ECONOMIC IMPLICATIONS OF POLLUTION PREVENTION OF GEOTHERMAL WASTEWATER DISCHARGES IN THE PERIMETER OF ORADEA (NORTHWESTERN ROMANIA)

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Abstract – U.E. policy concerning the implementation of effective protection of the environment by providing a sustainable energy development, as expressed by the White Paper and the European Directive 2001/77/EC on energy production from renewable sources, has led to increasing concerns about promoting renewable energy and industrial technology support. While Webster's Dictionary defines prevention as "action to prevent something to happen", the pollution prevention objective consists of eliminating or minimizing the creation of pollutants at the source through promotional activities, incentives and enforcement measures to prevent pollution. The medium and long term focus regarding the reduction of unwanted side products, ought to be cost efficiency and environmental protection. Pollution is a complex phenomenon of modifying the natural properties of pure water through the introduction of substances or energy forms. Pollution prevention applies to the production process through the implementation of clean technologies and recovery equipment. Discharge of used geothermal water is a problem that is intended to be solved by studying employment rates within the allowable limits of these parameters, especially by determining the main economic and financial indicators leading to recoup the costs of discharge.

Keywords: pollution, discharge, economics, geothermy.

1. INTRODUCTION

This paper argues that adoption of pollution prevention methods implies the need for careful consideration of their relation both to the surrounding territory as to the local scale. As many environmental problems now extend the local level, they seam to threaten the stability of the life-support system of the Earth. Wastewater discharge, air pollution, greenhouse gas emissions, dispersion of toxic chemicals, extinction of species, they all have a global scope.

Recent reviews of global environmental condition provide mankind with a summary of the environmental challenges that face the society with a bleak future of ecological collapse and social chaos if it doesn't act soon and decisively [1].

The interpretation of the effects of globalization on the natural environment of the Earth evokes different reactions. While one of them stresses the human progress over time and its ability to promote economic well-being as well as reverse and repair environmental problems [2, 10], the other one stresses the human inequality, the environmental disasters driven by economic globalization.

The natural environment is part of the existence of any economy. Ecology, which was originally considered a field of knowledge of the economy of nature, the investigation of complex relationships, direct or indirect, between animals and their environment organic and inorganic, covers the interrelationships between living organisms and their living environment.

The environmental aspects of the geothermal energy use are receiving increasing attention with the shift in attitude towards the world's natural resources.

All energy production causes some changes to the environment and requires some kind of engineering and construction activities that may lead to a variety of environmental impacts. Although geothermal energy is considered to be a clean energy source, its development can generate gas emissions or wastewaters that require disposal. Compared to nuclear and fossil fuels, geothermal is a benign energy source. The relative amounts of greenhouse gas emissions during electricity generation from geothermal origin are only a fraction of the amounts originating from fossil fuel, and are of the same magnitude as most other renewable energy sources, such as hydro and solar. The main environmental issues involved in geothermal development are [3]: surface disturbances, physical effects of fluid withdrawal, noise, thermal effects, chemical pollution, air pollution, social and economic effects, water quality impacts.

2. PRUDENT AND RATIONAL USE OF NATURAL RESOURCES

Housed in a continuous process of development, ecology becomes an interdisciplinary biological science – a complex science of nature.

As the economy records progress, human dependence on natural resources do not disappear, but rather is increasing. The use of advanced technologies to save the primary natural resources (minerals and energy)

in their recovery processes (e.g. waste recovery), and their reintroduction in the production and consumption (e.g. residue) leads to the creation of new capital [12].

The planet is increasingly saturated with consumers, each demanding a portion of Earth's resources. The current rate of population growth is one noteworthy indicator of rising consumption in an age of globalization.

The problem of natural resources has led to various international disputes, for environmental issues to become a subject of debate at the global level [4, 10] – as countries' interests become the achieving an ecological balance.

The assignment of correct economic values of natural resources involves two things: their price should reflect the total value (cost of production or resource extraction) and their sustainable exploitation (user cost).

The second principle of the Stockholm Declaration (1972) merely to list the components of the environment as "the world's natural resources, including air, water, soil, flora and fauna and, in particular, representative samples of natural ecosystems must be maintained in the interest of present and future generations through careful planning or management according to our needs" [6].

A globalized environment refers to the global compression of the interrelationship of economic, political, social and environmental development process and economic growth.

Growth process, viewed from the perspective of environmental policy, is the transformation of quantitative and qualitative systems, directly quantifiable with existing instruments at a time of economic structures and political and social lifestyle and quality of life, human consciousness, environment etc., the general behavior of the socio-economic system.

Growth and development are, according to the model of François Perroux, interdependent. The capture of quantitative aspects of growth nationally, being equated with sustainable increase of national income, represents "a sustainable size of the economic measure of a simple or complex unit, achieved by structural changes and possibly accompanied by systems and economic progress. No progress can be classified as economic if it is not accompanied by social progress. As well as social progress helps to easier and support economic growth." [11]. Unlike the economic growth, development becomes "all the changes in social structures and mental training that creates a mutual relationship between production and population", thus managing the national economy to secure the cumulative and sustained growth of his real global product.

The need for an interdisciplinary approach – ecological economy – comes from the fact that natural ecosystems interrelate with human economies. In the process of production and consumption, humans use ecosystems and their services, affect their development and are beneficiaries of their actions on ecosystems [9, 15].

The rhythm of production growth (urbanization) and of the acquisition of resources from the environment is accelerating and represented in abstract models, which eliminate their entire field marketing while forgetting the natural factor. The urge to rethink the relationship between economic activity and the environment, environmental awareness training, development of environmental economics and changing attitudes toward nature, comes from the growing imbalance between economy and environment.

3. ECONOMIC ASSESMENTS OF POLLUTION PREVENTION

Two major interrelated actions lead to conflict between society and the environment [5]:

- Economic activities geared towards increasing production. The main consequences of this phenomenon are: reduction of the stock of resources due to high consumption, overuse of technology in production followed by the appearance of pollutants in water, air, soil and waste residue mass increase and expansion of anthropogenic environments at the expense of the use of land for other purposes;
- Exploitation of resources coming from poor and underdeveloped countries by large consumers of developed countries.

The fact that natural resources are limited, assume in the economic life two ways of thinking [8, 12]:

- Increased use of natural resources without a sudden stop by the emergence of crises and, therefore, a collapse of our economic system;
- The slow transition from our current state to a non-growth in terms of resource use.

The consequences of this phenomenon are: the destruction of developing indigenous natural media and increasing alert to economic disparities.

Thus, the green economy can be seen as the study of interactions and co-evolution in time and space of human economies and ecosystems in which human economies are embedded. The objective of ecological economics becomes bridging the gap between economy and ecology by finding links between human economies and ecosystems [15].

U.E. policy concerning the implementation of effective protection of the environment [13, 19] by providing a sustainable energy development, as expressed by the White Paper and the European Directive 2001/77/EC on energy production from renewable sources, has led to increasing concerns about promoting renewable energy and industrial technology support.

While pollution is a complex phenomenon of modifying the natural properties of pure water through the introduction of substances or energy forms, prevention becomes an "action to prevent something to happen", as defined in the Webster's Dictionary. Sources of water pollution can be natural or artificial; in this case we speak about natural pollution, because geothermal water is a natural mineral deposit resource, which is chemically loaded. For example the geothermal waters originating from the Triassic aquifer from Oradea contain a high level of certain dissolved ions like SO_4^{2-}, HCO_3^{2-}, Ca^{2+} and Mg^{2+}. By measuring the concentration of geothermal wastewaters, the data proved the maximum admissible concentration (CMA) for sulfate ions (well 4005-Oradea) (Fig.1.). As a consequence, this parameter

requires carefully monitoring and proper solutions to be found in order to reduce his concentration. The levels of the other dissolved ions are within the acceptable limits imposed by the national law.

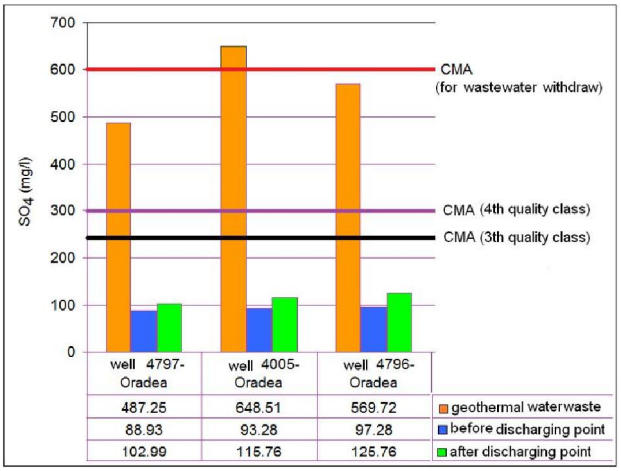

Fig.1. Surface water contamination due to geothermal wastewater withdraw (Oradea perimeter)

Pollution prevention applies to the production process through the implementation of clean technologies and recovery equipment.

4. SOLLUTION CONCEPTS

Implementation of ecological-economic regulations implies a process that includes appropriate tools which provide useful economic and financial instruments. The necessity of the emergence and introduction of market-based instruments, such as taxes and environmental costs, was generated by economic activities in conflict with the natural environment and by the need to determine the operators to take account of and protect the environment [12] through means of active employment of capital, labour, and other scarce resources.

The government considers pollution as an externality, "un unintended consequence of market decisions which affect individuals other than decision maker". In the environment context, the economist's notion of (opportunity) cost is a "measure of the value of whatever must be sacrificed to prevent or reduce the risk of an environmental impact". When transitional costs and indirect costs are small, methods which measure the cost to firms of purchasing and maintaining pollution-abatement equipment plus costs to government of administrating a policy are acceptable [16].

Rio Declaration (1992), along with other international documents, calls on states to promote the use of economic instruments in Principle 16. These regulations are designed to target interstate producers to conduct an environmental sustainable development and to increase compatibility with the "polluter pays" principle.

Market-based instruments, as seen in the Oxford Reference Dictionary, encourage behaviour through signals rather than through explicit directives regarding pollution-control levels or methods [17, 20].

These policy instruments, market-based instruments, such as environmental taxes, tradable permit systems or direct subsidies, are an effective way to protect and improve the environment and are often described as "tapping market forces" because they encourage enterprises (and/or individuals) to control efforts in gaining acceptance as an important mechanism for achieving policy objectives of environmental protection.

4.1. Environmental taxes

Environmental taxes are used to restrict the use of a product – establishing an additional fee on a product increases its cost [7]. Pollution charge systems are based on identifying the appropriate environmental tax rates.

We can identify the following types of tax systems [7, 8, 14, 16, 18]:

- *Unit-charge systems* finance municipal solid waste collection, where household and business are charged the incremental costs of collection and disposal;
- *Deposit refund systems*, whereby consumers pay a surcharge when purchasing potentially polluting products, and receive a refund when returning the product to an approved centre for recycling or disposal;
- *Environmental user charges* fund specific environmentally related services like insurance premium taxes;
- *Sales taxes* are used on motor fuels, ozone-depleting chemicals, agriculture inputs, and low-mileage motor vehicles;
- *Tax differentiation* is being used to encourage the use of renewable energy resources.

4.2 Tradable permits

Under a tradable permit system, a general level of pollution is established and distributed in the form of permits. Operators, who maintain emission levels below the allocated levels, can sell the excess of permits to other operators or use them to offset excess emissions in another part of their operations [7].

According to the U.S. Environmental Protection Agency (2000), tradable permits have been the most frequently used market-based system. They include also the water quality permit trading, the sulphur dioxide (SO_2) allowance trading system and the European Union's greenhouse gas emission trading scheme.

4.3 Direct subsidies

National subsidies, that are mainly prohibited under Article 87 of the Treaty Establishing the European Community, are considered to affect the free movement of goods, but they are implemented in each Member State. The Commission has established the structure of financial assistance in the environmental field to represent 15-30% of total investments since 1974 (revised in 1993) and it sets out the conditions for

compatibility between environmental financial assistance and the Treaty [7, 8]. Environmental funds, designed to directly fund nature protection, are the main method of creating the subsidies. Assistance is permissible in two situations (as shown in the General Direction C37/3/3.2.200): when the environmental costs may be integrated into the production process or when firms are boosted to invest in less polluting facilities [7].

Reducing subsidies, that promote economically inefficient and environmentally unsound practices, rather than internalizing externalities, can increase efficiency and improve environmental quality. Therefore, increased attention has been given to cutting inefficient subsidies that promote the use of fossil fuels, instead of nonconventional ones, because of concerns about global climate change [16].

5. CONCLUSIONS

1. The objective of pollution prevention consists of eliminating or minimizing the creation of pollutants at the source through promotional activities, incentives and enforcement measures to prevent pollution.
2. The medium and long term focus regarding the reduction of unwanted side products, ought to be cost efficiency and environmental protection.
3. The government's cost savings can reduce pollution from geothermal wastewater discharges by setting the total number of permits below their total existing emission levels and allowing them to be traded.
4. Ecological economics aims at choosing environmental policy instruments and economic ecological models in order to provide affect the benefits and the costs of environmental protection stemming from both ecosystems and human economies.
5. Although the geothermal energy is classified as a clean energy, the management and exploitation of geothermal resources should be done with utmost care to avoid the negative effects on the environment and human health that could result from chemical or physical contamination.

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