ECONOMIC EFFICIENCY OF RENEWABLE ENERGY SOURCES

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ABSTRACT

The present article analyzes the expected trends in production and consumption of electricity in Slovakia, and also points to the possibilities of the contribution of renewable energy sources to ensure these requirements. Also discusses the support system of renewable energy sources in the EU and Slovakia, and provides a procedure for determining the amount of support based on the criteria of economic efficiency too.

1. INTRODUCTION

Increasing the share of renewable energy sources (RES) for electricity and heat to create the appropriate additional energy sources, needed to cover domestic demand, is one of the main priorities of ensuring energy security of Slovakia. Energy sources based on renewable energy playing in Slovakia's energy balance up to now an insignificant role. But the world trend clearly moving towards greater use of clean energies, so their increased use is enshrined among the strategic objectives of energy policy in most countries worldwide, including Slovakia.

Investment decision in a market economy is of paramount importance, is this multiple true in the so capital-intensive economic sector, such as electric power engineering is. The initial step in evaluating the feasibility of each project must therefore be an assessment of its economic efficiency.

Approach to economic evaluation of projects can be divided according to the character of the entity that evaluates the project or spends funds to implement it and carries its economic consequences. In principle, we can talk about the aspect of project or about the aspect of the entrepreneur. Evaluation from the perspective of the project may well serve when it is necessary to evaluate a variety of projects in terms of total requirements and effects. The effect for the investor is only a part of the overall effect of project, and this part may not be sufficient for the concrete investor. In the case of society-wide importance projects, typical example of which is investment to energy saving and to renewable energy sources, we must first choose projects suitable according to aspect of the projects and then from the aspect of investor determine the extent of support that makes the project economically attractive.

2. BALANCE OF PRODUCTION AND CONSUMPTION OF ELECTRICITY IN SLOVAKIA

Slovak Republic almost 90% of primary production of electricity provides by purchasing energy sources outside the territory of the EU internal market. The only significant domestic energy resources are lignite, extraction of natural gas and crude oil is insignificant.

Strategy of Energy Security of the SR with a view to 2030 to ensure self-sufficiency in electricity production, optimal pricing, the ability of SR pro-export, strengthening its position in the transit of electricity, gas and oil, and reliable supplies of thermal energy by other energy carriers.

Based on analyzes can be expected in the long term (until 2030) that the primary role in covering of electricity consumption will play a greater use of nuclear fuel, natural gas and RES. This development assumes that a tightening of emission limits will decrease consumption of coal.

Expected development of the consumption of primary energy sources in Slovakia till 2030 is shown in Fig. 1.

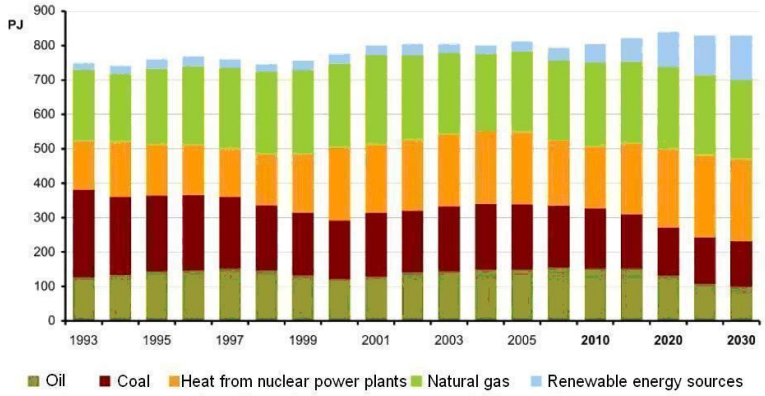

Figure 1 - Development of consumption of primary energy sources in Slovakia till 2030.

Effective coverage of expected consumption and increasing energy security can be achieved by selecting the appropriate energy mix, increasing the share of renewable energy, reducing energy intensity of the national economy and by reducing the consumption of fossil fuels.

The strategic objective is to lay the foundations to achieve a comparable standard of living of developed European countries. Achieving this goal makes the provision of sufficient electricity to meet all the needs associated with the growth of living standards. The prognosis of the expected development of electricity consumption in Slovakia according to the current document is displayed in Table 1.

Table 1 - Forecast of electricity consumption in Slovakia

scenario		unit	2015	2020	2025
reference	SES	TWh	34,7	37,5	40,4
	new forecast		32	34,6	36,9
low	SES		32	33,3	34,5
	new forecast		30,7	32	33
high	SES		37	41,5	46,4
	new forecast		34,2	38,2	41,8

Notes: SES is a document “Strategy of Energy Security” (2008), the new forecast takes into account the impact of the financial and natural gas crisis at the turn of the years 2008/2009.

Slovakia is obliged to increase use of renewable energies in relation to gross final energy consumption from 6.7% (34.1 PJ) in 2005 to 14% in 2020. Assuming that the gross final energy consumption in 2020 will remain the same as at present, therefore, about 500 PJ, this 14% RES in the form of electricity, heat and biofuels means about 70 PJ. Due to the transformation of these different forms of energy is necessary to use a total 80 PJ of renewable energy sources.

The technical potential of various types of renewable energy in Slovakia is shown in Fig. 2. It is clear, that biomass has the largest technical potential (147 PJ), which represents 18% of gross domestic energy consumption in SR.

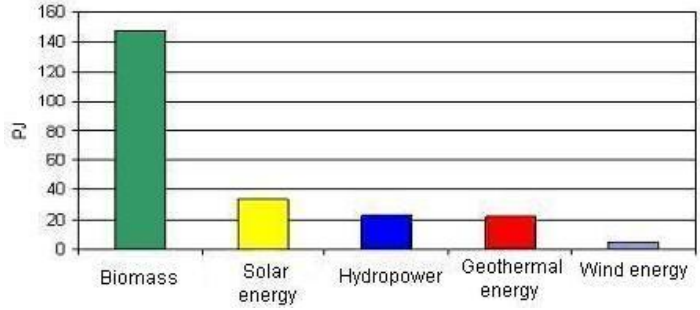

Figure 2 - Technical potential of RES in SR.

3. ANALYSIS OF SUPPORT SYSTEM FOR RENEWABLE ENERGY IN THE EU AND SLOVAKIA

EU Member States are obliged under the Directive 2001/77/EC respectively 2009/28/EC to promote electricity generation from renewable sources in their territory. Given that this Directive does not prescribe for Member States unified support scheme, support systems of renewable energy sources are different and in many cases they are used their combinations too. The EU uses these systems to support renewable energy sources: feed-in prices, increases in the fixed market price (the green bonuses), green certificates, tax credits and direct investments (subsidies).

These systems the support of renewable energy across Europe are captured in Fig. 3.

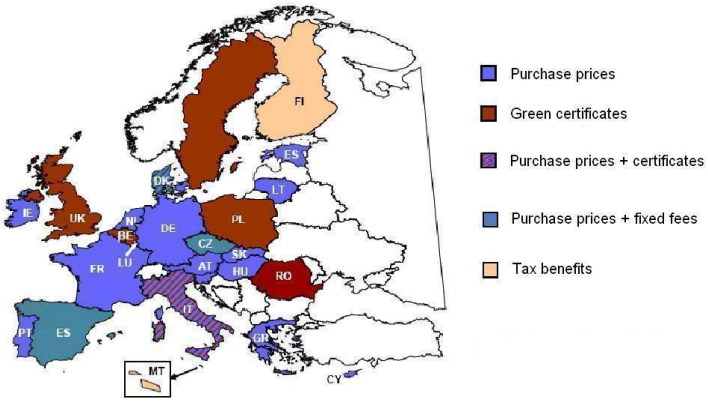

Figure 3 - Overview of RES support in Europe.

Support the production of electricity from RES in SR is solved by Act. 309/2009 Z. z., that optimizes the electricity market in renewable energy and combined heat and power. Guaranteed prices of electricity for 15 years support the construction of facilities for electricity production from RES, and also have a positive impact on investment in electricity generation technologies for small and medium enterprises, thus contributing to regional and local development. The pricing takes into account the type of renewable energy, the technology used, the date of putting in operation and the installed capacity of equipment.

The main instrument for promoting renewable energy is a support system through the purchase prices. From an investor point of view this system can be considered beneficial, from reason of guarantee the return of investment. By setting purchase prices and therefore the payback period, the government or regulator (URSO) can prefer some development plans in the RES.

4. THE ECONOMIC EFFECTIVENESS OF PROJECTS

A basic and generally applicable method of economic evaluation is the Net Present Value of Investment (*NPV*-method). The essence of this method is to compare all the costs and benefits arising from the implementation of investment project. Net present value of the investment *NPV* can be expressed as the difference between the present value of expected revenues CF_P during the life of the investment T_z (the difference between revenues and operating costs in each year) and the updated capital costs N_{ip}:

$$NPV = CF_p - N_{ip} = \sum_{t=1}^{Tz} CF_t (1+k)^{-t} - N_{ip} \overset{!}{=} \max$$

A positive *NPV* means that the project is profitable, it is advantageous to implement it. If the *NPV* has negative value, it is necessary to reject the project. By comparing of several alternatives is the most favorable one that has the maximum of net present value.

The minimum price of production and the possible annual subsidy DOT_t can be determined from the condition NPV = 0

$$\sum_{t=1}^{Tž}\left(c_{\min t}\cdot Q_t + DOT_t\right)\cdot\left(1+k\right)^{-t} = \sum_{t=1}^{Tž} N_t\cdot\left(1+k\right)^{-t}$$

where N_t reflects annual production costs in year *t*, Q_t amount of electricity produced in year *t*, and $c_{min t}$ is the minimum price of electricity in year *t*.

5. CONCLUSIONS

The paper analyzes the expected trends in production and consumption of electricity in Slovakia and also points to the possibilities of renewable energy sources to ensure energy independence of the country. Also discusses the system of support of RES in the EU and Slovakia, and provides a procedure for determining the amount of support based on the criteria of economic efficiency.

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