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## THE USE OF SOLAR ENERGY IN THE SOUTH MORAVIAN REGION

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### ABSTRACT

The main arguments for renewable energy production are recoverability and production of pollutants from burning fossil fuels. This production usually requires a relatively vacant space, which is mainly available in rural areas. Alternative sources play an important role in securing regional self-sufficiency in energy supply. The production depends on specific environmental conditions. Alternative sources play an important role in ensuring regional self-sufficiency in energy supply.

The aim of the project is to map the situation, to analyze existing resources in the region and to analyze territorial context of selected typical cases of solar energy. This project doesn't attempt to solve the technological or economic problems of using energy from renewable sources. We prefer to solve a territorial context of production energy from renewable sources in the South Moravian Region. The purpose of this project is to obtain an overview of the issues in the South Moravian Region, which could be used in teaching, in scientific studies on rural development, possibly it could be used as a basis for decision-making within the South Moravian Region.

The mapping of natural and other conditions is the first step for the production of this energy. The selection and analysis of specific examples primarily focusing on the territorial context is the next step. The final step in the project is an attempt to generalize findings. The project maps the situation, analyzes the existing resources and the territorial context of selected cases.

The South Moravian Region can be considered as an agricultural region of significantly rural character. Thanks to its geographical conditions and the specific economic system, the region could become a leader in the production of alternative energy in the Czech Republic. The highest production of solar energy account for district Znojmo, the second position occupied by Brno - countryside and Hodonín.

**Key words:** renewable energy, solar energy, the South Moravian Region, the Czech Republic

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## INTRODUCTION

Renewable energy sources are currently used to produce electricity, heat and transport fuels. Biomass, solar, hydro, wind and geothermal energies are generally regarded as renewable energy sources. All these alternative sources play an important role in ensuring regional self-sufficiency in energy supply in the context of the South Moravian Region.

Disadvantages of the energy from renewable sources are the lack of its local concentration, difficult prediction of its evolution in space and time and diametric structural differences between the individual types of renewable energy. For this reason, it is not possible to effectively apply general solutions in large areas. It is necessary to evaluate the specific potential in the South Moravian Region. This project does not attempt to solve technological or economic problems of using energy from renewable sources. The authors rather prefer to analyze the territorial context in the South Moravian Region.

The solar energy is one of the renewable energy. The project aims at mapping the situation, analyzing the existing resources in the region and evaluating the territorial context of selected typical cases of solar energy. The aim is to obtain an overview of the issues in the South Moravian Region, which could be used in teaching, in scientific studies related to rural development, including as a basis for decision-making in the South Moravian Region.

Obtaining of electricity directly from solar radiation is environmentally clean and low-impact way of its production. Efficiency of conversion of sunlight into electricity, is currently in the range of 10 – 15 %. Efficiency of the conversion of solar radiation into electricity allows gaining up to 110 kWh of electric energy per year from 1 meter of active area. Actual production logically derives from the intensity of solar radiation.

South Moravian Region is a region with the largest average annual sunshine duration in the range of 1,650 – 1,800 hours and thus also the areas with the largest annual solar energy in the Czech Republic (KEA, Inc. 2004). In the South Moravian Region, mean annual air temperatures range from 9 - 10°C. Average temperatures in the summer half year range from 14 - 18°C. The intensity and time of solar radiation are affected by altitude, clouds and other local conditions such as frequent morning fogs, pollution and sunray incidence angle. If the sky is cloudless, the performance of solar radiation is about 1 kWh/m<sup>2</sup>. When the sky is cloudy, solar radiation is up to 10 times less intense. In this country, the average intensity of solar radiation is estimated at 950 – 1,340 kWh/m<sup>2</sup> per year.

## MATERIAL AND METHODS

This project analyzes the solar energy. The first part of the project maps the natural and other conditions for the energy production from the sun. The second part is an overview of the existing state and its documentation including historical development. The third part focuses on the selection and analysis of specific cases for each type of energy. The evaluation of work potential and consequences of energy production from renewable sources in the South Moravian Region is the last step.

The project is methodologically based on the study of domestic and foreign literature, analysis of available statistical data, consultation with experts from the field of research and sociological methods. Some general characteristics of the South Moravian countryside were subject of a preliminary analysis (VAISHAR et al. 2011). This work is updated, specified and elaborated in greater detail in this project.

The general data of the South Moravian Region and natural prerequisite for the production of energy from renewable sources are taken from standard statistical sources, mainly from the Czech Statistical Office and departmental statistics. Data on installed capacity and power generation from renewable sources were obtained usually by own research and sociological methods or cooperation with the South Moravian Region. Analysis of solar energy is also based on documents and information obtained from the internet survey of companies.

## RESULT

There are two case studies in the solar energy. The first case study maps the photovoltaic power station Vranovská Ves (Fig. 1) lying in the same village about 15 km northwest of Znojmo. This area seems to be one of the most suitable sites for the location of the photovoltaic power stations in the Czech Republic with regard to natural conditions. The photovoltaic power station is the largest photovoltaic power station in the South Moravian Region, the fifth largest in the Czech Republic, and is also among the largest in the Central Europe. The solar power station covers an area of almost 90 hectares. The supports are fixed to the carrying piles embedded to the land, which create the base for 84,384 solar panels on the performance of 16.033 MW. The photovoltaic power station is owned by Dominica FPI, Inc. This company is a subsidiary company of the company ČEZ, Ltd. The power station was set into operation in 2010. The company pays 1.4 million crowns in cash to the village each year and finances investment projects. The money were used for municipal waste, two new playgrounds and renovated sports complex. The photovoltaic power station Vranovská Ves annual electricity production is energy for 4,000 households in southern Moravia (ČEZ, Ltd.). The photovoltaic power station has worked for three years. The year 2011 was a test one, even the conditions above standard levels of solar radiation. The time series is very short, so it was not possible to determine the long-term average.



*Fig. 1 The photovoltaic power station Vranovská Ves (Photo: Doskočilová)*



*Fig. 2 The photovoltaic power station Kamínky (Photo: Doskočilová)*

The second case study deals with the photovoltaic power station Kamínky (Fig. 2). The company Silekro, Inc. owns this photovoltaic power station on the power of 66.42 kW. The power station is built on the southern part of the leased roof of elementary school Kamínky 5 - Nový Lískovec, Brno. The company takes care of the roof, so the primary school does not deal with leaks on the roof in next 20 years. The solar power station consists of 324 pieces of photovoltaic panels with south orientation placed at an angle 30° on area 1,400 m<sup>2</sup> (SILEKTRO, Inc.). The rows of photovoltaic panels, mounted on the aluminum structure anchored to concrete thresholds, do not block each other. The photovoltaic power station Kamínky has operated since 2009. The minimum estimate of its annual production is 61 MWh. The annual savings in CO<sub>2</sub> emissions is 72 tons. The produced energy is supplied to the distribution system of the company E.ON, Inc. The company Silekro, Inc. pays 60,000 crowns per year for the lease roof of elementary school.

The school purchased new furniture and equipment to the classes from these money. The primary school can use this power station in Physics.

## DISCUSSION

Solar energy is a stable source of renewable energy because solar energy is ubiquitous, inexhaustible and free. Due to solar energy is free, the operating costs are low. Solar plants are easy to operate, maintenance of solar panels is minimal. The life of solar equipment is guaranteed for 20 - 25 years. Solar power plants are not noisy and are environmentally friendly because they produce no emissions. The electricity generated by solar power decreases the value of CO<sub>2</sub> in the atmosphere. Solar energy does not have a specific location, unlike some other types of renewable energy. It is important that solar systems can be installed even in dense urban areas.

However, some authors also point to possible negatives and we meet environmentalists at opposition against energy production from renewable sources. Solar power plants occupy a large area and thus damaging the landscape. Mass construction of solar power plants on high-quality agricultural soils of southern Moravia is quite visible disruption of possible food safety as well. The main disadvantage of solar energy is the high initial cost of the return from 8 - 15 years depending on the size plant. The performance of solar panels dropping every year by about 1 %. Efficiency of the solar panels can also affect a layer of dust or snow on the surface. Production of energy from the sun is a time variable, because solar radiation varies during the day and year. The creation of new jobs is significant only at the time of construction of the plant, the commissioning is needed only a few workers to maintenance of solar panels.

The perception of the support to renewable energy sources has been significantly negatively affected by extremely high solar subsidies, which have significantly raised the price of electric energy, imposing a future burden of the population apart from that, profit thereof goes likely out of the Czech Republic. It is not the aim of this study to analyze specific political causes of the failure of Czech energy policy. However, it is clear that the green ideology in conjunction with the "business" intentions of certain circles has played a negative role the consequences of which harm the very idea of sustainability.

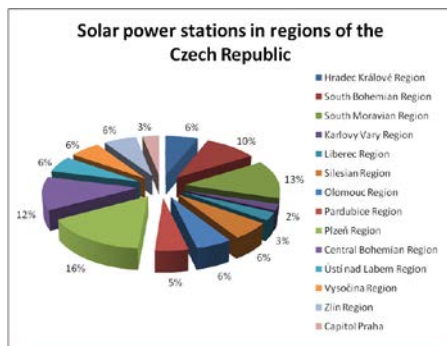


Fig. 3 The percentage distribution of solar power station in regions of the Czech Republic (Data source JV PROJECT – created by Doskočilová)

The photovoltaic power station were financially supported in the Czech Republic since 2006. Due to these significant government subsidies, solar power station experienced a huge development. There are currently 12,929 photovoltaic power station in operation. There are 1,737 photovoltaic power station in the South Moravian Region (Fig. 3). Even though there are the best conditions for solar energy in the South Moravian Region (13 %) among the regions in the Czech Republic, the most number of solar power stations is in the Plzeňský Region (16 %). The total power of the photovoltaic power stations in the South Moravian Region is nearly 443 MW (Tab. 1). In the years 2009 – 2010, the purchase price of electricity was half of its previous price. Large solar power stations has not longer supported since 2012 ever. Therefore the investors do not pay for building of large photovoltaic power stations. Due to previous reason, the growth of large solar power stations during the last three years is almost zero. According to legislative changes, large projects are no longer supported, which contributed to the development of small projects, namely roof installations on family houses and prefabricated apartment houses and public buildings. There are 1,689 small power plants with capacity of up to 3 MW, 33 medium-sized power plants with an power of 3 - 5 MW and 15 large power plants with a capacity of over 5 MW in the South Moravian Region. The highest production of solar energy account for district Znojmo, the second position occupied by Brno – countryside and the third Hodonín (Tab. 1).

*Tab. 1 The total number and the total power of photovoltaic power stations in the districts of the South Moravian Region (Data source JV PROJECT – created by Doskočilová)*

District of the South Moravian Region	Total number of photovoltaic power stations [pcs]	Total power of photovoltaic power stations [MW]
Blansko	162	28.135
Brno - countryside	205	29.577
Brno - town	419	100.949
Břeclav	224	57.16
Hodonín	385	97.121
Vyškov	97	14.675
Znojmo	245	115.164
<b>Total</b>	<b>1737</b>	<b>442.781</b>

## CONCLUSIONS

The South Moravian Region meets all the requirements for significant development of renewable energy sources and creating a stable position in the supply of energy from alternative sources in the Czech Republic. Renewable energy has a great potential for the development of rural areas in relation with the requirement of agriculture diversification and landscape maintenance. In the South Moravian Region, which can be considered an agricultural region of distinctly rural character, the potential reaches a high level, but there are still reserves in its utilization.

Due to climatic conditions of the Czech Republic, solar energy also plays a significant role in the South Moravian Region. The region exhibits the highest annual average air temperatures and average temperatures in the summer half of the year, especially in the southernmost areas.

Due to the development of photovoltaic power stations, Czech Republic fulfilled its obligation to produce 8 % of its electricity from renewable sources in 2010. In 2012, photovoltaic power stations produced 2,118 GWh of electricity in the Czech Republic. It is nearly 2.5 % of total gross electricity production in the Czech Republic. It is very important the locality selection, low operation over the lifetime of panels and legislative ensure maintenance of the end of the life cycle in the production of energy from the sun.

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