

TYPES OF INFRASTRUCTURE FOR GREEN ENERGY IN ROMANIA**MAFTEI DANIEL***POSTDOCTORAL RESEARCHER, INSTITUTE OF NATIONAL ECONOMY, ROMANIAN
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Abstract: *Across the world governments make decisions on climate change and environmental pollution saying that is the most important goal for the future of their states. Accumulation of environmental problems was done in decades of irrational and unplanned exploitation. Industrialization itself is not a bad thing for humanity [9], but how this is achieved can be detrimental to the future of global society. Environment reverses the conditions created for man in so many thousands of years: thus, economic life is becoming increasingly difficult through its activities. Plants and animals disappear land turns into deserts, people get sick. The present paper attempts to find solutions to a global, national and regional situation, referring to those types of infrastructure viable to produce clean energy in Romania. This paper argues the need of green energy and propose alternative and environmentally friendly cleaner solutions.*

Keywords: *green energy infrastructure, energy security, green alternatives, green investment*

J.E.L. Classification.: *Q42, Q53, Q54, Q56.*

1. Introduction - Infrastructure for green energy - multicriterial argumentation

Until the Industrial Revolution, [17] man has satisfied the everyday needs in a simple way through fire, water and wind, when fossil fuels, such as non-renewable (coal, oil, gas) have changed whole face of the world and changing even today. In the last century the number of habitants has grown and the technology has diversified and the way of exploitation of the same fuels has created major environmental disturbances, moreover, for the whole world. Energy needs have become increasingly supported, so today burn quantities equivalent to tens of millions of tons of oil. But we must consider that these sources are non-renewable and someday they will be exhausted. We are in a position to accept an approximation of the operating period of about 40 years of oil [12], the operation of gas, 60 years and coal 200 years. And if the operation continues, the pollution will have a considerable impact on the atmosphere and ecosystems. The solution comes from appointment of contrary - the inexhaustible energy sources that does not affect the environment.

For an overview of traditional forms of energy production, they release large amounts of greenhouse gases, especially carbon dioxide. Secondly, the consequences have repercussions on the environment and trigger acid rain, dust pollution, extreme events such as floods, storms, heat, melting glaciers, endangerment of various species of plants and animals to human settlements, and from a point, even the man himself. Water damaged, air too - these things endanger the health of the population which suffers from diseases which become more complicated and harder to treat. Thermal stress caused by increasingly heat is doubled by multiplying infectious diseases, especially in tropical areas.

That being the case, inevitably we face a dilemma - which, however, it seems that each one carries itself.. Sounds like a mute dialogue that hide behind their silence personal interests, a dialogue of the deaf who, although they are told what to do, they will not act, having the same reasons, a dialogue of the blind, which although are shown devastating effects, they do not want to see, building a new reality for themselves and the public. We are in a position to illuminate our homes bulbs, to travel, to govern ourselves without fossil fuels. Renewable resources seem to be the solution: they are very clean and provide a sustainable energy future construction. Even if clean energy is currently more expensive because of high investment, it offers countless benefits. Technological leaps will certainly improve their performance by providing a viable alternative to polluting sources.

How man has agreed to take part in the exploitation of the universe reveals undeniable realities of nature with direct reference to the environment in which he has worked. Aggressive attitude built a reality that is becoming increasingly difficult. Moments of admiration for nature disappear gradually with the increasingly understanding of functioning mechanisms of world. Although the fear of revenge of nature constantly trying man, he persevered in creating numerous imbalances. Thus, the conflict between man and nature has deepened and nature seems to find harsh ways of retaliation. The impact of what man has built swept across the planet, affecting ecosystems at global, regional and local level.

Globally there is an intensification of the greenhouse effect, ozone layer destruction, pollution of intracontinentale seas, systematic destruction of forests. The greenhouse effect has a positive role too - if it did not

exist, the global temperature would be around -19 degrees Celsius; problem lies in the intensification of its effect on global temperature increase, with more than catastrophic scenarios.

More than 50% of the greenhouse effect is causing of carbon dioxide with direct socio-economic implications, mostly resulting in energy field. On the concentration of carbon dioxide in 1989 [11] The United States was for about 20% of emissions, states of the former USSR approximately 15%, as well as the European Economic Community, 7% China, 4% Brazil and India, 36% other countries.

In 2008 [15] the situation is different: China 23%, U.S. 19%, EU 13%, India 6%, Russian Federation 6%, Japan 4%, other countries 30%. On the concentration of CO₂ emitted we add the emission of other gases, such as nitrogen oxides, methane, chlorine. Methane accounts for approximately 15% of the greenhouse effect, the oxides of nitrogen with about 5%. [11]

2. Types of green energy infrastructure in Romania

Infrastructure for green energy derive, primarily, from the diversity of sources to produce energy in a clean way. Given the world situation that we have discussed in detail in the parts above, we can say with certainty that renewable energy offers a very promising potential energy that can be used in a wide range from local, regional, national and internationally.

These new types of energy production brings new strengths to a territory which they adopt. They provide energy in a safe way, chasing the uncertainty import of energy resources to energy production. Infrastructure for green energy accompany renewable energy - so between the most important note we remember[4]:

Table no. 1 - Types of green energy

Solar energy	
Wind energy	
energy derived from biomass	biodiesel, bioethanol, biogas
hydropower	hydropower, tidal energy, osmotic potential
Geothermal	

2.1 Solar energy

Along with the awareness of danger of global warming and the imperative necessity of continuous use of energy, solar energy has become increasingly more popular. In many areas of the planet, the sun becomes really a very viable solution for dealing with the energy gaps, especially as the population is constantly increasing and the standard of living too.

Solar Energy reveals its many advantages, but also disadvantages [4]. Benefits include the inexhaustible character, clean, availability and gratuity. Among the disadvantages remember variability depending on the cycles of the seasons and day-night alternation, and local weather conditions. Also a disadvantage is the energy dispersion since sunrise and until sunset, which induces new costs for storage. Arise the circumstances which we have to found a solution - talking about cold weather problem when energy demand is high, but solar radiation is low; also, the consumption level is high in the morning and evening, but solar radiation, at this time, has the same minimum character; scattering of solar radiation lead to the implementation of extensive infrastructure to capture the sun that regard spaciousness issues.

However, if we consider just one second, the sun transmit a much higher energy than mankind has consumed throughout its existence. Most of the energy is lost in space, but a large part reaches the land surface and can be used by man for his work. However, the amount of energy received from the sun is distributed uniformly by taking account of the shape of the earth. Regarding solar energy capture, some areas are clear advantaged: Southern Europe, North Africa, Central and South Asia, Central Australia [13].

Research in the capture of solar energy, are in continuous development and expansion, some of them using very large scale, while others are still in the experimental stage. Solar energy, in the form in which it is located, can not be used - it must be converted into another kind of energy such as biomass, thermal or electrical energy.

On this disadvantage, if you join all the other disadvantages listed above, we see that we are in a position to make rational arguments to small energy production using solar resource - the costs are quite high, and the efficiency is too. In recent years new technologies have emerged, and among these are added the so-called photovoltaic cells which have the advantage of low cost and higher efficiency. They have the advantage of being used especially in isolated areas where it is difficult to produce electricity through conventional sources. However, the amount of radiation can be

focused - can be achieved with panels or with water which concentrate the heat in her upper layers. Temperature

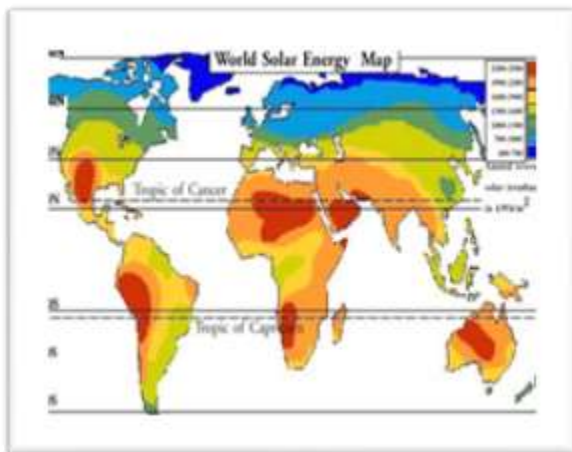
**Map no. 3 –
The distribution of wind resources in the world in terms of intensity**

Source:
<http://tckctck.org/climate-solutions/wind-power>



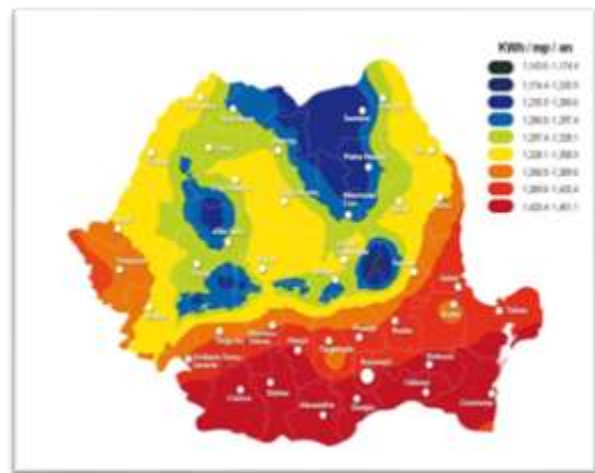
difference with deep layers creates electricity, being created so-called solar lakes and the conversion of energy in the ocean.

Map no. 1 – The distribution of solar resources in the world in terms of intensity



Source: <http://www.alternative-energy-resources.net>

Map no. 2 – The distribution of solar resources of Romania in terms of intensity



Source: http://www.sistemeeco.ro/harta_verde.html

The potential, for the use of solar energy regarding Romania is quite important, but never as intense as in other European countries or the world. The situation differs from area to area - there are areas where energy flow reaches about 1500 kw/m²/year, and areas with 1200 kw/m²/year. The degree of sunlight varies from one month to another and from one day to another and does not give a constant flow to produce electricity.

2.2 Wind energy

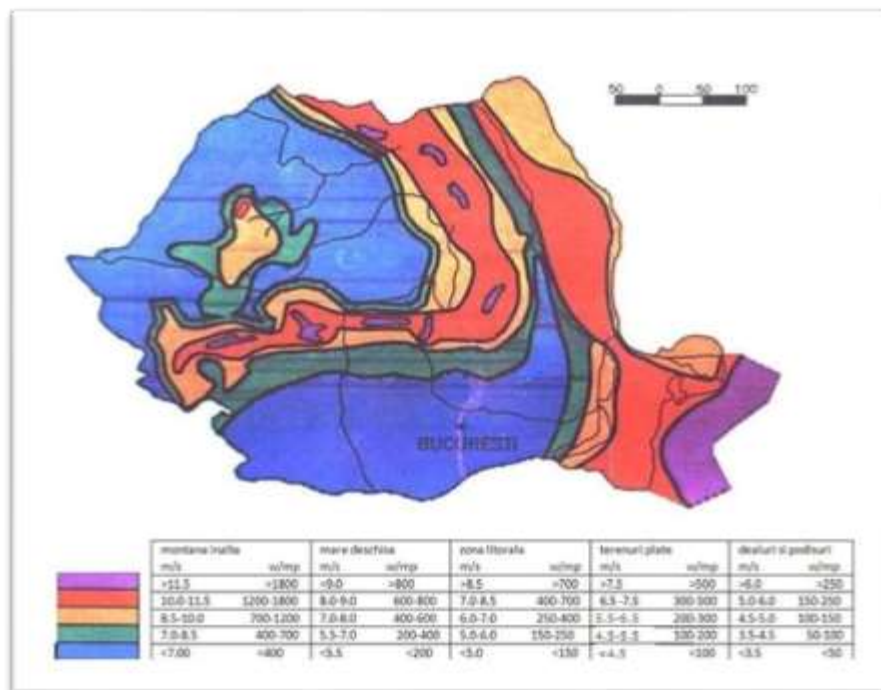
The energy produced in wind turbines is the result of a termic and pressure difference in the atmosphere that is not heat uniformly. More the difference is largest and strongest and the wind will be intensifying, the mechanical effect will be superior and will result a larger amount of electricity.

We must also refer to the irregular character on planet of this type of energy - it is a disadvantage of widespread use. However, in some areas has become so profitable that they doing serious competition from coal plants. In time will replace polluting energy sources. It seems that globally there are enough "wind" as producing 5-6 times the Earth's electricity needs. Using this type of energy increases every year more and more. If we average over the last ten years, the annual increase would be about 29% compared with traditional energy sources, which had an average increase of 2% [13]. Because such alarming figures on global warming, the "wind plants" is spreading with the fastest speed.

Taking into consideration the alternative sources of energy production - is also considering the depletion of conventional fuels worrying forecasts and possible food crisis. Taking into account the forecasts is understood the widespread use of wind energy. Europe, concerning the use of wind energy is the continent with the more intensive use. If we analyze the energy strategy for clean and renewable energy resources the EU wind potential is approximated at around 15,000 MW. This potential energy can provide an estimated amount of around 4,000 GW hours in each year. These data are, however, calculated in theory, the practice is much lower, given the various obstacles encountered in the field.

**Map no. 4 –
The distribution of wind
resources in Romania in
terms of intensity**

Source:
<http://www.wall-street.ro>



However, the use of wind energy presents a number of disadvantages: firstly it is the land - this type of farming takes up quite large areas. We must consider that these turbines can be located in remote areas, they are built near populated areas where electricity is needed. We add to this landscape view, the danger for birds.

Regarding Romania, the wind potential is quite high [14] as estimates of various studies and estimates by NMA (National Meteorological Agency). Concerning the specific area we stand pretty well in comparison with neighboring countries, but weaker than Western Europe. The situation is different in the country, from west to east: East is privileged, especially S-Eastern, Dobrogea.

2.3 Geothermal energy

When we refer to "geothermal" we refer to the underground and internal earth heat. Temperature increases with depth and is transmitted by several methods, technically important for an investor that wants a project in this area: conduction, thermal conductivity, temperature gradient and convection.

This energy comes from two sources: the radioactive source and general source during the formation of the planet. In this type of investment, for such infrastructure type, will take into account that there is more than evidence between the tectonics plates and geothermal phenomenon. We will tell about an area that has a geothermal potential when it has geological conditions, but also economic, for this type of energy to be exploited.

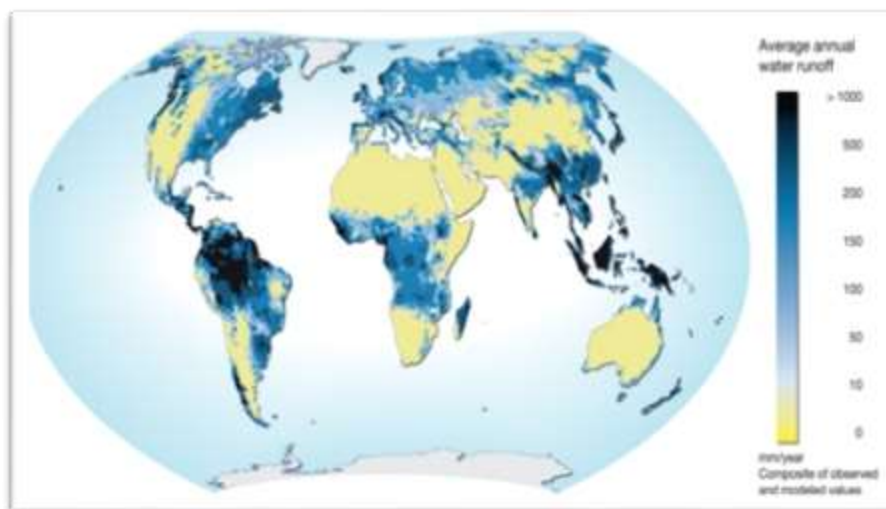
Exploitation can be achieved depending on the nature of the geothermal reservoir through hydrothermal systems, mainly on steam and water systems, pressurized systems in deep and hot rock systems, the largest: about 80%. At the same time, the operation is done through geothermal power plants which can use the steam and water. By using geothermal energy, renewable sources, we can conserve non-renewable energy, and environmental impact is insignificant, polante emissions are nonexistent. With approximation by 2020, about 10% of world electricity is thus obtained.

Regarding Romania, geothermal resources have low temperatures, up to 100 degrees and can be used only for the thermic energy supply. Advantaged parts of country are the West and South Romanian Plains, around Bucharest and Carpathians. Regarding this type of geothermal resources, their impact on energy production will remain limited. It

can achieve an increase in use, but not significant enough considering the human, technical and physical capital

**Map no. 7 –
Distribution of
hydropower resources
of the world according
to the intensity of
rainfall**

Source:
<http://www.siswebs.org>



existing in the field.

2.4 Energy derived from biomass

Biomass, generally speaking, is represented by the organic matter, formed by the process of photosynthesis, using energy from the sun, and through the fixing of nitrogen and carbon dioxide from the air. It is considered a battery for energy. The use of biomass conversion is achieved by thermal or other conversion. Concerning the potential of biomass, they created 8 regions of analysis: the Danube Delta, Dobrogea, Moldova, Carpathian Mountains, Transylvania, Subcarpathians, Southern Plain.

Regarding biofuels, they are organic compounds that are used for transportation. The best known, and most widely used is Biodizel, obtained from plant materials and bioethanol, made from sugar-rich plants. EU gives special attention because they are the only ones so far to find viable substitutes derived from petroleum products.

There are other methods, but they have severe implications on auto changes and food systems. Besides the advantage of a clean transport, biofuels have another advantage: helping to reduce greenhouse gas emissions – but, unfortunately, they are quite expensive to be widely used.

2.5 Hidropower

Hydroelectric power plants are used to produce electricity based on the use of water force that moves turbines. Thus, these plants are placed on rivers that have a high enough flow to support a relatively constant production of electricity. Water power has been known since ancient times, being a primary energy source, clean, inexhaustible due to the phenomenon that we call the water cycle in nature. Investments to be made for such hydropower plants are quite high, higher than the heatpower plants, but it has two major advantages: the cost of energy production is almost non-existent, because water is a free source, and secondly, referring to air pollution, which is non-existent.

Although the initial investment is high for the construction of dams, canals, road networks, such construction solves a number of problems related to irrigation, water supply, improvement of rivers. On the other hand, such powerplants have disadvantages relating to rivers fauna. In the same time the rivers navigation is stopped. Hydroelectric produced energy is several times cheaper than energy from heatplants. Depending on the size of hydropower plant it is set the electricity price – if hydropower plant is higher, the electricity prices are low.

**Map no. 8 –
The valuation of
hydropower resources
of Romania**

Source:
<http://www.alea.ro>



Given this method of obtaining electricity, hydropower potential type of planet is approximated at about 6 million MW. More than half of it can be arranged. When discussing about energy potential, China has the first advantage, followed by Russia, Brazil, Canada. To these are added some smaller states such as Japan, Sweden, Norway, Finland and France. Overall, hydropower provides about 18% of global energy with major differences from one country to another. The European Union remains the leader by 30% and North America 25% [13]. Otherwise, half the hydro of the world are concentrated in developed countries.

Water resources on rivers in Romania are used only in half considering that they are not arranged and there are quite fluctuating water levels to maintain a constant power supply. Some areas of Romania are very poor in water. Therefore, it requires an accumulation of water. Regarding the potential of our country it amounts to about 250TW hour per year.

3. Conclusions

The need to find new forward ways to mitigate the effects of energy production on the environment becomes imperative, with direct reference to the energy system, which is the largest polluter in the world. The main effect is that of global warming, which attracts others effects with total adverse consequences for human, such as rising sea levels, loss of productivity in agriculture, floods, intensification of extreme events etc.

Regarding the social, economic and political implications of these changes we consider the global balance of resources; in some areas will increase (eg. glaciers induce development of hydropower electricity production) and in other areas will decrease (eg. the oil and gas exporting countries). On the other hand, these shifts in "resources migration" involve various political and military forces in the so-called "settlement" of global energy issues. On these problems are added uncertainty and irreversibility or reversibility idea of these phenomena, and the conflict between generations. Regarding the greenhouse effect, the opinions are quite contradictory because the information necessary for a complete analysis are not sufficiently documented. Some are extremely pessimistic, others show undue optimism.

Going further with our analysis on finding arguments to support green energy through examples and negative implications of traditional sources, highly polluting, we now regard the ozone layer - here the situation is much clearer than in the case of global warming. The number of cases of skin cancer has increased [16] both among tourists, but also among those who by nature of their profession, are exposed to ultraviolet rays.

An impressive amount of harmful substances is discharged into the air and water, intervening in an uncontrolled manner on these ecosystems. Thus, an increasing number of plants and animals are declared endangered. In addition, we add the regional ecological accidents in the oil industry, chemical industry, nuclear energy, water and air pollution for communities that have no accountability and no obligation to support such exposures. Although citizens are protected from legal point of view, the effectiveness of the legal framework is quite limited, especially after such an event took place.

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