

Non-Technical  
Executive Summary

MARGONIN WIND FARM  
PROJECT, POLAND



## Introduction

EDP Renovaveis, the world's fourth largest wind power operator is developing a major wind farm in the central part of Poland - Wielkopolskie Voivodship associated with the construction and development of wind farm projects in the Margonin area by EDP Renovaveis. The aim of this non-technical summary is to ensure that a cumulative assessment of the planned wind farm developments in the region can be presented to enable meaningful public and stakeholders engagement process.

Attached to this documents are non-technical resumes which are integral part of the Environmental Impact Assessment Reports which are presented separately. In line with the Polish environmental regulations the need of preparation of an Environmental Impact Assessment is required for this project.

## General project presentation

EDP Renovaveis is a leading international wind power developer, with a number of active wind farms located in the USA, Brazil, Spain, France, Belgium and Portugal. Installed capacity of EDP wind energy increased four-fold between 2005 and 2007, and now the company is among the world top three firms in the world in terms of growth in this sector.

As a leading wind developer, the company is committed to guide the business activity in accordance with the sustainable development principles of the EDP Group, including among others:

- Efficient use of resources, including the development of cleaner and more efficient energy technology and development of energy generation means based on renewable sources;
- Environmental protection with minimization of the environmental impact of all business activities and participation in initiatives that contribute to the conservation of the environment;
- Support social development.

Additional information on EDP sustainability can be found here:

[www.edp.pt/en/sustentabilidade/Pages/HPSustentabilidade.aspx](http://www.edp.pt/en/sustentabilidade/Pages/HPSustentabilidade.aspx)

EDP has established a set of guidelines to minimise environmental impact during various development phases in the construction of new wind farms, including project design phase, construction phase, operating phase and finally deactivation phase. In Poland, EDP Renovaveis is in the process of developing one of the largest wind farm projects, located near the Notec River in central Poland (the "Project"). It is planned that a total of 240 MWe will be developed by EDP in the region. The first stages (Margonin wind farm) are already operational or under development, with an additional Pawlowo wind farm planned in the years 2010-12. The Company will implement environmental management system in accordance with ISO 14001 within 2 years of completing the Margonin east and west wind farms.

The project Margonin consists of two main phases, currently at different stages of the development:

1. Margonin Zachod wind farm - under construction, total power 22 MW, and
2. Margonin Wschod wind farm - permitted and under construction, 98 MW.

In total 60 individual wind turbines, each of 2 MW of power, are constructed at Margonin wind farms. The power stations with blades are installed on 100-metre high structures. The maximum height of the turbines reaches 145 m (tower plus blades).

Adjacent to the Margonin project the Developer plans to construct another wind farm (Pawlowo), which due to the cumulative impact has been included in this summary. Pawlowo wind farm is under an initial stage of development, and due to administrative procedure it can be divided into 3 individual but finally combined parts, including:

1. Golancz Commune wind farm – at the stage of environmental decision verification and construction conditions setting; initial plans - 90 MW and 60 individual wind turbines, each 1.5 MW;
2. Golancz Commune wind farm – the same commune but different location, a stage of zoning plan preparation, 5 wind turbines, each 1.5 MW;
3. Wagrowiec Commune wind farm - at the stage of a zoning plan preparation - 31 wind turbines; it is planned to develop this part together with 5 turbines in Golancz commune.

Other energy-oriented projects located in the area are also discussed. These include:

- Reconstruction of an existing 110 kV overhead power line. This investment includes deconstruction of existing structures including transmission line supports and a construction of a new two-track 110 kV overhead line on the route Pila - Krzewina – Chodziej – Margonin, of total length of approximately 24.3 km, as well as a construction of 83 new high voltage overhead transmission line supports;
- Development of electrical substation with electric cables net;
- Significantly smaller scale wind farms located in Morakowo village (close to Pawlowo wind farm) and Budzyn wind farm (close to Margonin East wind farm).

## Wind turbine description

A typical wind turbine consists of a tower and a gondola comprising a rotor and measurement apparatus. The rotor is composed of the blades and an axle, attached to each other by a bearing. The blades are moved by the wind and transmit this force to the bearing, which is connected to a multiplier that increases the axle speed. The mechanical energy is transferred from the multiplier to an electricity generator, which transforms it into electricity for subsequent injection into the grid.



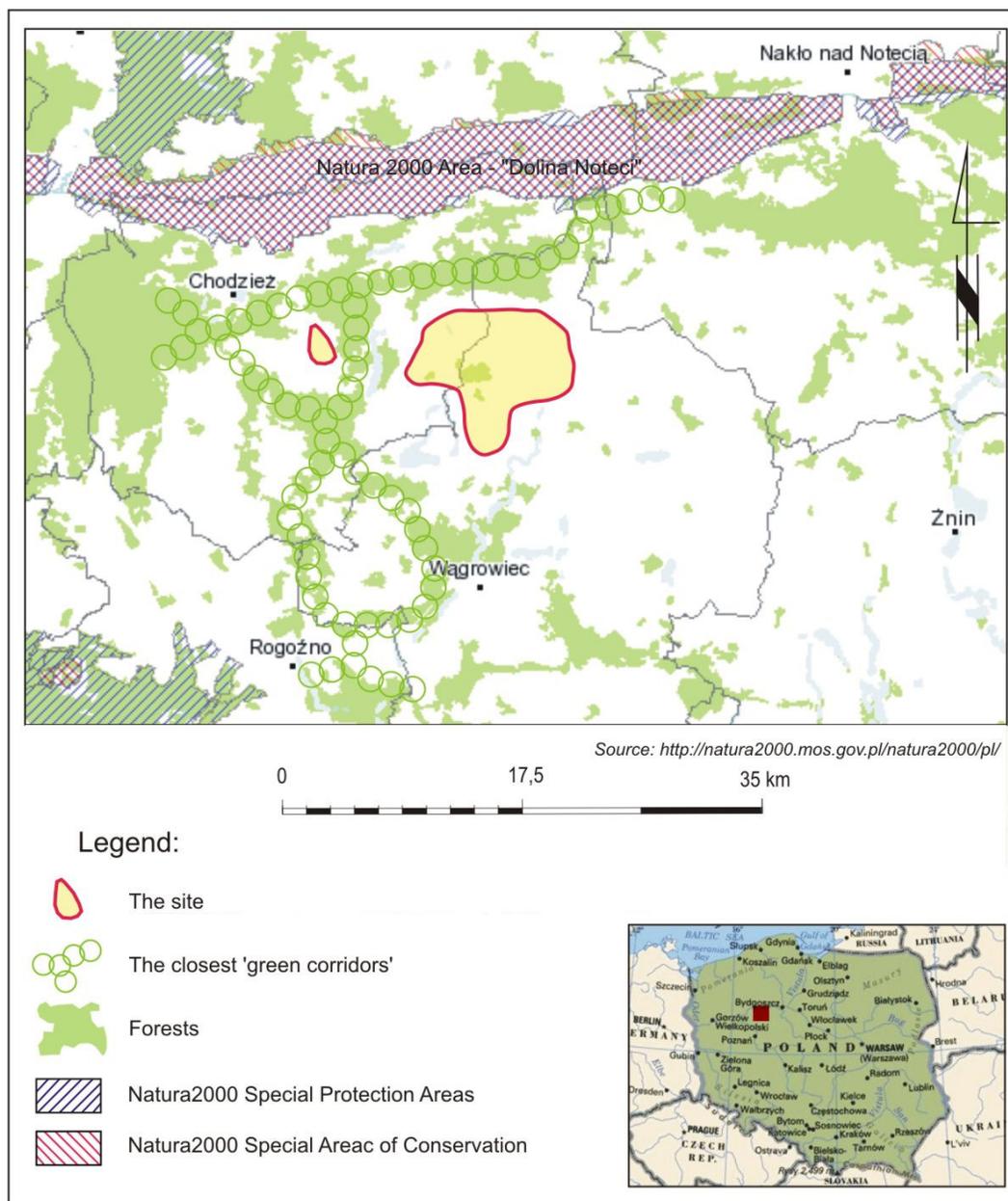
Source: [www.gamesacorp.com](http://www.gamesacorp.com)

The wind turbines installed in Margonin wind farm of Gamesa producer are installed on 100-metre towers with blades of 90 m of height. The maximum height of the turbines reaches 145 m (tower plus blades). Each of the turbines can generate 2 MW of power.

Assuming that the Margonin wind farms (60 wind turbines) will operate 40% of time the energy production will equal approximately to 63,000 MWh. This allows to avoid the emissions to the atmosphere of over 65,000 tons of carbon dioxide each year (if the same amount of energy is generated at the power plant fuelled with brown coal).

## Project Location

The planned wind farm is located in the central-western Poland between Poznan and Bydgoszcz cities, eastern part of Wielkopolskie Voivodship.



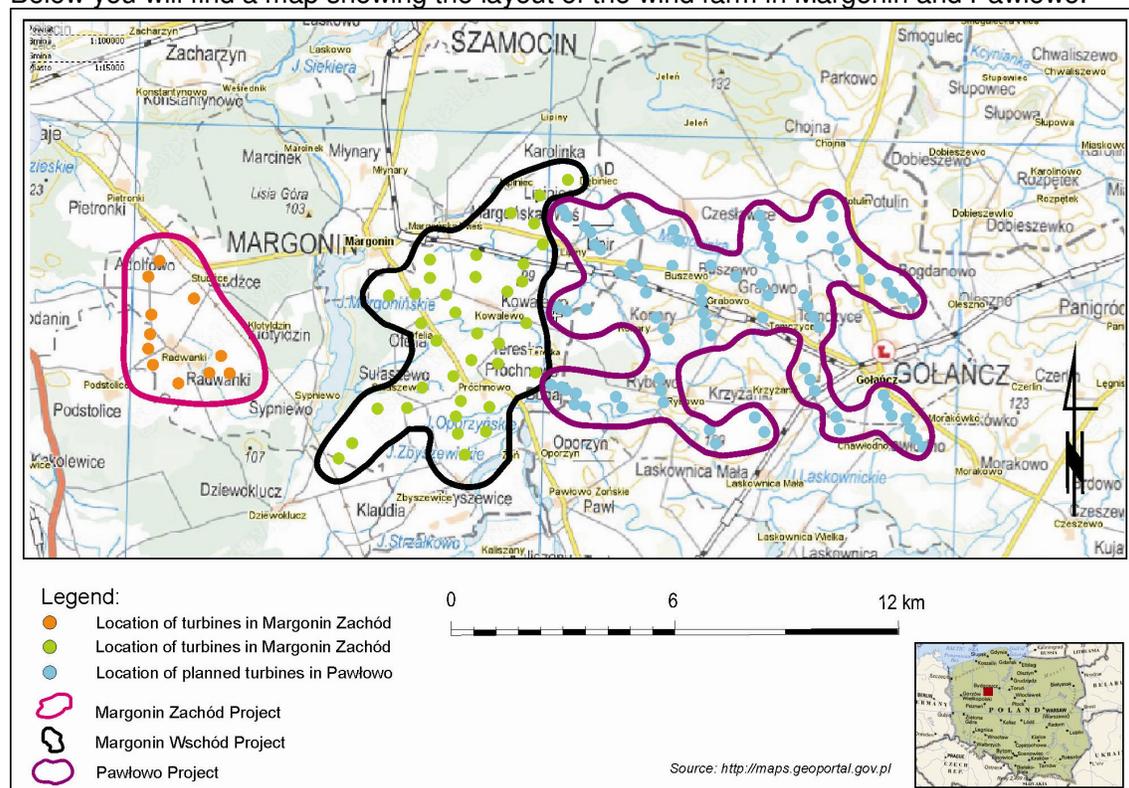
From administrative point of view the project is located predominantly in Margonin commune (Margonin Wschod and Margonin Zachod wind farms, in total 60 wind turbines and 120 MW), county of Chodzież. The Pawlowo is located in Wagrowiec county and Golancz Commune (approximately 60 wind turbines, 90 MW in total) and Wagrowiec Commune (31 wind turbines – 46.5 MW). At the same administrative area, the third party wind farms are located in Golancz commune, Wagrowiec county (one turbine) and Budzyn commune and Chodzież county (two turbines).

Visually it consists of two unified sections including eastern part comprising Margonin Wschod wind farm and Pawlowo wind farm and western smaller part encompassing Margonin Zachod wind farm, located over 2 km (in the nearest point) from the first section. The surroundings comprise predominantly rural areas with arable fields with sparsely populated areas. The biggest settlements located adjacent to the wind farm are Margonin town and Golancz town, each with approximately 3,000 inhabitants.

The areas of the investment are located outside major and dense forest complexes, marshy areas, areas identified as valuable for scientific interest. During the inventorying and observation works completed to date, the areas have not been found to be important for birds (attractive feeding grounds, routes of regular migration passages, routes of regular passages to feeding grounds or roosting places). The planned investment is over 6 km (in the closest point) away from the border of the special bird protection zone under 'Natura 2000'.

Similarly to the wind turbines, majority of the 110 kV overhead line crosses rural areas, not classified as of special interest for the nature protection. A relatively small part of the line on the distance of 4 km crosses the Notec river valley, including 3.3 km in the 'Natura 2000' areas with special bird protection zone and special protection areas of habitats.

Below you will find a map showing the layout of the wind farm in Margonin and Pawlowo.



## Rationale for this Project

In line with European Climate Change Program, many European countries, including Poland, have adopted national programmes aimed at reducing emissions. These cover various policies, adopted at the European level as well as national levels, includes among others:

- Planned increase in use of renewable energy (wind, solar, biomass)
- Improvements in energy efficiency in e.g. buildings, industry, household appliances;

The main regulations of EU countries to reduce emissions is the cost-effectively Emission Trading Scheme of carbon dioxide and legislation tackling with emissions of fluorinated greenhouse gases.

In March 2007, the EU approved an ambitious climate change and energy plan to limit greenhouse gas emissions by at least 20 % by 2020 (comparing to 1990 levels) and achieve, by 2020, a target of 20 % of total EU primary energy use through renewable energy. In January 2008, the European Commission proposed an energy and climate package to achieve objectives of reducing greenhouse gas emissions and boosting renewable energies by 2020. Currently, the UN are attempting to finalise a legally binding global climate treaty to succeed the Kyoto Protocol in 2013.

Poland, currently is finalizing formal approval of its energetic policy until 2030 "Polityka energetyczna Polski do 2030 roku". Based on this draft document Poland plans to increase the fraction of renewable sources in total energy consumption by at least 15 % by 2020 with its further growth. Currently the percentage of energy produced through renewable energy is significantly smaller.

The development of wind energy is one of the measures to be implemented which leads to the limitations of air emissions and increase of production of energy from renewable source. The main benefit is that wind turbines convert the wind's kinetic energy to electricity, while producing none of the emissions to the air. Conventional energy sources, mainly based on various types of coal incineration, when producing energy generate emissions of greenhouse gases, SO<sub>2</sub>, dust and others.

Assuming that the Margonin wind farms will operate 40% of time, the energy production will equal approximately to 63,000 MWh. Such production of energy in the biggest Polish power plant Belchatow, fuelled with brown coal, would result in annual emission of:

- carbon dioxide: 67,410 ton;
- particle matter: 8 ton;
- sulphur dioxide: 134 ton;
- nitrogen oxides: 89 ton.

The emissions are calculated based on emission factors presented on the web page of Polish energy generating plant, Elektrownia Belchatow: <http://www.elb.pl/> for the year 2008. Taking into account emission factors presented on the UK web page <http://chp.decc.gov.uk/cms/chp-emission-reductions>, the typical emission from the coal fired heat and power generating plants would be even greater and could amount to:

- carbon dioxide: 170,100 ton
- particle matter: no data available;
- sulphur dioxide (for sulphur content in coal equal 1.2%): 1,260 ton;
- nitrogen oxides: 328 ton.

Exploitation of the subject wind farm is therefore a measure to avoid the emissions to the atmosphere of the comparable amounts of pollutants. Future activation of the Pawlowo wind farm will double those advantages.

The issues which are in favor for location of the wind farm in this region include among others, approving attitude of the local Authorities, lack of protected areas in the neighborhood and favorable wind conditions; additionally successful realization of such investment is connected with benefits for the local communities, including reconstruction of power supply installations, new occupation and improvement of the local road infrastructure.

## Legislative Context and Public Consultations

According to environmental regulations *on disclosure on environmental information, public participation in environment protection and on environmental impact assessments*, an Environmental Impact Assessment (EIA) procedure must be performed for projects which can always significantly impact the environment (group I projects) or particular ones which can potentially impact the environment (group II projects), or may impact an area of 'Natura 2000' protected land. An EIA is carried out to obtain a decision on Environmental Conditions (environmental decision) which is obligatory for a realization of an individual project.

In the administrative procedure for the project Margonin East and Margonin West the Authorities, including County Authorities and Sanitary Inspectorate of Chodziej, obligated the Investor to prepare EIA reports for the planned project.

Information on the planned investment together with EIA Reports were made available for comments of the public, including local communities and potential interested parties, such as nature protection bodies and ecological organizations. Announcements on Margonin project were presented to the public in all villages where the project would be conducted, as it is routine and accepted practice in the region. Entire EIA reports were published on the web page of the Commune Authorities: [www.margonin.pl](http://www.margonin.pl). As required Voivodship Authorities, and Voivodship Sanitary Inspectorate were informed about the investment to come up with any potential issues. In addition, the society of the Margonin commune has been notified on the planned investment of Margonin East through articles printed in the local press, including:

- Margoninski Informator Samorządowy - Biuletyn Urzędu Miasta i Gminy Margonin (free newspaper brochure delivered together with the mail to every inhabitant) – presented information on wind farm development process and environmental impact assessment procedure, in an interview with the Commune Mayor.
- Chodziejzanin, local county magazine – presented an article characterizing the investment on provided information how to get more detailed information on this project.
- "Tygodnik Nowy", a weekly magazine popular in the area of the former Pilskie Province – included an article on how to get more detailed information on this project.

During the EIA procedure, apart from modifications in wind turbines layout due to the birds conservation needs, one of the parties included in the process filed any reservations.

Following preparation of the EIA reports the investor has been granted with five environmental decisions issued on March 31, 2008 (for five circuit of the wind farm, as inquired by the Developer) for the Margonin East and two environmental decision for Margonin Zachod (on April 27, 2007 and one turbine on August 14, 2008).

The decisions are attached.

The key environmental condition for the project have been set forth:

- to use materials with no adverse impact on the environment;
- to use construction equipment complying with noise and exhaust fumes abatement levels while excavating for foundations and building provisional access roads;
- to survey noise levels on Margonin East and on individual turbine on Margonin West after project completion/start-up;
- in case of a pollution as a result of a failure or breakdown, to proceed in compliance with environmental protection regulations and notify competent bodies;
- to comply with the ban on noisy works at night.

The overhead power line construction was preceded by issuing an environmental decision of October 31, 2008. The developer has fulfilled the obligation set in the decision and now is waiting for project formal acceptance.

Pawlowo wind farm is at the initial stage of the project development. Due to existence of two different development procedures, associated with presence of master plans on one portion of the investment and the need for obtaining a localization decision for other part fragment the wind farm has been divided into two stages of development. For the farm located in Golancz commune (60 turbines and 90 MW of initial plans) the developer has prepared EIA, and sent the application for issuing the environmental decision.

As part of the pre-development procedure, apart from the required public consultations including EIA disclosure, the developer organized in June and July 2009 additional meetings for any party interested in the project development. During the public consultation, stakeholders were informed on potential impacts associated with the investment, in particular impacts on landscape, acoustic environment, shadow flicker phenomena and infrasound. Tree local inhabitants protested against the investment and submitted a formal protest to the investors. Following the protest the investor has decided to remove two wind turbines, despite the lack of environmental contradictions to those turbines. Other protests, associated mainly with potential negative impacts on the birds population, have also been submitted to the Regional Environmental Inspectorate. On December 15<sup>th</sup> the Inspectorate decided that the arisen issues have been resolved by the developer and issued a required agreement (with detailed requirements to be completed) for the Pawlowo project.

In Wagrowiec commune the Authorities have accepted a resolution on initiate the procedure of master plan preparation, which will give permission and set formal conditions for development of the planned wind farm.

## What is the current condition of the existing environment?

The planned wind turbines of Pawlowo and Margonin wind farms are not situated within borders of any nature and landscape protected areas. The investments are located over 6 km away from the borders of 'Natura 2000' special birds and habitats protection zones.

As a part of the pre-investment process, including preparation of the EIA report, two several-day long series of ornithological observations were conducted for the project Margonin. First conducted in the breeding/nesting season in 2007 (Margonin East wind farm), the second between February 8, 2008 and April 5, 2008 (Margonin East and West wind farms) over the spring migration period. Observations were carried out in designated locations on the

planned investment and within immediate vicinity, particular attention was paid to water reservoirs.

With respect to the Margonin West 21 bird species of birds were observed. These are mostly common species, typical for other parts of Greater Poland. No particularly rare species for Poland or Wielkopolska were identified. In March and April large flocks (up to a few hundred of specimens) of Passeriformes were observed flying over and feeding on the fields.

The first stage of inventory on Margonin East wind farm allowed to identify 66 bird species, mostly common species. The most valuable were Little Bittern (*Ixobrychus minutus*), White Stork (*Ciconia ciconia*), and Marsh-harrier (*Circus aeruginosus*). In 2008, 45 bird species were identified in the examined area. These were mostly common species, typical for the two habitats: fields and meadows (i) and water reservoirs (ii). The results showed that the farm may impact avifauna of:

- Oporzynskie Lake - This lake was identified as the beginning of an ecological connection zone and likely as a part of migration route between local complexes of lakes. As many as 12 bird species staying on the lake surface were identified. This lake may be the feeding and resting ground for the birds during their migration.
- Margoninskie Lake - The main lake located between the Margonin Wschod and Margonin Zachod wind farms. It was assessed that the wind turbines (located east of the lake) may have an unfavourable impact on the water and marsh birds moving between the local complexes of lakes. In total 15 species of birds were identified on the lake. This lake may be the feeding and resting ground for the birds during their migration. Only once (15<sup>th</sup> March, 2008) geese (*Anser sp.*) flying south in V-formation over the lake were noticed. The planned investment may also have a negative impact on the Grey Heron colonies, using the lake as a feeding ground.

Following the results the observation the investor has modified layout of the wind farm to reduce the negative impact of the investment on birds (see section below).

The Environmental Impact Assessments conducted for the wind farms showed the locations should not have influence on the migration of birds in the Notec Valley ('Nature 2000'). Further, with respect to Margonin Wschod wind farm the Regional Directorate of Environment Protection in Poznan stated that the project will have no significant impact on the 'Natura 2000' areas.

A detailed ornithological monitoring has been being conducted for the entire planned Pawlowo wind farm since May 1, 2008. The observation comprised in-deep studies with recordings of species and numbers of observed birds, investigation of intensity of space used by birds and estimation of rare species. Following the analyses it was concluded that the observed avifauna is typical for the region of lowlands of Wielkopolska, with a large number of observed bird species, nevertheless the rare and infrequent species were observed only during individual observation series. Basing on the findings, it was recommended that the wind farm may be developed, excluding from the development indicated areas.

Two bats observation series were conducted for the area of Pawlowo wind farm in autumn 2008 and spring 2009. Within the conducted investigations over 80 bats were noted in each of the series, belonging to 4 and 5 bats species, for autumn and spring periods, respectively. Bats were indentified in less than 10% of the listening points, mainly along roads with rows of trees and close to forested areas. No bats activity was noted at open spaces. All the observed bats species belong to most characteristics species to Polish lowlands. Taking into

account the status of protection, all these are included in a group with low risk of quantity change and therefore with no needs of undertaking significant conservations measures.

The 110kV overhead line on the route Pila - Krzewina – Chodziej – Margonin (entire project comprises deconstruction of old line and the construction of the new two-track 110kV line) crosses the Notec river valley on the distance of 4 km, including 3.3 km in the Natura 2000 areas. These included the Natura 2000 special bird protection zone no. PLB300001 - the Valley of Middle Notec and the Channel of Bydgoszcz and 'Natura 2000' special protection areas of habitats under Nature 2000 PLH300004. Below there is a summary of these two areas prepared based on the approved characterization of the 'Natura 2000' areas:

- 'Middle Notec and the Channel of Bydgoszcz' cover the postglacial stream valley with a width varying from 2 to 8 km. There are 2 birds sanctuaries of a European importance: E37 (Ostrowek and Smogulec ponds) and E38 (Slesin and Wystep ponds) within the area. At least 18 bird species specified in Annex 1 to the Bird Directive and 8 species specified in the Polish Red List live in the protected zone.
- 'The Valley of Notec' covers a fragment of the Notec river valley, between Wielen and Bydgoszcz. This area is largely occupied by low peat land, with fragments of marshy meadows and reeds, with patches of forest and shrubs. It comprises a rich variety of habitats included in Annex I to Council Directive 92/43/EEC (15 types), with priority riparian forests and well preserved meadows complexes, although in total they cover less than 20% of the entire area.

Please refer to the map on page no. 5 for location of the Natura 2000 zone in a view of the investment.

## Social impacts

Development of the Project has not required any displacement of the people or business - no physical or economical resettlement had taken place. The land for the Project purposes was achieved based on lease contracts signed with the land owners.

The Project has direct socio-economic impacts on development of the Margonin commune and local inhabitants. The following direct impacts have been identified:

- increase of the commune tax income by approximately 10%;
- increase of the annual income of land leasers by approximately PLN 8,000 a year for each;
- improvement of the local communication routes (approximately 10 km of local roads have already been constructed or remodeled by the Company);

Moreover, the following indirect impacts have been discussed with the head of the commune:

- the wind farm is expected by the local authorities to be an interesting tourist attraction which will help development of the commune and create new sources of income for the inhabitants;

- the Project related works increase the safety of the electricity supply to the commune, which creates more attractive environment for business development.

The negative impact is related to decrease of the land area used for agricultural purposes, however, this is compensated by the land lease fees.

The Company has implemented measures to compensate any damages that could result from the construction works undertaken. In general, any works-related damages reported by the land owners are immediately verified on-site by the Company representative assisted by the land owner. Then the range of damages and a compensation level is negotiated between the parties. Agreed compensation is paid to the victim. As reported by the Company representatives in all cases occurred so far, the agreement between the parties was achieved and no court trials had taken place.

## What impacts during construction will there be?

The main impacts of the projects associated with the wind farm development relate to earth works (primarily during setting of foundations for the towers), construction works and increased transport traffic and include intrusion and disturbance within soils strata, temporary change of groundwater level (when groundwater draining is required during the construction), increased noise and vibration.

The Company is in the process of undertaking construction, and best practice is being developed. To limit the impact the investor has been applying numbers of measure as:

- to limit the disturbance of soil structure, humus/topsoil layers has been separated from the infertile deposits to use it correctly after completion of works;
- to use construction equipment complying with noise and exhaust fumes abatement levels while excavating for foundations and building provisional access roads;
- to plan transport routes for cars and heavy machinery in such way that local citizens are least disrupted; in addition, to reduce noise emissions during the investment delivery stage, construction works which could cause excessive noise emissions should be reserved for daytime and organized in such a manner to reduce the noise-related nuisance to a minimum;
- to provide protection of trees within the access roads construction site with protective bands which should be removed immediately upon completion of construction works.
- to prevent contamination of construction site with polluting substances, e.g. by well sealed fuel distribution to equipment and vehicles operated during construction and maintenance;
- to conduct waste management in line with the provisions of Waste Act and local commune regulations.

Special attention has been paid to deconstruction and development works conducted within the 'Natura 2000' zone (i.e. reconstruction of the overhead power line). Works with highest potential impact have been carried out in between vegetative periods and after the bird breeding season. Close to the Notec river and other water courses, special attention was paid to management of chemicals or construction waste materials, and to avoiding potential landslides during major earthwork in order not to impact free water flow.

Given the presence of archeological sites in the area of construction works the Investment should be carried in accordance with formal requirements for potential archeological sites.

## What will be the impacts during operation?

Completed investigations and public consultations conducted primarily as part of the environmental impact assessments procedure identified that main environmental impacts associated with the operation of the wind farm refer to increased noise levels, change in the landscape and influence on avifauna and bats. In addition, issues connected with shadow flickers and electromagnetic field are presented in this summary.

### Noise generation

Due to the predicted impact on the acoustic climate of the neighboring areas the developer has completed noise level analyses. The purpose of such impact analysis of the planned investment was to define conditional circumstances it should comply with, in order to guarantee that its impact on acoustic climate will not exceed binding environmental quality standards, as set for homestead housing - amounting to 55 dB for daytime and 45 dB for nighttime. Due to distance of the Margonin Wschod and Margonin Zachod wind farms (over 2 km and assumed lack of noise interactions between those two parts) the effect of cumulated impact on acoustic climate was taken into account separately for all wind turbines of wind farm Margonin Wschod and separately for Margonin Zachod.

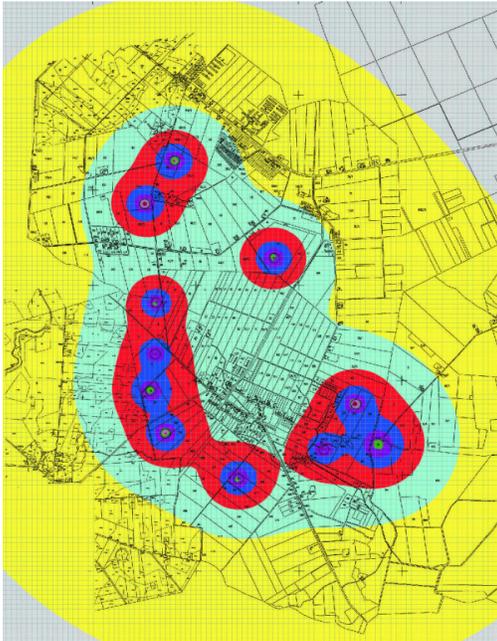
The calculation of impact of the planned enterprise on acoustic climate on the boarder of protected zone was carried out by a computer method of noise emission simulation for all noise sources in the planned Wind Farm MARGONIN: receptor nets and places located at the nearest residential area subject to acoustic protection. For the commuter calculations numbers of additional factors (including impact of the proximity of the source to the observation point; alteration by acoustic screens, wave diffraction, noise reduction by green zones or air).

Based on planned technical solutions and site development project for the investment, range and level of the acoustic impact on the environment was defined. The values of noise emissions obtained, showed that the noise levels did not exceed the amounts allowed for the homestead housing for daytime and nighttime in the area where the housing is situated. The maps illustrating acoustic climate constitute is presented below.

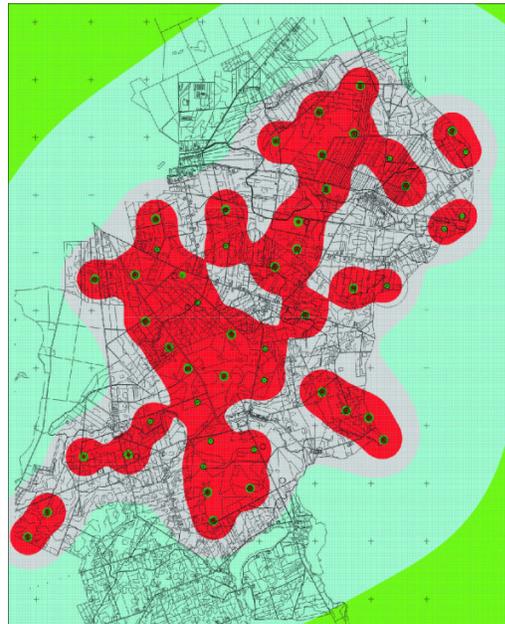
Similar calculations have been completed for Pawlowo (Golancz part) wind farm. Taking into account the planned technical solutions, the results showed that the values of noise emissions obtained from the calculations, in none of the points with noise level restriction the noise levels did not exceed the amounts allowed for daytime and nighttime. It should be pointed out that, taking into account the cumulative impact, the calculations for Pawlowo have been completed together with 12 nearby wind turbines of Margonin project.

The maps illustrating the calculated acoustic climate are presented below.

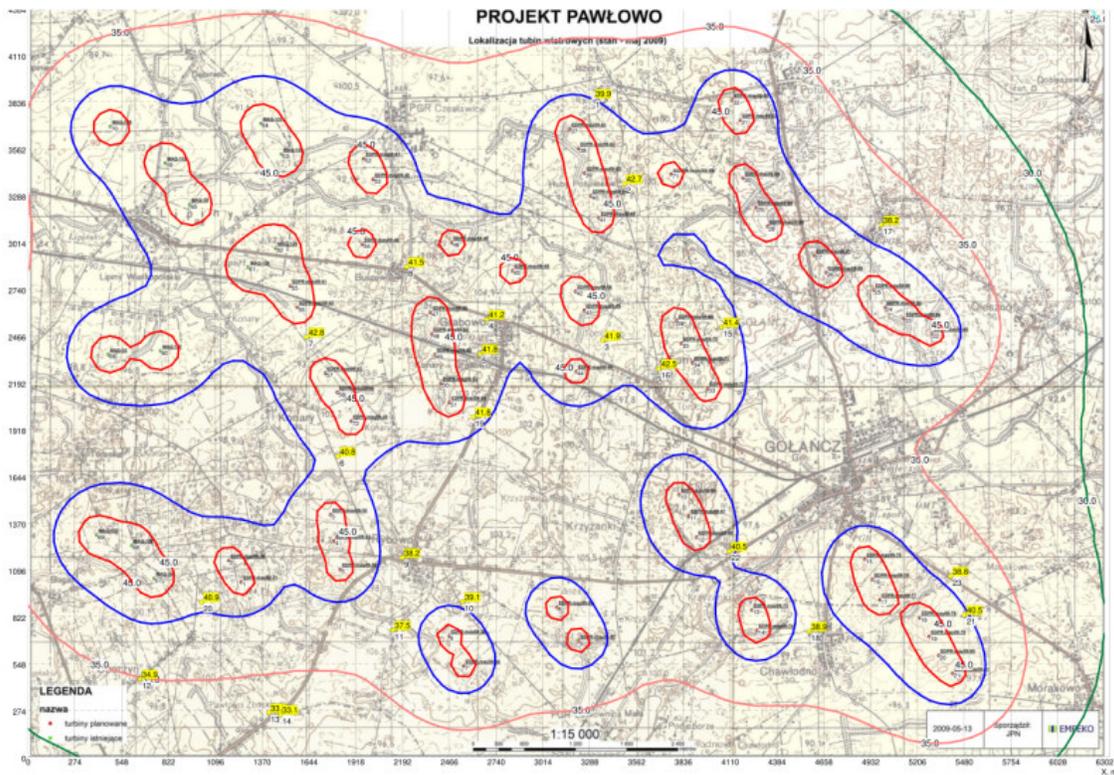
Margonin West wind farm



Margonin East wind farm



Pawlowo wind farm



## Birds and bats

The location of approximately 150 wind turbines (60 at Margonin wind farm and approximately 90 at the planned Pawlowo wind farm) will create a threat to birds and bats. Nevertheless it should be pointed that number of observations and reports on active wind farms and its impact on birds populations indicates that birds avoid collisions with wind turbines. The number of deaths within birds resulting from collisions with wind turbines is significantly smaller than those caused by collisions with e.g. cars, power lines and houses. In the places particularly hazardous for birds in terms of transmission line (where the valley of the river Notec crosses the power line) a signaling spiral should be installed in order to prevent electrocution.

To recognize the local birds populations and undertake applicable measures during the planning stage the investor has conducted number of ornithological observation on the areas of the planned wind farms. In a view of the pre-investments monitoring results the identified avifauna was classified as a typical for the rural areas of the Greater Poland lowlands, characterized as with lots of observed bird species but insignificant records of rare and infrequent species. The areas included in this project (excluding the overhead power line zone) has not been identified as valuable or of special interest concerning wildlife and nature protection needs.

The most valuable areas with the biggest concentration of observed birds are the local lakes located south of Margonin and south of Golancz and associated with them ecological corridors. These areas may be the feeding and resting ground for the birds during their migration and have been excluded from the project. Taking into account the presence of the River Notec, north of the site, it was recommended not to move the wind turbines northwards during the planning stage of the investment.

Collisions of birds with the new objects may occur, especially at night, with weather conditions resulting in limited visibility. However observations from existing wind farms show that those would be very isolated incidents and would not have a significant effect on local bird populations. Since the wind farm is not on a migration route and is not an important breeding ground for protected species. It is therefore expected that collisions may only occur incidentally and will not have a significant effect on the populations.

In line with EUROBATS guidelines (dealing with impact of wind farms on bats) the identified species of bats belongs to a group with high risk of collision with wind turbines. However taking into account the spatial distribution of wind turbines and areas where bats were observed it was concluded that the risk may be significantly reduced by moving the turbines from forested areas and borders of residential areas – as it was in this case. Due to the need of bats conservation the location of the wind farm has been approved by the reports on bats population. Nevertheless post-construction bats monitoring has been proposed.

Taking into account the characteristics of the investment, it has been concluded that the undertaking will have no negative impact on the species and habitats protected under 'Natura 2000'.

The existing 110kV line may also influence on birds and bats population. A high voltage line may kill birds in collisions and due to electric shock. For the designed high-voltage line it was predicted that its impact on bird fauna will not be significant. The line will replace an old one which had been there for many years, so the birds became accustomed to it and learned to bypass this obstruction. In the vicinity of the planned investment project there is a bridge higher than the planned line supports, and it is a much more serious obstruction for flying birds than the high-voltage line. In addition to minimize the impact the line also provides modern protection measures to reduce the bird death rates.

Landscape



The development of the Margonin project (encompassing 60 wind turbines with the maximal level above the ground outlined by the blade of 145 m) and Pawlowo project with approximately 90 wind turbines with the maximal height of 121 m) will influence the landscape of the subject communes. The turbines which are currently regarded as visually intrusive to current rural landscape will form architectonic dominant objects in the environment. Nevertheless, it should be stressed that the evaluation of the influence of the wind farm on the landscape is difficult and always subjective and depends on the individual approach. It may be assumed that the projects will gain supporters and critics taking into account the influence on landscape.

The pictures on the previous page present the rural landscape with several installed wind turbines.

Further, taking into account the lack of both nature landscape protection zones as well as protected man-made parks complexes the influence on the landscape in the final version of the wind farms has been significantly limited. The version of Pawlowo wind farms with towers situated close to landscape protection zone "Obszar Chronionego Krajobrazu „Dolina Welny i Rynna Gołaniecko-Wągrowiecka" was rejected (due to, as assessed, having higher impact on the landscape values) on the stage of the environmental impact assessment procedure.

Finally, it must be pointed that the influence on the landscape is not permanent. Given the expected "lifetime of the product" i.e. 25 years. After this period the disassembly of the power station is planned, reconstruction is also possible.

The development apart from the stable visually intrusive change will create so called shadow flicker caused by rotating turbine blades. This impacts residents living in close proximity to the rotating shadow source. The Investor has completed a shadow flicker analyses for wind turbines located in the vicinity of Grabowo village, central part of Pawlowo project. The results showed that the turbines will impact the nearby residential dwellings by the flickering shadows between 9 and 105 hours per year in maximum and from 0.2 hour to 1.2 hour per day maximum. While lack of clouds and barriers between the receptor and wind turbine was assumed the results showed only the theoretical and maximal impact. In fact it is expected that the real influence would be significantly lower than the outputs of the calculations.

## Electric and magnetic fields

Additional calculations have been performed to check potential emissions of the electric and magnetic fields to the environments of the 110 kV power line. The calculations established that the standards defined in the Regulation of the Minister of Environmental Protection on permissible electromagnetic field levels in the environment that will not be exceeded in any place under or near the line. For areas accessible to humans the maximum intensity of the electric field may not exceed 10kV/m. This level will not be exceeded in any place under the line.

Stricter restrictions of 1kV/m apply to areas designated for residential development. As the line mainly passes through agricultural lands, this value will likewise be complied with. The only place where there was a risk that this limit could be exceeded was the area of one of the line supporters, where there is a house standing 3.12m away from the terminal cable (6.89m from the line axis). For this location, special simulations of the field distribution in the most adverse line operation conditions have been performed. They results found that the electric field intensity in the areas adjacent to the house, translated into actual conditions (actual horizontal distance, actual height of phase cables of the line) does not exceed the permissible 1kV/m level (0.693kV/m at the height of 2m and 0.731kV/m at the height of 4m).

Additionally, it should be noted that the above-mentioned building stands near the existing 110kV line and following completion of the project no deterioration of the line's impact on this location is expected.

## Measure Aiming at Limitation of the Impact

The main measure which may be used to prevent significant environmental impact of a wind farm is a good choice of the location. Thus, during the project preparation number of possibilities of different locations of wind turbines have been analyzed. Preparation of the variants of the investment, apart from technological and economic issues such as winds characteristics and costs of land purchase and use, have taken into account the following issues, important from the perspective of environmental protection:

- existing state and way of land development and use of areas, which includes distribution of residential housing, forests, farming land,
- mutual impact on individual objects on each other, including also possible adding up of sound waves,
- necessity of protecting the objects of residential housing against noise.
- location from the perspective of birds and bats protection,

The second aspect of choice, very important from the point of view of environmental protection, was the choice of a producer and a supplier of equipment. The investor has chosen modern installations minimal level of emitted noise.

Works consisting of placement of power stations and successive preparation of variants of individual power stations' location took several months. After many analyses of the preliminary lay-out of wind turbines, considering noise restrictions, avifauna protection, soil's characteristic, adjustment to lay-out have been implemented. In summary it may be stated, the layout of wind turbines has been planned in that way to achieve the following goals:

- not to exceed the binding environmental noise quality standards, set in Executive Order of the Ministry of Environment;
- to be located out of birds migration routes, birds concentrations, feeding or nesting areas;
- to be located out of valuable plants habitats, wetlands or forest areas
- to be located out of nature and landscape protected areas
- not to disturb the continuity of ecological corridors

Outcomes of the analyses resulted among others in removing of the 11th turbine, located to close to Oporzynskie Lake and moving one to remove it from Oporzynskie Lake close proximity. In Pawlowo wind farm the layout has been change in order to excluded from the investment ecological corridors and the most valuable areas with the biggest concentration of birds recognized within the pre-investment monitoring.

With respect to the power line, in order to protect birds from colliding, special modern protection measures have been implemented. These measures include signaling spirals mounted on horizontal transmission cables and preventing electric shock incidents. Insulators on the supports have been mounted vertically downwards, in distance in intervals on supports should be appropriately installed. The proximities between them should guarantee birds' security.

The electric and magnetic field analyses found generally that depending on the height of the working cables, the 1kV/m electric field level may be exceeded up to 10m from the line axis

at the farthest. To protect the interests of all owners of land located under the line, the investor decided to sign agreements with all owners in the strip of 2 x 10m from the line axis and pay them compensations for the loss of the possibility of constructing residential buildings in this strip.

## Post construction monitoring

### Noise

Environmental decisions conditions obliges the investor to conduct post construction noise level surveys for Margonin East wind turbines and one of the turbines (No. 11) of Margonin West with the effect of cumulated impact on acoustic climate with two adjacent turbines. The results should be presented to the Hall of Margonin.

It has been recommended in the EIA report to perform post-construction noise level measurements for Pawlowo wind farm. If the measurements indicate that permissible noise levels are exceeded, then noise reducing action will be necessary to be completed (i.e. reduction of the acoustic power of the subject wind turbine(s) or its temporary disconnection especially during the nighttime has been recommended). Following the measurements the investor will conduct one year long monitoring of the acoustic climate in the neighborhoods.

The Company declares to do monitoring the noise levels and publish them in the Hall of Margonin commune.

### Birds

No birds monitoring has been required by the Authorities for the Margonin wind farm In line with the current guidelines of Polish Wind Energy Association it has been proposed to conduct 2-year long post-development birds monitoring.

A detailed investigation has been recommended and required for the Pawlowo wind farm. In line with the current Polish Wind Energy Association it has been proposed to conduct 2-year long post-development birds monitoring. The scope of monitoring should be identical as observations conducted during the pre-investment observations and it should include:

- determination of quantity of species nesting on the area of the subject wind farm, conducted during the nesting season (from the beginning of May till the end of June);
- investigation of birds colliding with the turbines to discover any dead and hurt birds in the vicinity of the wind turbines,
- evaluation of the inaccuracy of the coalition investigation, resulting e.g. from collection and consumption of death birds by other animals.
- description of the reaction of migrating species and species feeding within the wind farm area on the operating wind farm.

The investors' plans to conduct similar observations also for the Margonin wind farm.

The results of the monitoring should be presented in written and electronic forms to the Regional Environmental Directorate in Poznan. The results will also be presented in the Hall of Margonin commune, immediately after completion of the first stage of the monitoring program.

## Bats

Bats monitoring has been also recommended for the Pawlowo wind farm. In line with good practice guidelines of EUROBATS 2006 a 3-year long post-development birds monitoring has been proposed. The scope of the monitoring should include:

- results of the listening monitoring and comparison with results of the pre-development monitoring,
- assessment of bats colliding with turbines, taking into account local and migrating species and description of the reactions on the presence of wind turbines
- monitoring of deaths, including information on species, location and inaccuracy of the investigation, resulting e.g. from collection and consumption of death birds by other animals

The results of the monitoring should be presented in written and electronic forms to the Regional Environmental Directorate in Poznan.

## Additional information and grievance procedure

Results of the post construction monitoring, apart from submitting them to the Environmental Inspectorate, are initially planned to be provided for the public via information boards in the Commune Hals. In addition the investor will conduct an education action on advantages of use of removable energy sources directed to the local communities.

The Company welcomes ongoing comments and suggestions on the project. Attached in the appendix is a form for comments.

A full EIA is available for the project and copies can be found in the Commune Hall . A hard copy can be requested from the Company.

All requests for additional information related to the Wind farm should be addressed to the Environmental Specialist of EDP Renovaveis:

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