

# **DISTRIBUTED GENERATION AND RENEWABLE ENERGY SOURCES FOR SUSTAINABLE LIFE**

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## **ABSTRACT**

*This article deals with utilisation of renewable energy sources with orientation on their benefits and handicaps. Possibilities of distributed generation and utilisation of the renewable energy sources are also mentioned. Actual conditions of these sources within the European Union are analysed, and their external costs are compared with the external costs of conventional energy sources. The continual development of the renewable energy sources utilisation is emphasised.*

## **KEYWORDS**

distributed generation, renewable energy, sustainable life, solar energy, wind energy

## **1. INTRODUCTION**

From the analysis of foregoing development, it results, that the mankind in the past was oriented to coal, oil and natural gas, which are exhaustible. Today, the exploitation of these energy sources has reached very high level, which is non-sustainable to the future from quantitative point of view. Their exhaustion is expected in the period 15 – 150 years. However, the utilization of these sources is limited not only by their reserves, but also because of the disturbance of the thermodynamic stability of planet. According to WEC analysis, this problem can be solved by the renewable energy sources (RES). Their quantity presents 20,000 – multiple of actual world energy consumption and reserves of these sources are practically inexhaustible [1]. The delaying of the RES utilisation through last decades causes serious international conflicts.

## **2. NON-RENEWABLE ENERGY SOURCES**

Important results of non-renewable energy sources utilisation are production of CO<sub>2</sub> and thermal emission, with the effects of global warming and climate changes. In consequence of unequal allocation of these sources, the costs of exploitation, processing and transport raise, because of long distance between the locations of mining and consumption. Countries with supplies of raw materials generally only sell them to developed countries for further manipulation [2].

Conserving the current structure of energy supply would increase the European Union's dependence on imports of raw materials dramatically to 71 % in 2030, as shows Fig. 1. Also some prognostic institutions (e.g. UDI) present the necessity of increasing of installed electricity power worldwide by 100 % to 7200 GW. However, the realisation of these prognoses is practically not possible. From these analyses, it result, that it is possible to anticipate serious economical, ecological and ethical problems over the world in following decades. The solution of these problems requires new methods and important change of life style.

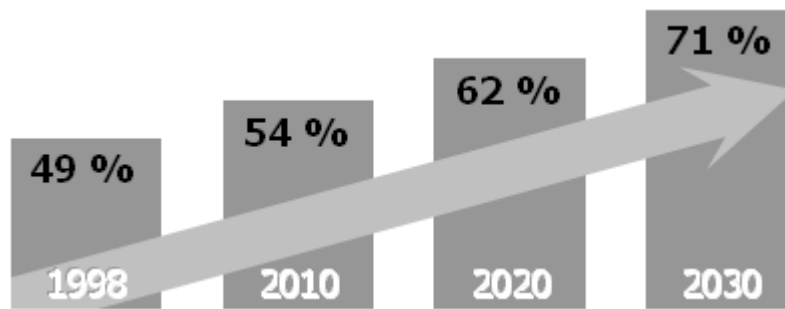


Fig. 1 Forecast of growing dependence of EU on fuel imports

The utilisation of non-renewable energy sources is doubtful also from economical point of view, because of their high external costs, i.e. social, political, environmental and nuclear costs. These forgotten costs are not included in selling price and they are by much higher than actual electricity price (Fig. 2).



Fig. 2 Price of energy supply – the conventional energy price iceberg

### 3. RENEWABLE ENERGY SOURCES

The main renewable energy source is solar energy. This energy is transformed to kinetic energy of wind, potential energy of water, chemical energy of biomass, or thermal energy on ground surface. Every type of these energies can be utilised for production of electrical, thermal or mechanical energy. The high potential of renewable energy sources is shown on Fig. 3. The highest potential is concentrated in solar radiation, kinetic wind energy, energy of the waves and sea, biomass and in hydrologic cycle. Actual world energy consumption per year is displayed in the diagram lower right corner and it is only little part compared to the whole potential of RES. The great benefit of renewable energy sources is their balanced allocation on Earth's surface. It allows their distributed utilisation.

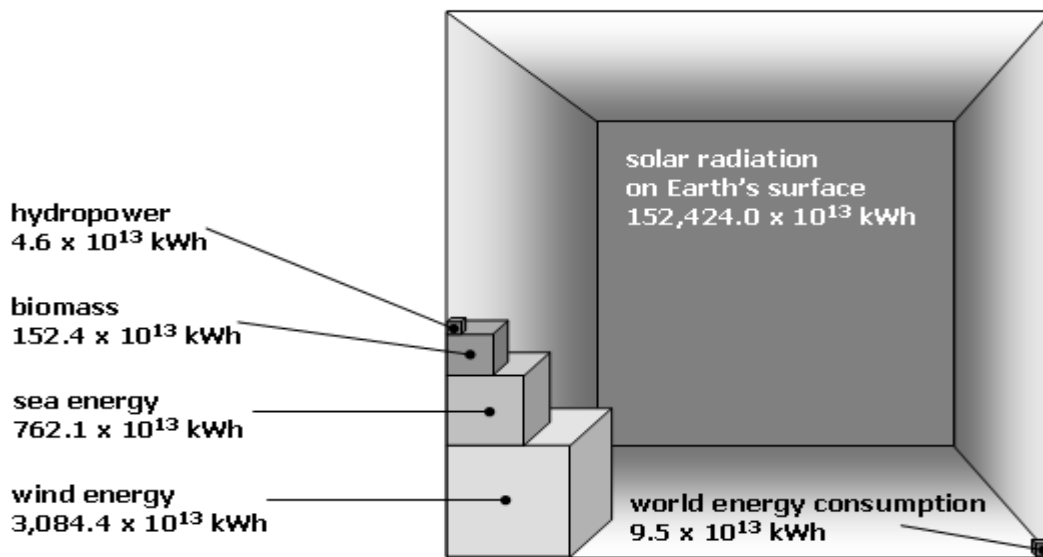


Fig. 3 Potential of renewable energies worldwide

The renewable energy sources have low external costs, as shows Fig. 4. It follows the benefit of global gain of life quality.

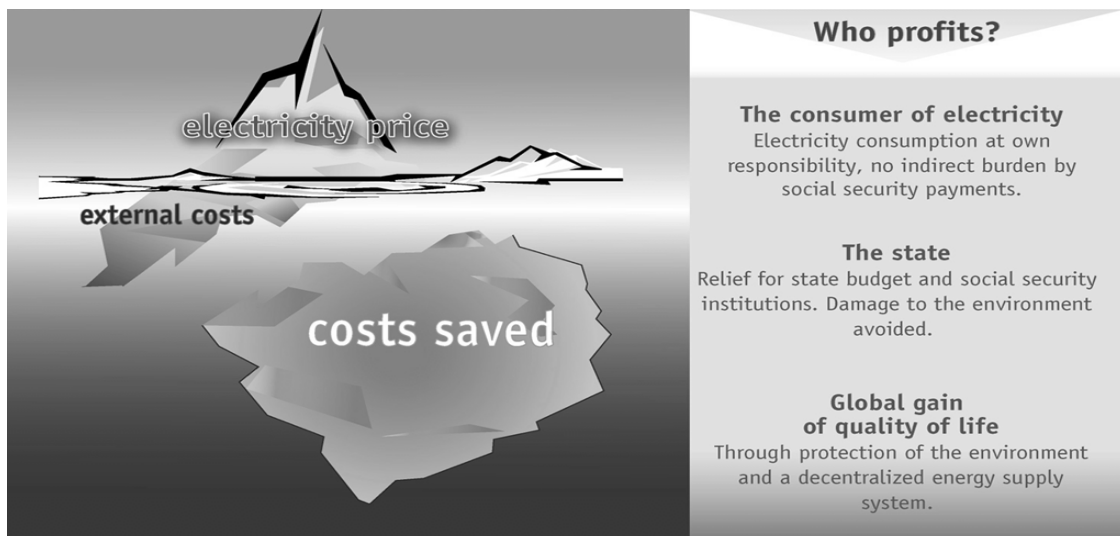


Fig. 4 Price of energy supply – saving costs through renewable energies

Present economic methods for energy sources evaluation have not included external costs, which charged the society and the environment. In last years, it has increased the interest in more complex economic approach, with analysis shown on Fig. 5. The diagram proves the low external costs of RES in comparison with conventional energy sources [3].

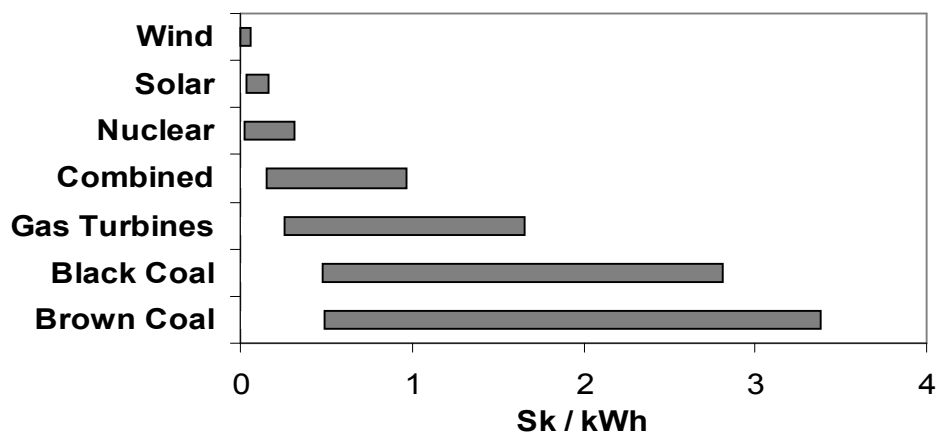


Fig. 5 External costs of electricity generation for various types of power plants

### 3.1 DEVELOPMENT OF RENEWABLE ENERGY SOURCES

Although the former problems have been well known already 30 years, the mankind has not concentrated its research potential and financial resources to solve these challenges. The results of scientific research have not been applied in practice. Introduction of a new energy source requires 15 – 30 years for research, prototype development, demonstration projects, experience gaining, preparation and starting of mass production. However, it has been spent much time, what causes delayed wide utilisation of RES.

The utilisation of RES has not been significant until the appreciation of the importance of grant funding for development and utilisation of these sources by some countries. At first, the equipments for photothermal conversion of solar energy were used, but gradually the wind power industry reached the highest growth. The most impressive results have been achieved in Germany (Fig. 6). Figure shows the political milestones with corresponding increase of installed capacity and number of wind turbines.

In Germany, in 1991 was adopted the Electricity Feed Act. Installed power capacity of wind power plants went up 20 – times until 1997. With respect to the mass interest, in 1997, it was necessary to change the German Building Code to achieve the privilege of wind turbines building. In 2000, the Renewable Energy Sources Act was adopted to make granting priority for RES. The consideration of law court was even necessary. In 2001, the European Court of Justice made decision that the German tariff model complies with European Competition Law. Previous experiences also stimulate to amend the RES Act in 2003.

As the result of presented way, it is above 16 GW of installed capacity of wind power plants and about 16,000 wind turbines. According to experience, the development of this industry has positive effect to the job creation and also to the export. In Germany, the wind energy industry has strong position and the grant funding aid is not necessary now.

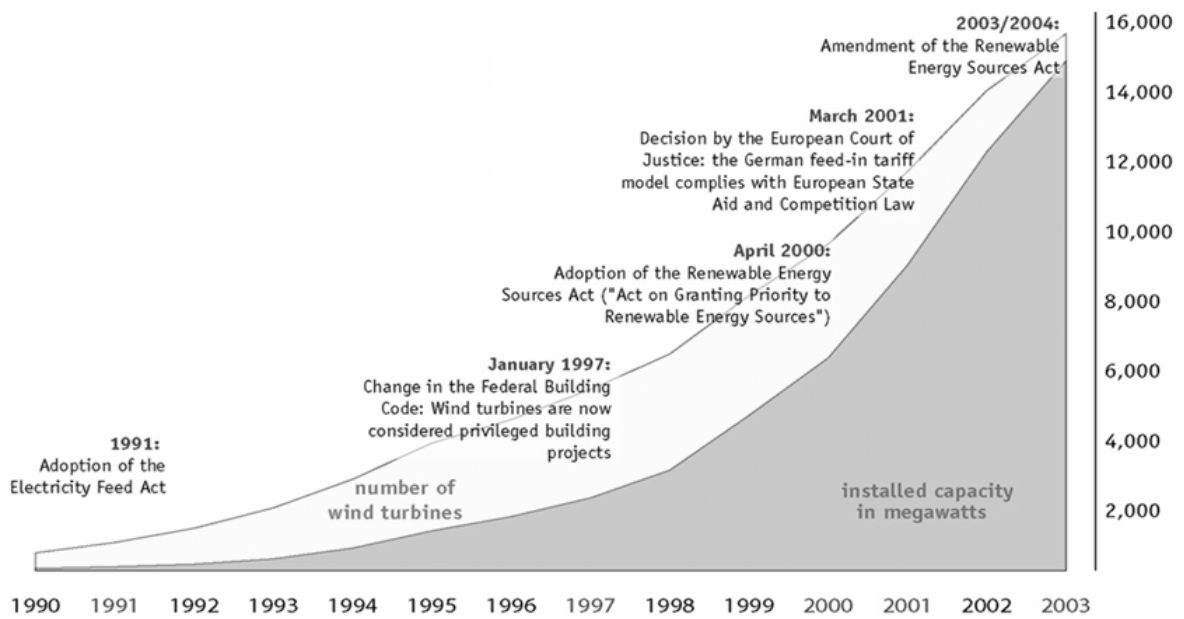


Fig. 6 Increase of installed capacity of wind power plants in Germany

Moreover, Fig. 7 indicates the interesting growth of world installed capacity of wind power plants. It reflects progress from experimental phase to mass production.

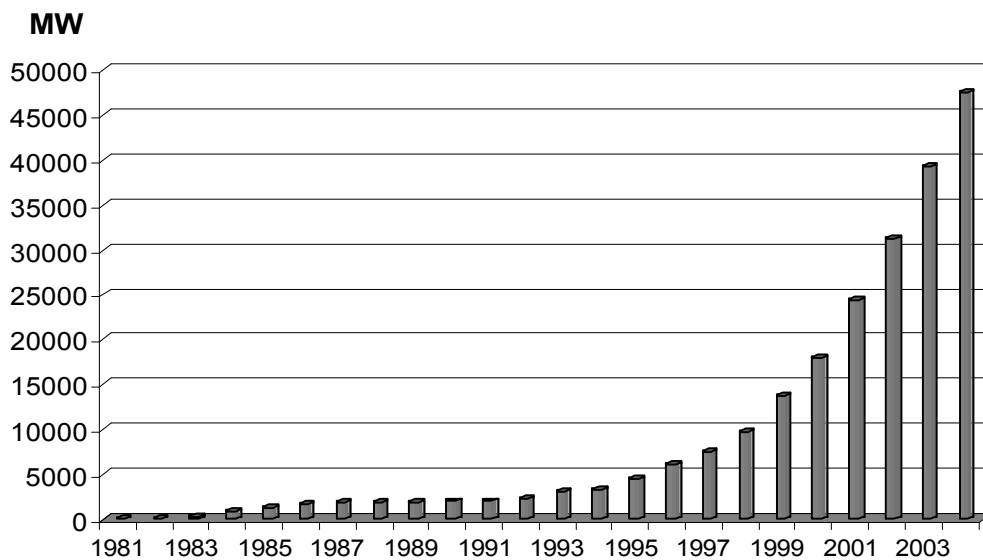


Fig. 7 Increase of installed capacity of wind power plants worldwide

Renewable energy sector has been not asserted in many countries because of bureaucratic barriers, especially in initial period of plants operation. It is evident in Slovakia, which began to use the TF (Technology Foresight) method as the last country of the European Union. This method can help to achieve the optimal solutions using the development of science and technology at power engineering [4].

#### 4. CONCLUSIONS

In despite of positive extra-scientific public image of renewable energies utilisation, the funding support of research is not corresponding. It is caused by serious economical difficulties during changes of dominant energy sources. But it is short-sighted policy, because of global character of these problems, and expert solutions should be preferred according to the global priorities.

The value of RES was underestimated and large part of expert community was prevailed only by practical results. Nowadays, world installed capacity of wind power plants overreaches 50 GW.

The European renewable energy sector has only just begun to reveal its enormous potential for growth. In a global economy, Europe's competitive advantage is to be found in its ability to develop and bring to market innovative products and services. For all that, it is important to create conditions that encourage European countries to produce and export high-tech, innovative, environmental technologies.

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