

## INTRODUCTION

Can you imagine life without television, cars or computers, without being able to prepare your food every day, without lighting in the house, without heating during the cold seasons of the year, etc.? But all this is the result of creative activity of scientists and inventors, especially during the last two hundred years. All this may disappear during the first half of the present century, following the drastic depletion of natural reserves of fossil fuels. Increased energy consumption leads to a continuous increase in the volume of extracting fossil fuels, which provides more than 85% of energy use today. Currently, the annual energy consumption is equivalent to more than 11 billion tons of conventional fuel (t.e.p.) or 459 EJ ( $459 \cdot 10^{18} \text{J}$ ), of which only 15,4% is of non-fossil origin. As the world population increases and the level of energy endowment of the economy grows, simultaneously, this figure is steadily increasing, which fact will have serious consequences. Most acceptable fuels, economically, - oil and natural gas - are supposed to be about exhausted in 30-50 years.

Today, most of the energy needed for daily consumption is produced by burning fossil fuels - coal, oil and natural gas. Several million years, plants and animals decomposing led to the formation of fossil fuels, which, however, were consumed during about 200 years, practically. Millions of years, Earth's atmosphere formed a whole plant system, and during a 200 years period, but, particularly in the last 100 years, the environment was seriously jeopardized and the world is facing an ecological disaster.

In 1960, 3000 TWh of electricity were produced and consumed. In 1970 it increased up to 6,000 TWh. 150 000 TWh were consumed in 2000. Even, if it is possible to reduce electricity consumption in industrialized countries (U.S., Germany, Japan etc.) by 1/2, and at the same time to increase consumption per capita, by only 25% of global electricity, in India, China etc. - third world countries, the overall demand would double from the today's one. What energy sources are able to meet these requirements? Increasing power generation by burning traditional fossil fuels would further endanger the ecological impact. Expectancy of power engineering professionals is based on finding new solutions and processes that would meet the energy needs of mankind in the coming decades or centuries. At the forefront, nuclear energy solutions have been related to, but after the power failures (the U.S. Three Miles Island and Chernobyl in Ukraine), the need to develop alternative solutions, environmentally friendly, has become an imperative.

The concept of energy efficiency (or energy optimization) became, at present, one of the main concerns of mankind on the whole world. With the first oil crisis of the early '70s, human society began to realize more than ever the need for a sustainable strategy by increasing the efficiency of energy use and implementing energy efficiency programs taking into account the depletion of fossil fuel reserves on Earth. Today, we speak of a global energy policy and a concerted strategy to reduce harmful emissions into the atmosphere, based on concrete economic and technical solutions for rational use of fossil fuel reserves (which still have the main share of energy production) and valorization of renewable energy resources on a large scale, the so-called "clean" energy or non-conventional energy, as an alternative to the current system of fuel reserves on Earth. Renewable energies (solar, wind, hydro, etc.) are environmentally friendly but today they are not able to meet these ever-growing needs.

These two serious issues - the energy crisis and environmental impact, are global problems of humanity, which settlement falls on the shoulders of engineers. Because the world is so dependent on energy, because most of Earth's population uses fossil fuels to meet energy needs, which causes a high degree of environmental pollution, it is strictly necessary to seek new sources of sustainable and environmentally friendly energy. Energy sources producing the least possible pollution will be found. Since all traditional energy sources pollute the environment, renewable energy is practically devoid of this negative effect of

environmental pollution.

Diversification of energy sources becomes an economic and environmental imperative. These alternative energies are called renewable energy. What are these alternative sources of energy? The best known renewable energy sources are solar energy (direct, photovoltaic and thermal), wind (as a derivative of solar energy), hydraulic (using potential and kinetic energy of water), geothermal, bioenergy, etc.

Renewable energy can be used both as a centralized and largely decentralized energy source. Decentralized sources are particularly advantageous, especially for rural and isolated consumers. At the same time, according to UN information, about 2 billion people lack access to electricity, while about 40 countries have no national electricity networks. The cost of the network is bigger in proportion of 4:1 or more to the cost of power plants. From this point of view, promoting decentralized energy sources is advantageous, as key programs of rural electrification and poverty reduction in rural areas. Disadvantages of decentralized energy systems: functioning instability and inability of electricity storage and redistribution, distribution networks having the role of electricity storage, too.

With a clear emphasis of the policy and actions, by contribution of a panel of international experts, the current status of renewable energy impact and future potential is set up, which includes social, political, economic, environmental and technological aspects.

Special attention is paid to energy potential, history of development and production of renewable energy conversion systems: solar, wind, hydro, sea waves. Today the European Parliament declared a clear signal how to promote renewable energies in the EU until 2020 in order to achieve 25% share of primary energy. At the same time, the European Council on Renewable Energy (ECRE) has been established for this purpose. *“Parliament’s vote today is an historic opportunity for the Commission to test citizens’ demands for renewable energy. Together with the Parliament, leaders in building and securing legislative proposals for all three sectors must be: for electricity, heating and biofuel. The Commission should focus its attention on eliminating gaps in EU legislation for renewable energy - heating and cooling”*, said Oliver Schafer, policy director of ECRE. Leaders in research and professionals in various fields of renewable energies have met at EUREC Agency (European Renewable Energy Research Centres Agency) to completely redefine the position of renewable energy conversion technologies in the context of meeting global energy needs and recommend directions for development technology for each branch based on that analysis.

Aspiring to the future, Freeman Dyson of the University of Oxford, has justified that technological exchanges fundamentally alter our ethical and social arrangements and that three new technologies that are growing rapidly - renewable energy, genetic engineering and global communication, have the potential to create a more uniform distribution of global health today.

Developing countries that have low or inadequate resources of oil and coal, which also for the purpose of solving energy problems have cleared large areas of forests, are in a situation of using non-conventional energy resources, such as solar, hydraulic, wind, or combined with conventional fuels for higher efficiency.

Increased costs associated with fuel procurement, transportation and maintenance of engines, coupled with difficulties in quantifying the environmental costs make renewable energy an attractive alternative to combustion engines fuel-based generators.

The efforts of researchers are increasingly targeted to revitalization of existing technologies to reduce energy consumption and waste production, and also to use unconventional energy sources where possible. Desire to have more efficient production processes in terms of energy consumption has occurred, especially after the energy crisis of 1970, which led to rapid price growth.

During about 200 years, mankind has created a great energy complex and difficult to imagine, providing basic services: lighting, heating, refrigeration, transport, technological

processes, etc. Modern standards of welfare, education and health cannot be maintained without energy. However, it was recognized that the emergence of modern energy is guilty of many environmental problems. It is necessary to find a compromise between the growing demand for energy services and the critical need to protect the environment. In the opinion of the authors of this paper, the solution is to return humanity to renewable energy sources. In this way, it will naturally repair the chain, broken 200 years ago. The nineteenth century was the century of steam, the twentieth century – of the electricity, and the twenty-first century will be the century of renewable energy or will not be at all.