

## ECONOMY OF RENEWABLE RESOURCES OF ENERGY OPERATION

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**Summary** Nowadays the renewable resources continue to be more important in the Czech Republic especially thanks to tendency reach of 8 % share of total production of electricity power which the Czech Republic sing on the European Union. This article contains description of various kinds of the renewable resources of energy (water, wind, power cells, biomass, biogas and sun), their present using and possibilities of their expansion. Article follows effect of growing share of the renewable resources of price of electric energy for final consumers. Also describe potentialities of other construction of renewable resources of energy in the Czech Republic with respect to local economic conditions.

### 1. INTRODUCTION

Renewable resources of energy shelter a huge potential (wind, water, sun, biomass and earth's heat). Commitments to reducing of greenhouse effect lead into support of renewable resources of energy. By the year 2010 renewable resources should cover 20 % of gross consumption of power in the EU. The Czech Republic has committed to deal with 8 % share of pollution by the year 2010 (in the 2006 the share was 4,78 %). It is important to see the renewable resources not only from power aspect but and from economy propriety this resources.

### 2. THEORY

#### 2.1 Water power

In the Czech Republic big water power plants make on the average 1580 GWh per year and small ones 680 GWh per year (by the year 2010 it's going to be achieved 1140 GWh).

Existing weir Štětí-Račice on the river Elbe is one of the last possibilities to build-up small water power plants. Water power plants should be occupied by two turbines about total power 5,2 MW (yearly production of electricity is expected in about 31,5 GWh). Currently, the project has building license. Realization of this project will take approximately 2 years and the commercial operation is planned until the year 2010. It would be achieved only a small share (approx. 2 %) by the using of all water potential in the Czech Republic [3], [5].

#### 2.2 Wind power

Wind power is one of the fast expanding power systems which are coming to the market. Production of wind power plants has been growing up very fast. The biggest share in production has Nederland, Germany and the Great Britain. The European Union made decision to reach power of 100 GW by the year 2030. The biggest share should be focused on the lands with costal places.

Wind power could deliver up to 50 % of electricity to several countries, which are situated in

the location with favourable wind conditions. About a half of installed wind power plants on the world are located in the North Sea coast of Germany and Denmark. The offshore wind farms in the North Sea have a big potential for the all Europe.

There are claims on the regulation and reserve of the power in the wind power plants. The reserve requirements grow fast if the share of wind power is more than 20 %.

Wind power plants can additionally require highest investments in the transmission network from the coast to inland consumers.

In this branch the Czech Republic is at the beginning of the development. Wind power plants work on decade of locations and their power is about 75kW – 2 MW.

In the Czech Republic average wind speed is over 4 m/s in the high of 10 m and over 5,3 m/s in the high of 30 m. The friendliest locations are in the high over 700 m. The most frequent locations are on Českomoravská vrchovina and on the frontier zone. By the estimates it is possible to build approx. 350 power wind plants by the delivery of 170 MW in a location Krušné hory.

Preparation of wind park will take about 5 – 7 years. The landscape pattern is more important than economy of the wind power plant in the Czech Republic [2], [3], [6].

#### 2.3 Stationary fuel cells

Fuel cells present a new competing technology for the small combustion engines. They can product electricity and heat from gaseous and liquid fuels. Their advantages are seen in the high efficiency and minimum of emissions. Production of electricity is given directly from a chemical reaction in the fuel cells.

Installation of small (< 10 kW) stationary cells is mainly spreading into houses and buildings which are connected to distribution of natural gas.

The market which includes the large stationary fuel cells (>10 kW) is growing as well. The main opportunities for stationary fuel cells are commercial

and industry buildings. However, it will be possible only in the buildings with the connection to distribution of natural gas.

The best technology for these systems which burn the natural gas is Solid Oxide Fuel Cells (SOFC) [2].

The commercialization of fuel cells is in the car industry which needs 30 – 100 kW power systems. Many of the cars producers plan to start production of commercial fuel cells at the beginning of 2010.

The clean coal technology will be a source of fuels in fuel cell power plants in the future.

## 2.4 Biomass burning

The biomass conception includes all organic substances which originate from the photosynthesis or from the animal substances. This terminology often marks the vegetable biomass which is used for energy purposes as the renewable resources of energy.

The grown biomasses are energy plants and fast-growing wood species. The grown biomass from plants is for example rape, sun-flower and different grain, from grown wood species for example Canadian poplar or willow.

Biomass burning proved good in the smaller power resources with grate or fluid drum which make combination of electricity and heat. Economic efficiency of burning biomass is based on compensation the fossil fuel for biomass.

If we compare basic variables costs in the production of electrical energy we determine that fossil fuel burning is severalfold cheaper than biomass burning. It is mainly trough higher acquisition costs by biomass and transfer costs.

In the Czech Republic the biomass consumption is higher in the recent years and we can talk about its absence in some regions. This reality is caused by the growing biomass demand in Germany, Austria and Poland. In these days the export in these countries presents the same quantity as is the biomass consumption in the domestic trade for the production of electrical energy.

## 2.5 Station of biogas

It is a set of technology provisions in which the organically dissoluble systems are anaerobically cultivated. This process produce biogas and its energy is changed into electricity and heat.

The biogas is a burning gas with a percentage of methane (55 – 70 %), CO<sub>2</sub> (29 – 44 %) and 1 % associated gases (sulphide, nitrogen, hydrogen and oxygen). Its heating power by the 60 % of CH<sub>4</sub> (methane) is approx. 22 MJ.

Biogas arises from organic substance digestion without oxygen access by the given temperature and good shuffle.

The usage of biogas for production of electric energy is becoming more and more important in the

Czech Republic. The reason is a possibility to process material which we can not deposit to dump. For many agricultural companies with own biomass means the biomass station a stabile financial income from nonagricultural business.

The biogas can be used for electric production and sale for state-aided redemption price and sale for heat production (in the form warm water 80 – 85°C). The second possibility is addition of biogas to distribution of natural gas and its usage as the fuel to the cars.

The entering raw materials to the biogas station are for example dung, remains of feed, the pointing grown biomass, cornflour silage, herbal silage ... [4]

## 2.6 Solar power

In the Czech Republic there is an expansion of the solar power at the beginning. Under conditions in the Czech Republic the solar system produces 1 kW 900 – 1000 kWh of electric energy per year. The installed operation of solar systems in the Czech Republic should reach 84 MW by the 2010 and 541 MW by 2020.

In January 2007 the first large photovoltaic power plants was put into operation in the Czech Republic (Bušanovice) which is built and entirely operated by the private subject. The need of area for the production 1 kWh = 0,02 m<sup>2</sup> gross, 1 m<sup>2</sup> makes 50 kWh/year.

The solar power has guarantying redemption price 13 Kč/kWh for 15 years. The guarantying time should be increased for 20 years [3], [6].

## 3. ECONOMY OF RENEWABLE RESOURCES

### 3.1 The price of energy in the Czech Republic

*The influence of growing production of electricity from renewable resources of energy on the price of electricity for final consumers:*

The growth of contribution from 34,13 Kč/MWh in the year 2006 to approx. 140 Kč/MWh in the year 2010. And the growth of support from 1,6 mld. Kč (year 2005) to 4,9 mld. Kč (year 2010). Rise in price for systems services, today 8 mld. Kč, the production estimation only thanks to wind power for up to 3 mld. Kč.

The produced electricity from renewable resources of energy was 3,5 TWh (1,9 TWh from the supported renewable resources of energy and 1,58 TWh from the large water power plants) in the year 2006. The share of electricity production from renewable resources of energy was 4,87 % (The Energy Regulatory Office - ERO). By the development up to now is the aim of 8 % to the year 2010 unreal in the Czech Republic. The future development of renewable resources of energy in the Czech Republic anticipates the state energetic conception which indicates the potential of the

separate of renewable resources of energy in the year 2010 [3], [4].

**The shares of the separate categories on the total electrical produce from renewable resources in the 2006 [4]:**

• water power plant over 10 Mw <sub>e</sub>	45 %
• small water power plant into 10 Mw <sub>e</sub>	28 %
• biomass	21 %
• biogas + landfill gas	5 %
• wind power	1 %
• solar systems	0 %

**The shares of the separate components of rate for supply of electricity for households in the 2007 without VAT [4]:**

ERO has a limited possibility of regulation of the final price in the market for consumer approx. (30 – 45 %).

• electricity inclusive business margin	52,22 %
• distribution of electricity	37,73 %
• systems services CEPS	5,32 %
• transfer of electricity	2,98 %
• renewable resources and combined heat and power	1,24 %
• decentralizations produce	0,34 %
• market operator	0,17 %

### 3.2 Issuing permits

They control the production of CO<sub>2</sub> during the energy production. The market with permits should allow the financial privileges of operators which struggle for falling of emissions and on the other hand it should burden those ones that have not the spread of production based on the limitation CO<sub>2</sub>.

### 3.3 The technological trends

The European Market has grown during the last 10 years and it becomes stabile while the Asian countries have large investments programmes.

Most of the investments are pointed at the steam turbines. The steam turbines are mainly used in the coal-fired plants and in gas-fired combined cycle plants. Both markets are very large. The trend in the steam turbine is still increasing. The main argument is the coal-fired power plants which have the majority interest in the present production.

While the share of the gas turbines have been decreasing. Because of the growth in natural gas price the coal-fired plants enhance their share in the market. The market of gas turbines has the share approx. 24 % in the market.

It is expected that the nuclear plants will be used commonly in the future. The year's growth 3 GW is heightened on the growth 8 GW in a year to the year 2015. The nuclear plants and the renewable

resources should compensate the coal-fired plants if people want to reduce emissions of greenhouse effect [2].

## 4. CONCLUSION

State support is necessary to promote application of renewable resources. The price of energy made from the renewable resources must be as low as possible because of competition with other resources of energy. It influences investment costs, the operating costs, the possibility of financing, the quantity of made energy and the other effects.

ERO determines the minimal redemption prices of electrical energy. The price of the solar power should grow to double level of price while the price of wind power should fall.

In the Czech Republic the share of the alternative resources should reach 8 % by the year 2010. Currently, it is only approx. 4,5 %. Because it won't be possible to enhance operation of energy from the water plants, so there remain only the sun, the wind and the biomass.

In the Czech Republic the build up of other water plants is almost unreal due to water yield.

The main meaning of the water power plants is not in the power energy but they can react promptly on the prompt need of energy and they don't burden the environment. It is exploited mainly for the covering of peak load consumption.

The solar power has not a big perspective because there are no the suitable conditions in the Czech Republic. The support of the solar energy must be with intention of filling 8 % of electrical energy from renewable resources. Benefits of energy production are the falling prices of collector (investment cost reduction) and the escalating operation effectivity.

The wind capacity is evacuated in the Moravia (it is not a place for new wind plants so it should be profitably). Ústecko region is locked by the new projects which are in the process of approval. At the moment 900 MW are planned in the Moravia.

From the actual measuring on the chosen wind power plants in the Czech Republic was found out that operation ratio is 13,13 %. CEPS created a group of people who are interested in wind energetic and who solve the critical situations of network so that the wind doesn't complicate the incurred situations.

The main effort should be concentrated in the exchange of old and unsatisfactory wind power plants so the ratio of operation is higher.

Biomass has perspective mainly in the exploitation of unnecessary raw materials and its

conversion into the heat and electricity. So it must be built in the acceptable locations where the competent feed of raw material is ensured and where it will be the consumption of produced heat. The station for burning of biomass would lose its principle and function as long as the required raw material has to be transported from long distance places or for example straw is grown only for the purpose of combustion.

The control and regulation of redemption prices and subsidies in the sphere of energy of renewable resources are necessary so it doesn't lead to building of new energy resources mainly in order to gain financial profit.

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