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Renewable energy awareness among generations in Greece

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ABSTRACT: Nowadays environmental problems have taken on global dimensions and threaten both the quality of life and the viability of the planet. Today's interest in finding reliable, efficient and economic solutions is impressive. In this context, the broader development and utilization of renewable energies, seems to be a major priority issue. The aim of the present paper is the investigation of students 'views on environmental problems and renewable sources of energy. Since the alteration of human behavior is considered as capable and necessary condition for the solution of the important environmental problems of our planet, the understanding of the knowledge and the notions of students on the environment and the environmental problems is considered an action of primary importance. From the researched surveys it is seemed that students show a positive attitude towards environment and they are sensitive on environmental problems. However, their knowledge on the environment is limited, while school is not the first and basic source of informing students on environmental issues..

KEY WORDS: Renewable energy education, Teaching–learning resource materials, Introducing renewable energy in schools, Public understanding of renewable energy

I. INTRODUCTION

It is now a common belief that environmental protection is not only a matter of state activity but rather a matter of social mobilization. As part of this report, students ' awareness of the environment becomes particularly important. The purpose of this research is to explore pupils ' views on environmental problems and renewable energy sources. Today, more than ever, the idea that the basis of ecological reflection is more relevant to the change of human behavior and less to technological confrontation has matured. In this perspective, the recording of the current situation is a prerequisite for a change of attitude. Before any plan for the future it should be taken seriously and understand the knowledge, reactions and actions of the students on environmental and energy issues. The remaining paper is structured as follows: *Section 1* provides an introduction of the topic and *Section 2* a literature review. *Section 3* is an overview of the benefits for local communities, and *Section 4* analyse pupils ' views on environmental problems. *Section 5* concludes.

II. LITERATURE REVIEW

A. Renewable energy sources - meaning

Renewable energy sources (RES) are the non-fossil renewable energy sources, i.e. wind, solar and geothermal energy, wave energy, tidal energy, hydraulic energy, gas from landfill sites, from Biological purification plants and biogas, as defined in Directive 2001/77/EC. The broader concept of renewable energy sources refers to any source that can be used for the production of electricity and is renewed through natural phenomena of permanent cycle. These are clean types of energy, very environmentally friendly, not releasing hydrocarbons, carbon dioxide or toxic and radioactive waste such as other energy sources used on a large scale. While for their exploitation, no active intervention is required, such as extraction, burning, but simply the exploitation of the already existing energy flow in nature. This means that



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these are inexhaustible sources of energy based on various natural processes such as: the sun, the wind, the chutes, the energy of waves, streams, oceans, biomass, geothermy (MEECC, 2012). The interest for the broader utilization of res, as well as for the development of reliable and cost-effective technologies that commit their potential, was presented initially after the first oil use of 1979 as a result mainly of multilayer Oil crises of that time, and consolidated in the last decade, following the awareness of global environmental problems from the use of classic energy sources (MEECC, 2012). Since the Kyoto Protocol was in 1997, investments in renewable sources have been increasing rapidly. The installed power in wind turbines increases by 25-30% annually, the photovoltaic panels by 50-60% annually, the solar collectors for water heating by 15-20% annually (installed in 50 million households worldwide in 2007) and the production and use Biofuels by 15-20% annually (Kyritsaki, 2009).

B. Renewable energy sources - content

1) **Wind power:** The exploitation of wind energy (wind energy) by man is a practice that finds its roots in antiquity. Typical examples of the exploitation of wind energy are sailboats and windmills. Today, the use of wind energy is used in wind turbines (A/C) (IPCC, 2001). A/C is used for the full coverage or the completion of energy needs. The electricity produced by the wind turbines is either consumed or injected and injected into the electricity grid to be consumed elsewhere. The electricity produced by the A/C, when production is greater than demand, is often stored to be used later when demand is greater than production. Today's storage is done in two economically viable ways, depending on the size of the energy produced. The electric accumulators are the most well-known and widespread storage method of the E/R, which is used for small-scale production. Our country has exceptionally rich wind potential, in several areas of Crete, the Peloponnese, Evia and of course in the Ionian and Aegean Islands (Bouradas, 2010; Kaldellis, 2005). Wind energy is a practically inexhaustible source of energy. The exploitation of its high potential in our country, combined with the rapid development of technologies incorporated in modern efficient wind turbines, has a huge importance for sustainable development, saving energy resources, protecting the environment and tackling climate change (MEECC, 2012; Kyritsaki, 2009).

2) **Solar energy:** A significant type of renewable energy sources is considered to be today solar energy too. With the term solar energy refer all the various forms of energy coming from the sun. The light and heat that radiated, absorbed by elements and compounds on the earth and converted into other forms of energy. Technology today utilizes a small percentage of energy that reaches the surface of the planet with three kinds of systems: thermal solar, passive solar and photovoltaic systems (MEECC, 2012). The simplest and most widespread form of solar thermal systems are known to all our solar water heaters, who absorb solar energy and then carry it in the form of heat (Bouradas, 2010; MEECC, 2012). Passive solar systems consist of structural elements, appropriately designed and combined, to assist the exploitation of solar energy for the natural lighting of buildings or to regulate the temperature within them. Passive solar systems are the principle of bioclimatic architecture and can be applied to almost all types of buildings (Kyritsaki, 2009). Photovoltaics are systems that convert solar radiation into electricity and which, for many years, are used for the electrification of non-connected electrical consumption network (Bouradas, 2010; Kyritsaki, 2009).

3) **Biomass:** Biomass as a matter that has biological (organic) origin, is another source of renewable energy, practically included in it any material derived directly or indirectly from the plants. More specifically, with the term biomass we mean the plant and forest residues (firewood, branches, straw, sawdust, pomace, pips), animal waste (manure, waste fish), plants cultivated in energy plantations to be used as a source of energy, as well as municipal waste and residues of the food industry, the agricultural industry and the biodegradable fraction of municipal waste (Dilanas, 1999; Bouradas, 2010; MEECC, 2012). Biomass is mainly used for the production of thermal and electrical energy. In particular it can be used to cover energy needs (heating, cooling, electricity, etc.) and even for the production of liquid biofuels (bioethanol, biodiesel, etc.) (Dilanas, 1999; Bouradas, 2010; Kyritsaki, 2009).

4) **Geothermal energy:** Geothermy is a mild and practically inexhaustible energy source, which can with today's technological possibilities to cover heating and cooling needs, but also in some cases to produce electricity. Geothermy offers low cost energy, while it does not burden the environment with emissions of harmful pollutants (MEECC, 2012). The temperature of the geothermal fluid or steam varies from region to region, and usually ranges from 25 C to 360 C. In cases where geothermal fluids have a high temperature (above 150 °c), geothermal energy is mainly used for the Power Generation (Bouradas, 2010; Kyritsaki, 2009). The main thermal use of geothermal energy worldwide concerns the heating of greenhouses. It is still used in aquaculture, where aquatic organisms are bred but also for district heating,



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i.e. heating of buildings, settlements, villages or cities (Dilanas, 1999; Kyritsaki, 2009). Today in Greece, the exploitation of geothermal energy is made exclusively for use in thermal applications, which are equally important with the production of electricity. Also, due to the rich geothermal energy of our country, mainly along the volcanic arc of southern Aegean (Milos, Nisyros, Santorini), it can have a wide application for the thermal desalination of seawater in order to metered Mainly in arid island and coastal areas. Such an application has a lower cost than that required to supply these areas with potable water through aquifers (Dilanas, 1999; Bouradas, 2010; Kyritsaki, 2009).

5) Hydroelectric energy (H/E) Hydroelectric energy (H/E) is the energy which is based on the exploitation and conversion of the dynamic energy of the water of the lakes and the kinetic energy of the water of rivers into electricity. This conversion is done in two stages. In the first stage, through the impeller of the turbine, we convert the kinetic energy of water into mechanical energy in the form of rotation of the impeller shaft and in the second stage, through the generator; we achieve the conversion of mechanics electricity. All equipment works through which the hydraulic energy is converted into electric, is called hydroelectric project (hydroelectric) (Bouradas, 2010; MEECC, 2012). The storing of quantities of water in natural or artificial lakes, for a hydroelectric plant, is practically tantamount to the saving of hydropower. The planned release of these quantities of water and their boost to the turbines leads to the controlled production of electricity. Given the availability of appropriate water resources and their adequate supply with the necessary rainfall, the H/E becomes a major alternative source of renewable energy (MEECC, 2012). The environmental benefits of a hydropower plant are varied. Even the disadvantage of environmental impacts because of large-scale civil engineering projects, which a large hydroelectric project requires, with a designed study, can be turned into an advantage. Characteristic is the case of Plastiras Lake, which during the flood of the area from the waters after the creation of the dam, created a new wetland, which soon became a pole of tourist attraction while giving new irrigation capabilities in the surrounding area (Bouradas, 2010; MEECC, 2012).

III. RENEWABLE ENERGY SOURCES: THE BENEFITS FOR LOCAL COMMUNITIES.

The benefits arising from the operation of renewable energy sources are not only about socio-economic developments at the country level but also at local community level. The establishment and operation of RES projects creates strong poles of local development and environmental upgrading and confer multiple, measurable and substantial benefits to local communities, in whose areas the projects are installed. The construction of RES projects in one area is accompanied by the parallel implementation of a series of compensatory benefits, in addition to direct and measurable financial inputs and generated jobs. Specifically (Kyritsaki, 2009): They are manufactured or improved, at no cost to the citizens, important infrastructure projects in the wider area (road network, telecommunications, electricity network). They are manufactured as compensatory benefits (free of cost) for local municipalities, various charitable projects such as community roads, schools, kindergartens etc., while offered by investors and similar sponsorships. New, alternative and highly profitable forms of tourism are promoted in the region, such as ecotourism (visits to installations of ecological energy sources such as wind farms). The construction of RES projects contributes decisively to the protection of the environment of a region, since it limits to a significant extent the emissions of harmful to the health of polluting substances caused by the combustion of fossil fuels (coal, petroleum, gas). For example, the construction and operation of a 10 MW wind farm in our country has the effect of preventing an air release of about 465 tonnes of sulphur dioxide, 36 tonnes per year of nitrogen oxides, 24 tonnes per year of suspended particulate matter and 25,500 tonnes per year of carbon dioxide (gas responsible for the greenhouse effect) (IPCC, 2001). Valid studies of the European Union have shown that a significant substitution of conventional fuels with renewable energy sources, and in particular wind farms already in the planning or implementation stage, could help reduce emissions of carbon dioxide in electricity generation by at least 11%, and thus to reduce the adverse effects of the greenhouse effect (Dilanas, 1999; Kyritsaki, 2009) respectively.

IV. PUPILS' VIEWS ON ENVIRONMENTAL ISSUES

The number of studies that have as the subject of exploring the views of pupils and schoolgirls for the environment, environmental attitudes and behaviour increases in recent years at a fast pace. In general terms, it is clear that the point of view of environmental issues is constantly widening. Nevertheless, at both scientific and political level, the dialogue on measures and methods that could push citizens into a more environmentally friendly behaviour seems to be particularly acute (Papadimitriou 2007). Irrespective of the fact that the involvement of a multitude of parameters and factors in this particular issue makes it difficult to 'negotiate' at political level and to introduce concrete measures,



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further difficulties arise from the fact that Environmental behaviour of individuals occurs unstable and is characterized by an inconsistency. We mean that the same person, while often able to behave in a positive way in another case, is not at all environmentally friendly (Papadimitriou 2007). Research shows that an important indicator for the development of environmental interest is more in the perceptions or opinions of individuals and less in the knowledge of the environment. More generally, the schools through the choices of the curriculum, and the actions they develop, form, to a certain extent, the views of the students for the Environment (Papadimitriou 2007). Economou (2008) in a research conducted to investigate pupils' knowledge and perceptions of waste and their management concludes that pupils' environmental knowledge is incomplete and their views Important environmental issues are confused. Douvli (1997), conducted an investigation with students of the A' Lyceum and concluded that environmental knowledge is generally limited, while students are showing a positive attitude to the environment. It has also shown that pupils in urban areas have more knowledge than students of rural areas and do not show any difference in attitudes and that there is no difference in knowledge between the sexes, while schoolgirls have a positive attitude (Bouradas, 2010).

The Panches and others (1996), in a survey conducted with young people (18-25 years old) found that the majority of young people have the basic knowledge about the functions of natural phenomena, and favorable to the ecological positions views. Also, that there is a uniformity of knowledge between young and older, while young people appear to be more sensitized (Bouradas, 2010). Everyday experiences in combination with the environment where one lives, influence the perceptions and attitudes of individuals in various ways. Rizou-Gusia and Sdrali (2005) in a survey examined the hypothesis that the implementation of environmental programs in the school as well as the educational level of parents can influence the general interest of pupils and schoolgirls for the environment . The collection of data was made by the method of filling in questionnaires in October 2003, in a sample of 130 pupils and schoolgirls attended in schools in the prefectures of Evia and Corinth.

The research has shown that improving the school environment and organised action are key factors in increasing the participation of pupils in environmental programmes. Students, in fact, who participate in environmental programs, maintain a high level of positive individual behaviour towards the environment. Equally, an important factor of the same research is the role of the educational level of the parents, which has a global influence on the views of pupils. The survey concludes that in the effort to raise adolescent pupils' awareness of environmental problems, both the educational level of their parents and the existing school environment should be taken into account. Bouradas (2010) in his diploma thesis in Ntua, entitled "The contribution of education to renewable energy sources" demonstrated the positive contribution of environmental education to renewable energy sources (RES). In particular, it found that the role of environmental education (ϵ) can act as a catalyst, so that everyone realises the importance and necessity of renewable energy sources (RES) in all sectors and expressions of our lives.

In a survey conducted by MMC and Matzianos (2006) In order to study student attitudes and their knowledge of the environment, they concluded that pupils had the theoretical background on environmental Issues of their time, without, however, knowing details but also basic concepts about them. They also conclude that the only documented knowledge of environmental issues can only come from the school area where particular emphasis should be placed in this respect. Stephanopoulos and Dimopoulou (2006) in a survey conducted in the framework of the 2nd Student Festival organized by the prefecture of Piraeus on "The City I Dream to live" concluded that pupils and students knew very well the Environmental problems of their region. However, pupils describe the problems without knowing the real causes of the problems. In terms of solving the problems they emphasized more on individual behaviour.

Papagewrgaki (2006) considered an important factor of environmental behaviour that is called ' control limits of environmental behaviour ' or simply ' control of environmental behaviour ' and refers to the belief that the individual has, Whether it can, by its own actions, contribute to tackling environmental problems. A deeper understanding of this factor is of particular importance, both at the theoretical level, and in terms of planning and implementation of environmental education programmes, as it is considered to be a factor that cannot be taught directly in the classroom, only be reinforced through practices such as school-Community cooperation, etc. The investigation was conducted with the help of interviews. The results include the recording of pupils' beliefs about each dimension of environmental control, and the identification of key recurring issues related to control and can be considered to reflect either individual or social beliefs. The overall conclusion reached is that pupils are interested in the environment and environmental problems, however, are pessimistic and believe that the situation cannot be addressed (Papagewrgaki, 2006).

Papadimitriou (2007) refers to the issue of environmental attitudes and environmental behaviour, to the characteristics of these two parameters of environmental awareness and to their relationship. The basis for the analysis is the data gathered in the context of an empirical research conducted by the author during the school year 2005-2006 to students school and tee of the prefecture of Rodopi with the method of questionnaire. The researcher's specific interest focuses



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on the recording of pupils' views on the environmental issue, its dimensions and possible developments in the future. Further consideration is given to whether these attitudes are changing in cases where environmental protection appears to be competitive with other priorities such as local development. The above elements are examined in relation to the environmental behaviour of the pupils. The analysis of the data showed the existence of positive environmental attitudes to pupils, but these attitudes are not accompanied by similar positive environmental behaviour. What is more, the attitude that pupils seem to adhere to in the dilemma of "developing or protecting the environment?" is generally rather neutral. Finally, the research by Papadimitriou (2006) found differences between boys and girls as the attitude of the girls towards the issue of environmental protection is more positive. One area that has been highly studied is the correlation between knowledge and attitudes. A number of relevant research shows that every aspect can be demonstrated (Bouradas, 2010).

In contrast, the research by Yount and Horton (1992) showed that increasing people's knowledge of environmental issues does not change their attitude towards them. It has also been noted that the relationship of attitude and behaviour is not automatic or given under any circumstances (Paraskevopoulos & Panteleiadou, 1993). For example, people who develop a positive attitude towards the environment are not certain to protect the environment in a given case (Bouradas, 2010). According to Antoniou (2010), a prerequisite for the manifestation of environmental behaviour is knowledge, which by using appropriate tools, as assistive means in learning, can "bind" pupils to teaching and allow easier transport. But the ultimate goal is not knowledge but action. Early action, even when you don't have the whole truth, is more important than having the whole truth and being late (UNESCO-UNEP, 1985:33). One of the factors that shape the attitude of the individual and influence the manifestation of behaviour is knowledge. In fact, many elements converge on finding the existence of a positive correlation between knowledge and attitude, a relationship that is not linear and in which many factors intervene. The attitudes and knowledge of individuals for the natural environment are the key factors for their environmental awareness, but also their activation with the aim of solving environmental problems.

V. CONCLUSION AND RECOMMENDATIONS

A concerted effort is required in order for the school to provide pupils and students with the opportunity to gain more knowledge on issues related to the environment, while also focusing on issues of changing attitudes. As regards the first element, that is, the acquisition of knowledge, today it is observed that the main reference to environmental issues is done through other courses, such as science classes, but also through elective courses, such as the lesson of Environmental Science. Emphasis should therefore be placed on this point in order to include in the timetable a programme of all classes which concern the environment, so that students can gradually acquire and according to their age the knowledge required. In order to finish high school they have gained a comprehensive knowledge of environmental issues. With regard to the second element of the change of attitudes, emphasis should be placed on active and experiential learning activities, which can bring about significant changes in attitudes and perceptions of pupils. It is also important that the work carried out in each school, in terms of environmental education, is not limited "within the walls" of this school, but that the school's cooperation with other actors is reinforced and more generally it promotes the opening up of the school to society.

Finally, in the same direction and particularly important in changing the attitudes of the pupils is the taking of initiatives from each school outside the planned activities relating to environmental education. A prerequisite for the completion of the above is the training of teachers in order to gain knowledge and environmental sensitivity. This necessity is particularly important today as in the perspective of applying the new school and on the basis of the new analytical curricula teachers should plan their teaching, which will adapt them to specificities and the needs of their pupils by drawing data from a variety of sources. In this context, an educated teacher will be able in collaboration with his students to make key interventions in environmental issues.

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