Strategic Eco Innovation in Energy - The Road to Sustainable Development

Aleksandra Kokić Arsić[1)]

Jovan Milivojević[1)]

Milosav Đorđević [2)]

1) Center for Quality, Faculty of Mechanical Engineering, University of Kragujevac, Serbia

2) Higher Technical School, Kragujevac

Abstract: *The study of eco innovation in industrial and communal energy throughout the life cycle of energy there is to a series of eco-innovation of which a significant number of strategic. Their application in the coming decades should allow for the sustainability of energy resources and provide high energy and eco-efficiency of production, distribution and use of energy. These innovations are related primarily to the energy intensity and efficiency in the entire energy cycle, the use of CHP wherever feasible, to transition the entire energy system on natural gas (interim solution), the intensive development of renewable energy sources, with their balanced use, application polyenergy and decentralized energy systems, and finally, the transition to hydrogen energy (fuel cells, thermonuclear fusion, cold fusion). In all of this must take into account the sustainable use of energy resources with minimal use of non-renewable and renewable resources use below the limit of their renewal, to ensure sufficient energy for future generations with maximum eco-efficiency of all energy process.*

Keywords: *eco-innovation, energy, energy resources, sustainable development, eco-efficiency.*

1. INTRODUCTION

In the production of energy gases and dust resulting combustion of coal, fuel oil or natural gas continuously pollute the atmosphere and global impact of climate change; damage the ozone layer, acid rain phenomenon, disappearance of sensitive ecosystems, and etc. Furthermore, there is a pollution of soil and water courses, directly and indirectly, because the life cycle of energy starts with the coal mines, oil and gas, and ends with mechanical work and returning heat to the environment. In the statement about climate change, the EU Commission concluded that the 50% of reduction in greenhouse gas emissions will in the future achieve through improving energy efficiency. All EU member states have committed themselves to develop the forms of energy that do not emit greenhouse gases, "green" electric energy, biofuels, and so on. They have already worked out plans for saving energy in main sectors. In order to achieve the EU has launched Eco Innovation (CIP ECO-INNOVATION). At the core of the program is eco-innovation. What eco-innovation presents is best illustrated by these definitions:

Creating new and valuable competitive assets, processes, systems, services and procedures, designed to meet human needs and provide better quality of life for everyone with minimal use of

natural resources throughout the life cycle (materials, including energy and surface-soil) per unit of output and dispensing with the least toxic substances (definition from 2008.).

Eco-innovation (OECD and experts from the EU - 2005th): consistent activities that produce goods and services for measuring, protection, limit, minimize or correct damage to water, air and soil, as well as services that are related to problems of waste, noise and ecosystems . These include clean technologies, products and services that reduce risk to the environment and minimize pollution and use of resources. At the same time there are four classified categories of goods and services: pollution control, clean technologies and products, management of resources and products that protect the environment.

Eco-innovation can be conditionally divided into those that are realized in the short term - short termed, the medium-termed and strategic. In this paper, the focus is on strategic eco-innovation and their impact on the further development of energy sector.

Eco-innovation strategy	The impact on the provision of sufficient quantities of clean energy	Impact on the environment and quality of life
Reducing intensity of energy	Huge reserves of energy in the energetic intensity of products and processes.	Reduced dynamics of use of energy resources while maintaining and improving the environment.
Improving energy efficiency	Huge reserves for promotion of the efficient use of all forms of energy.	Reduced dynamics of use of energy resources while maintaining and improving the environment.
Change in the behavior of society (population, economy, planners)	Acceptance and implementation of advance standards in the field of energy.	Reducing energy consumption with environmentally friendly.
Change in the behavior of society (population, economy, planners)	The transition to the energy of natural gas, and then to the energy of hydrogen.	The movement toward clean energy sources. Improving the environment and quality of life.
The transition energy system	Improving the energy efficiency of the use of local renewable energy sources.	Reduced dynamics of use of energy resources while maintaining and improving the environment.
The development of distributed systems and polyenergetics	Development of renewable energy in order to get source which permanently provide clean energy.	Switching to renewable sources of clean energy. Improving the environment and quality of life.
The development of renewable energy sources	The development of new sources with huge amounts of energy which are able to provide long-term energy needs of mankind	The transition to new sources of clean energy. Improving the environment and quality of life.
The development of new energy sources	A significant improvement of energy efficiency.	Reduction of atmospher pollution and improve environmental performance.
Reduction and elimination of pollution and waste	The realization of the process for obtaining pure primary and final energy.	Improving the environment and quality of life.
Excelence eco-efficiency	Security ekselentne eco efficiency in the overall life cycle energy	Improving the environmental quality of life and secure future for new generations of people.

Table 1: Strategic of eco innovation in the energy sector

2. TYPES OF STRATEGIC ECO-INNOVATION

When it comes to product life cycle, in this case energy, there is trying to integrate environmental criteria in the performance of energy, price, quality, cultural, legal and technical criteria. You can work that by starting with the analysis of life cycle products.

After the design phase, life cycle products can be divided into seven stages:

- Mining and processing of primary energy (non-renewable and renewable sources)
- Transport of primary energy
- Production of final energy
- Transportation, distribution and storage of final energy
- Final energy use
- Energy recovery
- Waste energy (emissions in the environment)

Such a life cycle approach includes toxicity reduction during production of primary and final energy, the introduction of clean technologies, reducing energy consumption in all sectors of use, energy efficiency in all stages of life energy, renewable energy sources and development of low-energy products and services the broadest spectrum. From the analysis of life cycle energy it comes to strategic environmental innovations that are recognized by the following fundamental changes:

- Energetic and eco-efficiency and energy intensity
- Energetic infrastructure and management
- Behavior (citizenship, economy, planners)
- Transition of the energy system
- Distributed systems and poly energetic
- Renewable Sources
- New Energy Sources
- Reduction and elimination of pollution and waste

3. RENEWABLE ENERGY AND ENERGY-BALANCE EQULIBRIUM

Renewable energy sources on Earth are limited and partially available for use. These sources have their own dynamics and regeneration capacity and not benign as many told. This performance comes from life experience and philosophy of life that the sun and clean energy can be used indefinitely without any negative consequences for the environment. Wind energy is free, clean and close at hand and can be maximally used. But what is now meant by renewable energy sources. These are:

- Sun
- Wind
- Water
- Biomass
- Waves
- Earth's core (geotermal)
- Tides
- Hydrogen

If you perform an analysis of each of these sources in terms of primary energy source that powered the group, we will have the following renewable resources:

1) Primary energy the Sun (the amount of energy emitted by the sun to Earth at the time - hour, day, month, year), which varies depending on the dynamics of solar activity, the position of the Earth, the seasons - the climate, atmospheric dynamics and composition of the Earth, the degree of surface reflection country. The primary source of energy belong the following renewable resources:

- Direct radiation from the sun
- Wind
- Water
- Biomass
- Waves

2) The main energy core of the Earth (the amount of heat energy of our planet), above all, is thermal energy that heats the earth's crust and which is unevenly distributed in the Earth's surface. The

primary source of energy belongs to the following renewable resources:
- Direct radiation from the sun
- Geotermal energy
- Gulf stream
- Biomass

3) The main energy of the Moon's gravity (gravitational field of the earth's satellite, which in its struggle earth's crust movement and pulls the mass of water - ocean, sea) is responsible for the occurrence of high and low tide. The primary source of renewable energy source belongs to the following:
- Tide and ebb tide

4) The basic energy of hydrogen (the basic building blocks known universe element) element that constitutes about 75% of the total universe of matter. The primary source of energy belongs to the following renewable resources:
- Chemical energy (fuel cells)
- Thermonuclear energy (controlled).

5) Other primary energy that is only in the initial stage of research or research consideration is still far from practical applications. These are the power vacuum, ultra-fine particle levels, our energy and distant suns, gravity and a number of other options and all of these sources are far from our technological level and the level of our knowledge.

The emphasis in this paper is the functional connection of renewable energy sources and determining the level of the maximum load of each source which comes to the collapse of energy networks and the consequences of which the outcome can be a permanent loss of energy or change its position on the Earth (stable wind directions, for example) .

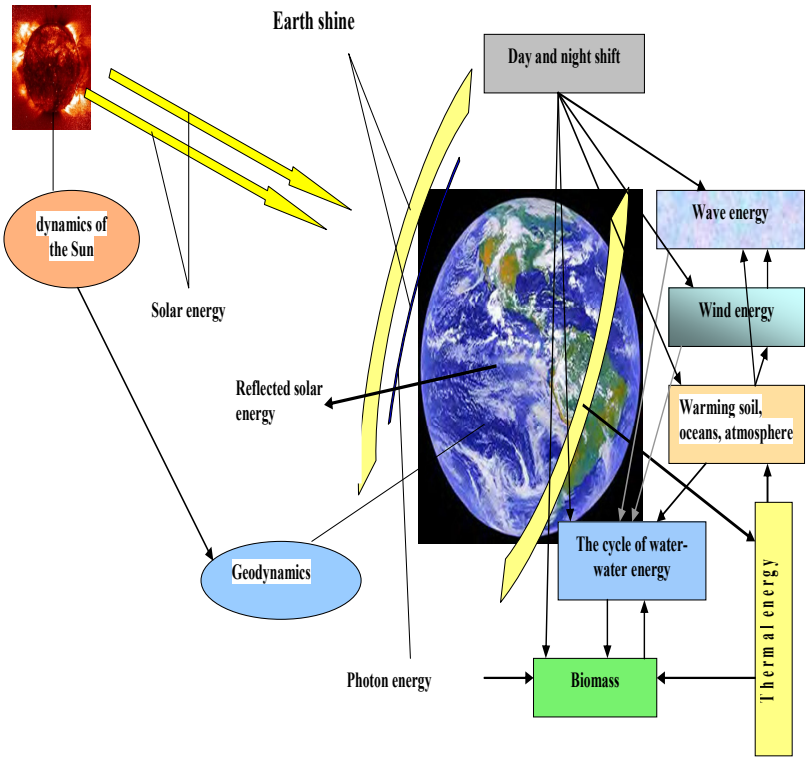

Figure 1 Renewable energy sources that are essentially solar energy

If we analyze a group of renewable sources related to sun who will see a series of connections and maintaining the fine balance of energy (energy distribution) between these sources, Figure 1 This network of renewable solar energy is distributed differently on Earth (Sahara, monsoons and pasat, oceans, fertile plains, great rivers, etc..), but in the global dynamic equilibrium.

Of course, in this analysis we start with the total solar radiation on the Earth. We know that the total solar radiation defined as the flow of energy, originating from the sun at the top of the atmosphere of the Earth, collected on all frequencies of the electromagnetic spectrum for the entire visible solar disk. Insolation is measured in a particular area of the Earth over a period of time and is in units of W/m2 or kW • h / (m² • day). At the Earth reaches 1.52 x 1018 kWh / year. or 0.5 billionths parts of the solar energy, which corresponds to a force of 1.75 x 1017 W. Relationship between flux of radiation from the surface of the sun and the radiation flux reaches the Earth is calculated according to the formula:

$$P_z = P_s (R_z^2 / 4\, r_{zs}^2) \text{ [W]}$$

where:

P_z – power of solar radiation that reaches the Earth

P_s - the total power of solar radiation

R_z - the radius of the Earth

R_{so} – Earth – Sun distance

Bearing in mind, the above formula calculates the solar constant (incoming flux from the sun), which amounts to 1366.1 W/m2, and the average daily mean values. The differences of minimum and maximum are in the range of 1363-1368 W/m2.

The question remains distribution of incoming solar energy on earth: how much energy (mostly heat) absorbed by land, how many oceans, and how much atmosphere? Even more complex problem analysis the amount of energy contained in wind, water cycle, waves and biomass. Given the complex dynamics of these processes and their mutual relationship is only possible to assess their average values and their fluctuations

If we turn to the global network of renewable energy produced on the basis of solar energy: thermal energy - photon energy - wind - water - waves - biomass and if we try to establish a reciprocal effects model, the first thing that it can see is that the system was extremely balanced. The question is to what extent we can encumber any of the following sources of energy and what is important not to disturb the natural equilibrium established? In the example of wind energy it can be considered a set problem. If we start from the assumption that the total wind energy in northwest Europe Eu (expressed in TWh) and that it is practically possible to use about 70% of this energy (Ek = 0.7 eu), and that at the direction of wind flow field set up wind turbines, We can claim with high confidence that the high load (Inada border renewal) of this source leads to disturbance of natural balance in the network of renewable energy sources. It can lead to fear the usual disturbance of air in Europe, diverting rainfall to other areas, climate change, reduction of biomass energy, minimizing the energy of water, reducing energy waves and the disappearance of many ecosystems on land and in water. If we don't want this to come reliably determined load level of wind energy sources. Also, it should be defined for all other renewable energy sources.

4. SUSTAINABLE USE OF ENERGY RESOURCES

Sustainable development is essential for improving the quality of life and the road to sustainable and economical development of the country with excellent eco-efficiency of the entire development. That is the main goal of sustainable use of energy resources that provide sufficient

amount of energy for future generations, which is measured by indicators of energy (Figure 2). Energy indicators for sustainable development have been classified into three dimensions: social, economic and environmental. The social dimension is composed of 4 sets of indicators, the 16 sets of economic indicators, and environmental dimensions of 10 sets of indicators.

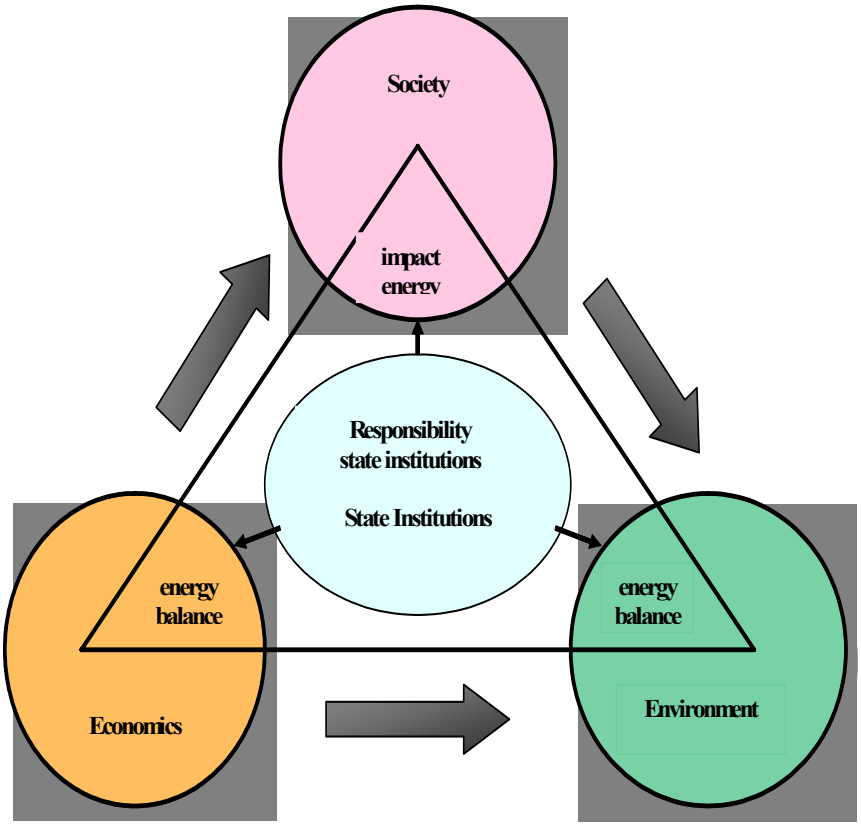

Figure 2 Dimensions of sustainable energy development

Indicators are defined in accordance with the country's economy and its energy resources. When it comes to the economy is measured by energy consumption per unit of gross domestic product (BDP). Of course the effectiveness and efficiency of the economy reflected in lower levels of energy consumption relative to BDP achieved. Economic development must certainly take into consideration the strategic eco-innovation in the energy sector. Otherwise, fast spending of energy resources and pollution of the planet can lead the world economy
to a dead end.

Sustainable use includes all forms of energy sources: non-renewable, renewable and new sources. The non-renewable energy sources (fossil, etc.) are used moderately, while renewable sources used in accordance with the permissible load (below the repetition) with preserving the natural balance of renewable energy network. New (future) energy will be used in accordance with the parameters of sources (size, accessibility and regeneration dynamics, functional relationship with other sources of energy, and so on).
When it comes to new sources of energy is

going in two directions: getting power from the space environment and obtaining energy from micro space. Efforts in this direction have been thinking about using solar energy in the space area and its transport to the Earth, whereas the part of ultra-fine goes to research in the field of controlled fusion (thermonuclear energy). Of course neither of these sources are not inexhaustible, no matter how large were, and independent. For now it is still not enough known their functional relationship in the natural system of energy and can be neither seen the consequences of their excessive use. How and in what direction will develop new energy sources and what are their consequences for the environment time will show.

5. CONCLUSION

World falls into the energy crisis and the hunger for energy in all countries of the world becomes more evident. On the other hand, environmental pollution processes of production and use of energy in the future threatens to endanger the survival of life on Earth. The question is how to reconcile rapid economic development, continuous hunger for energy and the requirement to maintain minimum levels of environmental quality that are important for survival. Because it is necessary to:

- to develop and implement a program of strategic innovation in the complete energy sector from energy production to its use (along the entire life cycle of energy) provide a low intensity of products and processes with high energy efficiency of production and use of energy
- intensify the development of renewable energy sources (sun, wind, water, etc.) with the ultimate goal in the future be the main sources of energy,
- ensure the sustainable use of energy sources with the principle that the burden of renewable energy sources does not exceed the limit renewal resources and respecting the natural balance in the global network of energy sources,
- energy efficiency to ecological processes is a key factor in the further development of the energy sector.

Respecting these strategic, guidelines can provide an adequate economic and social development with the provision of sufficient quantities of clean energy for development and prosperity of future generations.

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