation.

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Final commissioning and start the installation of renewable energy production took place on 26.09.2008, when launched its commissioning (from 26 September to 25 November 2008).

During the operation of the plant took place the following events:

- 30.03 - 01.04.2009 – Control failure HZ-2,
- 2.04 – 6.04.2009 – Damage to tachometer HZ-1,
- 4.10 – 15.10.2009 – Installation of drinking water, stop HZ-1 i HZ-2.

<u>Stages of preparation and implementation of the project:</u>

The table below shows the process of obtaining key administrative decisions issued during the preparation and realization of investment.

*Table 9.6.9. **History of the process of obtaining the administrative decisions during the preparation and realization of the wind farm***

Type of document	Date
Signing a contract to join by received terms of connection to the grid	03.03.2008
Issuance of building permit	28.03.2006 17.04.2008

1.6.10. Wind Park LIPNIKI (TAURON)

The project, which is the subject of an application for a letter of approval has been completed and the date the application is under full operation.

Starting date of the project is 18.10.2008, when the permit decision has been taken by the District Inspector of Construction Supervision for the construction of power plants GAMESA ENERGIA POLSKA Sp. z.o.o.

Construction of the plant started on 19.01.2010, and was terminated on 5.07.2011 Running the farm was on 22.07.2011 and till 18.08.2011 lasted starting period.

Final commissioning and start the installation of renewable energy production took place on 05.07.2011, when starting period started.

During the operation of the farm have been three accidents and one planned outage.
The first accident occurred on Oct. 6, 2011, at the temporary rent wiring of 110 kV, and than the GPO station (Main Reception Punk) Lipniki was temporarily connected to the 110 kV line.. On the removal of the overhead occurred completed explosion of phase L2. The farm was started on October 14, after 9 days total standstill.
The second crash took place on 16 - 28 October (13 days). This time the head was damaged in L3 phase.
The third accident occurred on 10 November 2011, when there was a head damage on phase L1. As a result, farm was standing 21 days to November 30.
Beyond the above listed failures, occurred one planned shutdown associated with switching the temporary farm connection to the target in the GPO Main Supply Point - GPZ Cieszanowice on 23 - 27 March and 2-4 April 2012.

Stages of preparation and implementation of the project:

The table below shows the process of obtaining key administrative decisions issued during the preparation and realization of investment.

Table 10.6.10. History of the process of obtaining the administrative decisions during the preparation and realization of the wind farm

Type of document	Date
Application for building permit	16.01.2008 06.05.2011
Issuance of building permit	18.01.2008 25.05.2011 23.12.2010
Issuance of the commune Mayor's decision, defining environmental determinants of consent for the project	23.08.2007 23.12.2010 26.04.2011

1.6.11. Wind Park WARTKOWO

The project, which is the subject of an application for a letter of approval has been completed and the date the application is under full operation.

Final commissioning and start the installation of renewable energy production took place on 12 January 2012 (the date on which the construction of the General Contractor).

Wind turbine failures are very rare, due to the constant monitoring conducted remotely. **For the installation there is not received information about possible failures or downtime.**

Stages of preparation and implementation of the project:

The table below shows the process of obtaining key administrative decisions issued during the preparation and realization of investment.

Table 11.6.11. History of the process of obtaining the administrative decisions during the preparation and realization of the wind farm

Type of document	Date
Issuance of the commune Mayor's decision, defining environmental determinants of consent for the project	13.07.2009
Issuance of the permit decision to the use	15.11.2011

1.6.12. Wind Park WOLBÓRZ

The project, which is the subject of an application for a letter of approval has been completed and the date the application is under full operation.

Starting date of the project is 22.12.2009 , when the location of wind turbine with the infrastructure for the current investor - WINDPROJECT Sp. z o.o , was positevly agreeded.

Final commissioning and start the installation of renewable energy production took place on 15 September 2011, when, after receiving the proper licenses began production of electricity.

Wind turbine failures are very rare, due to the constant monitoring conducted remotely. For the installation there was not received information about possible failures or downtime.

Stages of preparation and implementation of the project:

The table below shows the process of obtaining key administrative decisions issued during the preparation and realization of investment.

Table 12.6.12. History of the process of obtaining the administrative decisions during the preparation and realization of the wind farm

Type of document	Date
Application for the issue conditions of grid connection	27.10.2008 (Wolbórz) 29.09.2009 (Żarnowica)
Issue terms of connection to the grid	16.12.2008 (Wolbórz) 24.11.2008 (Żarnowica)
Signing a contract to join by received terms of connection to the grid	28.01.2011
Issuance of the commune Mayor's decision, defining environmental determinants of consent for the project	22.07.2009 (Wolbórz) 01.09.2009 (Żarnowica)
A license for electricity generation	15.09.2011

1.6.13. Group of Wind Parks ŻEŃSKO

The project, which is the subject of an application for a letter of approval has been completed and the date the application is under full operation.

Starting date of the project is October 2007, when land was secured for lease investment agreements.

Final commissioning and start the installation of renewable energy production took place on 25 sierpnia 2011

Wind turbine failures are very rare, due to the constant monitoring conducted remotely. **For the installation there is not received information about possible failures or downtime.**

Stages of preparation and implementation of the project:

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The table below shows the process of obtaining key administrative decisions issued during the preparation and realization of investment.

Table 1.6..13. History of the process of obtaining the administrative decisions during the preparation and realization of the wind farm

Type of document	Date
Issue terms of connection to the grid	02.2008
Signing a contract to join by received terms of connection to the grid	02.2010 08.2011
Granting concessions promise for electricity generation	11.2008 05.2010
Application for building permit	11.2010 03.2011
Issuance of building permit	04.2009 12.2009 11.2011 03.2011
Issuance of the commune Mayor's decision, defining environmental determinants of consent for the project	03.2009
Issuance a license for electricity generation	09.2011

1.7. Technical description of the project, including technology or solutions used in the project, indicating the innovation of technology, the best available techniques, the use results of research and development applied in the project

1.7.1. *Group of Wind Parks CZYŻEWO*

Technology and solutions applied in the project

Group of Wind Parks Czyżewo uses 3 wind turbines type G90 - 2.0 MW made by GAMESA, feature the following solutions :

Main parameters of the installation

- Number of turbines: 3
- Individual installed capacity of the turbines: 2 MW
- Power of the combination 6 MW
- Height of the turbine tower: 100 m
- Total high of wind parks 145,0 m
- Diameter of the rotor blades: 90 m

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- Rotation range: 9 - 19 rot/min
- Max. cut off threshold (threshold wind speed): 21 m/s

Power station is designed for maintenance-free, automatic measurement and control conditions. It only requires periodic maintenance. The functioning of power is to use wind energy for rotation of the rotor, which rotates the generator generates electricity. The turbine is equipped with a microprocessor-controlled rotor blades tilt adjustment, which ensures continuous and optimal adjustment angles to the direction and strength of the wind. The turbine is automatically stopped when the wind speed exceeds 21 m/sec. Gondola with propellers is set along the wind direction thereby minimizing the load on the tower.

The used wind turbine consists of three blades with variable angle, made of fiberglass reinforced plastic. Number of revolutions of the rotor ranges from 9 to 19 rot./Min. Rotary motion is transmitted to the generator through the main shaft and gearbox. Gyms are equipped with a safety system rotor drive shaft and electronic components against lightning. Tower power station will be constructed of welded steel pipes. It will be set on a concrete foundation. Details of the method depends on the foundation of local geotechnical conditions.

Electricity output of the inverter is transformed into voltage 15kV in the transformer.

Metering system

Electricity metering system features the following solutions:

- Type of counter: ZMD405CT.44.0459
- Producent of counter: Landis+Gyr
- Class of counter: class 0.5
- The distinction between basic and backup counter: Only basic counter
- Frequency of verification: according to the Decree of the Minister of Economy of 07 January 2008, once during 8 years.

The figure below shows a general scheme of the turbine G-90 Gamesa 2 MW - used in this project:

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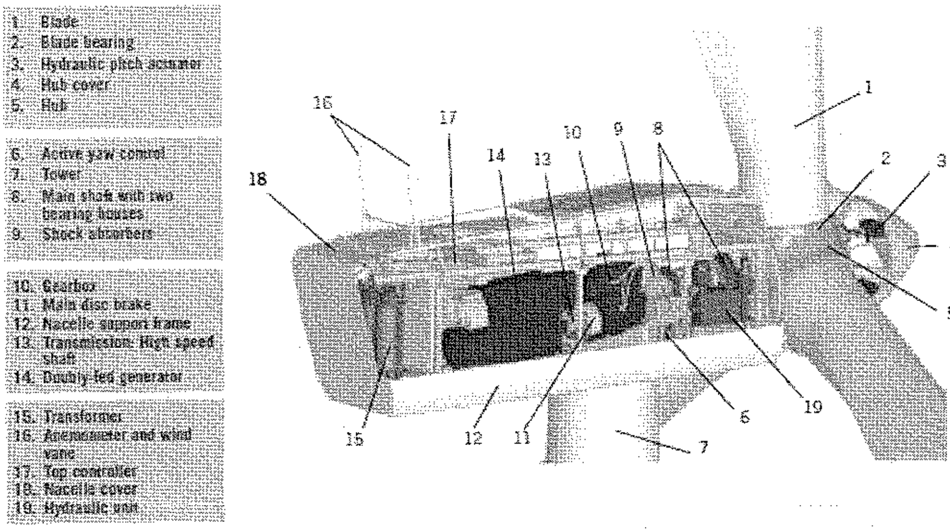

Figure ***1.7.1 General scheme of the Gamesa G-90 Turbine.***

1.7.2. Wind Park Działoszyn

Technology and solutions applied in the project

Wind Park DZIAŁOSZYN - V90 2MW uses 2 wind turbines. This type of wind turbines V90-1,8/2.0 MW made by VESTAS company, feature the following solutions:

Main parameters of the installation

- Number of turbines: 2
- Individual installed capacity of the turbines: 4 MW
- Height of the turbine tower: 105 m
- Diameter of the rotor blades: 90 m
- Rotation range: 8,8 – 14,9 rot/min
- Max. cut off threshold (threshold wind speed): 25 m/s

V90-1.8/2.0 MW turbines are suitable for sites with low turbulence and low and medium winds. These innovative wind turbines are particularly powerful because they can produce 25% more power than the V80. The technology is used in many plants around the world, because it is at the same time tested and innovative.
Each turbine of this type utilizes OptiSpeed, which allows differentiation of the rotor speed and the optimum use of the aerodynamic efficiency of the rotor. The present plant is also equipped with modern technology OptiTip - blade pitch control system (pitch). OptiTip monitors the angle of the blades so that they are optimally positioned for the current wind conditions. This allows you to optimize the size of the energy produced and the level of noise.
The wind turbine is in full automatic mode, the controller VMP (driver Vestas Multi Processor). This controller consists of a gondola driver, driver, driver hub and grounding.

The transformer is located in the nacelle. The transformer is a three-phase dry transformer, which is self-extinguishing.

Metering system:

The electricity produced is sent to the network ZEŁ-T SA via:

- transformator 0,69/15 kV with power 2100 kVA.

Under the terms of grid connection of a two-way flow of energy metering is a system built in the indirect measurement MV-15 kV.

In the counter table type PROFILINE prod. Moeller are:

- Four-square counter type ZMD405CT44.0459 with transmition data modem) and system of time synchronization US-151,
- Control four-square counter type ZMD405CT44.0459 with communication modem CU-B2 (RS-485),
- control and measuring strip WAGO 20 847-356-060-000,
- additional euro splint,
- two slots 230 V powered by transformer GSE 20,
- power supply UPS type NETYS PE 800VA (voltage guaranteed 230 AC).

Measurement and control system has an internal clock that is synchronized with the clock signal after the Frankfurt connection to the meter antenna.

The figure below shows a general scheme of the turbine VESTAS V90-1.8/2.0 MW - used in this project :

1) sterownik piasty
2) cylinder systemu sterowania łopatami
3) oś główna
4) chłodnica oleju
5) skrzynia przekładniowa
6) sterownik VIP z konwerterem
7) hamulec postojowy
8) dźwig serwisowy
9) transformator
10) piasta wirnika
11) łożysko łopaty
12) łopata
13) układ blokowania wirnika
14) układ hydrauliczny
15) tarcza hydraulicznego układu hamowania wirnika
16) pierścień układu kierunkowania
17) rama
18) koła zębate układu kierunkowania
19) generator
20) chłodnica generatora.

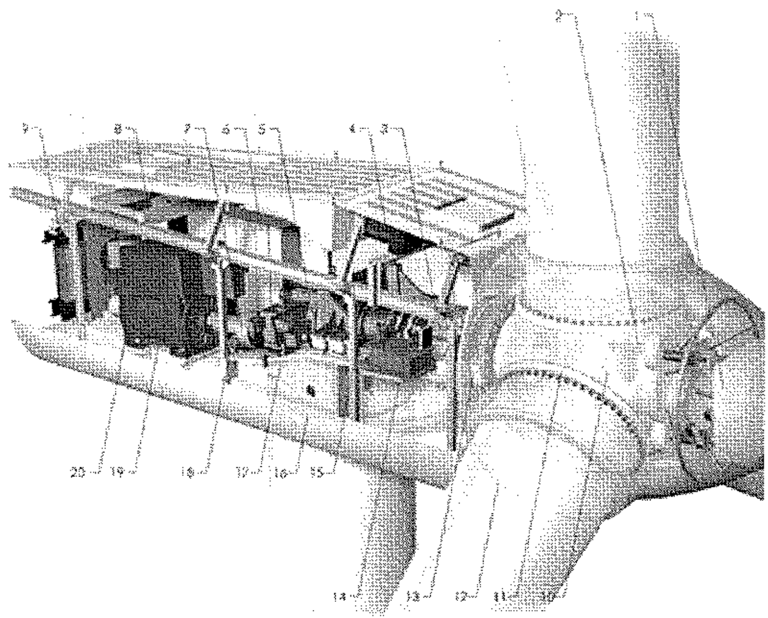

*Figure **1.7.2a. General scheme of the** VESTAS V90-1.8/2.0 MW turbine*

Photovoltaic cells:

Group of generators contain:

1) Wind generator as a electricity generator connected and generating energy to 15kV medium voltage network.
2) Solar generator panels consisting of photovoltaic cells connected to the converter off-line 1x230V and battery and transformer 0.69 / 0.230 providing power converter.

The installation of the generator enables cost savings associated with reduced power consumption by devices that are necessary to operate the wind generator as well as the device provides backup power in times of power failure.

List of solar generator system components:

- polycrystalline solar panels in quantities of 14 pieces,
- The off-line converter, DC-DC converters for solar panels, service charge battery discharge rated at 5kVA,
- mount solar panels made to order (constant-angle),
- battery pack in a matrix of 3x3 12V gel batteries with a capacity of 100 Ah capacity each and charge / discharge 3kW,
- 690/230V single-phase transformer to power the inverter,
- Electrical wiring in the form of solar panels, if necessary, additional by-pass diodes, power socket, respectively 230x1 Network:
    a) From the network when there is insufficient sunlight or at night, and when the batteries are uncharged
    b) the inverter DC / AC collecting energy from the batteries with no voltage or with a fully charged battery.

In the figure. 1.7.2b. assembled diagram of generators used in Wind Park DZIAŁOSZYN.

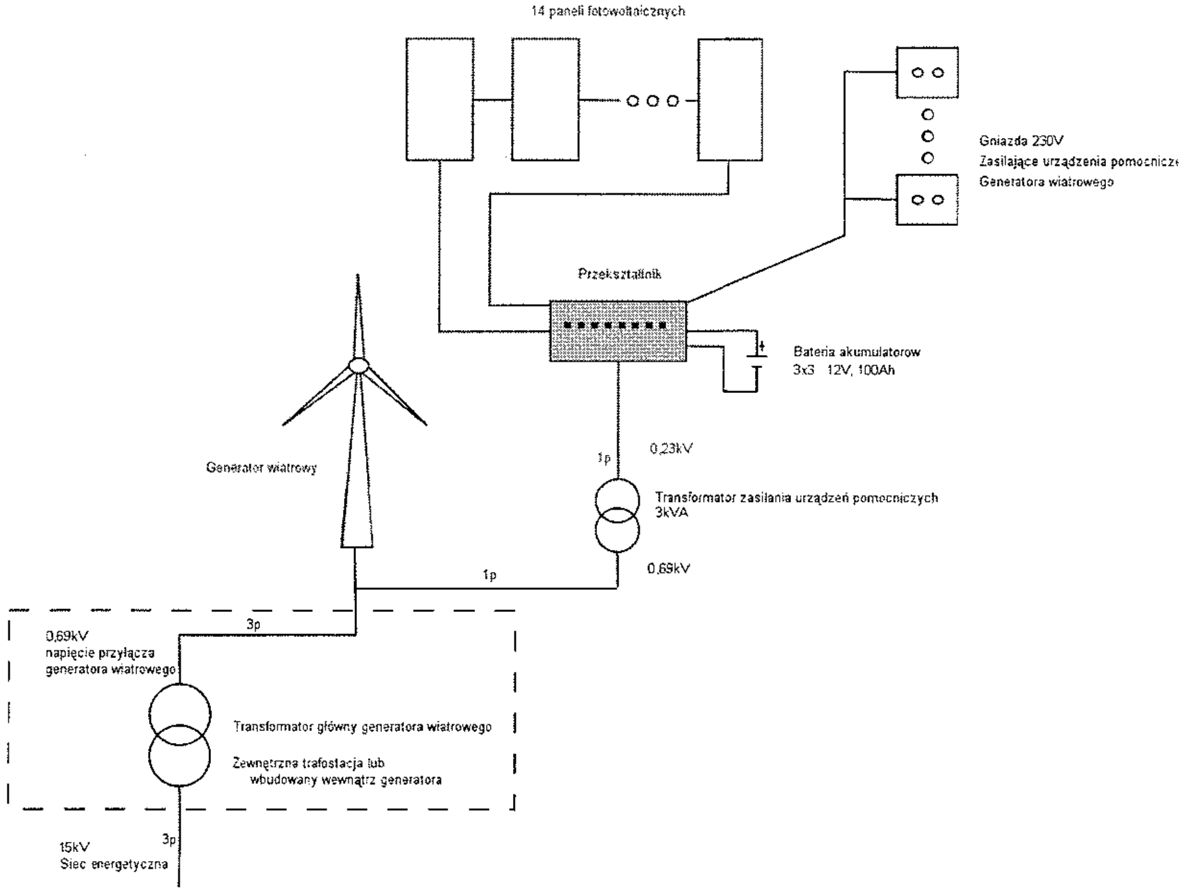

Figure *1.7.2.b diagram of generators.*

The purpose of generator is to provide a solar of solar energy conversion into electricity with buffering in batteries and powering auxiliary equipment. These devices depending on the needs can be:

- telecommunications system for monitoring turbine, part of the GSM and part radiolinks / DSL equipment, IP routers, etc.
- medium voltage switchgear lighting, which is located outside the turbine
- obstruction light wind generator
- burglar alarm system
- air conditioning system to cool the air supplied to the wind generator ventilation system (in the event that there were problems with the cooling wind generator).

Depending on the choice and the aforementioned power devices it is possible to maintain the auxiliary power-clock exclusively by solar energy. Average annual production of each team of solar generator is about 2.9 MWh per year.

1.7.3. Wind Park EKO - Energia

<u>**Technology and solutions applied in the project**</u>

CARBON ENGINEERING

Prezes Zarządu Komplementariusza Przemysław Kowalski

Wind Park EKO-Energia uses 4 wind turbines with a capa city of 0,8 MW made by Enercon GmbH, characterized by the following arrangements:

Main parameters of the installation

• Number of turbines:	4
• Individual installed capacity of the turbines:	0,8 MW
• ***Total capacity of wind farm:***	***3,2 MW***
• Height of the turbine tower:	73 m
• Diameter of the rotor blades:	52.9 m
• Rotation range:	12 – 28.3 obr/min
• Max. cut off threshold (threshold wind speed):	28 m/s

ECO-Energy Company decided to use floating technology revolution. This technology changes the generator speed and frequency of a fixed frequency of the electricity is achieved through electronic circuits that produce alternating current with fixed parameters. This technology uses a synchronous AC generator where energy is converted into layouts DC rectifier and inverter systems, then, is made of solid AC performance.

The technology used in the design is regarded as a more modern and effective with respect to all the previous solutions, but it is not an innovative technology.

The essence of the applied solution here lies in the construction of special, ring AC generator of large diameter, which even at low wind speeds, allows to achieve optimum efficiency. This resulted in a computerized system linking electricity and maximize security tied to the system failure rate.

Also thanks fans consume minimum power for the production of their own, while ensuring a stable energy production.

Another feature of the technology is how to accomplish the construction of windmills. The stator of the generator is installed in the frame generator, and directly coupled to each other rotors: blades and generator are mounted on a fixed pivot forms part of the frame. The development of the external surface of the stator to good heat dissipation, which arises during operation of the generator and the coil temperature is maintained at a low level. Windings using vacuum sealed in epoxy resins, have insulation class F (150 ° C). The copper wires are coated with a special coating that guarantees a high degree of safety and durability.

Metering system

Counter-EW Bartoszewice:

- Model ZMD 405
- accuracy class: 0,5
- Counter number: 96502914
- Voltage: 3x58/240

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- Current: 1/6A

Counter -EW Płużnica:

- Model: ZMD 405 CT
- Accuracy class: 0,5
- Counter number: 96502915
- Voltage 3x58/240
- Current: 1/6A

Counter -EW Nowa Wieś Królewska:

- Model: ZMD405
- Accuracy class: 0,5
- Counter number: 96502912
- Voltage 3x58/240
- Current: 1/6A

The figure below shows a general scheme of the turbine ENERCON E-53 800 kW - used in this project:

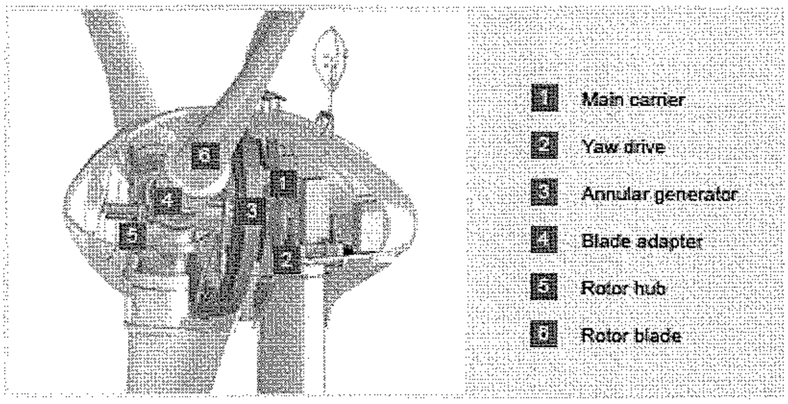

Figure 1.7.3. *General scheme of the ENERCON E-53 - 800 kW* ***turbine.***
wg (http://www.wind-turbine-manufacturers.com/2011/11/enercon-e-53800-kw/)

1.7.4. Wind Park GRABOSZEWO

Technology and solutions applied in the project

Wind Park GRABOSZEWO uses 1 wind turbine type Enercon E-82 with capa city of 2 MW feature the following solutions:

Main parameters of the installation

- Number of turbines: 1
- Individual installed capacity of the turbines: 2 MW

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- Height of the turbine tower: 108 m
- Diameter of the rotor blades: 82 m
- Rotation range: 6 - 17.5 obr/min
- Max. cut off threshold (threshold wind speed): 25 m/s

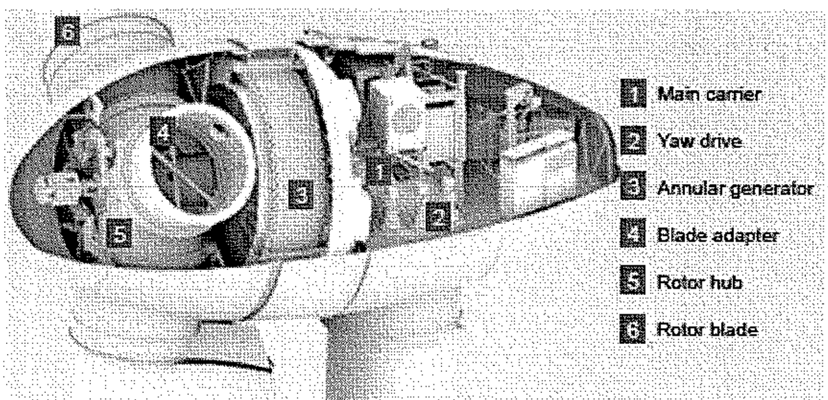
The present plant is designed for an average wind power. The large diameter of the rotor blades and efficient geometry for maximum productivity and a significant reduction in the cost of producing 1 kWh of energy. Enercon GmbH, based in Aurich (Germany), is the third wind turbine manufacturer in the world and a major in Germany.
The new concept of rotor blades Enercon appointed new opportunities for revenue size, noise levels and minimize the weight of the unit. With the modified geometry also utilize blade inner surface, which causes a significant increase in efficiency. Furthermore, the new blades are less susceptible to turbulence and provide uniform flow around the entire length of the blade profile.
In the technology, the non-transmission system ring generator plays the most important role. Because it provides a steady supply of energy. The slow turnover of the few moving parts provide low wear material. Unlike previous asynchronous generators, ENERCON annular generator consumes almost no mechanical components and ensures long service life. This prevents a lengthy repairs and associated downtime.

Metering system

Information concerning the metering installed in Wind Park GRABOSZEWO:

Type: ZMD405CT44.0459
Manufacturer: Landis+Gyr
Class: klasa 0.5
The distinction between basic and backup count: only a basic counter
According to Decree of Minister of Economy of Poland of 7 January 2008 on metrological control of measurement equipment (Law Gazette from 14 January 2008) electricity meters of more than 30kW rated power have initial legalization term of 8 years and 8 years of validity for subsequential legalizations.

The figure below shows a general scheme of the turbine ENERCOM E-82 - 2.0 MW - used in this project:



Cross sectional drawing of nacelle E-82 / 2,000 kW

*Figure **1.7.4.** **General scheme of the** Enercom E-82 -2 MW turbine.*
(wg http://www.enercon.de/en-en/62.htm)

1.7.5. Wind Park JAROGNIEW - MOŁTOWO

Technology and solutions applied in the project

In this Wind Farm there were used german wind turbines from REpower Systems Company. REpower is one of the leading manufacturers of wind turbines in the world.

Wind Park uses 10 wind turbines type MM92-2.0 MW made by REpower company, feature the following solutions:

Main parameters of the installation

- Number of turbines: 10
- Individual installed capacity of the turbines: 2 MW
- Height of the turbine tower: 100 m
- Diameter of the rotor blades: 92,5 m
- Rotation range: 7.8 – 15 rot/min
- Max. cut off threshold (threshold wind speed): 24 m/s

Each turbine is equipped with this type of servo directing wind turbine. Wind turbines are equipped with a control system that allows you to avoid mechanical damage to the plant and allows the most efficient use of its potential.
The life of wind power unit is planned for 25 years.
Electricity output of the inverter is transformed into voltage 15kV in the transformer.

Metering system:
Counter boxes of the energy measurement: SLTW1-10.

Meters to measure the "gray" energy:

1. Basic:
   a. Producent: Landys+Gyr
   b. Model: E850
   c. Type:ZMQ202
   d. Class: 0.5
   e. Serial No. : 93 509 529
2. Reserve:
   a. Producent: Landys+Gyr
   b. Model: E650
   c. Type:ZMD402
   d. Class: 0.5

e. Serial No.: 96670218

The figure below shows a general scheme of the turbine REpower MM92-2.0 MW - used in this project:

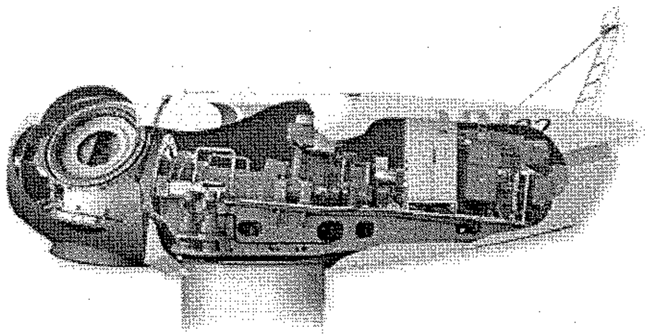


*Figure 1.7.5. **General scheme of the** REpower MM92-2.0 MW turbine.*
(wg http://www.repower.de/wind-power-solutions/wind-turbines/mm92/)

The function of this team is to convert wind farm wind energy with technical facilities of electricity, and then send it to customers using the existing system of power distribution network 110kV Power Concern Energa SA

1.7.6. Wind Park KALNIKÓW

<u>Technology and solutions applied in the project</u>

Wind park Kalników uses 4 wind turbines type Fuhrländer MD77, feature the following solutions:

<u>Main parameters of the installation</u>

- Number of turbines: 4
- Individual installed capacity of the turbines: 1,5 MW
- Height of the turbine tower: 100 m
- Diameter of the rotor blades: 77 m
- Rotation range: 9,2-17,3 obr/min
- Max. cut off threshold (threshold wind speed): 20 m/s

As a pioneer in the use of wind energy onshore (land) in the country and independent of the company's wind turbine manufacturer Fuhrländer AG counts on strong turbine concepts - as standard to Fuhrländer 2.5 MW class. These wind turbines generate automatically the fault and send it to the server Fuhrländer data that informs online service team. This enables quick response and action-oriented service, making wind turbine is again very quickly connected to the network. Supplementary Condition Monitoring System (monitoring conditions) provides forward-looking maintenance and depreciation prevents installation.

The figure below shows a general scheme of the turbine Fuhrländer (FL) MD77 1,5 MW - used in this project:

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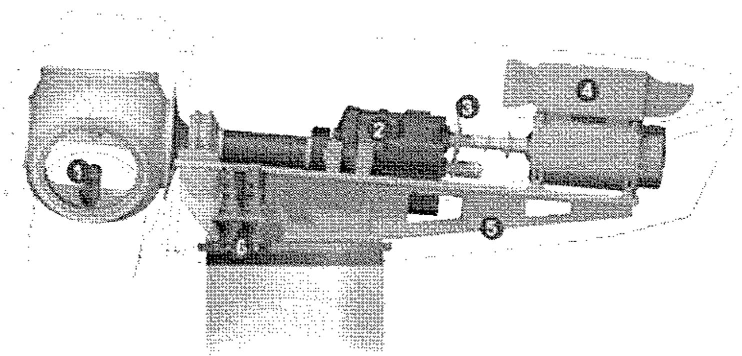


Figure 1.7.6 *General scheme of the Furhländer (FL) MD77 1,5 MW turbine.*
(wg http://en.wind-turbine.com/marktplatz/marktplatz_anzeige,315,Fuhrlaender-FL-MD-77.htm)

1.7.7. Wind Park KRZEMIEŃ i WSPÓLNICY

Technology and solutions applied in the project

Wind Park Krzemień Wspólnicy uses 4 wind turbines type TACKE TW – 600, feature the following solutions:

Main parameters of the installation

• Number of turbines:	4
• Individual installed capacity of the turbines:	0,6 MW
• ***Total capacity of wind farm:***	***2,4 MW***
• Height of the turbine tower:	50 m
• Diameter of the rotor blades:	43 m
• Rotation range:	11-20 obr/min
• Max. cut off threshold (threshold wind speed):	25 m/s

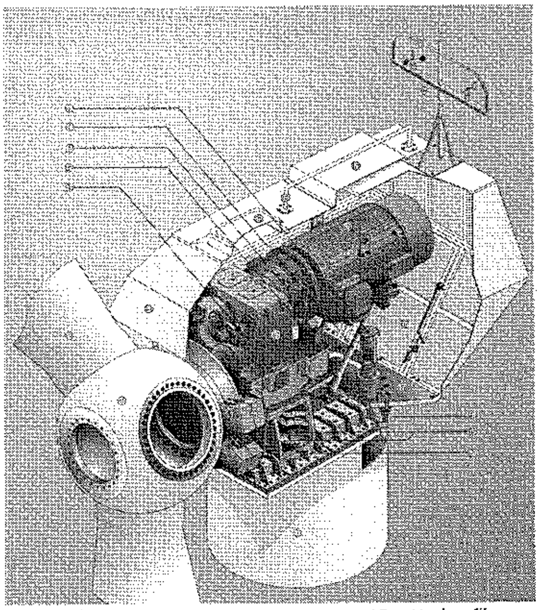
Electricity output of the inverter is transformed into voltage 15kV in the transformer.

Metering system:

Electronic counters EQABP type-N and N are FQABP-D version of the popular counter EAP and are intended for energy measurement in networks with unidirectional or bi-directional flow of energy. These are multi-tariff meters with internal switching time zones, equipped with battery backup time clock and non-volatile memory EEPROM and Flash to record measured values, settings and parameters.
These meters are equipped with a dedicated LCD display for most of the recorded sequence of states and size. They have the ability to communicate with external devices via the implemented hardware and software communications interface. They are resistant to high magnetic neodymium.

Energy measurement is performed by an independent sampling frequency of 4 Hz voltage and current through the analog-to-digital converter. Samples sizes are sent to the digital signal processor (Digital Signal Processor - DSP), which calculates the energy and sends the result to the microcontroller. The microcontroller processes the received data and stores the results in memory.

The figure below shows a general scheme of the turbine **TACKE TW – 600 kW** - used in this project:



Legende:

1 Rotornabe
2 Rotorblatt
3 Maschinenhaus
4 Dachluke
5 Sicherungsbügel
6 Entlüftung
7 Windfahne, Anemometer
8 Generator
9 Getriebe
10 Betriebsbremse
11 Sekundärbremse
12 Hydraulikaggregat
13 elastische Rutschkupplung
14 Generatorstütze
15 Azimutgetriebe
16 Wartungsluke
17 Grundplatte
18 Kugeldrehverbindung
19 Azimutbremse
20 Körperschallentkopplung
21 Turm

Figure 1.7.7. ***General scheme of the*** **TACKE TW – 600 kW turbine.**
(wg http://www.hi-windkraft.de/technik.html)

1.7.8. Wind Park SANNIKI

Technology and solutions applied in the project

Wind Park SANNIKI uses 3 wind turbines V90 2.0 MW made by VESTAS feature the following solutions:

Main parameters of the installation

- Number of turbines: 3
- Individual installed capacity of the turbines: 2 MW
- ***Total capacity of the wind farm*** ***6 MW***

- Height of the turbine tower: 105 m
- Diameter of the rotor blades: 90 m
- Rotation range: 8,8 – 14,9 obr/min
- Max. cut off threshold (threshold wind speed): 25 m/s

The figure below shows a general scheme of the turbine **Vestas V90 2 MW** - used in this project:

1) sterownik piasty
2) cylinder systemu sterowania łopatami
3) oś główna
4) chłodnica oleju
5) skrzynia przekładniowa
6) sterownik VIP z konwerterem
7) hamulec postojowy
8) dźwig serwisowy
9) transformator
10) piasta wirnika
11) łożysko łopaty
12) łopata
13) układ blokowania wirnika
14) układ hydrauliczny
15) tarcza hydraulicznego układu hamowania wirnika
16) pierścień układu kierunkowania
17) rama
18) koła zębate układu kierunkowania
19) generator
20) chłodnica generatora

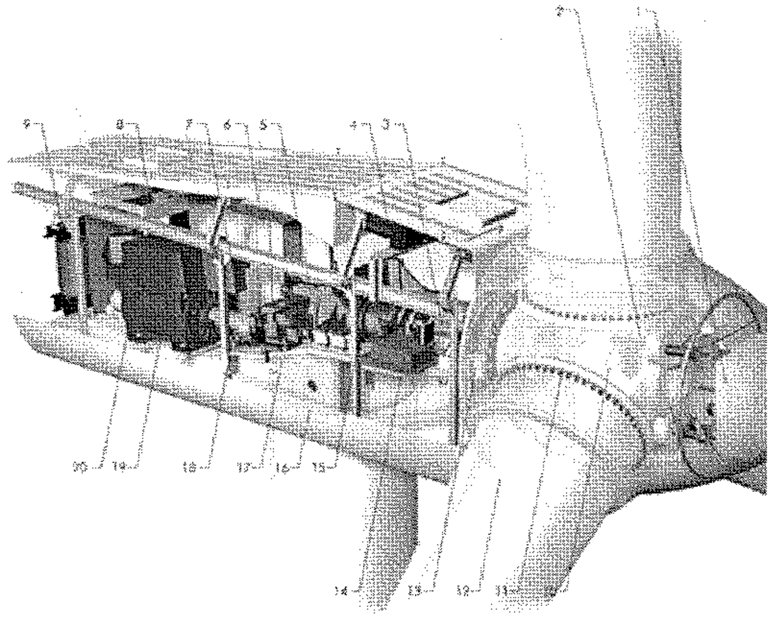


Figure ***1.7.8. General scheme of the*** *VESTAS V90-1.8/2.0 MW* ***turbine.***

1.7.9. Water-Power Plant BOBROWICE IV (TAURON)

Technology and solutions applied in the project

Water-Power Plant BOBROWICE IV uses 2 turbines type RTKs-1200, made by GAJEK ENGINEERING sp. z o.o. company feature the following solutions:

Main parameters of the installation

- Number of turbines: 2
- Individual installed capacity of the turbines: 0,5 MW
- ***Total Capacity of the plant*** ***1 MW***
- Rotation range: 1000 rot/min

Metering system

To measure the energy produced in the generators are installed 2 meters by Elster, model A1500-W045-741-OSL-1065X-V1H00, one for each generator. The same type of meter used to measure the energy placed into the network (net energy). To measure the needs of your business is mounted Elster meter, model A1500-D061-441-OSL-1065S-V1000. Legalization of counters is conducted

Meters are connected to a GPRS modem by Elster, model DM 600 DCF 77 antenna DC 110.

The figure below shows a general scheme of the turbine **RTKs-1200**- used in this project:

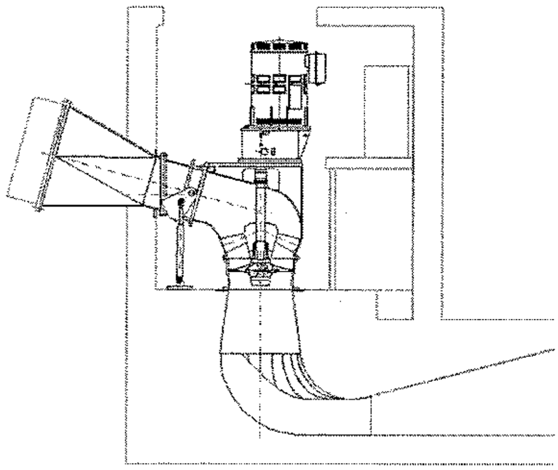


*Figure **1.7.9. General scheme of the** RTKs-1200 turbine*

(wg http://www.ecoenergia.pl/index.php?id_art=234&plik=urzadzenia_dla_elektrowni_wodnych.htm)

1.7.10. Wind Park LIPNIKI (TAURON)

Technology and solutions applied in the project

Wind Park LIPNIKI uses 15 wind turbines MM92, REPower company, feature the following solutions:

Main parameters of the installation

- Number of turbines: 15
- Individual installed capacity of the turbines: 2,05 MW
- ***Total Wind Park capacity: 30,75 MW***
- Height of the turbine tower: 80 m
- Diameter of the rotor blades: 92,5 m
- Rotation range: 7.8 - 15 obr/min
- Max. cut off threshold (threshold wind speed): 24 m/s

The turbines are located on parcels: 626/4, 623, 622, 621/1, 280/4, 278, 276,1 275, 204/3, 89/2, 87/2, 4/2, 172, 84, 131/1, 132/1.

Each this type turbine is equipped with of servo directing wind turbine. Wind turbines are equipped with a control system that allows you to avoid mechanical damage to the plant and allows the most efficient use of its potential. The life of wind power unit is planned for 25 years.

Metering system

On the Lipniki farm tere are 18 energy meters installed, which are used in amount of 17 (15 turbines and two sub-stations net meters - main and reserve), all of Landis + Gyr type ZMQ202C.8r4af6
02S class of active power measurement
Class 0.5 reactive power measurement
Legalization of counters is conducted every 8 years from the beginning of the following year made legalization. Energy meters for turbines are connected in series to a single-mode fiber optic power meter at the Central Point of Acceptance. After switching to GPZ counter is not used to read energy, is only closed loop fiber. Reading of the meter is carried out remotely using GPRS modems located in the turbine No. 6 (the one using the OSD, the second TAURON Ekoenergia). 2 counters in the substation, primary and secondary, are also connected to the GPRS modem with them also run a remote reading. OSD conducts automated readings from these meters every day from 0:00 to 6:00 at night.

The figure below shows a general scheme of the turbine **MM92 REPower company's–2,05 MW** - used in this project:

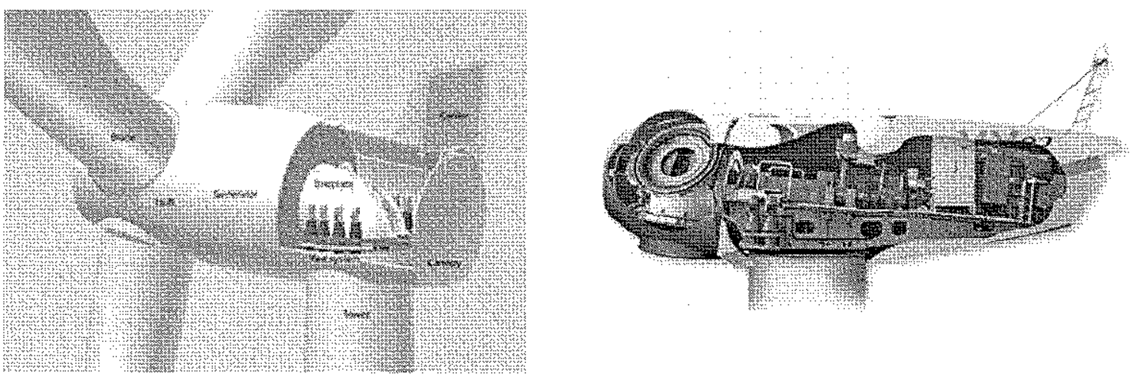


*Figure **1.7.10. General scheme of the** MM92turbine from REPower–2,05 MW company.*
(wg http://elementalpower.com.au/news/?m=201012
http://www.repower.de/fileadmin/download/produkte/PP_MM92_uk.pdf)

1.7.11. Wind Park WARTKOWO

Technology and solutions applied in the project

Wind Park WARTKOWO uses 15 wind turbines GAMESA G90 with a rated power 2 MW feature the following solutions:

Main parameters of the installation

- Number of turbines: 15
- Individual installed capacity of the turbines: 2 MW
- ***Total capacity of the Wind Park*** ***30 MW***
- Height of the turbine tower: 100 m
- Diameter of the rotor blades: 92 m
- Rotation range: 9.0 – 19.0 obr/min
- Max. cut off threshold (threshold wind speed): 21 m/s

Metering system

For FW WARTKOWO there are three systems of measurement of energy. At the core / coil first made a basic system for billing purposes between ENERGA and GDF SUEZ., While the core / second winding is made up system and measure the energy analyzer reinforced IBERDROLA and current-voltage winding power quality analyzer and measuring module TCP devices.
For the measurement of the primary and backup provides two counters ZMQ202 class 0.2 for measuring active energy, and energy measurement for Iberdrola will run for one counter ZMD402 in class 0.2. Each meter has an additional power supply that allows meter reading in the absence of voltage in voltage (additional power from its own needs guaranteed voltage 230VAC). Loss or reduction of excessive voltage in voltage is controlled by the same counter and signaled its output pin. This information is entered on TCP digital input driver. located in a security cabinet.
Iberdrola Energy meter DCF77 clock is synchronized to a US151/REL/P3/230. Counters are synchronized with ZMQ Converge system.
For the execution of the measurement system provided in a wiring closet chassis measuring strips WAGO 847-296/060-000 type in the closet and PXC-meter strips SKA04 Phoenix Contact. It is also anticipated YKSYFtly cabling type 5x2, 5mm2 - for voltage circuits and YKSYFtly 7x6mm2 - for circuits. Cables are run in protected pipes from the transformer to the cabinet cable, and the cable to the control cabinet in conduit within the station and on the floor in the control room. In order to maintain the appropriate class to the circumference measurement, voltage measurement, accompanied by a set of resistors loading the truck, which was built on the wiring closet and plugged in to the terminal control and measurement in accordance with the diagrams. Energy measurement system has been installed in the meter cupboard FQ201.
To enable remote reading of meters, all three counters are equipped with modules type CU-B4 (RS232 and RS485). This solution enables the use of three independent communication channels for remote meter reading.
The first path (read from P1 and P2) with RS485 interface via RS485 bus to ENERGA (basic). The second route 232 to 5250 NPortu then through the Ethernet connection to the server GDF SUEZ, the third (read from P1, P2), with interfaces RS485 communication module type counter CU-B4, bus 485 via a modem | CUP32 Energa GPRS (Standby). Counter P3 CORE Iberdrola settlement system via TCP using the pulse outputs.

The figure below shows a general scheme of the turbine G-90 Gamesa 2 MW - used in this project:

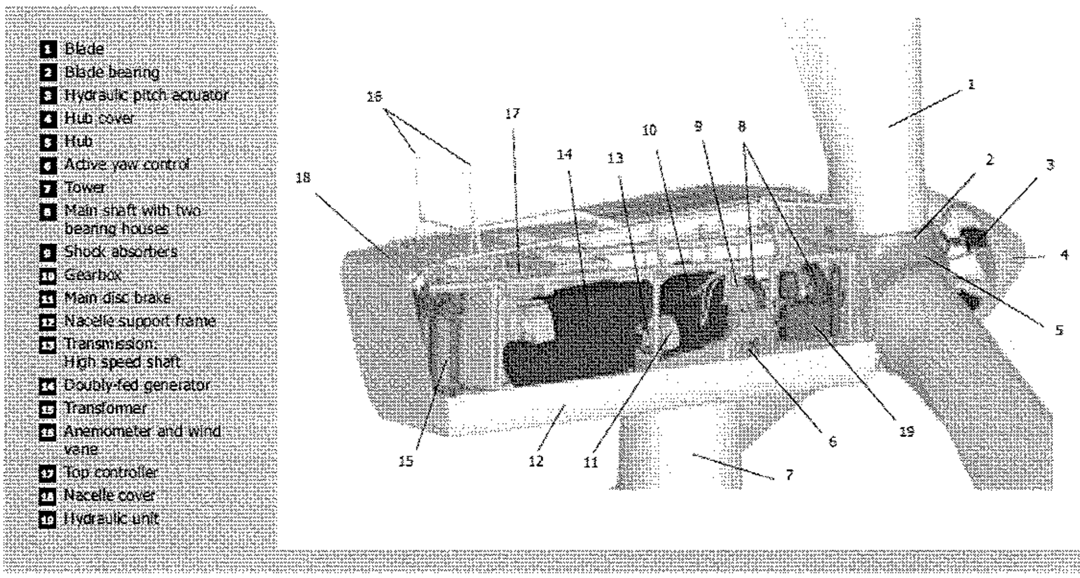


Figure ***1.7.11. General scheme of the*** *GAMESA V90-1.8/2.0 MW turbine.*

1.7.12. Wind Park WOLBÓRZ

Technology and solutions applied in the project

This wind park uses 2 wind turbines VESTAS V90 2,0 MW feature the following solutions:

Main parameters of the installation

- Number of turbines: 2
- Individual installed capacity of the turbines: : 2 MW
- Total capacity of Wind park ***4 MW***
- Height of the turbine tower: 100 m
- Diameter of the rotor blades: 90 m
- Rotation range: 8,8-14,9 obr/min
- Max. cut off threshold (threshold wind speed): 25 m/s

Electricity output of the inverter is transformed into voltage 15kV in the transformer.

Metering system

The electricity produced is sent to the network ZEŁ-T SA through:
- Transformer 0.69 / 15 kV capacity of 2100 kVA

Under the terms of grid connection bi-directional energy flow metering is a system built in the indirect measurement MV-15 kV. The project provides three buildings measuring current transformers type CTS_25.
PROFI counting array type + prod. Moeller was built on:
- Counter four-square ZMD405CT44.0459 type of modem GSM / GPRS type CU-P32 and system time synchronization US-151,
- Counter Control four-square ZMD405CT44.0459 type of communication module CU-B2,
- Control and measuring strip WAGO 20 847-356-060-000,
- Additional euro rail,
- Two 230 V power socket with transformer GSE 20,
- UPS 800VA PE NETYS type.

Metering and billing system has an internal clock that is synchronized with the clock signal after the Frankfurt connection to the meter antenna. The purpose of clock synchronization is real-time counter with an accuracy of one minute, at least once a day (Module US-151).

The figure below shows a general scheme of the turbine **VESTAS V90-2.0 MW** - used in this project:

1) sterownik piasty
2) cylinder systemu sterowania łopatami
3) oś główna
4) chłodnica oleju
5) skrzynia przekładniowa
6) sterownik VIP z konwerterem
7) hamulec postojowy
8) dźwig serwisowy
9) transformator
10) piasta wirnika
11) łożysko łopaty
12) łopata
13) układ blokowania wirnika
14) układ hydrauliczny
15) tarcza hydraulicznego układu hamowania wirnika
16) pierścień układu kierunkowania
17) rama
18) koła zębate układu kierunkowania
19) generator
20) chłodnica generatora.

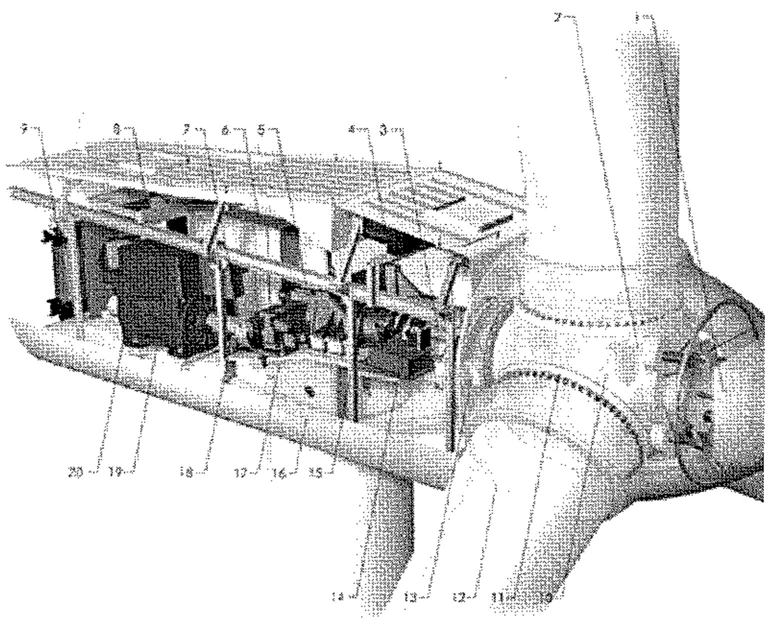


*Figure **1.7.12. General scheme of the** VESTAS V90-2.0 MW turbine.*

1.7.13. Group of Wind Parks ŻEŃSKO

Technology and solutions applied in the project

Group of Wind Parks ŻEŃSKO uses 3 wind turbines GE 2,5 xl compnys, each of capacity of 2,5 MW, with the diameter of the rotor - 100m and hub high 100m. The units are located on land registration precinct Żeńsko: plot No. 103, 106 and 107.

Main parameters of the installation

- Number of turbines: 3
- Individual installed capacity of the turbines: 2,5 MW
- ***Total capacity of Wind Turbines*** ***7,5 MW***
- Height of the turbine tower: 100 m
- Diameter of the rotor blades: 100 m
- Rotation range: 5 – 14,1 rot/min
- Max. cut off threshold (threshold wind speed): 25 m/s

Electricity output of the inverter is transformed into voltage 15kV in the transformer.

Metering system

Metering and billing system includes:
- Three type current transformers ISN 5h 147 POLCONTACT Warszawa company with parameters:
  - The highest voltage limits – 1,2 kV
  - Transmission 2000/5 A
  - Power- 5VA
  - Class 0,5
  - Safety Factor FS5
  - Prąd Ith – 120 kA
- Three type current transformers ISN 43 h 126 POLCONTACT Warszawa company with parameters:
  - The highest voltage limits – 1,2 kV
  - Transmission 2000/5A
  - Class 0,5
  - Safety Factor FS5
  - Prąd Ith – 120 kA
- Generation system for each tower – four-square meter, multi-zone power measurement and power of two-way flow of electricity type ZMD 405 CT 44.0459 S.3 communication module production CU-P32 LANDIS + GYR Sp. Z o.o. with parameters:
  - Class P=0,5, Q=1
  - Tension 3x58/100 V
  - Current n. 5A.
- Measuring stick LPW, WAGO company, type 847-103
- Clock synchronous type time U162/20/N5/230, TIME-NET Sp. z o.o. company
- Communication module CU-P32 produced byLANDIS+GYR Sp. z o.o. o with parameters:
  - Mode of operation GSM or GPRS

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- Modul GSM/GPRS type Siemens Cellular Engine MC35i
- Consumption: 3W/5,5 A
- External removable SIM card 1,8/3v
- Interface: CS+, RS485

- Converter of serial port MOXA NPort 5130 RS-422/485/Ethernet
  - 1 port RS-232, connector DB9 male
  - autodetection 10/100 Mbps Ethernet
  - Automatic network connection recovery
  - Surge Protection 15 kV ESD for each signal
  - TCP Server, TCP Client, UDP, Real COM, Pair Connection, Ethernet Modem
  - SNMP MIB-II for network management
- Securing a RBK00 voltage transformers with a fuse elements WTN00-6A-690V

The settlement is based on monthly readings. The data is read by Enea Operator in the presence of KSM Energia using an electronic device and stored by Enea Operator. In addition, shall be drawn up of meter reading, a copy forwarded to the KSM.

The figure below shows a general scheme of the turbine **GE-2,5 MW** - used in this project:

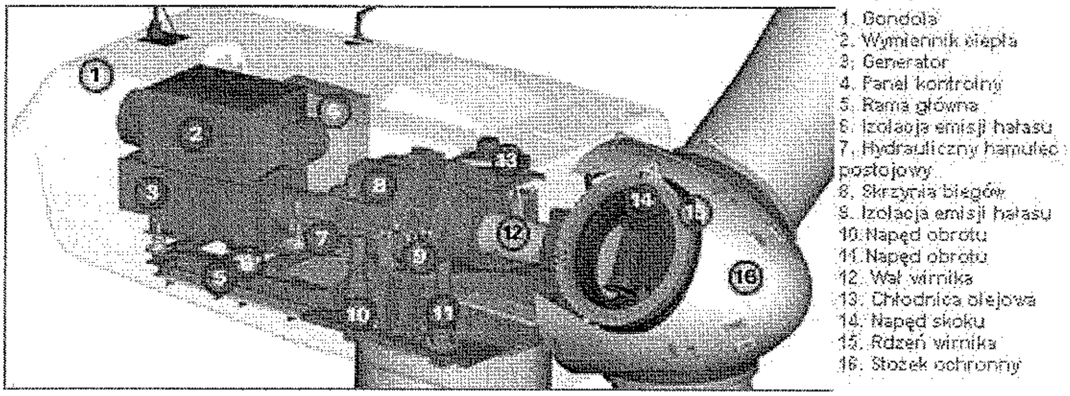

Figure 1.7.13. *General scheme of the 2.5xl GE Energy turbine*
wg (http://www.ekoenergia.pl/index.php?id_art=907&cms=217&plik=Elektrownie_wiatrowe_GE_ecomagination_cz.1.html)

1.8. Description of the method of achievement of the greenhouse gas emissions avoidance below a set baseline

The result of the implementation of this project is the electricity generated from renewable sources, what results in a reduction of GHG emissions (CO_2eq) through the replacement of electricity produced from non-renewable sources, that build the energy sector in Poland. The scenario of the project involves the construction of wind farms and water-power plant.

Assuming that the emission baseline is higher than the emissions from the project (that equal zero), the project has features of additionality and contributes to the reduction of anthropogenic GHG emissions below levels that would have occured in case the implementation of the project had been abandoned.

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Detailed information and data reduction were included in the calculations, below, in the project documentation.

1.9. Description of the project's impact on the environment

1.10. Scope of the project's impact on the environment, regarding avoidance of the greenhouse gases emission

Conduction of a report on the project's environmental impact was commissioned for the purpose of obtaining a decision on environmental conditions of approval for the project. The report did not show any significant impact on the environment.

Based on a report prepared on the environmental impact the project has been approved by the municipal environmental authorities. The project does not cause transboundary environmental impact. It reduces GHG emissions , as well as the emission of pollutants such as: NOx, SO_2, dust.

The project's boundary is defined by the Polish power grid. No other location of energy produced is expected to be set.

1.11. Name of the entity developing the project documentation

CARBON ENGINEERING

Carbon Engineering sp. z o. o.
28/12 Szlak Str.
31-153 Kraków
office: +48 12 376 82 43

fax: +48 12 378 93 23
www.carbonengineering.pl
KRS (National Court Registry Number): 0000351847

NIP (Tax Identifiaction Number): 676-241-61-56
REGON (Statistic ID Number): 12118233

1.12. Calculation of the planned costs and revenue related to the project

A detailed information on the project financing in the years 2008-2031, taking into account the costs of O&M and revenues from the project are presented in detail in **Annex 1 The detailed scheme of the financial structure of the project**. Information on expected ERU price and income from this sale can also be found in the a/m document.

2. DESCRIPTION OF THE PROJECT FUNDING SOURCES

2.1. Method of the project's financing

2.1.1. Group of Wind Parks CZYŻEWO

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Project – building of Group od Wind Parks CZYŻEWO - was financed mainly based on bank credit and loans from a shareholder (Table 2.2.1.). In the course of the investment received EU funding.

2.1.2a. Wind Park DZIAŁOSZYN

Project – building of Wind Park DZIAŁOSZYN V90 4MW - has been funded on the basis of long-term bank loan (about 85% of investment costs) and a loan from shareholders (approximately 15% of the investment costs of the project). In the course of the investment, part of the expenditure of the grant is funded by the EU on the basis of the refund.

Wind farm Działoszyn – Bella Enterprise

Own resources (incl. bank loans and shareholder loans)	4 116 250,00	33,8%
Subsidy	8 048 500,00	66,2%

1. Long-term bank loan in the amount of 10 327 800 PLN, loan in tranches run into co-slips stages of the investment, the planned date of the loan - January 2011. Crediting period of 15 years (in the base without subsidies) the planned repayment of the loan 12/31/2026 the resulting subsidy in 2012, partly to repay a bank loan and
2. Loan from a shareholder in the amount of 1 836 950,00 PLN (basic amount), the planned date of start-up of the first tranche of the loan - in 2010, and the repayment of the loan is scheduled on 31 December 2027.

Wind farm Działoszyn – Flower Enterprise

Own resources (incl. bank loans and shareholder loans)	6 918 811,05	46,1%
Subsidy	8 084 935,00	53,9%

1. Long-term bank loan in the amount of 10 434 522 PLN, loan in tranches run into co-slips stages of the investment, the planned date of the loan - January 2011.
2. Crediting period of 15 years (in the base without subsidies) the planned repayment of the loan 12/31/2026 the resulting subsidy in 2012, partly to repay a bank loan and Loan from a shareholder in the amount of 1 863 630.50 PLN (basic amount), the planned date of start-up of the first tranche of the loan - in 2010, and the repayment of the loan is scheduled on 31 December 2027.

2.1.3. Wind Park EKO – Energia

Project – building of Wind Park EKO - Energia – was financed mainly based on bank credit and on the basis of own funds (including loans). (Table 2.1.3 and Table 2.1.3b).

2.1.4. Wind Park GRABOSZEWO

Project – building of Wind Park GRABOSZEWO - was financed mainly based on bank credit and loans from a shareholder (Table 7.4). In the course of the investment, part of the expenses was covered by the EU-funded grant.

2.1.5. Wind Park JAROGNIEW – MOŁTOWO

Project – building of Wind Park JAROGNIEW- MOŁTOWO - was financed using a loan, funding from the Ministry of Economic Affairs (under grant agreement no POIS/09.04.00-00-016/09-00) and own funds (Table 7.5).

2.1.6. Wind Park KALNIKÓW

Project – building of Wind Park Kalników - has been funded on the basis of the investor's own contribution (own funds and credit), and a grant from the EU funds under the Operational Programme Infrastructure and Environment.

2.1.7. Wind Park KRZEMIEŃ i WSPÓLNICYcompany

Project – building of Wind Park Krzemień i Wspólnicy company- was financed entirely from own funds shareholders. For the realization this investment company does not make use of external sources of financing.

2.1.8. Wind Park SANNIKI

Project – building of Wind Park SANNIKI - has been funded on the basis of an investment loan and own funds (Table 2.2.8).

2.1.9. Water-Power Plant BOBROWICE IV (TAURON)

Project – building of Water-Power Plant BOBROWICE IV - was financed from own funds company TAURON in the amount of 9 364 463.22 PLN. The project also included the renovation and expansion of the power supply channel Bobrowice III. It is included in the cost of Bobrowice IV, because they use the channel in 87% because Bobrowice III are activated only in exceptional circumstances.

2.1.10. Wind Park LIPNIKI (TAURON)

Project – building of Wind Park FW LIPNIKI - was financed mainly on credit and loan.

Capital expenditures include additional consideration for the company WSB because the farm was purchased already in the process of its use. These investments are only those of the Tauron Ekoenergia:

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Investment (zł)	
2011	235 000 000,00
2012	2 196 121,79

The operating costs (zł)	
2011	3 225 748,76
2012	4 580 726,74
2013	4 751 765,58

For the year 2012 is given the execution cost until June 2012, and forecasts for the end of the year.

The company took out a loan for Lipniki Wind Farm in PKO BP. At the date of acquisition by TAURON Ekoenergia (TEE) shares in Lipniki (28.09.2011 onwards), the Company has incurred in TEE loan in the amount of 144,054,078.55 PLN, which amount to 100% of covered pay off the loan plus accrued interest and commissions. This operation was part of the acquisition of shares Lipniki Ltd. by TEE. In order to balance the transaction TEE issued bonds with a value of 150,000,000.00 PLN.

Until 01/06/2012, were calculated (but not charged) for the above-mentioned interest. loan. On this day, there has been a combination of the two entities and the current loan amount (principal + interest) was 149,070,323.06 PLN compensation. For the moment, therefore, the Company has no debt, which can be directly defined as contracted for the construction of the farm, but indirectly can thus be considered 150,000,000.00 PLN bonds issued for the entire purchase process of the Company.

2.1.11. Wind Park WARTKOWO

Project – building of Wind Park FW WARTKOWO - has been funded on the basis of investment credit.

2.1.12. Wind Park WOLBÓRZ

Project – building of Wind Park WOLBÓRZ - was financed using equity and loan investment.

2.1.13 Group of Wind Parks ŻEŃSKO

Project – building of Group of Wind Parks Żeńsko - has been funded on the basis of the investor's own funds and investment loan and grant from the European Union Cohesion Fund under the Infrastructure and Environment (Table 2.2.13).

2.2. Project's financing sources

2.2.1. Group of Wind Parks CZYŻEWO

The table below presents a diagram of of the project funding sources:

Table 7.2.1 Project's financing scheme Group of Wind Parks CZYŻEWO.

Description of the method and sources of funding of the project - including investment, operating and maintenance costs (the total amount)	
Investment	Total amount: 34 158 441,05 PLN financial costs: 1 529 903,94 PLN including interest accrued on loans and credit 568 247,06 PLN
Living expenses such as general and administrative expenses, salaries, security, financial management - Technical	about. 4 000,00 PLN per month
Operating costs - ie energy for their own services, telecommunications, without depreciation	about 125 000 PLN per month
Details of any external sources of financing, including loans and aid obtained to finance investment	
Bank loan	Bank loan: 26 496 125,96 PLN payment of 51 installments, payable quarterly on 30 June 2012 to 31 December 2024
Loans from shareholder	As at 31 March 2012, the average is 3 390 682.64 PLN, all outstanding subordinate loan agreement - fixed interest rate of 7% for the most part and variable loans at 3M + 3 pp account for about 6% of debt
State aid - EU funding	the amount of funding received by 22 June 2012: 13 118 722,42 PLN

2.2.2. Wind Park DZIAŁOSZYN

The table below presents a diagram of of the project funding sources for 2011 (the net amount):

Table 7.2.2.a Project's financing scheme Wind Park DZIAŁOSZYN I.

Sources of funding	Amount (net)	Currency
Bank loan	10 327 800,00	PLN
Loan from shareholder	1 836 950,00	PLN
sum	**12 164 750,00**	PLN

The table below shows the final schedule of the project funding including grants and all ineligible costs, including VAT for 2011 (gross amount):

Table 7.2.2.b The final schedule of financing wind power DZIAŁOSZYN II.

Sources of funding	Amount (gross)	Currency
Investment loan	6 792 495,00	PLN

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funding (European Regional Development Fund)	8 048 500,00	PLN
sum	**14 840 995,00**	PLN

2.2.3. *Wind Farm EKO – Energia*

The wind farm ECO - Energy, funding under Measure 9.4 Infrastructure and Environment Programme for 2007-2013 was: 13 462 375,51 PLN

The table below presents the project finance scheme in 2010:

Table 2.2.3a. **Project funding scheme Wind Farm** *Eko Energia.*

Sources of funding	Amount	Currency
Surcharge for capital	4 137 800,00	PLN
Investment loan	2 068 900,00	PLN
Loan pomostowy	14 482 300,00	PLN
Sum	**20 689 000,00**	PLN

Below are the final (including grants) Net investment financing structure in 2010:

*Table **2.2.3b*** Funding scheme including subsidies Wind Farm Project *Eko Energia*

Sources of funding	Amount	Currency
own funds (including loans)	6 206 700,00	PLN
funding (European Regional Development Fund)	14 482 300,00	PLN
Sum	**20 689 000,00**	PLN

2.2.4. *Wind Park GRABOSZEWO*

The following table shows the funding pattern of the project):

Table 2.2.4. Funding scheme of wind power *GRABOSZEWO.*

Description of the method and sources of funding of the project - including investment, operating and maintenance costs (the total amount)	
Investment	the total amount (amount invested): 15 079 688,78 PLN in it: - reconstruction of roads included in the indirect costs of activity: 341 990,98 PLN, - accrued interest 110 347,16 PLN, - finance costs (including interest)358 848,39 PLN

Living expenses such as general and administrative expenses	there is no separate cost of living for part of the investment, for total investment (ZEW Słupca 2.8 / EW Graboszewo 2.0 MW), they are about 3 000,00 PLN per month
Operating costs - ie energy for their own services, telecommunications, security, financial management - technical, with no depreciation	there is no separate cost of living for part of the investment, for total investment (ZEW Słupca 2.8 / EW Graboszewo 2.0 MW), they are about 56 000,00 PLN per month
Details of any external sources of financing, including loans and aid obtained to finance investment	
Bank loan	Bank loan (for the day 06.08.2012): 6 203 669,89 PLN Repayment schedule will be determined after the settlement of the grant. The final repayment date: 3 June 2025 year grace period for repayment of: 31 December 2012, excluding the impact of the unsettled part of the grant.
Loans from shareholder	For the day 06.08.2012 their value is 1 750 00,00 PLN and about 250 000,00 PLN of the accrued interest
State aid - EU funding	the amount of funding received by August 6 2012: 6 936 010,45 PLN recived in 5 664 523, 22 PLN

2.2.5. Wind Park JAROGNIEW – MOŁTOWO

The table below presents the project finance scheme:

Table 2.2.5. . Funding scheme of wind power *JAROGNIEW - MOŁTOWO.*

Sources of funding	Amount	Currency
Loan	102 915	PLN
Funding from the Ministry of Economy	40 000	PLN
Own funds	1 796	PLN
sum	144 711	PLN

2.2.6. Wind Park KALNIKÓW

The table below presents the project finance scheme:

Table 2.2.6 Funding scheme of wind power *KALNIKÓW.*

Sources of funding	Amount	Currency
Community contribution - contribution	32 595,50	PLN
own funds (own funds and loan)	14 494,37	PLN
sum	**47 089,87**	PLN

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2.2.7. Wind Park of KRZEMIEŃ i WSPÓLNICY company

The table below presents the project finance scheme for 2011 (net amount):

Table 2.2.7. Funding scheme of wind power KRZEMIEŃ I WSPÓLNICY.

Sources of funding	Amount	Currency
Own funds	6 063 496,17	PLN

2.2.8. Wind Park SANNIKI

The table below presents the project finance scheme:

Table 2.2.8 Funding scheme of wind power *SANNIKI.*

Sources of funding	Amount	Currency
BGŻ investment loan	31 000 000	PLN
Own funds (capital)	8 040 000	PLN
sum	**39 040 000**	**PLN**

2.2.9. Water-Power Plant BOBROWICE IV (TAURON)

See 2.1.9

2.2.10.Wind Park LIPNIKI (TAURON)

See 2.2.10.

2.2.11.Wind Park WARTKOWO

The table below presents the project finance schemefor 2011 (net amounts):

Table 2.2.11. Funding scheme of wind power *WARTKOWO.*

Sources of funding	Amount	Currency
Loan	215 484 908,96	PLN

2.2.12. Wind Park WOLBÓRZ

The table below presents the project finance scheme:

Table 2.2.12 Funding scheme of wind power *WOLBÓRZ.*

Sources of funding	Amount	Currency
Own funding	4 958 702	PLN
External financing (investment credit)	20 000 000	PLN
sum	**24 958 702**	PLN

INVESTMENT RECEIVED A GRANT FROM ROP II.9 IN HEIGHTS 11 229 770 ZŁ.

2.2.13Group of Wind Parks ŻEŃSKO

The table below presents the project finance scheme:

Table 2.2.13. Funding scheme of group of wind parks *Żeńsko*.

Sources of funding	Amount	Currency
own funds and investment credit	26 545 295,60	PLN
EU funding	11 350 679,50	PLN
sum	**37 895 975,10**	**PLN**

3. DESCRIPTION OF THE PROJECT'S BASELINE, THE DESIGN AND THE METHOD FOR ITS DETERMINING

3.1. Method of baseline determination, icluding the methodology applied in the project, with a justification

Baseline scenario

CDM Methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" Version 13.0.0 has been used, with two variations:

1. where ACM0002 refers to the "Tool to calculate the emission factor for an electricity system", a JI specific approach has been used, as the emission factor for the Polish national grid electricity system is provided by the the National Centre for Emissions Management (KOBiZE). The emission factor is fixed ex ante for the whole 2008-2012 period and is 0.812t CO_2/MWh;

2. Second variation from the CDM Methodology ACM0002 Version 13.0.0 is the project scenario demonstration of additionality, where Guidance on criteria for baseline setting and monitoring Version 3 (JISC 26, Annex 2) using option Annex I A 44. (b): Provision of traceable and transparent information showing that the same approach for additionality demonstration has already been taken in cases for which determination is deemed final and which can be regarded as comparable, using the criteria outlined for baseline determination in paragraph 12 (...).

Applicability

This methodology is applicable to grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).

As the project activity is the installation of a power plant/unit of a wind power plant/unit and is not the following:

- Project activitiy that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;
- Biomass fired power plant;

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- A hydro power plant that results in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the power plant is less than 4 W/m^2;

An applicability condition of the methodology are met.

Identification of the baseline scenario

The project activity is the installation of a new grid-connected renewable power plant/unit. The baseline scenario is the following:
Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

Baseline methodology is chosen to present best scenario that would occur in the case of no previous project. Baseline scenario implies that in the event of withdrawal of a project the electricity would be produced by operating, connected to the network, power plants and by adding a new source of production.

Electricity generation in Poland is based on fossil fuels, mainly coal and lignite. Polish energy system is dominated by conventional energy sources and it is expected that the current fuel mix will remain the same throughout the project's crediting period.

Main reasons for that are:

- very high (and rising) market prices of of oil and gas which means that their use for energy production is neither competitive norprofitable,
- limited water resources, which make it impossible to increase the participation of hydro power in the RES market,
- distant prospect of opening the first nuclear power plant (years 2021- 22) according to the national energy policy,
- large national deposits of coal, along with the relatively stable and low price,
- rather limited area with very good wind conditions suitable for efficient production of electricity (mostly along the coast and in the mountains).

Project scenario

Identification of the baseline scenario
Since the proposed project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected by the baseline emission factor published by KOBIZE.

In accordance with the provision laid down in article 41 paragraph 3 of the Act on the system of managing emissions of greenhouse gases and other substances of 17th of July 20091 (Polish Journal of Laws no. 130, item 1070, with subsequent amendments), the Minister of the Environment can determine, in a way of a decree, criteria for baseline setting, including emission factors or sectoral baselines and their monitoring methodologies.

KOBiZE has determined an emission factor, specifically for projects involving reduction of electricity production from non-renewable resources or reduction of energy consumption in installations covered by the EU ETS. This factor, which was approved by the Minister of the Environment, is the basis to determine the baseline and calculate the emissions avoided or reduced by the project. The factor was calculated in relation to monitored, verified and reported CO_2 emissions. It does not take into account CO_2 emissions from small energy sources, which are not covered by the EU ETS (due to the negligibly small scale of production and emissions from these installations as compared to CO_2emissions in the production of electricity from installations covered by the EU ETS). http://www.kobize.pl/materialy/jicdm/JI-wskaznik_referencyjny_26sie2011_publik.pdf

The scenario of the project involves the construction of wind park or water- power plant. Renewable energy produced by wind and water replaces energy produced based on non-renewable sources by conventional power plants and supplied to the Polish distribution network.

Emission reduction will be calculated based on the total amount of CO_2 emissions avoided by the operation of this project. Baseline implies a higher rate than the scenario of the project , for which the emission rate is zero. This implies that emissions from the project also equal zero.

Project boundary

The boundaries of the project are determined by the Polish Power Grid.

Baseline emission factor

The reference rate per unit of carbon dioxide emission from electricity production for JI projects implemented in Poland, given by National Centre for Emission Balancing and Management was used to set the baseline and amounts to 0.812 t CO_2/MWh.

Emission ratio is the basis for determining the baseline and for calculation of emissions avoided or reduced.

3.2. Source data used for the calculation of baseline

The following data have been assumed for the baseline calculation:

- the amount of electricity, supplied to the grid in particular years of operation of wind farm [MWh/yr]. Data on the amount of electricity, supplied in each year to the grid were acquired from the Operator, on the basis of invoices regarding the sale of electricity;
- carbon dioxide emission ratio for electricity production [t CO_2 / MWh].

Emission ratio provides a basis for determining the baseline and calculating the emission reduction resulting from implementation of this project.

Determined reference value of emission ratio should be used for setting the baseline for projects that reduce electricity production from non-renewable resources (ratio related to the production ratio), or reduce electricity consumption, derived by the operator of the national power grid.

As recommended by the National Centre for Emission Balancing and Management (KOBIZE) reference ratio of carbon dioxide emission for electricity production at the level of 0.812 t CO_2 / MWh has been applied.

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Data was obtained from the website of KOBiZE. Detailed information can be found in the study "The reference ratio per unit emission of carbon dioxide for electricity generation for the determination of baseline for JI projects implemented in Poland", available at www.kobize.pl

3.3. Determination of the applied baseline with justification

<u>Baseline emissions</u>

BE_y baseline [t CO_2/yr] has been calculated as the product of:

- amount of electricity, which was supplied to the network each year or the amount of electricity that will be supplied (based on real values and forecasts of electricity production) $EG_{PJ,y}$ [MWh/yr],
- reference carbon dioxide emission ratio for electricity production $EF_{grid,y} = 0.812$ [t CO_2/MWh];

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

$$BE_y = EG_{PJ,y} * EF_{grid,y}$$

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2/yr)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity in year *y* (MWh/yr)
$EF_{grid,CM,y}$	=	reference carbon dioxide emission ratio for electricity production 0.812 [t CO_2/MWh]

<u>Calculation of $EG_{PJ,y}$</u>

The calculation formula of $EG_{PJ,y}$ is selected for: (a) greenfield plants.

If the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, then:

$$EG_{PJ,y} = EG_{facility,y}$$

Where:

$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EG_{facility,y}$	=	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh/yr)

Additional emissions from the project

Emissions from the project are not taken into account. The main potential additional emissions are those that have arisen as a result of activities such as the construction of power plants and emissions from fossil fuel use (eg earth-works, in industrial processes, transport). These emissions are intentionally omitted.

3.4. Date of baseline setting

The date of the setting of the base level is **23.07.2012.**

3.5. Name of the entity setting the baseline

Carbon Engineering sp. z o. o.
28/12 Szlak Str.
31-153 Kraków
office: +48 12 376 82 43

fax: +48 12 378 93 23
www.carbonengineering.pl
KRS (National Court Registry Number): 0000351847

NIP (Tax Identifiaction Number): 676-241-61-56
REGON (Statistic ID Number): 12118233

4. ESTIMATION OF THE GREENHOUSE GAS EMISSIONS AVOIDANCE AND DESCRIPTION OF THE APPLIED EVALUATION METHODOLOGY

4.1. *Group of Wind Parks CZYŻEWO*

A.1. Determination of annual amounts

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

ER_y	=	Emission reductions in year *y* (tCO_2e/yr)
BE_y	=	Baseline emissions in year *y* (tCO_2/yr)
PE_y	=	Project emissions in year *y* (tCO_2e/yr)

The amount of the annual GHG emissions avoidance has been calculated as the product of the amount of electricity [MWh], which will be supplied into the grid each year, calculated on the basis of supplier invoices for sales of electricity and the reference ratio of emission of carbon dioxide for the production of electricity, amounting to 0.812 [t CO_2MWh].

The total amount of electricity supplied into the grid

Table 4.1a. ***Total amount of energy supplied annually to the grid***

year	The actual amount of electricity, supplied into the grid [MWh/yr]	Estimated amount of electricity [MWh/yr]	Total amount of electricity supplied into the grid [MWh/yr]	Commentary
2011	4895,96		4895,95	
2012	8936,468	8442	17 378	

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Annual GHG emission avoidance:

Table 4.1b Annual GHG emission avoidance

year	Total amount of electricity supplied into the grid [MWh]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [$tCO_{2/yr}$]
2011	4895,95	0,812	3 976
2012	17 378	0,812	14 111

B.1. Determining the total amount for the crediting period 2008-2012

The size of the total electricity production in the reference period 2008-2012 is estimated at 22 274,428 MWh. The emission avoided in the reference period 2008-2012 will amount to 18 087 Mg $CO_{2,}$ which is equivalent to 18 087 emission reduction units (ERUs).

C.1. Determining the total amount during the project's operation

In order to estimate the total emissions avoided during the operation of the project, a forecast of electricity production of 16 880 MWh/rok.

$$EG_{PJ,y} = 16\,884 \text{ [MWh/yr]}$$

Forecasted electricity production in 2013-2033 equals to:

$$EG_{PJ} = 20 \times 16\,884 = 337\,680 \quad \text{[MWh]}$$

The table below presents the total amount of emissions avoided during the project's operation, ie in the years 2008-2033:

Table 4.1c Total amount of GHG emission avoided during the project's operation

year	Total amount of electricity supplied into the grid $EG_{PJ,y}$ [MWh/yr]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [tCO_2/yr]
2008	-	0,812	
2009	-	0,812	
2010	-	0,812	
2011	4895,95	0,812	3 976
2012	17378,468	0,812	14 111
2013-2033	337 680	0,812	274 196

The amount of the total electricity production during the project's operation is estimated at 359 954 [MWh]. The amount of emissions avoided during the project's operation will amount to 292 283 [Mg CO_2], which equals to 292 283 ERU.

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D.1. Starting date for greenhouse gas emissions avoidance

Starting date for greenhouse gas emissions avoidance is 14.09.2011 (start of monitoring system).

E.1. Emission reductions generation period

It was assumed that the generation of ERUs from project covers the period from **14.09.2011 to 31.12.2012**, which is in line with international and national provisions governing the JI reduction projects, which are defined as a flexible mechanism for meeting the objectives of the Kyoto Protocol.

F.1. Estimation of the amount of greenhouse gas emissions generated by the project's operation

According to ACM0002 Version 13.0.0 for most renewable power generation project activities PE_y = 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

The proposed project activity does not consume any fossil fuels, is not a geothermal power plant and no hydro.

An emergency generator is located in the perimeter of the wind farm and is a source of power in case of power shortage from the 110kV grid. Immediately after a power failure, battery group is used to provide backup power.

Having in mind the above, it can be assumed that this project does not generate any GHG.

4.2.a. Wind Park DZIAŁOSZYN

A.2a. Determination of annual amounts

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

ER_y	=	Emission reductions in year *y* (tCO_2e/yr)
BE_y	=	Baseline emissions in year *y* (tCO_2/yr)
PE_y	=	Project emissions in year *y* (tCO_2e/yr)

The amount of the annual GHG emissions avoidance has been calculated as the product of the amount of electricity [MWh], which will be supplied into the grid each year, calculated on the basis of supplier invoices for sales of electricity and the reference ratio of emission of carbon dioxide for the production of electricity, amounting to 0.812 [t CO_2/MWh].

The total amount of electricity supplied into the grid

Table 4.2a. ***Total amount of energy supplied annually to the grid***

year	The actual amount of electricity, supplied into the grid [MWh/yr]	Estimated amount of electricity [MWh/yr]	Total amount of electricity supplied into the grid [MWh/yr]	Commentary
2012	3435,619	7751,381	11187	

Annual GHG emission avoidance:

Table 13.2b. ***Annual GHG emission avoidance***

year	Total amount of electricity supplied into the grid [MWh]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid/y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [$tCO_{2/yr}$]
2012	11187	0,812	9083,844

B.2a. Determining the total amount for the crediting period 2008-2012

The size of the total electricity production in the reference period 2008-2012 is estimated at 11187 MWh. The emission avoided in the reference period 2008-2012 will amount to 9083 Mg CO_2, which is equivalent to 9083 emission reduction units (ERUs).

C.2a. Determining the total amount during the project's operation

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In order to estimate the total emissions avoided during the operation of the project, a forecast of electricity production of 11,187 GWh.

$$EG_{PJ,y} = 11187\ [MWh/yr]$$

Forecasted electricity production in 2013-2033 equals to:

$$EG_{PJ} = 20 \times 11187 = 223\,740\ [MWh]$$

The table below presents the total amount of emissions avoided during the project's operation, ie. in the years 2008-2033:

***Table 4.2c** Total amount of GHG emission avoided during the project's operation*

year	Total amount of electricity supplied into the grid $EG_{PJ,y}$ [MWh/yr]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [t CO_2/yr]
2012	11187	0,812	9083
2013-2033	223 740	0,812	181 676

The amount of the total electricity production during the project's operation is estimated at 223 740 [MWh]. The amount of emissions avoided during the project's operation will amount to 181 676 [Mg CO_2], which equals to 181 676 emission reduction units (ERUs).

D.2a. Starting date for greenhouse gas emissions avoidance

Starting date for greenhouse gas emissions avoidance is **30.01.2012**

E.2a. Emission reductions generation period

It was assumed that the generation of ERUs from project covers the period from **30.01.2012 to 31.12.2012,** which is in line with international and national provisions governing the JI reduction projects, which are defined as a flexible mechanism for meeting the objectives of the Kyoto Protocol.

F.2a. Estimation of the amount of greenhouse gas emissions generated by the project's operation

According to ACM0002 Version 13.0.0 for most renewable power generation project activities PE_y = 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

The proposed project activity does not consume any fossil fuels, is not a geothermal power plant and no hydro.

An emergency generator is located in the perimeter of the wind farm and is a source of power in case of power shortage from the 110kV grid. Immediately after a power failure, battery group is used to provide backup power.

Having in mind the above, it can be assumed that this project does not generate any GHG.

4.3. Wind Park EKO – Energia

A.3. Determination of annual amounts

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad (5)$$

Where:

ER_y	=	Emission reductions in year *y* (tCO_2e/yr)
BE_y	=	Baseline emissions in year *y* (tCO_2/yr)
PE_y	=	Project emissions in year *y* (tCO_2e/yr)

The amount of the annual GHG emissions avoidance has been calculated as the product of the amount of electricity [MWh], which will be supplied into the grid each year, calculated on the basis of supplier invoices for sales of electricity and the reference ratio of emission of carbon dioxide for the production of electricity, amounting to 0.812 [t CO_2/MWh].

The total amount of electricity supplied into the grid

Table 4.14a. ***Total amount of energy supplied annually to the grid***

	The actual amount of	Estimated amount of	Total amount of	Commentary

year	electricity, supplied into the grid [MWh/yr]	electricity [MWh/yr]	electricity supplied into the grid [MWh/yr]	
2010	140,921		1 40,921	
2011	7 332,729		7 332,729	
2012	3 156,44	5002	8158,835	

Annual GHG emission avoidance:

Table 4.3b. *Annual GHG emission avoidance*

year	Total amount of electricity supplied into the grid [MWh]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [$tCO_{2/yr}$]
2010	140,921	0,812	114
2011	7 332,729	0,812	5 954
2012	8 159	0,812	6 625

B.3. Określenie wielkości całkowitej w okresie rozliczeniowym 2008-2012

The size of the total electricity production in the reference period 2008-2012 is estimated at 15 632,49 MWh. The emission avoided in the reference period 2008-2012 will amount to 12 694 Mg CO_2, which is equivalent to 12 694 emission reduction units (ERUs).

C.3. Determining the total amount during the project's operation

In order to estimate the total emissions avoided during the operation of the project, a forecast of electricity production of 7,504 GWh.

$EG_{PJ,y}$ = 7503,6 [MWh/yr]

Forecasted electricity production in 2013-2033 equals to 150 080 MWh

EG_{PJ} = 20 × 7503,6= 150 072[MWh]

The table below presents the total amount of emissions avoided during the project's operation, ie in the years 2008-2033:

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Table 4.3c. Total amount of GHG emission avoided during the project's operation

year	Total amount of electricity supplied into the grid $EG_{PJ,y}$ [MWh/yr]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [t CO_2/yr]
2010	140,921	0,812	114
2011	7 332,729	0,812	5 954
2012	8 159	0,812	6 625
2013 - 2033	150 072	0,812	121 858

The amount of the total electricity production during the project's operation is estimated at 165 704 [MWh]. The amount of emissions avoided during the project's operation will amount to 134 551[Mg CO_2], which equals 134 551 emission reduction units (ERUs).

D.3. Starting date for greenhouse gas emissions avoidance

Starting date for greenhouse gas emissions avoidance is **31.12.2010**

E.3. Emission reductions generation period

It was assumed that the generation of ERUs from project covers the period from **31.12.2010 to 31.12.2012**, which is in line with international and national provisions governing the JI reduction projects, which are defined as a flexible mechanism for meeting the objectives of the Kyoto Protocol.

F.3. Estimation of the amount of greenhouse gas emissions generated by the project's operation

According to ACM0002 Version 13.0.0 for most renewable power generation project activities $PE_y = 0$. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad \textbf{(6)}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

The proposed project activity does not consume any fossil fuels, is not a geothermal power plant and no hydro.

Having in mind the above, it can be assumed that this project does not generate any GHG.

4.4. *Wind Park GRABOSZEWO*

A.4. Determination of annual amounts

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad (7)$$

Where:

ER_y = Emission reductions in year *y* (tCO_2e/yr)

BE_y = Baseline emissions in year *y* (tCO_2/yr)

PE_y = Project emissions in year *y* (tCO_2e/yr)

The amount of the annual GHG emissions avoidance has been calculated as the product of the amount of electricity [MWh], which will be supplied into the grid each year, calculated on the basis of supplier invoices for sales of electricity and the reference ratio of emission of carbon dioxide for the production of electricity, amounting to 0.812 [t CO_2/MWh].

The total amount of electricity supplied into the grid

Table 4.4a. The total amount of electricity supplied into the grid

year	The actual amount of electricity, supplied into the grid [MWh/yr]	Estimated amount of electricity [MWh/yr]	Total amount of electricity supplied into the grid [MWh/yr]	Commentary
2011	1 842,258		1 842,258	
2012	2800,403	2785,597	5586	

Annual GHG emission avoidance:

Table 15.4b. **Annual GHG emission avoidance**

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year	Total amount of electricity supplied into the grid [MWh]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [$tCO_{2/yr}$]
2011	1 842,258	0,812	1 496
2012	5 586	0,812	4536

B.4. Determining the total amount for the crediting period 2008-2012

The size of the total electricity production in the reference period 2008-2012 is estimated at 7 428,258 MWh. The emission avoided in the reference period 2008-2012 will amount to 6 032 Mg CO_2, which is equivalent to 6 032 emission reduction units (ERUs).

C.4. Determining the total amount during the project's operation

In order to estimate the total emissions avoided during the operation of the project, a forecast of electricity production of 5,571 GWh

$$EG_{PJ,y} = 5\,571 \text{ [MWh/yr]}$$

Forecasted electricity production in 2013-2033 equals to 111 424 MWh.

$$EG_{PJ} = 20 \times 5571 = 111\,424 \text{ [MWh]}$$

The table below presents the total amount of emissions avoided during the project's operation, ie in the years 2008-2033:

Table 4.4c. ***Total amount of GHG emission avoided during the project's operation***

year	Total amount of electricity supplied into the grid $EG_{PJ,y}$ [MWh/yr]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [t CO_2/yr]
2011	1 842,258	0,812	1 496
2012	5 586	0,812	4 536
2013-2033	111 424	0,812	90 476

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The amount of the total electricity production during the project's operation is estimated at 118 852 [MWh]. The amount of emissions avoided during the project's operation will amount to 96 508 [Mg CO_2], which equals to 96 508 emission reduction units (ERUs).

D.4. Starting date for greenhouse gas emissions avoidance

Starting date for greenhouse gas emissions avoidance is **31.08.2011,** (start of monitoring system).

E.4. Emission reductions generation period

It was assumed that the generation of ERUs from project covers the period from **od 31.08.2011 to 31.12.2012,** which is in line with international and national provisions governing the JI reduction projects, which are defined as a flexible mechanism for meeting the objectives of the Kyoto Protocol.

F.4. Estimation of the amount of greenhouse gas emissions generated by the project's operation

According to ACM0002 Version 13.0.0 for most renewable power generation project activities PE_y = 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \qquad (1)$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

The proposed project activity does not consume any fossil fuels, is not a geothermal power plant and no hydro.

An emergency generator is located in the perimeter of the wind farm and is a source of power in case of power shortage from the 110kV grid. Immediately after a power failure, battery group is used to provide backup power.

Having in mind the above, it can be assumed that this project does not generate any GHG.

4.5. Wind Park JAROGNIEW – MOŁTOWO

A.5. Determination of annual amounts

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad (2)$$

Where:

ER_y = Emission reductions in year *y* (tCO_2e/yr)

BE_y = Baseline emissions in year *y* (tCO_2/yr)

PE_y = Project emissions in year *y* (tCO_2e/yr)

The amount of the annual GHG emissions avoidance has been calculated as the product of the amount of electricity [MWh], which will be supplied into the grid each year, calculated on the basis of supplier invoices for sales of electricity and the reference ratio of emission of carbon dioxide for the production of electricity, amounting to 0.812 [t CO_2/MWh].

The total amount of electricity supplied into the grid

Table 4.5a The total amount of electricity supplied into the grid

year	The actual amount of electricity, supplied into the grid [MWh/yr]	Estimated amount of electricity [MWh/yr]	Total amount of electricity supplied into the grid [MWh/yr]	Commentary
2010	6 730,46		6 730,46	
2011	53916,223		53916,223	
2012	34174,897	33833,739	68008,636	

Annual GHG emission avoidance:

Table 16.5b Annual GHG emission avoidance

year	Total amount of electricity supplied into the grid [MWh]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [$tCO_{2/yr}$]
2010	6 730,46	0,812	5 465
2011	53916,223	0,812	43780
2012	68008,636	0,812	55223

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B.5. Determining the total amount for the crediting period 2008-2012

The size of the total electricity production in the reference period 2008-2012 is estimated at 128 655,3 MWh. The emission avoided in the reference period 2008-2012 will amount to 104 468 Mg CO_2, which is equivalent to 104 468 emission reduction units (ERUs).

C.5. Determining the total amount during the project's operation

In order to estimate the total emissions avoided during the operation of the project, a forecast of electricity production of 59,379 GWh.

$$EG_{PJ,y} = 59\,379{,}38 \text{ [MWh/yr]}$$

Forecasted electricity production in 2013-2033 equals to 1 009 449 MWh

$$EG_{PJ} = 17 \times 59\,379{,}38 = 1\,009\,449 \text{ [MWh]}$$

The table below presents the total amount of emissions avoided during the project's operation, ie in the years 2008-2033:

Table 4.17c. ***Total amount of GHG emission avoided during the project's operation***

year	Total amount of electricity supplied into the grid $EG_{PJ,y}$ [MWh/yr]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [tCO_2/yr]
2010	6 730,46	0,812	5 465
2011	53 916,223	0,812	43 780
2012	68 008,636	0,812	55 223
2013 - 2030	1 009 449	0,812	819 673

The amount of the total electricity production during the project's operation is estimated at 1 138 105 [MWh]. The amount of emissions avoided during the project's operation will amount to 924 141 [Mg CO_2],], which equals to 924 141 emission reduction units (ERUs).

D.5. Starting date for greenhouse gas emissions avoidance

Starting date for greenhouse gas emissions avoidance is 01.11.2010, when wind park Jarogniew – Mołtowo started.

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E.5. Emission reductions generation period

It was assumed that the generation of ERUs from project covers the period from **01.11.2010 to 31.12.2012,** which is in line with international and national provisions governing the JI reduction projects, which are defined as a flexible mechanism for meeting the objectives of the Kyoto Protocol.

F.5. Określenie Estimation of the amount of greenhouse gas emissions generated by the project's operation

According to ACM0002 Version 13.0.0 for most renewable power generation project activities PE_y = 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad (3)$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

The proposed project activity does not consume any fossil fuels, is not a geothermal power plant and no hydro.

An emergency generator is located in the perimeter of the wind farm and is a source of power in case of power shortage from the 110kV grid. Immediately after a power failure, battery group is used to provide backup power.

Having in mind the above, it can be assumed that this project does not generate any GHG.

4.6. Wind Park KALNIKÓW

A.6. . Determination of annual amounts

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad (4)$$

Where:

ER_y	=	Emission reductions in year *y* (tCO_2e/yr)

BE_y = Baseline emissions in year *y* (tCO_2/yr)

PE_y = Project emissions in year *y* (tCO_2e/yr)

The amount of the annual GHG emissions avoidance has been calculated as the product of the amount of electricity [MWh], which will be supplied into the grid each year, calculated on the basis of supplier invoices for sales of electricity and the reference ratio of emission of carbon dioxide for the production of electricity, amounting to 0.812 [t CO_2/MWh].

The total amount of electricity supplied into the grid

Table 4.6a. Total amount of energy supplied annually to the grid

year	The actual amount of electricity, supplied into the grid [MWh/yr]	Estimated amount of electricity [MWh/yr]	Total amount of electricity supplied into the grid [MWh/yr]	Commentary
2012	4555,337	9110,674	13 666,011	

Annual GHG emission avoidance:

Table 18.6b Annual GHG emission avoidance

year	Total amount of electricity supplied into the grid [MWh]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [$tCO_{2/yr}$]
2012	13 666,011	0,812	11 097

B.6. Determining the total amount for the crediting period 2008-2012

The size of the total electricity production in the reference period 2008-2012 is estimated at 13 666,011 MWh. The emission avoided in the reference period 2008-2012 will amount to 11 097 Mg CO_2, which is equivalent to 11 097 emission reduction units (ERUs).

C.6. Determining the total amount during the project's operation

In order to estimate the total emissions avoided during the operation of the project, a forecast of electricity production of 13,666 GWh.

$EG_{PJ,y}$ = 13 666 [MWh/yr]

Forecasted electricity production in 2013-2033 equals to 273 320 MWh

$EG_{PJ} = 20 \times 13\,666 = 273\,320$ [MWh]

The table below presents the total amount of emissions avoided during the project's operation, ie in the years 2008-2033:

Table 4.19c. ***Total amount of GHG emission avoided during the project's operation***

year	Total amount of electricity supplied into the grid $EG_{PJ,y}$ [MWh/yr]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [tCO_2/yr]
2012	13 666,011	0,812	11 097
2013 - 2033	273 320	0,812	221 936

The amount of the total electricity production during the project's operation is estimated at 286 986 [MWh]. The amount of emissions avoided during the project's operation will amount to 233 033 [Mg CO_2], which equals to 233 033 emission reduction units (ERUs).

D.6. Starting date for greenhouse gas emissions avoidance

Starting date for greenhouse gas emissions avoidance is **29.09.2011.**

E.6. Emission reductions generation period

It was assumed that the generation of ERUs from project covers the period from **29.09.2011 to 31.12.2012,** which is in line with international and national provisions governing the JI reduction projects, which are defined as a flexible mechanism for meeting the objectives of the Kyoto Protocol.

F.6. Estimation of the amount of greenhouse gas emissions generated by the project's operation

According to ACM0002 Version 13.0.0 for most renewable power generation project activities $PE_y = 0$. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad \textbf{(5)}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

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The proposed project activity does not consume any fossil fuels, is not a geothermal power plant and no hydro.

An emergency generator is located in the perimeter of the wind farm and is a source of power in case of power shortage from the 110kV grid. Immediately after a power failure, battery group is used to provide backup power.

Having in mind the above, it can be assumed that this project does not generate any GHG.

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4.7. Wind Park KRZEMIEŃ i WSPÓLNICYcompany

A.7. Determination of annual amounts

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad \textbf{(6)}$$

Where:

ER_y = Emission reductions in year *y* (tCO_2e/yr)

BE_y = Baseline emissions in year *y* (tCO_2/yr)

PE_y = Project emissions in year *y* (tCO_2e/yr)

The amount of the annual GHG emissions avoidance has been calculated as the product of the amount of electricity [MWh], which will be supplied into the grid each year, calculated on the basis of supplier invoices for sales of electricity and the reference ratio of emission of carbon dioxide for the production of electricity, amounting to 0.812 [t CO_2/MWh].

The total amount of electricity supplied into the grid

Table 4.7a. ***Total amount of energy supplied annually to the grid***

year	The actual amount of electricity, supplied into the grid [MWh/yr]	Estimated amount of electricity [MWh/yr]	Total amount of electricity supplied into the grid [MWh/yr]	Commentary
2008	1 779,22		1 779,22	
2009	2 702,003		2 702,003	
2010	2 990,024		2 990,024	
2011	3 445,504		3 445,504	

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2012	1 095,017	2402,354	3497,371	

Annual GHG emission avoidance:

Table ***20.7b.*** *Annual GHG emission avoidance*

year	Total amount of electricity supplied into the grid [MWh]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [$tCO_{2/yr}$]
2008	1779,22	0,812	1 445
2009	2702,003	0,812	2 194
2010	2990,024	0,812	2 428
2011	3445,504	0,812	2 798
2012	3497,371	0,812	2 840

B.7. Determining the total amount for the crediting period 2008-2012

The size of the total electricity production in the reference period 2008-2012 is estimated at 14 414,1216 MWh. The emission avoided in the reference period 2008-2012 will amount to 11 704 Mg CO_2, which is equivalent to 11 704 emission reduction units (ERUs).

C.7. Determining the total amount during the project's operation

In order to estimate the total emissions avoided during the operation of the project, a forecast of electricity production of 3,203 GWh.

$$EG_{PJ,y} = 3\ 203{,}14 [MWh/yr]$$

Forecasted electricity production in 2013-2033 equals to 28 828 MWh.

$$EG_{PJ} = 9 \times 3\ 203{,}14 = 28\ 828\ [MWh]$$

The table below presents the total amount of emissions avoided during the project's operation, ie in the years 2008-2033:

Table ***4.7c.*** *Total amount of GHG emission avoided during the project's operation*

year	Total amount of electricity supplied into the grid $EG_{PJ,y}$ [MWh/yr]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [tCO_2/yr]
2008	1779,22	0,812	1 445

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2009	2702,003	0,812	2 194
2010	2990,024	0,812	2 428
2011	3445,504	0,812	2 798
2012	3497,371	0,812	2 840
2013-2022	28 828	0,812	23 409

The amount of the total electricity production during the project's operation is estimated at 43 242 [MWh]. The amount of emissions avoided during the project's operation will amount to 35 114[Mg CO_2], which equals to 35 114 emission reduction units (ERUs).

D.7. Starting date for greenhouse gas emissions avoidance

Starting date for greenhouse gas emissions avoidance is **20.06.2008**

E.7. Emission reductions generation period

It was assumed that the generation of ERUs from project covers the period from **20.06.2008 to 31.12.2012**, which is in line with international and national provisions governing the JI reduction projects, which are defined as a flexible mechanism for meeting the objectives of the Kyoto Protocol.

F.7. Estimation of the amount of greenhouse gas emissions generated by the project's operation

According to ACM0002 Version 13.0.0 for most renewable power generation project activities PE_y = 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \tag{7}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

The proposed project activity does not consume any fossil fuels, is not a geothermal power plant and no hydro.

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An emergency generator is located in the perimeter of the wind farm and is a source of power in case of power shortage from the 110kV grid. Immediately after a power failure, battery group is used to provide backup power.

Having in mind the above, it can be assumed that this project does not generate any GHG.

4.8. Wind Park SANNIKI

A. 8. Determination of annual amounts

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad (3)$$

Where:

ER_y = Emission reductions in year *y* (tCO_2e/yr)

BE_y = Baseline emissions in year *y* (tCO_2/yr)

PE_y = Project emissions in year *y* (tCO_2e/yr)

The amount of the annual GHG emissions avoidance has been calculated as the product of the amount of electricity [MWh], which will be supplied into the grid each year, calculated on the basis of supplier invoices for sales of electricity and the reference ratio of emission of carbon dioxide for the production of electricity, amounting to 0.812 [t CO_2/MWh].

The total amount of electricity supplied into the grid

Table 4.8a. ***Total amount of energy supplied annually to the grid***

year	The actual amount of electricity, supplied into the grid [MWh/yr]	Estimated amount of electricity [MWh/yr]	Total amount of electricity supplied into the grid [MWh/yr]	Commentary
2011	1 551,671		1 551,671	
2012	10 323,171	7421,776	17 744,947	

Annual GHG emission avoidance:

Table abela 21.8b. ***Annual GHG emission avoidance***

year	Total amount of electricity supplied into the grid [MWh]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [$tCO_{2/yr}$]
2011	1 551,167	0,812	1 260

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2012	17 744,947	0,812	14 409

B.8. Determining the total amount for the crediting period 2008-2012

The size of the total electricity production in the reference period 2008-2012 is estimated at 19 296,6182 MWh. The emission avoided in the reference period 2008-2012 will amount to 15 669 Mg CO_2, which is equivalent to 15 669 emission reduction units (ERUs).

C.8. Determining the total amount during the project's operation

In order to estimate the total emissions avoided during the operation of the project, a forecast of electricity production of 17,812 GWh

$$\mathbf{EG_{PJ,y} = 17\ 812{,}26\ [MWh/yr]}$$

Forecasted electricity production in 2013-2033 equals to: 356 245 MWh.

$$\mathbf{EG_{PJ} = 20\times 17\ 812{,}26 = 356\ 245\ [MWh]}$$

The table below presents the total amount of emissions avoided during the project's operation, ie in the years 2008-2033:

Table 4.8c. ***Total amount of GHG emission avoided during the project's operation***

year	Total amount of electricity supplied into the grid $EG_{PJ,y}$ [MWh/yr]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [tCO_2/yr]
2011	1 551,167	0,812	1 260
2012	17 744,946	0,812	14 409
2013-2033	356 245	0,812	289 271

The amount of the total electricity production during the project's operation is estimated at 375 542 [MWh]. The amount of emissions avoided during the project's operation will amount to 304 940 [Mg CO_2], co which equals to 304 940 emission reduction units (ERUs).

D.8. Starting date for greenhouse gas emissions avoidance

Starting date for greenhouse gas emissions avoidance is **12.2011**

E.8. Emission reductions generation period

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It was assumed that the generation of ERUs from project covers the period from **12.2011 to 31.12.2012** which is in line with international and national provisions governing the JI reduction projects, which are defined as a flexible mechanism for meeting the objectives of the Kyoto Protocol.

F.8. Estimation of the amount of greenhouse gas emissions generated by the project's operation

According to ACM0002 Version 13.0.0 for most renewable power generation project activities PE_y = 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad (8)$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

The proposed project activity does not consume any fossil fuels, is not a geothermal power plant and no hydro.

An emergency generator is located in the perimeter of the wind farm and is a source of power in case of power shortage from the 110kV grid. Immediately after a power failure, battery group is used to provide backup power.

Having in mind the above, it can be assumed that this project does not generate any GHG.

4.9. Water-Power Plant BOBROWICE IV (TAURON)

A.9. Determination of annual amounts

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad (9)$$

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Where:

ER_y = Emission reductions in year *y* (tCO_2e/yr)

BE_y = Baseline emissions in year *y* (tCO_2/yr)

PE_y = Project emissions in year *y* (tCO_2e/yr)

The amount of the annual GHG emissions avoidance has been calculated as the product of the amount of electricity [MWh], which will be supplied into the grid each year, calculated on the basis of supplier invoices for sales of electricity and the reference ratio of emission of carbon dioxide for the production of electricity, amounting to 0.812 [t CO_2/MWh].

The total amount of electricity supplied into the grid

Table 4.9a. Total amount of energy supplied annually to the grid

year	The actual amount of electricity, supplied into the grid [MWh/yr]	Estimated amount of electricity [MWh/yr]	Total amount of electricity supplied into the grid [MWh/yr]	Commentary
2008	790,134		790,134	
2009	4276,63		4276,63	
2010	4392,887		4392,887	
2011	3866,301		3866,301	
2012	2563,852	2072,583	4636,435	

Annual GHG emission avoidance:

Table 22.9b. Annual GHG emission avoidance

year	Total amount of electricity supplied into the grid [MWh]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [$tCO_{2/yr}$]
2008	790,134	0,812	642
2009	4276,63	0,812	3473
2010	4392,887	0,812	3567
2011	3866,301	0,812	3139
2012	4636,435	0,812	3765

B.9. Determining the total amount for the crediting period 2008-2012

The size of the total electricity production in the reference period 2008-2012 is estimated at 17 962,387 MWh.

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The emission avoided in the reference period 2008-2012 will amount to 14 585Mg CO_2, which is equivalent to 14 585 emission reduction units (ERUs).

C.9. Determining the total amount during the project's operation

In order to estimate the total emissions avoided during the operation of the project, a forecast of electricity production of 4,145 GWh.

$$EG_{PJ,y} = 4145,17 \text{ [MWh/yr]}$$

Forecasted electricity production in 2013-2033 equals to 83 903,4 MWh.

$$EG_{PJ} = 20 \times 4145,17 = 82\,903,4 \text{ [MWh]}$$

The table below presents the total amount of emissions avoided during the project's operation, ie in the years 2008-2033:

Table 4.9c. ***Total amount of GHG emission avoided during the project's operation***

year	Total amount of electricity supplied into the grid $EG_{PJ,y}$ [MWh/yr]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [tCO_2/yr]
2008	790,134	0,812	642
2009	4276,63	0,812	3473
2010	4392,887	0,812	3567
2011	3866,301	0,812	3139
2012	4636,435	0,812	3765
2013-2033	83 903,4	0,812	67 318

The amount of the total electricity production during the project's operation is estimated at 100 866 [MWh]. The amount of emissions avoided during the project's operation will amount to 81 904 [Mg CO_2], which equals to 81 904 emission reduction units (ERUs).

D.9. Starting date for greenhouse gas emissions avoidance

Starting date for greenhouse gas emissions avoidance is **26th September 2008 .**

E.9. Emission reductions generation period

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It was assumed that the generation of ERUs from project covers the period from **26.09.2008 to 31.12.2012**, which is in line with international and national provisions governing the JI reduction projects, which are defined as a flexible mechanism for meeting the objectives of the Kyoto Protocol.

F.9. Estimation of the amount of greenhouse gas emissions generated by the project's operation

According to ACM0002 Version 13.0.0 for most renewable power generation project activities PE_y = 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad (15)$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

4.10. Wind Park LIPNIKI (TAURON)

A.10. Determination of annual amounts

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad (10)$$

Where:

ER_y	=	Emission reductions in year *y* (tCO_2e/yr)
BE_y	=	Baseline emissions in year *y* (tCO_2/yr)
PE_y	=	Project emissions in year *y* (tCO_2e/yr)

The amount of the annual GHG emissions avoidance has been calculated as the product of the amount of electricity [MWh], which will be supplied into the grid each year, calculated on the basis of supplier invoices for sales of electricity and the reference ratio of emission of carbon dioxide for the production of electricity, amounting to 0.812 [t CO_2/MWh].

The total amount of electricity supplied into the grid

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Table 4.10a. *Total amount of energy supplied annually to the grid*

year	The actual amount of electricity, supplied into the grid [MWh/yr]	Estimated amount of electricity [MWh/yr]	Total amount of electricity supplied into the grid [MWh/yr]	Commentary
2011	16 554,220		16 554,220	
2012	35 496,54	26 025,380	61 521,920	

Annual GHG emission avoidance:

Table 23.10b. *Annual GHG emission avoidance*

year	Total amount of electricity supplied into the grid [MWh]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [$tCO_{2/yr}$]
2011	16 554,220	0,812	13 442
2012	61 521,920	0,812	49 956

B.10. Determining the total amount for the crediting period 2008-2012

The size of the total electricity production in the reference period 2008-2012 is estimated at 78 076,14 MWh. The emission avoided in the reference period 2008-2012 will amount to 63 398 Mg CO_2, which is equivalent to 63 398 emission reduction units (ERUs).

C.10. Determining the total amount during the project's operation

In order to estimate the total emissions avoided during the operation of the project, a forecast of electricity production of 52,050 GWh

$$EG_{PJ,y} = 52\,050{,}76\ [MWh/yr]$$

Forecasted electricity production in 2013-2033 equals to: 1 041 015 MWh.

$$EG_{PJ} = 20 \times 52\,050{,}76 = 1\,041\,015\ [MWh]$$

The table below presents the total amount of emissions avoided during the project's operation, ie in the years 2008-2033:

Table 4.10c. *Total amount of GHG emission avoided during the project's operation*

year	Total amount of electricity supplied into the grid	Reference ratio of emission of carbon dioxide for the production of electricity	Annual GHG emission avoidance ER_y [tCO_2/yr]

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	$EG_{PJ,y}$ [MWh/yr]	$EF_{grid,y}$ [t CO_2/MWh]	
2011	16 554,220	0,812	13 442
2012	61 521,920	0,812	49 956
2013-2033	1 041 015	0,812	845 304

The amount of the total electricity production during the project's operation is estimated at 1 119 091 [MWh]. The amount of emissions avoided during the project's operation will amount to 908 702 [Mg CO_2], which equals to 908 702 emission reduction units (ERUs).

D.10. Starting date for greenhouse gas emissions avoidance

Starting date for greenhouse gas emissions avoidance is **05.07.2011**

E.10. Emission reductions generation period

It was assumed that the generation of ERUs from project covers the period from **05.07.2011 to 31.12.2012,** which is in line with international and national provisions governing the JI reduction projects, which are defined as a flexible mechanism for meeting the objectives of the Kyoto Protocol.

F.10. Estimation of the amount of greenhouse gas emissions generated by the project's operation

According to ACM0002 Version 13.0.0 for most renewable power generation project activities $PE_y = 0$. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad \textbf{(11)}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

The proposed project activity does not consume any fossil fuels, is not a geothermal power plant and no hydro.

Having in mind the above, it can be assumed that this project does not generate any GHG.

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4.11. Wind Park WARTKOWO

A.11. Determination of annual amounts

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad (18)$$

Where:

ER_y = Emission reductions in year *y* (tCO_2e/yr)

BE_y = Baseline emissions in year *y* (tCO_2/yr)

PE_y = Project emissions in year *y* (tCO_2e/yr)

The amount of the annual GHG emissions avoidance has been calculated as the product of the amount of electricity [MWh], which will be supplied into the grid each year, calculated on the basis of supplier invoices for sales of electricity and the reference ratio of emission of carbon dioxide for the production of electricity, amounting to 0.812 [t CO_2/MWh].

The total amount of electricity supplied into the grid

***Table 4.10a.** . Total amount of energy supplied annually to the grid*

year	The actual amount of electricity, supplied into the grid [MWh/yr]	Estimated amount of electricity [MWh/yr]	Total amount of electricity supplied into the grid [MWh/yr]	Commentary
2012	32 786,733	36 877,037	69 663,77	

Annual GHG emission avoidance

***Table 24.10b.** Annual GHG emission avoidance*

year	Total amount of electricity supplied into the grid [MWh]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [$tCO_{2/yr}$]
2012	69 663,77	0,812	56 567

B.10. Determining the total amount for the crediting period 2008-2012

The size of the total electricity production in the reference period 2008-2012 is estimated at 69 663,77 MWh. The emission avoided in the reference period 2008-2012 will amount to 56 567 Mg CO_2, which is equivalent to

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56 567 emission reduction units (ERUs).

C.10. Determining the total amount during the project's operation

In order to estimate the total emissions avoided during the operation of the project, a forecast of electricity production of 64,305 GWh

$EG_{PJ,y}$ = **64 305,02 [MWh/yr]**

Forecasted electricity production in 2013-2033 equals to: 1 286 100,4 MWh.

EG_{PJ} = **20 × 64 305,02= 1 286 100,4 [MWh]**

The table below presents the total amount of emissions avoided during the project's operation, ie in the years 2008-2033:

*Table **4.10c.** Total amount of GHG emission avoided during the project's operation*

year	Total amount of electricity supplied into the grid $EG_{PJ,y}$ [MWh/yr]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [tCO_2/yr]
2012	94 506,302	0,812	76 739
2013-2033	1 286 100	0,812	1 044 313

The amount of the total electricity production during the project's operation is estimated at 1 355 764 [MWh]. The amount of emissions avoided during the project's operation will amount to 1 100 880 [Mg CO_2], which equals to 1 100 880 emission reduction units (ERUs).

D.11. Starting date for greenhouse gas emissions avoidance

Starting date for greenhouse gas emissions avoidance is **12.01.2012** .

E.11. Emission reductions generation period

It was assumed that the generation of ERUs from project covers the period from **12.01.2012 to 31.12.2012**, which is in line with international and national provisions governing the JI reduction projects, which are defined as a flexible mechanism for meeting the objectives of the Kyoto Protocol.

F. 11. Estimation of the amount of greenhouse gas emissions generated by the project's operation

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According to ACM0002 Version 13.0.0 for most renewable power generation project activities $PE_y = 0$. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad \textbf{(19)}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

The proposed project activity does not consume any fossil fuels, is not a geothermal power plant and no hydro.

An emergency generator is located in the perimeter of the wind farm and is a source of power in case of power shortage from the 110kV grid. Immediately after a power failure, battery group is used to provide backup power.

Having in mind the above, it can be assumed that this project does not generate any GHG.

4.12. Wind Park WOLBÓRZ

A.12. Determination of annual amounts

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad \textbf{(12)}$$

Where:

ER_y	=	Emission reductions in year *y* (tCO_2e/yr)
BE_y	=	Baseline emissions in year *y* (tCO_2/yr)
PE_y	=	Project emissions in year *y* (tCO_2e/yr)

The amount of the annual GHG emissions avoidance has been calculated as the product of the amount of electricity [MWh], which will be supplied into the grid each year, calculated on the basis of supplier invoices for sales of electricity and the reference ratio of emission of carbon dioxide for the production of electricity, amounting to 0.812 [t CO_2/MWh].

The total amount of electricity supplied into the grid

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Table 4.12a. *Total amount of energy supplied annually to the grid*

year	The actual amount of electricity, supplied into the grid [MWh/yr]	Estimated amount of electricity [MWh/yr]	Total amount of electricity supplied into the grid [MWh/yr]	Commentary
2011	3 646,205		3 646,205	
2012	5 987,894	4 379,136	10 367	

Annual GHG emission avoidance:

Table ***25.12b.*** *Annual GHG emission avoidance*

year	Total amount of electricity supplied into the grid [MWh]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [$tCO_{2/yr}$]
2011	3 646,205	0,812	2 961
2012	10 367	0,812	8 418

B.12. Determining the total amount for the crediting period 2008-2012

The size of the total electricity production in the reference period 2008-2012 is estimated at 14 013,234 MWh. The emission avoided in the reference period 2008-2012 will amount to 11 379 Mg CO_2, which is equivalent to 11 379 emission reduction units (ERUs).

C.12. Determining the total amount during the project's operation

In order to estimate the total emissions avoided during the operation of the project, a forecast of electricity production of 10,51 GWh

$$EG_{PJ,y} = 10\ 509{,}93 [MWh/yr]$$

Forecasted electricity production in 2013-2033 equals to: 210 198,6 MWh.

$$EG_{PJ} = 20 \times 10\ 509{,}93 = 210\ 198{,}6\ [MWh]$$

The table below presents the total amount of emissions avoided during the project's operation, ie in the years 2008-2033:

Table 4.12c. *Total amount of GHG emission avoided during the project's operation*

year	Total amount of electricity supplied	Reference ratio of emission of carbon dioxide for the	Annual GHG emission avoidance

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	into the grid $EG_{PJ,y}$ [MWh/yr]	production of electricity $EF_{grid,y}$ [t CO_2/MWh]	ER_y [tCO_2/yr]
2011	3 646,205	0,812	2 961
2012	10 367,03	0,812	8 418
2013-2033	210 198,6	0,812	170 681

The amount of the total electricity production during the project's operation is estimated at 224 212 [MWh]. The amount of emissions avoided during the project's operation will amount to 182 060 [Mg CO_2], which equals to 182 060 emission reduction units (ERUs).

D.12. Starting date for greenhouse gas emissions avoidance

Starting date for greenhouse gas emissions avoidance is **15.09.2011**

E.12. Emission reductions generation period

It was assumed that the generation of ERUs from project covers the period from **15.09.2011 to 31.12.2012**, which is in line with international and national provisions governing the JI reduction projects, which are defined as a flexible mechanism for meeting the objectives of the Kyoto Protocol.

F. 12. Estimation of the amount of greenhouse gas emissions generated by the project's operation

According to ACM0002 Version 13.0.0 for most renewable power generation project activities $PE_y = 0$. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad \textbf{(13)}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

The proposed project activity does not consume any fossil fuels, is not a geothermal power plant and no hydro.

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An emergency generator is located in the perimeter of the wind farm and is a source of power in case of power shortage from the 110kV grid. Immediately after a power failure, battery group is used to provide backup power.

Having in mind the above, it can be assumed that this project does not generate any GHG.

4.13. Group of Wind Parks ŻEŃSKO

A.13. Determination of annual amounts

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \tag{14}$$

Where:

ER_y = Emission reductions in year *y* (tCO_2e/yr)

BE_y = Baseline emissions in year *y* (tCO_2/yr)

PE_y = Project emissions in year *y* (tCO_2e/yr)

The amount of the annual GHG emissions avoidance has been calculated as the product of the amount of electricity [MWh], which will be supplied into the grid each year, calculated on the basis of supplier invoices for sales of electricity and the reference ratio of emission of carbon dioxide for the production of electricity, amounting to 0.812 [t CO_2/MWh].

The total amount of electricity supplied into the grid

Table 4.126a. ***Total amount of energy supplied annually to the grid***

year	The actual amount of electricity, supplied into the grid [MWh/yr]	Estimated amount of electricity [MWh/yr]	Total amount of electricity supplied into the grid [MWh/yr]	Commentary
2011	7 891,776		7 891,776	
2012	7 510,01	13 690	21 200	

Annual GHG emission avoidance

Table 27.13b. ***Annual GHG emission avoidance***

year	Total amount of electricity supplied into the grid [MWh]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [$tCO_{2/yr}$]

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2011	7 891,776	0,812	6 408
2012	21 200	0,812	17 215

B.13 Determining the total amount for the crediting period 2008-2012

The size of the total electricity production in the reference period 2008-2012 is estimated at 29 092,262 MWh. The emission avoided in the reference period 2008-2012 will amount to 23 623 Mg CO_2, which is equivalent to 23 623 emission reduction units (ERUs).

C.13. Determining the total amount during the project's operation

In order to estimate the total emissions avoided during the operation of the project, a forecast of electricity production of 20,536 GWh.

$$EG_{PJ,y} = 20\,535{,}71\ [MWh/yr]$$

Forecasted electricity production in 2013-2033 equals to 410 714,2 MWh.

$$EG_{PJ} = 20 \times 20\,535{,}71 = 410\,714{,}2\ [MWh]$$

The table below presents the total amount of emissions avoided during the project's operation, ie in the years 2008-2033:

Table 4.13c. Total amount of GHG emission avoided during the project's operation

year	Total amount of electricity supplied into the grid $EG_{PJ,y}$ [MWh/yr]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [tCO_2/yr]
2011	7 891,776	0,812	6 408
2012	21 200,486	0,812	17 215
2013-2033	410 714,2	0,812	333 500

The amount of the total electricity production during the project's operation is estimated at 439 807 [MWh]. The amount of emissions avoided during the project's operation will amount to 357 123 [Mg CO_2], which equals to 357 123 emission reduction units (ERUs).

D.13. Starting date for greenhouse gas emissions avoidance

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Starting date for greenhouse gas emissions avoidance is **25.08.2011**

E.13. Emission reductions generation period

It was assumed that the generation of ERUs from project covers the period from **25.08.2011 to 31.12.2012**, which is in line with international and national provisions governing the JI reduction projects, which are defined as a flexible mechanism for meeting the objectives of the Kyoto Protocol.

F. 13. Estimation of the amount of greenhouse gas emissions generated by the project's operation

According to ACM0002 Version 13.0.0 for most renewable power generation project activities $PE_y = 0$. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \qquad \textbf{(15)}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

The proposed project activity does not consume any fossil fuels, is not a geothermal power plant and no hydro.

An emergency generator is located in the perimeter of the wind farm and is a source of power in case of power shortage from the 110kV grid. Immediately after a power failure, battery group is used to provide backup power.

Having in mind the above, it can be assumed that this project does not generate any GHG.

F. 14. Determination of the total greenhouse gas emissions generated by the project

year	Total amount of electricity supplied into the grid $EG_{PJ,y}$ [MWh/yr]	Reference ratio of emission of carbon dioxide for the production of electricity $EF_{grid,y}$ [t CO_2/MWh]	Annual GHG emission avoidance ER_y [t CO_2/yr]	Expected revenue derived from the sale of ERUs 4EURO@ 4,00PLN [PLN]

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2008	2569,354	0,812	2086	33 376
2009	6978,633	0,812	5667	90 672
2010	14254,292	0,812	11574	185 184
2011	104942,847	0,812	85214	1 363 424
2012	312617	0,812	253846	4 061 536
2013-2033	5 735 063	0,812	4 656 871	74 509 942
2008-2033	6 176 425	0,812	5 015 257	80 244 117

The total amount of the electricity production in the period of the project is estimated at 6 176 425 [MWh]. Size avoided emissions during the project will be so 5 015 257 [Mg CO_2], which corresponds to emission reduction units 5 015 257 (ERUs). Estimated revenue from the sale of ERUs in the period 2008-2012 will amount to 4 061 519 PLN taking price 4EURO for one unit of ERUs at the exchange rate 1 EUR / PLN 4.

5. ASSESSMENT OF THE ADDITIONALITY CONNECTED WITH THE REALIZATION OF AN EMISSION AVOIDANCE PROJECT

5.1. National and sectoral policies

<u>Analysis of the wind energy sector in Poland</u>

Against the background of European countries, especially in view of these with a high utilization rate of renewable energy sources such as Germany, Spain and Denmark, Poland is a country that is definitely just in the phase of wind energy development. This source of renewable energy had practically not been used in Poland before 2000.

Large areas of the country with favorable wind velocity (5.5-7.0 m / s at a height of 50 m), make Poland one of the most attractive locations of wind farms in Europe. Interest of domestic and foreign companies in the acquisition of projects related to wind energy has been growing significantly as well.

According to the estimates presented by Polish Wind Energy Association (PWEA), more than 100 entities, which are developing projects or obtaining wind project investment areas - sub-contractors involved in the development of wind farms and experts engaged in environmental and energy development, designers and service companies, are currently operating in the domestic market.

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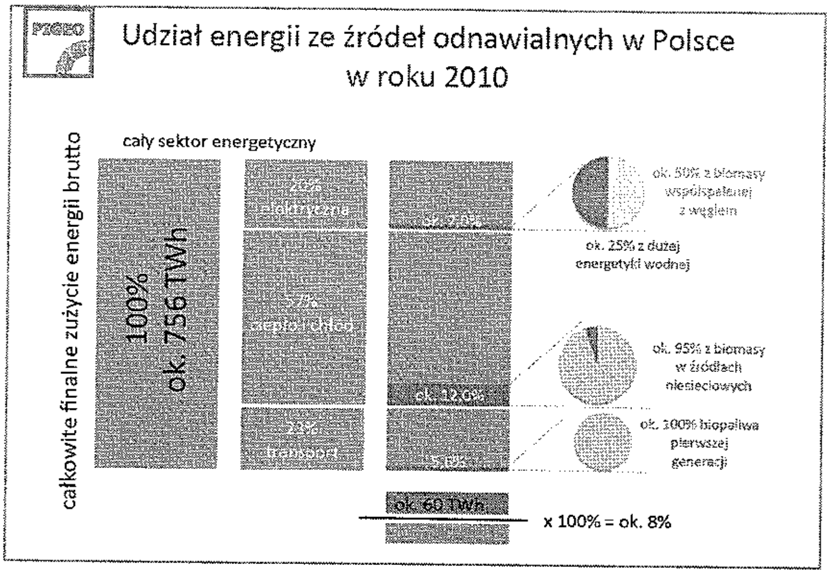

*Figure 2 **Udział energii OZE w Polsce w 2010** źródło: PIGEO*

In recent years, there has been a significant increase in installed capacity of wind farms in Poland, between 2000 and September 2009 it has increased by more than 166 times. The dynamic development is also proved by installation of facilities with a total capacity of 206 MW between 2007 and 2008.

However, according to PWEA analysis, saturation of wind power in Poland is among the lowest in Europe. The installed capacity in wind energy per capita is 0.012 kW, and per km2 of land area equals to 1.44 kW.

Electricity production in Poland – wind farms (GWh)					
2004	2005	2006	2007	2008	I-V 2009
142,3	*135,3*	*388,4*	*494,2*	*790,2*	*233,3*

*Table 28 **Produkcja energii elektrycznej w Polsce przez zawodowe farmy wiatrowe***
źródło: Urząd Regulacji Energetyki

According to the report "Wind power development in Poland - 2020 perspective" developed by PWEA, in 2020 wind farms will be the cheapest renewable source of electricity - a technology where the electricity production costs will be comparable with the costs of electricity production in existing nuclear power plants. Participation of wind power in electricity production will increase rapidly to 17% in 2020 and almost 29% in 2030.

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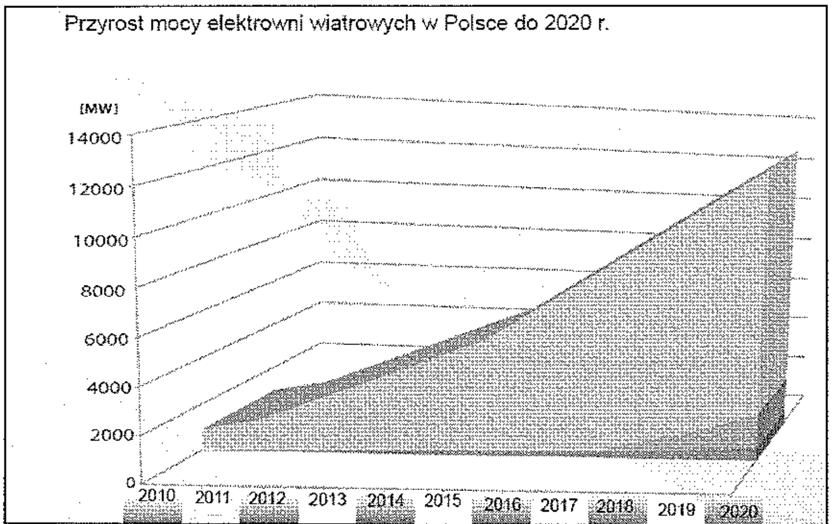

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
EW na lądzie	920	1404	2303	3202	4101	5000	6561	8098	9060	10008	10893
EW na morzu	0	0	0	0	0	0	0	0	500	1000	1500
Małe EW	1	5	10	70	130	190	250	310	369	429	600

Źródło: „Wizja rozwoju energetyki wiatrowej w Polsce do 2020 roku"

Figure 3 ***Prognoza przyrostu mocy elektrowni wiatrowych w Polsce do 2020***
Źródło: Raport „Wizja rozwoju energetyki wiatrowej w Polsce do 2020", PSEW

Wind energy is one of the cheapest technological options to avoid the emission of CO_2. According to the scenario, avoidance of the emission of CO_2 using wind energy will reach 33 million tons in 2020, with further potential for growth up to 65 million tonnes in 2030.

The development of wind energy sector will influence local business activity. Income from municipal property tax in 2020 is likely to equal to even 212 million PLN / year (about 2% of all rural municipalities' own revenues, and in case of municipalities with favourable wind conditions up to 17%). Tenants' revenues from wind farm sites in 2020 may account for over 100 million PLN / year. Wind energy will make a significant contribute to the implementation of 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 in the perspective of 2020.

__National and sectoral RES politicies__

No.	Title of the document	Main assumptions
1	**STATE ENVIRONMENTAL POLICY FOR THE PERIOD 2009-2012 with the prospect of 2016** (adopted the Resolution of the Parliament of 22 May 2009)	adoption of of the new Polish energy policy until 2030, which will incorporate mechanisms to stimulate both energy savings and promote development of renewable energy
2	**CLIMATE POLICY - Strategies to reduce greenhouse gas emissions in Poland by 2020** (adopted by the Council of Ministers on 4 November 2003)	after 2010 there will be need to build new capacity in power plants, construction of new coal plants means maintaining the relatively high CO_2 emissions from burning coal throughout many years; use of renewable energy resources (RES) is one of the most important actions that allow to effectively reduce GHG emissions, most

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		prospective technologies in Poland are: biomass power plants, wind farms, hydropower plants;
3	**POLAND'S ENERGY POLICY - 2025** (adopted by the Council of Ministers on 4 January 2005)	action plan for the wind energy boils down to just three tasks: to prepare maps of areas intended for start-up projects related to wind energy, the development of the concept of combination pumped storage power plants with wind turbines and a comparison of schemes to support renewable energy sources used in different countries; in the long term one should not expect significant changes in the Polish power sector, which will remain strongly focused on the coal;
4	**RENEWABLE ENERGY DEVELOPMENT STRATEGY** (adopted by the Council of Ministers on 5 September 2000)	strategic objective for participation of renewable energy in the fuel and energy balance in 2010 for Poland is almost half the size of the EU objective; however, forecasts regarding share of renewable energy in the fuel and energy balance of the country do not indicate that this participation by 2010 could be higher than 7.5%; it is necessary to iniciate development programs for various types of renewable energy sources that contribute to achieving strategic goals; these actions should allow for doubling the share of renewable energy in the fuel and energy balance in the perspective of 2020. compared to 2010 and obtaining the value of 14%;
5	**SUSTAINABLE DEVELOPMENT STRATEGY FOR POLAND 2025** (adopted by the Council of Ministers on 26 July 2000)	pro-ecologic activities, including the use of renewable energy resources and recycling materials will become competitive in the market through appropriate financial and fiscal policies, introducing the internalisation of external costs of health and environment protection products to the market prices;
6	**NATIONAL DEVELOPMENT PLAN 2007-2013** (adopted by the Council of Ministers on 11 January 2005)	increase in the participation of energy from renewable energy sources as one of the priorities of national development and as a key component of national energy security growth, through diversifying sources of energy production; it is also planned to modernize electricity grids and the RES energy infrastructure;

1. According to the **Environmental Policy** it is necessary to adoption as soon as possible a new Polish energy policy until 2030, which will incorporate mechanisms to stimulate both energy savings and promote development of renewable energy sources; these two methods, in the most radical way, reduce the emission of any pollutant into the environment, as well as they are cost effective and socially acceptable. **Poland committed itself to the participation of renewable energy sources in 2010 amounted to no less than 7.5% and in 2020 - 14% (according to the European Commission participation shall be not less than 15%). Only through extensive promotion of the use of these sources, along with economic and organizational incentives Poland can meet the objectives set by the EU.**

2. **Analysis of the potential of GHG emission reductions** undertaken within the **Polish Climate Policy** indicates that at a moderate rate of growth of electricity demand and a significant surplus of generation capacity in Poland after 2010, there is a need to build new capacity in power plants. **Among the energy technologies available in Polish conditions it is best chance of use have coal technologies (coal or lignite) or gas.** From the viewpoint of optimal allocation of fuel coal of the Polish mines to

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different consumers it would be beneficial to concentrate its exploitation in large energy facilities. In such facilities there are suitable technical and economic conditions for the use of effective technologies of the protection of the atmosphere from pollution from coal combustion.

On the other hand, construction of new coal power plants means maintaining relatively high CO_2 emissions from burning coal for many years. From the perspective of GHG emission reduction strategies it would be better to use high-efficiency natural gas-burning technology, working in the gas - steam cycle.

Moreover, the use of renewable energy resources (RES) - the use of technologies using renewable energy sources and projects in the field of energy saving are the most important activities allowing effective reduction of GHG emissions. Rational use of energy from renewable sources of energy such as rivers, wind, solar radiation geothermal energy or biomass, is one of the essential components of sustainable development, bringing measurable benefits and energy effects. **Most promising technologies in Poland are: biomass power plants, wind farms, hydroelectric power plants**

In this document, different variants of realization of climate policy were presented in three scenarios of GHG emission reductions:

- **Reduction reference scenario**: reduction of GHG emissions in accordance with current policy of the state (the most important is the assumption of the coal sector to maintain its activity at the level set on the basis of government reform program of coal mining. assumed 100-65 million tonnes of extraction and maintenance of electricity production based on lignite at the current level by 2020)but without forcing theshare of RES in the energy balance by 2020., which is set by the renewable energy strategy at the level of 14%;

- **Reduction market scenario**: a policy implemented in the released energy market - the release of structural limitations, including lack of forcing a 14% share of RES in the energy balance by 2020.,

- **Reduction ecological scenario:** a policy implemented in conditions of release of structural limitations, but forcing 14% share of RES in the energy balance by 2020, set by the renewable energy strategy.

3. **Polish Energy Policy until 2025 includes long-term forecasts of energy and action plans for the Polish government.** Key objectives include: increased the increase of (including the diversification of energy sources), increase of competitiveness for Polish energy sources in domestic and foreign markets, environmental protection, energy efficiency and reduction of carbon emissions associated with energy production.

The strategy takes into account the need to meet the obligations of the Treaty of Accession and EU directives (especially Directive 2001/77/EC, 2001/80/EC and 2001/81/EC), as well as it assumes certain transitional periods. However, an **action plan for the wind energy sector reduced only to three**

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tasks: to prepare maps of areas intended for launching of projects related to wind energy, the development of the concept of connections of pumped-storage hydro plants with wind farms and a comparison of schemes to support renewable energy sources used in different countries. In addition, "Polish Energy Policy" confirms that the Polish authorities are serious about building the first nuclear power plant in the years 2018-2020.

There are four different scenarios for long-term development of the Polish energy sector presented in the document - Treaty Variant, Coal Variant, Gas Variant, and Performance Variant. Forecasts for the use of various energy sources in different scenarios are based on the current structure the fuel consumption in the Polish energy sector, hence the assumption of continued domination of coal, particularly in the Treaty and Coal Variant, where the increase of coal consumption is expected. All scenarios assume the construction of nuclear power plant and use of nuclear energy around 2020.

Detailed investment plans of particular power plants are not publicly known. However, **based on consolidated data of the PSE it can be expected that after 2008 there will be an increased activity in the construction of new installations.** However, alongside with the modernization and construction of new power units, the old units will be switched off, which in turn can cause a drop in the total installed capacity.

In the long term one should not expect significant changes in the Polish power sector, which will remain firmly oriented towards coal. Polish International commitments will force the government to revise the policy in order to change the structure of electricity sources in Poland. However, the effects of these changes will not affect the emissivity of energy production before year 2012, which is the end of the crediting period.

4. The conclusions of the **Renewable Energy Development Strategy** indicate that the next few years, renewable energy will constitute a significant component of the energy balance of the European Union. The strategic goal for the share of renewable energy in the fuel and energy balance in 2010 for Poland is almost half the size of the EU. However, forecasts regarding the share of renewable energy in the fuel and energy balance of the country do not indicate that this share could be higher than 7.5% by 2010. During this time, the mechanisms proposed in this strategy and new solutions developed, will be checked and verified. At the same time we should proceed to development programs for various types of renewable energy sources that contribute to achieving strategic goals. These actions should allow for doubling the share of renewable energy in the national fuel and energy balance in the perspective of 2020. compared to 2010. and achieving the value of 14%.

The development of renewable energy sources offers an opportunity, especially for local communities, to maintain energy independence, regional development and new workplaces, as well as eco-friendly modernization, diversification and decentralization of the national energy sector. It is estimated that implementation of the objectives contained in the Strategy will allow the reduction of GHG emissions by approximately 18 million tons and to create additional 30-40 thousand. of workplaces. The sooner Poland engages in the development of renewable energy, the faster the domestic renewable energy industry, especially small and medium-sized enterprises will become an equal participant in the global market for renewable energy technologies. The existing technical potential of

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renewable energy sources requires the implementation of the tasks aimed at its best use, and without support from the state, the rapid development of renewable energy is not possible.

5. **Sustainable Development Strategy** confirms the previously discussed assumptions. The strategy underlines **the postulate that the pro-ecological activity, including the use of renewable energy resources and recycling materials will become competitive in the market through appropriate financial and fiscal policies, introducing the internalisation of external costs of health and the environment protection with market prices.** It is also necessary to support the development of science and environment-friendly technologies and intellectual property rights protection for these technologies , the free transfer of technology and environmental investments and support for the export of Polish technical ideas in this regard.

Polish Strategy for Sustainable Development must be supported by properly designed sectoral policies, including the state environmental policy, the policy of economic development, the policy of the development of the fuel and energy sector, resources policy, agricultural development policy, transport policy, planning policy and the regions of the country, politics development of science, education and higher education, health care policy, foreign affairs and home affairs, policy of the development of law and justice, labour and payroll policies, and finally, financial,, fiscal, customs and public procurement policy. In addition, the environmental components should be included in privatization programs, investment programs, educational programs and propaganda. Responsibility for their implementation must rest on environmental departments and the Treasury.

6. **The National Development Plan - Preliminary Draft for 2007-2013 - mentions the increase in the share of energy produced from renewable energy sources as one of the priorities of national development and growth and as a key component of national energy security by diversification of sources of energy production. The modernization of energy networks and energy infrastructure using RES is also planned.** These postulates were included in the new programming period of European funds, and the Operational Programme Infrastructure and Environment and Innovative Economy Operational Programme have been equipped with mechanisms and measures aimed at increasing the share of result in the production of "green" energy in overall energy balance of the country.

All the above mentioned strategies, relating in their thematic scope to the development of the RES and their main objectives and priorities clearly indicate that from the viewpoint of both the national economy, energy security and sustainable development, taking into account the interests of future generations, the support for the renewable energy sector is a very important goal for Poland in the next decades. This suggestion is based both on the Polish Government's commitments included in the international agreements such as the Kyoto Protocol and the Community rules, plans and strategies, in particular, the regulations included in the so-called. Climate-energy package 3x20.

Unfortunately, **the realization of these objectives and targets is not fully reflected in national legislation nor does it translate into real, tangible help in the investment process for the investors who are planning and implementing projects such as wind farms in Poland. The length of the entire investment process, which can take up to 8 years,and all kinds of barriers and difficulties, especially technical and organizational,** faced by investors are a major disincentive to renewable energy projects. On the one hand there are real commitments regarding the achievement of the share of energy production from renewable sources in the national balance

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sheet at 15%. Officially there is also a public aid for projects (mainly within EU structural funds, regional programs, Green Investment Scheme).

In reality, however, application for the support for investment is limited by various kinds of criteria, which are often difficult to meet and also by the size of the allocation alone. Number of entities that can benefit from such support is, therefore, in effect, very limited. Investors can be assured only of revenues from the sale of "green" energy and the revenues from the sale of certificates of origin. This does not always allow the full coverage of costs of investment and ongoing operation of the project. Therefore, **the possibility of obtaining revenue from the sale of emission reduction units (ERUs), granted for a certain level of CO_2 avoidance, is an additional, strong incentive for investors. This may be in many cases a very important condition that enables the decision to implement renewable energy investments in Poland, despite the not entirely favourable technical, organizational and legal conditions. This was also the case with the investor .**

5.2. The estimated internal rate of return with and without revenue from the sale of emission reduction units

For the calculation of the internal rate of return on investment was taken 4 EURO as the price per unit ERUs and exchange rate 4.00 PLN / 1 EURO. The estimated internal rate of return of the proceeds from the sale of ERUs in 2013 reflects the impact of the sale of ERUs for the whole period 2008-2012.

5.2.1. Group of Wind Parks CZYŻEWO

Estimated internal rate of return without revenue from the sale of emission reduction units: 15,50%
Estimated internal rate of return including revenue from the sale of emission reduction units: 15,59%

5.2.2. Wind Park DZIAŁOSZYN I – Bella Enterprise

Estimated internal rate of return without revenue from the sale of emission reduction units: 17,86%
Estimated internal rate of return including revenue from the sale of emission reduction units: 17,94%

5.2.3. Wind Park DIZAŁOSZYN II – Flower Enterprise

Estimated internal rate of return without revenue from the sale of emission reduction units: 17,62%
Estimated internal rate of return including revenue from the sale of emission reduction units: 17,69%

5.2.4. Wind Park EKO – Energia

Estimated internal rate of return without revenue from the sale of emission reduction units: 13,92%
Estimated internal rate of return including revenue from the sale of emission reduction units: 14,01%

5.2.5. Wind Park GRABOSZEWO

Estimated internal rate of return without revenue from the sale of emission reduction units: 12,54%
Estimated internal rate of return including revenue from the sale of emission reduction units: 12,61%

5.2.6. Wind Park JAROGNIEW – MOŁTOWO

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Estimated internal rate of return without revenue from the sale of emission reduction units: 18,12%
Estimated internal rate of return including revenue from the sale of emission reduction units: 18,14%

5.2.7. Wind Park KALNIKÓW

Estimated internal rate of return without revenue from the sale of emission reduction units: 17,50%
Estimated internal rate of return including revenue from the sale of emission reduction units: 17,63%

5.2.8. Wind Park KRZEMIEŃ I WSPÓLNICYcompany

Estimated internal rate of return without revenue from the sale of emission reduction units: 13,4%
Estimated internal rate of return including revenue from the sale of emission reduction units: 14,1%

5.2.9. Wind Park SANNIKI

Estimated internal rate of return without revenue from the sale of emission reduction units: 13,05%
Estimated internal rate of return including revenue from the sale of emission reduction units: 13,11%

5.2.10. Water-Power Plant BOBROWICE IV (TAURON)

Estimated internal rate of return without revenue from the sale of emission reduction units: 20,56%
Estimated internal rate of return including revenue from the sale of emission reduction units: 20,71%

5.2.11. Wind Park LIPNIKI (TAURON)

Estimated internal rate of return without revenue from the sale of emission reduction units: 12,70%
Estimated internal rate of return including revenue from the sale of emission reduction units: 12,79%

5.2.12. Wind Park WARTKOWO

Estimated internal rate of return without revenue from the sale of emission reduction units: 13,01%
Estimated internal rate of return including revenue from the sale of emission reduction units: 13,02%

5.2.13. Wind Park WOLBÓRZ

Estimated internal rate of return without revenue from the sale of emission reduction units: 17,50%
Estimated internal rate of return including revenue from the sale of emission reduction units: 17,63%

5.2.14. Group of Wind Parks ŻEŃSKO

Estimated internal rate of return without revenue from the sale of emission reduction units: 18,14%
Estimated internal rate of return including revenue from the sale of emission reduction units: 18,19%

5.3. Description of the difficulties that may occur during the implementation of the project and an indication of the way they are removed

List of formal, legal, economic, technical and social barriers identified by the investor during the preparation and implementation of investment

Legal barrier - One of the major barriers is the still unpredictable, inconsistent and ambiguous law. Concepts

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and principles of operation of renewable energy projects have changed several times in the past few years. In recent years there have been changes in a number of legal acts such as: Construction Law, Energy Law, Environmental Protection Law, The Nature Conservation Act, Public Procurement Law and the implementing regulations for these laws. The changes were very as far as legal conditions of the investment in wind energy are considered.

The difficulties indicated by the investor are largely coherent with the description of general and sectoral barriers for the investments in renewable energy sector, which are presented in a recent report of PKPP Lewiatan: *„The list of barriers in the energy sector"*, developed in May 2011, and also in the conclusions described in the report.: *„Wind energy in Poland"*, developed in November 2009 by the TPA Horwath and Domanski Zakrzewski Palinka.

In order to equalize the conditions of the operation of renewable energy installations in the energy market, there are instruments of support: legal (eg, quantitative liabilities), financial (eg subsidies from environmental funds and EU funds) and tax (eg the excise duty relief). They serve not only the renewable energy sector and obtaining its full competitiveness, but also the implementation of important general social objectives related to environmental protection, job creation, improving energy security, development of innovation and demonopolisation. These also serve directly the implementation of Poland's international obligations relating to i.a. environmental protection and in the current situation – the implementation of climate-energy package. However, they are difficult to access, application process is long and complicated, not always clear are the criteria upon which proposals are being rejected. It should be noted also that the funds are depleted long before the end of the programming period and the intensity of support is determined arbitrarily, in an uncoordinated manner and without a broader analysis of costs and technological learning curves.

Determination of the connection conditions by the investor of the project is one of the major ratios complicating and extending the investment process. Each case it requires difficult arrangements with the grid operator and the electricity company, before the final version of the document is accepted. In addition, each of of these evaluations must take into account other wind energy projects who have already received the connection conditions. However, most of these projects will not be implemented due to lack financial resources, and they simply block access to the network. Conditions remain valid for 2 years and during that period these projects keep exclusive rights for the connection in a particular location. This is why many new projects have difficulties obtaining the technical conditions of connection to the grid, especially if we consider the weak transmission system in certain regions of Poland.

The current state of transmission and distribution infrastructure does not allow for the transfer of such quantity of renewable energy to the grid, which in future years would enable the realization of a mandatory share of renewable energy in total energy sold. It should be emphasized that none of the existing regulations does oblige operators to modernize and develop the transmission infrastructure. This issue remains therefore a matter for the respective boards of corporations, but it is no secret that the primary investment objectives of all major energy groups are within the the area of reconstruction and construction of new capacity, rather than modernization of or construction of the transmission / distribution infrastructure. In practice, the source of wind mainly depends on the capacity of local distribution systems and to a lesser extent on the condition of national high voltage transmission system.

The result of the above described barriers to the development of wind energy sector is the fact that **duration of the investment process in Poland is still very long and equals to an average of 4 to 7 years, while the project preparation duration until the start construction works can take range from one year to 5 years, and the**

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lower limit of this range applies to projects of small capacity. Not all investors, despite the start of preparatory actions, finalize the scheduled projects.

5.4. Justification of the project's additionality

During the implementation of the wind power project in Korsze, company EDP Renowables Sp. z o.o. was forced to overcome the above mentioned barriers and difficulties, which were for her a financial, organizational and time ballast.

Thanks to the experience of persons involved in the project preparation and determination of the project owners (specialized in projects related to wind energy) it was possible to overcome such sectoral and individual barriers and to complete the project successfully. The above conclusions drawn from the history of the investment and difficulties encountered in connection with its realization, together with the analysis of RES industry sector presented in Section 5 A. of this project documentation implicate, according to the investor, the fulfillment of the condition of additionality of the project, within the meaning of Article 6.1 (b) of the Kyoto Protocol.

Annex 1, A. Additionality 44. Stipulates, that additionality can be demonstrated, by using one of the presented approaches. Option (b) has been selected:

(b) Provision of traceable and transparent information showing that the same approach for additionality demonstration has already been taken in cases for which determination is deemed final and which can be regarded as comparable, using the criteria outlined for baseline determination in paragraph 12 above.

Till now, only two JI project wind energy projects in Poland, received status of a "projects for which determination is deemed final":

Lake Ostrowo http://ji.unfccc.int/JIITLProject/DB/S4IZCRCSRZ9K8LO1W7SF42J9EY24KK/details (LoA 2007 Jan 31) ITL Project ID: PL1000063
http://www.dnv.com/focus/climate_change/upload/pdd%20and%20monitoring%20plan%20-%20lake%20ostrowo.pdf

and

Zagorze http://ji.unfccc.int/JIITLProject/DB/34F3QUAKGOUUEKOBGFVQPUREG06603/details (LoA 2005-01-10) ITL Project ID PL1000065 http://www.dnv.com/focus/climate_change/upload/zagorzewindpddpoland.pdf has been accepted and registered.

Lake Ostrowo is located nearby Wolin, a small city located in Zachodniopomorskie Province in Poland. The total installed nominal generating capacity is 30.6 MW, resulting from erecting 17 wind turbines of 1.8 MW installed capacity each

Zagorze wind farm is located on Wolin peninsula, a region in the north western part of Poland and utilizes 15 2MW Vestas wind turbines.

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As most recent, a Lake OSTROWO 30.6 MW JI Project was selected to prove comparability.

GUIDANCE ON CRITERIA FOR BASELINE SETTING AND MONITORING Version 03, B. paragraph 12, reads:

If a project participant wishes to use an approach for baseline setting and monitoring already taken in comparable cases, only those JI projects for which determination is deemed final can be considered as comparable. Moreover, a project may be considered comparable if appropriately substantiated and justified, and in any case shall be considered comparable if the following conditions apply:

(a) **środek redukcji GHG.** The boundaries of the proposed project and other project (s) will include similar sources of GHG emissions and emission reductions are achieved by similar means, and Both projects use turbines and renewable energy in the form of wind. The similarity can be demonstrated almost immediate, because in most cases they are the same or very similar structures (Lake Ostrowo used wind turbines Vestas V90-1.8MW)

(b) **Lokalizacja geograficzna i czas.** The proposed project, and another project (s) will be located within the same Host Country and the period of time between the start dates and other proposed project (s) that will not be a long five years, and

Both projects are located in Poland and connected to the same national power grid.

Project start date is 09/01/2006 Lake Ostrowo (PDD page 33 Chapter C.1) and the PWB project is 05.03.2007.

(c) **Skala.** The difference between the proposed project and another project (Project) is less than 50 per cent in relation to the size of the project (ie, installed capacity, increasing the installed capacity, etc.) or services, and

Both projects can be classified as large-scale operations. Lake Ostrowo consists of 17 units and an output of 30.6 MW. PWB design and consists of a larger number of smaller projects, where the installed capacity of less than 30MW. The total installed capacity of the project is about 120mW, but in a project of this type, the so-called crossing. large scale, the difference in installed capacity is only a matter of investment decision and the number of turbines. Projects do not adversely affect the environment, and other infrastructure is virtually identical.

(d) **Ramy prawne.** Between the starting dates of the proposed project and the other project(s) the regulatory framework has not changed in a manner that would affect the baseline of these projects.

No significant changes in regulatory framework have come into force between the starting dates of the projects, and none, that would affect the baseline. Poland's power mix structure did not change significanty even till 2012. Poland energy generation is still more than 90% based on coal. There were no significant investments made to improve Poland's old national power grid, and almost all capacity additions in Poland since 2006 (and earlier) were based on brown coal.

Both projects are characterized by a high volume of business, using the same technology and are connected to the same national network, so you can establish the link between reducing activities. Taking into account the above, has to fulfill the criteria of additionality under option b) set out in the decision JISC 26, Annex 2, A 44.

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6. MONITORING PLAN

Identification of the data and information that should be collected to monitor the project and the method of data collection, analysis and storage

In order to monitor the project it is necessary to systematically and accurately collect data on electricity production, introduced into the national grid, as a result of the wind farm.
The companies signed an agreement for the sale of energy from a distribution company.
Billing is done monthly or quarterly.
The official source of information about the amount of energy produced are certified electricity meters. Meter data are the basis for electricity sales invoices. Meter reading procedure is in accordance with the Energy Law.

Description of formulas used to calculate the emissions generated by the project, along with their description

The project contributes to the reduction of carbon dioxide emissions by transferring to the power grid the renewable electricity, which replaces the energy that would otherwise have been produced by conventional power plants using fossil fuels.

Emission reduction ERy by the Project during the year y is the difference between baseline emission (BEy) and emission of the project (PEy) and emission caused by leakage (Ly):

ERy = BEy – Pey – Ly

Baseline emission equals BEy:

BEy = Ey × WE

$EG_{PJ,y}$ – Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity in year y (MWh/yr)
$EF_{grid,y}$ – reference carbon dioxide emission rate for electricity production
$WE_{grid,y}$ = 0,812 [t CO_2/MWh]

The project does not result in GHG emissions, nor create a risk of of additional emissions due to leakage, therefore:

Pey = 0
Ly = 0

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Therefore, the project's emission reduction equals to:

$$ER_y = BE_y = E_y \times WE$$

Determination of procedure for monitoring the reliability of data and information gathered in order to monitor the project

MONITORING PLAN

The procedure for reviewing the accuracy of data and information collected to monitor the project Wind Park Korsze for the purpose of granting of the emission reduction units (ERUs)

	Name and surname	Position	Date	Signature
Developed by:				
Accepted by:				

A . Duration of the monitoring and the methodology applied:

The study contains a description of the procedures necessary to determine the amount of generated and delivered to the power grid used to calculate the number of emission reduction units (ERUs) generated by the project.

For the purpose of this project is expected to collect data on the amount of renewable energy supplied to the grid in the period 2008-2012. The methodology is a system for collecting and transmitting to the PWB (project coordinator) of all electricity sales documents (invoices) from individual participants during the project.

B. The allocation of responsibilities, rules for obtaining data, running the calculations and internal control:

The person designated in the PWB assembles and collates data in Excel on the sale of electricity generated by each of the project participants.

The project participants shall report to the end of February each year, selling a set of documents (invoices) for the previous year in the form of paper and electronic (scanned).

The person appointed by the PWB, make a list of all invoices in order to calculate the amount of electricity supplied to the grid in a calendar year - after a set of documents from the various participants.

The person appointed by the PWB, is responsible for monitoring whether the individual participants send the documents in accordance with this procedure. In case of any delays or lack of transfer documents, immediately contacted the president of PWB.

Calculations are performed in a spreadsheet, which leads a person appointed by the PWB.

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Calculations are based on adding up the total amount of energy that is delivered to the grid by all participants in a calendar year [MWh] and multiplying it by the volume to obtain the following reference benchmark of carbon dioxide for the production of electricity amounting to 0.812 [Mg CO_2 / MWh].

The form and layout of the monitoring report are determined in the decree of the Minister of the Environment of 10th November 2010 on the statement from monitoring and verification report on number of ERUs achieved by the JI project (Polish Journal of Laws no. 225, item 1472) – any possible change to the required layout and content of required information shall be verified against any changes by the Asset Manager before preparing of the monitoring report.

Storage of the Data

The information provided by the project participants (invoices) are stored in paper form at the registered office PWB.
All calculations carried out in a spreadsheet are archived on the server and after generating and testing the report in paper form in a folder by an employee designated by the President of the PWB.

Shelf life is 10 years.

C. Corrective actions procedure for the Monitoring Plan

1. Aim of the procedure

The aim of the procedure is to ensure that in case of non-conformance or threat to the quality of actions resulting from the Monitoring Plan, an adequate corrective or preventive measures are undertaken to eliminate the cause of the non-conformance and threats, depending on the degree of the problem's importance and the occurring threats.

2. Subject of the procedure

The Procedure incorporates the course of conduct to be followed during implementation of the corrective (preventive) measures from the time of the non-conformance (threats to quality) ascertainment to the time of the documented confirmation of the effectiveness of the measures and implementation of possible changes to the quality system documentation.

3. Responsibility

PWB President is responsible for the corrective action.

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Source of information for action are:

- reporting officer responsible for collecting data and making calculations
- the results of the annual internal control report prepared
- Notes, non verifier report

4. Procedure

CORRECTION

If as a result of an internal review or verification by an external verifier will be the errors in the data or calculations, proceed immediately to their removal and correction of the report.

CORRECTIVE ACTION

Regardless of the immediate correction of the data, and in other cases described in the third point, President of PWB alone or together with their team set up to analyze information as soon as available in order to determine their causes. Once the cause (if possible) the proposed corrective action and indicated the person responsible for their implementation. Both of the analysis of how the proposed activities are documented in a memo from the analysis. Responsible person at the end of the activities described in the note, shall prepare a report on the implementation of activities and sends it to the President of the PWB.

Note shall be kept at the registered office PWB.

PWB President or a person designated by him shall not be less like every 12 months reviewing the effectiveness of the introduction of corrective actions based on the information sent.

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