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Preliminary communication

SUSTAINABLE MANAGEMENT OF THE ENERGY RESOURCES OF SERBIA

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ABSTRACT

Energetics has been and remained the key factor of economic changes and economic development to date. If the energy sector is stable, modern, and organized in a quality manner, it also implies welfare for the economy as a whole. Changes in the significance and use of energy in the economy require the professional management of energy development. Irrespective of modern technology and the key discoveries in energy transformation and concentration, it has not declined in significance. On the contrary, energy is the basis of the human activity. On the other hand, the present structure of the primary sources of energy at the global level cannot follow the trend of increasing demand for energy. The limited reserves of the non-renewable sources of energy, especially of crude oil, require our turning towards the renewable sources of energy. The energy crisis of today is not only an expression of the bad condition of natural sources, but a consequence of the global policy for the exploitation of the existing sources of energy. The current condition of energy resources is a consequence of a monopolistic policy for big business and the New World Order founded on it. According to the assessments of the International Energy Agency (IEA), a further increase in primary energy consumption is expected in the period to come. Because of that, it is necessary to strategically plan the development of the energy sector both from the general developmental, technological-economic, and social-ecological points of view. The fact that Serbia has a relatively high energy consumption growth rate, that it is poorer in primary energy reserves in comparison with the world average, refers us yet more to the rational use of the existing reserves of energy and also to the production of energy from renewable sources: solar, the energy of the wind, geothermal, biomass, the energy of the tide and the waves of seas and oceans, and so on. The paper addresses the issues in the field of the sustainable development of energetics, safety and energy efficiency, as well as a future development of energetics in Serbia based on the renewable sources of energy. The economic effects of the production of energy from renewable sources have also been analyzed.

Keywords: energetics, renewable sources of energy, energy resources, sustainable development

INTRODUCTION

In a scientific-professional sense, energetics is the science of energy and the technical use of energy sources. In an economic sense, energetics is a set of the economic activities by means of which primary sources of energy are explored and produced, then transformed, conveyed and distributed to the consumer, and rationally used. More broadly speaking, energetics is the branch of the economy that enables supplying consumers with necessary energy-generating products (Ivezic & Zivkovic, 2010).

Given the fact that energy is the basis of man's every activity, economic development is accompanied by an increase in the need for and consumption of energy. At the global level, the

current structure of the primary sources of energy, however, cannot ensure such a trend of increasing production. The limited reserves of fossil fuels, especially of crude oil, lead humankind to turn to searching for a replacement for oil and its derivatives. Therefore, an energy crisis is not an expression of the bad condition of natural sources, but a consequence of a global policy, i.e. it is a result of the monopolistic policy of big business, whereas a shortage of energy is a product of technological development and the New World Order founded on it. Energetics has a huge impact on the development of the general energy development of society; it influences cheaper and more efficient production and the growth of the living standard of the citizens, which indirectly affects a greater consumption of energy.

Serbia has a high rate of energy consumption, whereas when speaking of the primary energy reserves it is much poorer in relation to the world average. That refers to the rational usage of the existing reserves of energy, as well as to a search for renewable energy sources (RES): solar, the energy of the wind, geothermal, hydro, biomass, the energy of the tide and the waves of seas and oceans, and so on.

The paper deals with the issues of the sustainable development of the energy sector in Serbia, its structure, its significance to the economy, the safety of the production of energy and energy efficiency. In the future development of the energy sector, the significance of the renewable energy sources is highlighted. A new institutional ambience which would enable the stimulation of the development of energy production from renewable sources with the aim of reducing the emission of the greenhouse gases (GHG) is also indicated.

SIGNIFICANCE OF ENERGETICS TO THE DEVELOPMENT OF THE ECONOMY

Energetics is one of the preconditions of the development of the overall material production and consumption of goods. It is classified into the most intensive branches of the economy from the investment point of view, has a multiple effect on the economic results of business doing and is the basis of the total development of each country. Also, the development of energetics is not only one of important conditions, but the key factor of changes in the economic structure and the propulsive factor of the economic development, too.

Due to the permanent growth of the needs for energy not only for the reason of an increase in the population, but also for the reason of an increase in the level and standard of living, energetics will increasingly be gaining in significance in the economic development of every country. Constant changes in the energy world market have been contributing to the whole of mankind paying due attention to energy. That has required the intensification of researching the existing conventional and new renewable sources of energy with the aim of reducing a loss of energy, mitigating the negative influence on the living environment, and maximally reducing the emission of the gases that cause the greenhouse effect.

The development of energetics contributes to the total material development and growth in two manners: firstly, by the using and valorization of energy resources energy-generating products are produced as goods in function of the growth of the total gross domestic product in the energy and other economic sectors; and secondly, the development of energetics stimulates the growth of production in other economic branches and sectors.

Given the fact that the economic position of energetics is worsened in the world, especially in European countries, today, that has caused market instability and strengthened the monopolistic position of energy producers. In many countries, the development of energetics has become a limiting factor of the total economic development.

The consumption of all kinds of the primary energy produced from non-renewable sources, especially oil, gas and fossil fuels has significantly increased in the world in the last 50 years.

Apart from the great significance of energetics and energy production in the field of economic development and economic growth, the effects of energy on the development of the living standard, especially the personal consumption of the population and an increase in the

quality of life, are also very important. Economic development directly depends on the achieved social productivity of labor, the development and application of science and technology, as well as the protection and preservation of the natural environment and resources. The further survival of human society on the Planet Earth will in a large degree depend on the future production and the rational use of food, water, and energy resources.

The degree to which and the manner in which resources have been exploited so far, as well as the manner in which the same are consumed in the time of the present energy and ecological crisis, are becoming unsustainable. This arises from the data about the pollution of the water and the air, the change in the chemical composition of the atmosphere, the appearance of ozone holes, soil degradation, the disappearance of plant and animal species, the shrinking of the land under forests (Eric, 2010).

Investing in the RES-based energetics is considered to be a rational solution since this industry branch has a huge investment multiplier that amounts to, say, 1.5 in the short run, which means that one dinar invested in energetics generates 1.5 dinars of the growth of the gross domestic product during one year. These investments have export goals and differ from investments in the food industry and the selective branches of agriculture, which have anti-import goals, since power may be sold to anyone free of marketing costs (Djuricin & Vuksanovic, 2012).

Due to the uneven and unequal distribution of energy potentials in the world, the question of energy has for a long time now been spreading beyond the state borders, which requires that the problems of energetics and the finding of new RESs should be considered and solved on a world scale. The accessibility of energy and the dependability of supply are of vital importance to all countries since without it not even minimum economic development is possible to achieve, either. The stability and accessibility of certain kinds of energy-generating products and energy on the world market have a big influence on an even and optimal energy supply, especially so in small and less developed countries, Serbia being one them.

SERBIAN ENERGETICS DEVELOPMENT

The development of energetics in any country, be it a developed one or not, is an important factor and a significant segment of total economic development. Requirements for and the possibilities of the development of energetics, as an especially significant industrial sector increase to the extent to which total economic progress is being made, while the consumption of energy by the corporate sector and the population simultaneously increases as well. Through energy production and consumption, apart from an influence on economic development, energetics also enables the development of personal consumption and the living standard of the population.

Until the beginning of the 1990s, Serbia had reached the level of the development of a medium-industrialized country. Dynamic economic development required an appropriate development of energy production. The development of Serbian energetics in the prior period, however, was not based on an energy-efficient policy and was not brought into compliance with energy potentials; frequently, it was noncompliant with economic development, either. Due to the nonexistence of the reforms of the energy sector, the development of energetics in Serbia during the 1980s was not harmonized with the development of energetics in the world, which on its part was changing under the effect of the "energy crisis". Not only did the weakness of the energy policy lead to a disproportion between the development of the economy and the development of energetics, but within the framework of the development of energetics itself it also led to disproportions in the consumption of certain forms of energy, increasingly relying on imports.

Technology for the production of energy dominantly influences an increase in energy efficiency, especially an increase in investment in the production of energy-generating

products. That also had an impact on the growth of investments made in the energy sector. The world energy crisis, however, required that the needs and problems of the development of energetics as an important segment of total technical progress should also be perceived in a more integral manner and over a longer haul. Frequent energy crises and changes in the prices of energy-generating products on the world market encouraged the introduction of contemporary production technology and the entrance of multinational companies' significant capital into this field.

The changes made in the development of energetics refer to an intensified interest of the state in that field. In order to provide the needed quantities of energy at as few costs as possible, every country puts in place, to a certain extent, a policy of the development of the energy sector. The provision of energy in an efficient manner is a multidimensional problem and includes the defining of the necessary quantities of energy from the standpoint of the objective possibilities and the conditions of the development of a country, the technical aspects of production, the conversion, transport and consumption of energy, as well as a choice of economically acceptable prices, safety and continuity in energy supply.

In the perception of the **economic position** of Serbia's energetics, unfavorable characteristics come to light. This, first of all, reflects in the position of the enterprises of the energy sector in the primary distribution, i.e. in the non-parity valuation of energy-generating products in market exchange. In forming prices for certain kinds of energy-generating products as goods, market regularities, as well as the freedom of the decision-making of the enterprises of the energy sector, had an insufficient influence on the business policy.

By adhering to a tight economic policy in the formation of prices for certain kinds of energy-generating products, the state had to a high degree influenced the economic conditions of the business doing of the enterprises of the energy sector. A disparity policy was being pursued on prices for certain energy-generating products in relation to the prices for other kinds of goods with the aim of facilitating the conditions of the business doing of enterprises in the other sectors of the economy and preserving the population's living standard. In that manner, the economic position of energetics was constantly the subject matter of the state regulations. Due to suchlike non-market position of energetics, it was difficult to ensure a satisfactory level of income and a profit in the enterprises of the energy sector for the purpose of creating an optimal economic basis for performing expanded reproduction.

Because of the deepening of the economic crisis in the 1990s and the introduction of the UN sanctions, the economic position and functioning of the energy sector of Serbia additionally worsened. During the sanctions, the functioning of the energy sectors was reduced to surviving and satisfying the needs of the economy and the population for the basic energy-generating products. The experiences of that period show that big energy systems must not be an instrument of the social policy and the preservation of standards since consequences are immeasurable, this being especially so from the standpoint of the possibility of the system consolidation and the necessity of ensuring funds for longer-term investments to be made in energy capacities. By controlling the prices for energy-generating products, the informative role was lost, which conditioned a change in the structure of energy consumption in favor of electrical energy, and a disbalance between energy production and consumption in the heating period.

In developed countries, the high consumption of electrical energy per capita is a result of its intensive use in the process of the production and creation of new values. In Serbia, however, the high consumption of electrical energy per capita is a consequence of its use in households and public and commercial activities primarily for heating.

FUTURE DEVELOPMENT OF ENERGETICS IN SERBIA

The energy basis of a country is represented by a set of all the energy sources available, which under certain technical-economic conditions may be used for the purpose of satisfying certain own needs or for international exchange.

The volume and structure of Serbia's energy reserves and resources are very unfavorable. The reserves of quality energy-generating products, such as oil and gas, are symbolical and account for less than 1% in the total balance-sheet reserves of Serbia, whereas the various types of coal, which are dominated by low-quality lignite, with a share of over 92% in the total balance-sheet reserves, account for the remaining 99% of the energy reserves. This especially refers to the lignite exploited in surface-exploitation mines, which together with the total exploitation reserves of about 13,350 million tons is Serbia's most significant domestic energy resource. (Strategija dugoročnog razvoja energetike Srbije do 2025. godine, 2015)

In the period to come, the main conventional fuels, namely oil, gas and coal, will continue to dominate, with an increased share of natural gas. In the meantime, the most important new RESs will achieve an accelerated growth in the structure of energy consumption, whereas the costs of production will be decreasing, which will contribute to a lesser pollution of the living environment. Although they have been known for centuries, it was only after the energy crisis of 1974 that RESs started gaining in significance. This is considered to be a transitional period from the epoch of the usage of conventional (fossil) fuels towards the epoch of the usage of new RESs. Their more intensive development and usage are expected in this century.

The energy potential of renewable energy sources in Serbia is significant and is estimated at over 5.6 million tons of the oil equivalent (toe) per annum, which is slightly less than one-half of the country's annual need for energy. That is a big potential, especially in comparison with some European countries such as Malta, which is deficient in renewable energy sources. In some kinds of renewable sources, however, according to its potential, Serbia lags behind some member EU countries, such as Denmark and Spain, in the field of the wind. Biomass is considered as the biggest potential in Serbia. The biomass potential is estimated at around 3.44 million tons of the oil equivalent, or 61% of the total potential. Also, 1.67 million toe is in the unused hydropotential (29%), 0.18 million toe in the geothermal sources (3.1%), 0.2 million toe in the energy of the wind (3%), and 0.24 million toe in the radiation emitted by the Sun (4.2%). (Energetski bilans RS, 2013).

The future available energy potentials of Serbia are as follows: the remaining reserves of lignite[1] at open-cuts (for the back-up capacities of 1000-1500 MW), then about 30% of the hydropotential, small-sized hydropower plants (<10MW), biomass (the waste biomass of agriculture and forestry), the energy of the wind, geothermal energy, the energy of the Sun, the unused potentials of small-sized coal mines (underground waters and surface excavations), as well as municipal and industrial waste. Of renewable energy sources in Serbia, only the hydropotential[2] and biomass have been used up to a greater extent.

Given the quantitative goals, the "Europe 2020" Strategy also defines some energy goals with respect to where the EU should be in 10 years, namely the following goals: a reduction in the emission of carbon-dioxide by 20% in relation to the level in 1990 (or by as much as 30%

[1] In Serbia, the largest part of energy originates from coal, which, apart from oil and natural gas, is used most. Coal is a dominant raw material in the production of electrical energy, whereas gas and wood are for the biggest part used in heating, although households have increasingly been turning to electric power and other energy-generating products for heating due to a higher price for gas.

[2] According to the EU regulations, in the production and consumption of energy from renewable sources, big hydropower plants are included, but in the field of the protection of the living environment they are not considered as ecological plants due to damaging effects that the construction of dams has on the living environment. In that context, the share of electrical power from renewable sources is insignificant without big hydropower plants.

if conditions enable it), an increase in the share of renewable energy by 27%, as well as an increase in energy efficiency by 20%.

The future use of all available energy sources will depend on the two key factors, namely: the first, ecological aspects, especially with respect to the emission of the "greenhouse"-effect gases, and the second, the price of energy.

Serbia has a substantial energy potential in renewable energy sources, but the same has not sufficiently been used up, such as the wind or the radiation emitted by the Sun. Apart from technological challenges, the undeveloped market and a lack of experience in Serbia, a greater use of renewable energy sources is also made more difficult by the legal and administrative barriers that repel investors. It is Serbia's goal to increase the share of energy from renewable sources, which is also its obligation arising from its membership in the Southeastern European Energy Community as the framework for integration into the EU energy market.

The additional need for using RESs has appeared in the past few decades after the alarming data about the consequences of the emission of the greenhouse-effect gases that are emitted by the combustion of fossil fuels were published. That has led to the climate changes throughout the world that have not sidestepped Serbia, either. Due to climate disturbances, dry and warm summers can be expected, as well as extreme changes in the weather conditions, temperature oscillations, periods of unstable climate, events such as floods and hailstorms. The EU has accepted the obligation to reduce the emission of the greenhouse-effect gases, which also include carbon-dioxide, by 20% by 2020 in relation to 1990, to increase to 20% the share of renewable energy sources, and to achieve 20% savings by implementing energy efficiency measures, all for the sake of fighting climate changes (Strategija "Evropa 2020").

Apart from the ecological significance of the use of RESs, their use is also economically significant. There is a reduction in the import dependency on energy resources, first of all fossil fuels. Domestic industry is developed and new jobs are provided. In Serbia, there are no assessments of what economic effects the development of this industry might bring with itself, first of all what influence it will have on the price for energy-generating products. When determining the value of the production of certain RESs, the existence of the "gray market" (biomass, illegal forest cutting and using it for one's own needs, and so on) is a great challenge. There are, however, several obstacles on the road to using energy from renewable sources. In the first place, investment procedures are lengthy and complex, regulations are insufficient, whereas standards are only partly defined. The price for electrical energy is a new obstacle given the fact that it is all but economic, namely energy generated from renewable sources would not be competitive due to the low price for electric power. The question of how much the distribution grid would be able to support the connection of the capacities from RESs without investment, and the question of how the same would reflect on the price for electric power are posed, and with a good reason as well. When speaking of RESs, there is also always the question of the stability of supply from such sources, which, just as is the case with the wind and the Sun, cannot ensure uniform supply throughout the year. The production of electrical energy from RESs is more expensive than the production of energy from fossil fuels, due to which fact measures for stimulating investment in plants are being introduced.

The EU has recognized energy efficiency as one of the key manners to achieve the goals of sustainable energy development, namely: a reduction in negative impacts on the environment from the energy sector; an improvement of the dependability of energy supply, and the satisfaction of a growing consumption of energy without more significant disturbances.

In electro energetics, an increase in energy efficiency would imply the use of the technologies such as the advanced coal-combustion technologies, gas-operated power plants of a high efficiency degree (up to 60%), a reduction in losses in the transport and distribution networks, their modernization and the use of information-communications technologies in the supervision and management of the network, the construction of power plants as close to the

places of the highest consumption as possible and the stimulation of the distributed production of electrical energy.

By signing the Agreement of the Southeastern European Energy Community, Serbia undertook to follow the energy policy of the EU. Therefore, adjustments for the purpose of satisfying a future energy policy with required goals of sustainable energy development are indispensable. The promotion of sustainable, competitive and dependable energy supply are the key principles of the EU energy policy. In January 2008, the EU defined its energy policy goals, and in 2010, it defined its priorities until 2020. In order for these goals and priorities to come true, it is necessary that a coordinated and integrated, regional and broader approach should be applied with the aim of solving important European common energy problems.

CONCLUSION

Savings in all forms of energy in the processes of the exploitation, processing, transporting and using of energy sources are especially significant to the sustainable development of energetics. In Serbia, the efficiency of energy production is at a low level since energy consumption is high as per energy product unit (4:1). Simultaneously, energy consumption per capita is amongst the lowest in Europe. In comparison with the achieved GDP and the reached level of the country's economic development it is very high, which is also indicative of the fact of the irrationality of such consumption. The reasons for the low efficiency of energy production in Serbia lie in the outdated production technology, high leaks in the transport and distribution grids, the bad quality of coal as a raw material in energy production, the low price for energy for households and the corporate sector, and so on.

For a larger number of years already, the energy price policy, implying simultaneously both the relation of the energy prices as against the movement of the product and service prices and the mutual relation of the prices for energy-generating products, has been non-market, non-economic and non-parity. It is therefore necessary that a fiscal policy, a price policy, taxes, credits and loans should be devised with the aim of quickly achieving a rational and efficient total energy system. Social problems may no longer be solved by applying low energy prices, especially not so regarding the price of electrical energy, but rather via social cards, so that energy could be available to everybody at an economic price. By putting in place the policy of low prices for energy, the need for the rational use of energy does not occur, while at same time producers, distributors and consumers are no longer interested in reducing the irrational consumption of energy by making additional investments and carrying out additional activities. Because of that, the country needs to ensure conditions for uninterrupted energy development, the rational use of and savings in energy, and the stable sources of funding the development and construction of energy capacities through an energy economic price policy and an appropriate plan for the construction of energy buildings via favorable credits.

Research studies have shown that the influences of energetics on man's environment are mainly negative, for the reason of which fact the problems of the protection of the living environment should be a priority in planning a future development of energetics. The problem is all the more complex since a compromise must be reached between the energy policy and the living environment protection policy, which on its part depends both on technical, economic and social possibilities and conditions and on the desired goals of protection. In order to reduce the impact on the living environment, it is necessary that energy organizations' obligations regarding the recovery of and a reduction in the consequences of the impact on the living environment through the revitalization of plants by applying new technologies should be determined in the forthcoming period (the recultivation of agricultural land, a reduction in the pollution of the atmosphere, waters and soil, and so forth).

In order to successfully solve problems of the protection of the living environment, it is necessary to follow and timely apply positive world experiences with an increased degree of

the usefulness of new technologies for the production, conversion and transformation of energy, the rationalization of the consumer's use of energy, a greater participation of the RESs, as well as the "clean technologies" of the production of energy from fossil fuels.

By producing energy, the energy sector creates preconditions for the normal functioning and development of the economy. For that reason, it is necessary to obtain an appropriate volume of investments (both domestic and foreign) in the future economic development of Serbia so as to both meet domestic needs for energy and ensure a significant foreign-exchange inflow from exporting energy.

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