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Renewable energy

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Renewable energy resources?



Renewable energy resources belong to energy recources that are commonly available, endlessly rich, spontaneously renewable in natural processes and have the least impact on environment.





Why renewable energy resources?

- Common access and endless resources,
- Less impact on environment when compared to traditional energy resources,
- An alternative to energy from burning fossil fuel,
- Considerable pollution reduction,
- Energy independence of a country,

Renewable energy resources:

- Geothermal
- Biomass
- Wind power
- Hydropower
- Solar energy

Geothermal energy

The source of geothermal energy comes from the core of the Earth crust, where the temperature reaches over 4000 °C (7,200 °F) up to 5000 °C.

This is accumulated heat in water or vaporations in quantities that allow their practical implementation.

The depths are nowadays measured from 3 - 4 km.

We distinguish **liquid-dominated** and **vapor-dominated** geothermal forms.



źródło: http://freeisoft.pl/2011/04/geotermalny-potencjal-energetyczny-polski-mapy/

Geothermal energy

Geothermal energy, although cheap in exploitation (free fuel!), requires very high investments.

First of all, one must establish the parameters of geothermal water in the specific place, which means very expensive drilling (the costs are even tens of millions zlotys) which do not guarantee reimbursement.

It may turn out that in that actual place – due to far from expected parameters of the hot springs – building the geothermal installation would not pay off.

The risk discourages potential investors.

Geothermal energy

The second reason is that in Poland there are few places where very hot springs could be found (those with temperature over 100 Celsius degrees (212 °F)).

We have more of the so called low-temperatured springs (with water temperature less than 100 °C), which basically, given the contemporary technology, do not pay off when used for heating buildings or electricity production.

They can be used solely for building thermal baths or related facilities. However, these investments are very expensive*.

* http://biznes.gazetaprawna.pl/artykuly/490373,polska_ma_najwieksze_zasoby_wod_geotermalnych_w_europie.html.

Geothermal energy in Rabka-Zdrój

Rabka-Zdrój is situated in the Outer Carpathian area, where the geological structure shows diminished ability to store groundwater.



źródło: www.mount.cad.pl

Geothermal energy in Rabka-Zdrój

There are confirmed geothermal springs in Rabka-Zdrój.

I was confirmed by the drilling commissioned by Uzdrowiska Rabka S.A. (Rabka Spa) in the vicinity of mount Bania in 1981, which reached the depth of 1 215 m.



Geothermal energy in Rabka-Zdrój

The efficiency of the drilling is estimated for 4,5 m3/h.

The available spring can be used solely for curing purposes (saline springs).

The temperature of water is 28 °C (82.4 °F) and it is too low for heating purposes.

Compare to water temperature in the Podhale region*, about 30-50 km from Rabka-Zdrój:

- Bańska Niżna 82-86 °C,
- Białka Tatrzańska 73 °C,
- Poronin 63 °C,
- Chochołów 82 °C,

Geothermal energy in the Podhale region

The first Polish Geothermal Centre in Bańska Niżna near Biały Dunajec in the Podhale region was established in the years1989-1993 (30 km from Rabka-Zdrój).



Źródło: https://www. geotermia.pl/

Geothermal Centre in Bańska Niżna in the Podhale region





Źródło: https://www. geotermia.pl/





Geothermal energy in the Podhale region

Geotermia Podhalańska S.A. was established for the commercial usage of geothermal water for heating and it 35% of the heat demand in Zakopane.

This company is engaged in activities such as production, transmition, distribution of heat and pruduction of electricity in cogeneration – one system consists of three different resources:

- Geothermal Centre in Bańska Niżna,
- Central Boiler House and Pardałówka Boiler House in Zakopane,
- urban heat distribution network (central Heating).



The heating power installed is 80,5 MW (including 40,7 MW in the geothermal heating plant, 38 MW in the Central Boiler House and 2,8 MW in Pardałówka Boiler House).

Biomass energy

According to the Ministry of Economy ordinance from the 14th of August 2008 biomass is solid or liquid matter derived from plants or animals, which undergo biodegradation, deriving from products, waste and residues from agriculture or forest production, pruduct

processing industry, but also remaining waste,

which undergo biodegradatic



źródło: http://www.solarinfo.pl

For energy purposes one can use following kind of biomass:

- wood waste in forestry and wood industryand wooden packages waste;
- straw grain, oleaginous plants or legumes and hay;
- energy crops plantation yields ;
- organic waste: slurry, sewage sludge, wastepaper; sugar plant, flax rettery, distillery, brewery organic waste etc.;
- Liquid biofuels for transportation purposes, such as plant oils, biodiesel, bioethanol from distillery and agriculture refinery;
- biogass from slurry, sewage sludge and municipal landfills.

Regarding the natural conditions (conservation zones, spa conservation zones) and the lack of raw material, this direction **is not taken into consideration** at the moment in Rabka-Zdrój municipality.





Kinetic energy of air flows is transformed into electricity thanks to wind turbines and also it can be used as mechanic energy in wind mills and windpumps.

In the picture you can see wind turbines – a view from the lighthouse at the Baltic in Darłówek.



źródło: www.darlowko.pl, foto: Marcin Pakuła

Wind energy resources

Wind power stations usually work when the wind flow speed reaches 5 - 25 m/s.

When the intensity of wind is too low it makes the electricity production impossible, similarly, too high speed, for example over 30 m/s can cause mechanical damage to the wind turbine.

Favorable conditions for building and being successful with such investment are possible anywhere with the annual average speed of 7 m/s.

These are mainly seaside regions.

The most part of our country shows the average wind speed of about 4 m/s.

According to **Proffesor Halina Lorenc** from the Institute of Meteorology and Water Management Polish area can be divided into wind energy zones:

- Zone I remarkably beneficial,
- Zone II very beneficial,
- Zone III beneficial,
- Zone IV less beneficial,
- Zone V unfavorable.



Wind energy condition zones in Poland



Hydroenergy

Hydroelectric power plant produces electricity using the energy of falling water – most commonly with the use of dams.

Water flowing from a bigher level to a lower one moves water turbines combined with generators.



źródło: http://www.fizyka.net.pl

The dam on the Dunajec River in Niedzica

In the close vicinity of **Niedzica** (50 km from Rabka-Zdrój), at the border of the Spiskie Pieniny Range and the Central Pieniny there is a ground dam thanks to which an artificial water reservoir was built on the Dunajec River.

Czorsztyn Reservoir.



źródło: http://www.niedzica.pl/

The dam on the Dunajec River in Niedzica

The construction of the dam at the foot of Niedzica Castle made the rapid Dunajec River that has long been the natural borderline between Poland the Austro-Hungarian Empire stop its flow in Niedzica,

a picturesque valley of Nowy Targ with meandering, capricious river turned into an artificial

Czorsztyński Lake.



The dam on the Dunajec River in Niedzica

The dam is 56 meters high, more than 400 m long and 7 m wide.



źródło: http://www.zzw-niedzica.com.pl

Hydropower in Rabka-Zdrój

Rabka-Zdrój municipality is situated in the valley of Raba. The Raba river flows there and it joins two right-bank tributaries namely the Poniczanka and the Słonka.

There are no hydropower plants in the Rabka region. Furthermore, due to low water falling such investments **have never been taken into consideration**.

The picturesque Raba river in the picture.



Źródło: https://pl.wikipedia.org



Solar energy is a specific form of renewable energy – it is easily available everywhere, however the energy (the energy flow) it produces may vary conciderably, depending on the geographical location, climate conditions and the time of the day and year.



źródło: www.fotolia.pl

Insolation in Poland

The average annual insolation in Poland is about 1000 kWh/m².

Insolation distribution is uneven over a year.

- About 80% of annual insolation falls on spring-summer period (April -September).
- Moreover, in each region there are temporary changes in insolation due to the climate, cloudiness, or pollution (due to industry for example).
- In Poland the average annual insolation is 1600 hours.



Źródło: http://www.enis-pv.com/naslonecznienie-w-polsce.html



One of the most popular examples of using solar energy are **solar panels**. Their name alone suggests that they use solar energy. They are highly recommended to be used in building designs, but also in modernising existing buildings.

Flat panels with a heated water container on a roof.



Źródło: https://pl.wikipedia.org/

Solar energy in Rabka-Zdrój

The climate of Rabka-Zdrój municipality is characterised by favourable insolation, small rainfall and natural hill barrier for strong wind.

Regarding **thermal conditions** Rabka-Zdrój meets the requirements of a spa resort.

Solar energy in Rabka-Zdrój

- The average annual temperature is **7,3 °C**.
- The average annual insolation is **1 645 hours**.
- Thus, insolation norm (min. 1 500 h/year) is met.



Solar energy in Rabka-Zdrój

In the Rabka-Zdrój strategy for the years 2014-2020, in the field of Ecology in order to meet the highest standards of environment protection we propose investments of **installing solar systems on 500 buildings** in the whole Rabka-Zdrój municipality.

It seems that such investments create the most desired direction of energy development for using renewable resources.

Renewable energy resources are an alternative to fossil fuels (coal, lignite etc.) and, most of all, they contribute to the reduction of greenhouse gases which means they are an opportunity for the improvement of air quality in Rabka-Zdrój.



For the sake of air quality improvement it is essential to change the buildings' sources of heating and hot water.

The use of appliances that do not cause pollution or those characterised by **very low level of pollution** is crucial.

Rabka-Zdrój as a spa municipality has to deal with the quality of natural environment protection and ecology in the first place.

Unfortunately, the municipality does not possess any legal possibility of enforcing people to use renewable sources of energy, which are not inexpensive to install and less efficient given the climate in Rabka.

Today, the main problem of Rabka-Zdrój municipality, which is also the case in neighbouring municipalities, is the emission coming from building heating systems and hot water supply caused by infavourable energy sources structures, which is dominated by coal and wood furnaces with manual fuel supply which do not meet emission requirements.



Various fossil fuel furnaces (mainly coal or wood boiler hoppers) make up – according to a survey – **over 70%** of all heating installations in individual houses in Rabka-Zdrój.



Different types of heating systems depending on the fuel (solid, liquid) in individual detached houses



The change in the structure of heating systems is essential for the municipality to improve the air quality and the standard of living of its own dwellers, but also to create its competitive advantage in the spa and tourist market regarding the quality of clean, uncontaminated natural environment.

The first option prefers the replacement of old, low-efficient solid fuel installations for new installations powered by gas, however it allows for, where there is a lack of gas network, the replacement for modern solid fuel installations on the condition that they meet specific emission requirements.

Furnaces DEFRO DUO by DEFRO Sp. z o.o. Meeting the norms PN-EN 303-5:2012



źródło: www.defro.pl

The second option clearly encourages **developing gas network**, replacing appliances solely for those powered by gas (where the gas network is available), developing installations based on renewable resources, and in the places where such actions are impossible, allowing eco fuel furnaces with minimal emission requirements for such appliances.





As far as air protection is concerned it is extremely important to **enhance people's awareness** of the need for change and the consequences of the lack of renewable energy resources on our health and climate.



Unfortunately, the cost of using renewable energy resources in Poland is high relative to people's income and do not bring quick and economically effective profits.



Therefore, the municipality has decided to gain funds from outside for the realisation of such actions and supporting its dwellers.

Rabka-Zdrój has joined a project within the integrated Małopolska Voivodeship Project LIFE "IMPLEMENTATION OF AIR QUALITY PLAN FOR MAŁOPOLSKA REGION – MAŁOPOLSKA IN A HEALTHY ATMOSPHERE", which has 45 partners including 38 municipalities.

Rabka - Zdrój is the leader in the project.

The total sum of the project is 70 mln zł.



As part of the LIFE project, the European Union finances various initiatives whose goal is to protect environment and nature. The programme was establish in 1992 for the purpose of financing such projects not only in the countries of the European Union, but also in some countries that candidate for the EU membership and neighbouring countries.

As part of the project a new job will be created, namely an **ECO-ADVISOR**, who will be held responsible for the air protection actions in the municipalities:

- information-education campaigns,
- analysis of air quality in municipalities that do not possess monitoring stations,
- enhancing of the control over burning rubbish.



At the end of 2015 Rabka-Zdrój municipality submitted an application for financing the replacement of **200 coal furnaces** for those with higher efficiency or gas ones together with **75 solar installations** for water heating in residential buildings.



Renewable energy resources in Rabka-Zdrój

Moreover, **Rabka-Zdrój Municipality** by realising its own tasks such as building and renovating its objects tries to use renewable energy through:

- installation of solar water heating system,
- installation of solar lamps on playgrounds,

- installation of solar lamps by pedestrian crossings and walking paths.



Lighting in the Zdrojowy Park and playgrounds in Rabka-Zdrój, Chabówka and Ponice







Lamps on playgrounds



Lamps on playgrounds



Lamps in Zdrojowy Park





Traffic lights by pedestrian crossings



















Renewable energy resources

Sources:

- 1. Plan Gospodarki Niskoemisyjnej Gminy Rabka-Zdrój, listopad 2015 r.
- 2. https://pl.wikipedia.org
- 3. https://www.geotermia.pl/
- 4. http://www.enis-pv.com/naslonecznienie-w-polsce.html

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