

USE OF RENEWABLE ENERGY SOURCES IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

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Abstract

Currently, the most debated issues globally are those related to the sustainable development of society, to the depletion of natural resources caused by the production of electricity and heat, to environmental pollution and, last but not least, energy wastes. Research into the use of renewable energies has emerged in response to these issues that bring to the forefront the use of alternative sources of energy such as solar, aeolian, geothermal, etc., also called green energy. As Romania is one of the most polluted countries in Europe because of energy production through the use of coal, green energy becomes a real necessity in producing energy in our country. In this context the authors of the paper present the alternative energy resources that can be exploited at national level in order to produce clean energy.

Key words: sustainable development, energy, pollution, alternative sources

INTRODUCTION

The concept of sustainable development or sustainable development of society has been clarified in particular in recent years, as part of international scientific events designed to identify solutions to the economic, social and environmental problems of the present and future, and the countries of the world have addressed this concept in the context of globalisation. (*Strategia Națională pentru Dezvoltare Durabilă a României*)

The concept of sustainable development emerged after the second half of the 20th century and was clearly defined in 1987, in the report called "*Our Common Future*" or "*Brundtland Report*" prepared by the World Committee on the Environment and Development.

In this report, sustainable development was defined as the development of society aimed at "*Satisfying current needs, without jeopardising the capacity of future generations to satisfy their own needs.*"

The Brundtland Commission also emphasised the existence of two major topics related to sustainable development, namely:

- The development of society must be of a fair nature and including, by increasing the standard of living of all citizens;
- The development of society can only be achieved by protecting the environment from the adverse effects of pollution, preserving ecological balance and rational use of natural resources. (Otiman et al., 2006)

Sustainable development, in this context, aims at merging three essential dimensions: ecological, economic, and social, as well as the establishment of a ratio between the three dimensions. (Coșea & Dunărințu, 2013)

The EU is among the main supporters of the process of extending the application of the principles and practices of sustainable development globally, of the reduction of poverty, economic, and social disparities, and of the promotion of policies responsible for the conservation and rational use of the planet's natural resources. (Mateoc-Sîrb & Mănescu, 2012)

The Financial Perspective 2014-2020 focuses on the principles of sustainable development with specific targets such as improving environmental conditions (measures to combat soil degradation and protection of flood-prone areas, to maintain plantations at a sufficient and sustainable level, to support disadvantaged areas, to improve the quality of the landscape), enhancing the competitiveness of certain sectors with environmental impact (use of renewable energy sources, improving water, waste, manure, fertilisers, pesticides, and herbicides management), improving the quality of life in rural areas (increasing incomes from agricultural, forestry and fisheries activities, expanding services and public utilities, diversifying of non-agricultural activities and entrepreneurial spirit). (*Strategia Națională pentru Dezvoltare Durabilă a României*)

MATERIAL AND METHOD

One of the methods used to prepare raw analysis material was to document the official databases provided by the National Institute of Statistics (*INS-Tempo Online*), the Statistical Yearbook of Romania – data collections published by EUROSTAT, as well as different publications or complementary information taken from the Internet.

RESULTS AND DISCUSSION

Increasing global demand for energy as a result of economic development, the gradual depletion of fossil fuel resources, the increase in gas emissions, and the unforeseeable oil price fluctuation have led to research into finding existing renewable energy resources around the globe.

Studies on the production of conventional energy highlight that this process can become an important source of environmental pollution. Through the combustion process occurring in the production of conventional energy are generated toxic pollutants in the atmosphere, with harmful effects both on the environment and on human health. Studies conducted by many NGOs campaigning for environmental protection have revealed that tens of thousands of Europeans are suffering from air pollution, with numerous cases of acute and serious respiratory diseases.

Protecting the environment from pollution caused by energy production, as well as promoting measures limiting the consumption of non-renewable natural resources, intervene as an obligation for the present society for future generations. (Otiman et al., 2011)

Romania's energy strategy 2019-2030 with the prospect of 2050 is an important document in terms of environmental protection in Romania, which draws the direction of our country's energy field for the future, having as its *main objective, ensuring clean energy and energy efficiency for consumers, thereby contributing to ensuring energy security, sustainable economic growth, improving the quality of life of citizens, all of which represent the components of the sustainable development process of Romanian society*. At the same time, particular attention is also given to the renewable energy sector, our country having real potential in the production of renewable energies, known to be environmentally friendly.

Romania aims at increasing its energy efficiency by putting particular emphasis on the exploitation of renewable energy sources, which can contribute to reducing the energy dependence of our country on imports, to limiting adverse effects on the environment and, last but not least, to increasing the supply of food to the population as a result of the use of renewable sources in agriculture such as geothermal waters which are in abundance in the western area of Romania.

The problem of alternative sources of energy is not a novelty of the last few years, when their use has been made more acute only because of the requirements of the European Union, but also the need to reduce sources of environmental pollution due mainly to residues resulting from the combustion of fuels, derived from fossil hydrocarbons (petroleum, natural gas). As far as the alternative energy resources to fossil sources is concerned, which can be used mainly in rural areas, but not only, currently the most used forms of renewable energy that can be utilised are:

- Wind power (of air currents and winds);
- Solar energy (light and heat);
- Biomass energy (plants, which store, during their growth and development, large amounts of energy);
- Geothermal energy;
- Hydraulic energy. (Cristina et al., 2015)

Wind energy is obtained with wind, a form of renewable energy known for a long time and with a strong development in the field of renewable energy. This form of energy can be used in non-electrified areas in parallel with energy storage systems.

Wind energy is known and used since the beginning of humanity, as a means of propulsion on water for various boats, and later as energy for windmills. The documents record that windmills were used from the 7th

century BC, by the Persians for grinding grain. European windmills were constructed since the 20th century in England and France, being used both for grinding grains and cutting logs, shredding tobacco, making paper, pressing linseed for oil and stone grinding for paints, etc., and evolved up to the modern wind turbines that turn wind energy into electricity producing between 50-60 KW (the smallest wind turbines) to 500-1500 KW (the large ones).

At the end of 2010, the global capacity of wind generators ensured 2.5% of world energy consumption. In 2011, the share of wind energy of the total domestic consumption was 24% in Denmark, 14% in Spain and Portugal, about 10% in Ireland and Germany, and 5.3% at EU level. In Romania, the share was 3% at the beginning of 2012, and there were over a thousand wind turbines, half of which were located in Dobrogea. Currently, Europe's largest terrestrial wind park is located in Scotland, Whitelee Wind Park.

Solar energy is the energy from the sun, being an important source of renewable energy available for everybody. The life span of the solar body is five billion years, according to our scale of time, the sun representing an inexhaustible, renewable energy.

"It is said that solar energy is the safest source of energy. The availability of solar energy depends on the day-night cycle, on the latitude where it is captured, on the season and on the degree of clouding". (Daniel, 2009)

Solar energy can be used for heating water or rooms (housing, greenhouses in aquaculture, etc.) by producing electricity using solar cells (photovoltaic) through solar thermal plants (solar power plants) by heating directly or using heat pumps or with the help of thermal solar panels. (David *et al.*, 2016)

Germany is the country with the largest production and market of solar energy in the world, followed by South Korea, France. Spain, Italy, and Greece.

Biomass and biogas energy are the energy that field specialists say has a safe future. Biomass is the main fuel mainly used in rural areas. In the context of sustainable development, biomass is a renewable energy, which supplies biofuels, generally in solid form, but that can also be easily transformed into liquid or gaseous fuels. Biomass is the biodegradable part of plants, waste and residues from agriculture, forestry or industry-related sectors, including plant and animal materials or industrial and urban waste. For example, **biogas** with a concentration of 60% methane and which can be produced from waste or manure can provide electricity for lighting or cooking. (Mateoc-Sîrb *et al.*, 2013)

France, Finland and Germany have designed important units producing biomass-based energy. In France, 15% of final electricity consumption is ensured by consumption of biomass and biogas (obtained from organic, domestic or non-recyclable waste).

Geothermal energy is a form of energy obtained from the heat inside the earth. Hot water and steam captured in areas with volcanic and tectonic activity are used for heating water, housing, for the production of electricity, heating of greenhouses and solaria, pasteurization of milk, etc., most often in rural areas provided that the distance from the place of extraction of hot water does not exceed 35 km.

The use of geothermal energy where possible reduces the consumption of fossil fuels considerably and an important point to remember is that geothermal systems can function continuously without being affected by climate conditions. (Daniel, 2009)

The Pannonian Depression, which, in Romania, includes Banat and western Apuseni Mountains, is rich in geothermal deposits. The counties of Timiș, Arad and Bihor have the most localities that could benefit from the existence of these resources in the area. In Timisoara, there is thermal water up to 80°C. (David et al., 2017)

Hydraulic or water energy is the energy that can be obtained in micro-hydropower plants, especially in areas where other forms of energy cannot be used, such as mountain areas, but the flow of rivers on which they are placed is to be taken into account as they can cause significant damage in the biodiversity of the areas.

At global level, wind energy, water energy, geothermal energy or biomass are used to produce electricity and supply it to national energy networks. Table 1 summarises the sources and forms of energy used to produce electricity for supply in national energy networks.

Table 1

Energy sources and forms for the production of electricity

Energy Form	Energy Source	Capacity	Great Producers
Wind energy	Kinetic wind energy	300 kWel...5 MWel	USA, Germany, Spain, India, etc.
Water energy	Kinetic water energy	5 GWel – rivers 1 MWel – small ones	Canada, Austria, Scandinavia, etc.
Deep geothermal energy	High temperature water or vapour	20...50 MWel	Philippines, Kenya, Costa Rica, Iceland, USA, etc.
Biomass energy	Wood, agricultural crops, vegetable mass	100 kWel...50 MWel.	Switzerland, Germany, Scandinavia, etc.
Solar energy	Direct or diffuse solar radiation	1 kWel...a few MWel	Germany, Japan, Luxembourg, etc.

Source: After Clima Therm Center, *Energii regenerabile*

The beneficial effect of renewable energies is manifested in the protection of the environment, but also in economic and social terms. The

main objectives pursued by promoting renewable energies are: increasing air quality, energy security, and increasing employment and developing the business environment. Reducing energy dependence is perhaps the most important aspect of renewable energies, which is why we believe that exploiting these types of resources must be promoted and financially supported.

CONCLUSIONS

- The World Bank defines sustainable development as a process of “*economic growth, poverty eradication and healthy environmental management*”;
- The concept of sustainable development defines a certain type of economic growth and human activity that brings together environmental considerations and the principles of progressive allocations and uses of resources, largely renewable, to achieve rational development;
- In economic growth, account must be taken of a number of ecological concepts with temporary connotations, such as uncertainty, deterioration threshold, degree of exhaustion, irreversibility, stability, shock resistance of the environment, etc., conditions in which the environment is a key factor in sustainable development;
- Sustainable development is a lasting phenomenon consisting of changes that must enable economic development while maintaining the quality of the environment at an appropriate level. This concept requires that natural resources be used in such a way that they do not exhaust or degrade, and are not affected by their use for future generations;
- In the current conditions of the economy, it is necessary to find an optimal ratio between agricultural technologies and between productions and ecology, ensuring the balanced economic and social development of rural area by:
 - Satisfying food and social requirements; Improving the quality of the environment and the sustainable exploitation of natural resources; Using with optimum and sustainable efficacy scarce, non-renewable resources; Improving the quality of rural life.

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