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THE BIOFUEL PRODUCTION AS A MEANS OF IMPROVEMENT OF THE QUALITY OF LIFE

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Abstract: *In the present paper, it is studied the implementation of energy plants cultivation (sweet sorghum, maize, wheat, cotton, sunflower, rape, cardoon, soy and sugar beet) for the production of biofuels (biodiesel and bioethanol), in the framework of the Directive 2003/30/EC/08.05.03 of the European Parliament, concerning the replacement of the conventional (oil and petrol) with alternative fuels, according to which, in each country of the European Union the minimum percentage 5,75% upon the sold motor fuels must be achieved until the year 2010. The motivation for the present paper is the need for the use of alternative and renewable fuels, instead of oil and its by-products, that started to play a very important role in the developed world, not only for environmental, but also for financial and managerial reasons. Data were collected by heads of selected households of the municipality of Apostolos Paul in Greece through personal interviews and by using a questionnaire.*

1. Introduction

With the exception of nuclear and geothermal, all energy is derived from the sun. Life on earth is dependant on the process of photosynthesis in which plants capture energy from the sun to form food for their growth and for animals. Plants are nature's 'solar collectors'. The idea of using plants for fuel is not new. When cave men first discovered fire, wood and other plant parts was the first thing they grabbed to keep the fire burning. For thousands of years mankind relied on plants to provide the fuel for their horses and oxen as well as heat for their homes and to cook their meals. They dammed every little stream to get water power to grind their grain and saw their lumber.

About 200 years ago, these methods began to be replaced by steam and internal combustion engines. The first fuels used for these were plant products also such as wood and alcohol. Gradually these plant fuels were replaced by fossil fuels. Fossil fuels are also plant products, products of solar energy, which were fossilized under the earth's surface. Coal and petroleum products like gasoline, heating oils and kerosene are used to heat homes run engines and generate electricity. Fossil fuels are a finite resource. No more are being made. At the start of the 21st century demand for fossil fuels is very high. Before they run out we need to look into some of the alternatives.

Prehistoric forests absorbed million tones of carbon dioxide from the atmosphere. Due to the planet's alteration, the forests were buried under the ground's surface, and the carbon remained trapped in the trees.

At the duration of million of years heat and pressure altered the trees in oil, carbon and natural gas. During the last hundred years we consumed in energy and transport half of the planet's reserves in fossil fuels - releasing at a rapid rate million tones of carbon dioxide once again in the atmosphere.

The economic and industrial development that was created during the 20th ce. at a very rapid rate was mainly supported in the existence of plenty and cheap energy. At the end of 20th century however a gradual but steady change of these data began, because liquid fuels' reserves decreased in a percentage that reached the borderline of their full consummation in the upcoming 20 with 50 years, depending on their thoughtless and wastefulness use; their prices reached in heights that would delimit henceforth the end of cheap energy. At this very time the energy crisis began (decade 1970 - 80), people and governments of developed but also developing countries started to speculate in the search of new ecological energy sources that continue till our days. In 1972 Professor Wilson warned by saying: "the world must effectively restrict its energy consumption and abandon massively its dependence on oil, because if not the threat of widespread destruction is open". Thereby human being is nowadays led to the search of alternative energy sources, under the pressure oil reserves' consumption and the requirement for improvement in quality of life.

Still, Greece prepares a special land-planning drawing for the renewable sources of energy, which will contribute so that is increased the production of Green Energy from the actual levels of the 11% in the 20% in 2010 and in the 30% in 2020.

In 2003 E.U. placed as objective the use of biofuels in percentage 5,75% in the transports in the states-member up to 2010, while this year it increased the objective in the 10% up to 2020, because the rise of prices of oil and climatic changes. The increase of objective, according to the report of E.U., is also combined with the growth of biofuels said "second generation", while today biofuels of "first generation" are produced from cerial, vegetation oils, animal fats, sugars and starches, make that requires the use of big extents for the production of energy plants, while the efficiency is lower than biofuels of "second generation", which however still have not entered in industrial scale.

First biofuels (biofuels 1st generation), that were used in different degree in the countries-member, but also internationally, they were biodiesel (methylesteres of fatty acids, origin from vegetable oils or animal fats) and the bioethanol (origin from simply sugars and starchy matters). In spite of the biofuels were on a par with the conventional fuels from side of properties and efficiency in the transports, gradually was expanded on a critical evaluation in combination with the effect of promotion of required energy cultivations in the agriculture and the biodiversity, and more generally the rational use of lands, as in level of states-member as in European level.

Finally, the research and growth are directed in the production of biofuels 2nd generation, which are originated from lignocelluloses raw materials, as timber, rural and forest products/residuals, as well as municipal organic residuals. Is studied, also, the growth of new biochemists (enzymatic hydrolysis of biomass and fermentation of the produced sugars in order to produce bioethanol) and/or thermo chemical processes (pyrolysis in order to produce bio-oil, vaporization for the production of synthesis's gas, in combination with the catalytic process Fischer-Tropsch for the production of biodiesel and petrol), via which plant by-products and residuals of human/industrial processes, will be exploited for the production of fuels friendly to the environment. In any case, in order to fulfill the objective of E.U. (10%), the report realizes that the 15% of cultivable land must be used in the European Union for the production of energy plants. This 15% is characterizes by the E.U. as moderate, mentioning that, a lot of extents that are today under the arrangement of set aside, will be used by the farmers for energy cultivations. As is underlined in the report, without biofuels of "second generation", the cost for the import of raw materials

and the use of lands for the production of energy plants will be increased, as the current situation with biofuels of "first generation" cannot satisfy absolutely the objective the 10% in 2020.
We can make the most of the forest biomass either from the existing forests or from reforestations of available extents (Figure 1). The dissimilarity of characteristics of various forest species and mainly the lack of sufficient elements and experience render the estimate of exploitable potential for most of these species impossible. The *Poplar* is particularly examined and analyzed because is considered one from the most suitable for forestation species (Tsoumis, Fillipou 1982, Fillipou 1982).

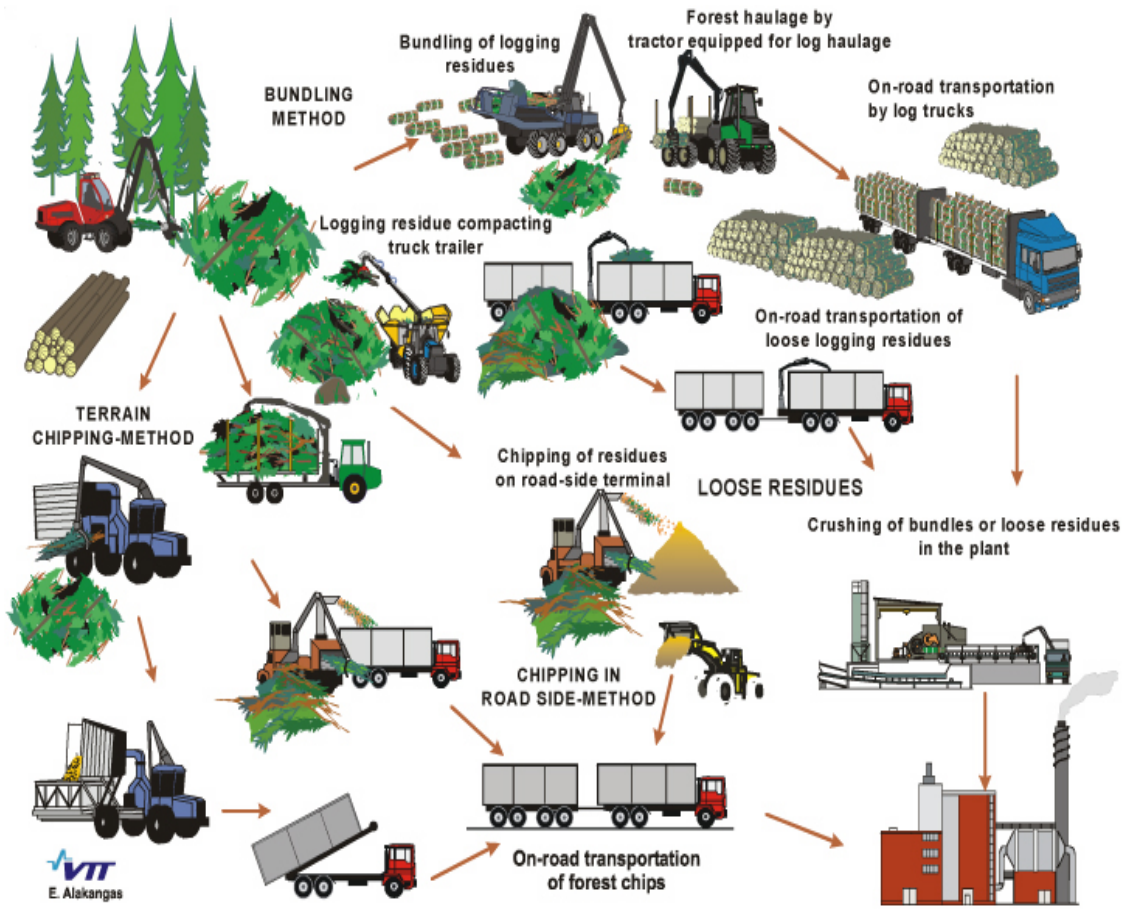

Figure 1: Biofuels Production from forest (Source: Eija Alakangas, VTT Energy)

The European Parliament, by creating the directive 2003/30/EU/08.05.03 relative to the promotion of biofuels or other renewable fuels for transport usage, summoned all the European Union members to substitute conventional fuels at least 20% until 2020. Also, all the members of the Union are obliged to use biofuels at the minimum percentage of 5.75%, which, in Greek standards is corresponded to a production of 390000 tones of bioethanol (Vakakis 2006).

For the production of bioethanol the agricultural plants which can be used are the sugar beet, the sugar cane, the corn, the wheat and sweet sorghum. The last one gave unexceptionable results in the experimental cultivations which took place in North Greece and in Kopaida region. Its output in sugar is remarkable and is characterized by a high photosynthetic ability contributor.

The aim of the paper is to investigate if the idea of the establishment of an industrial unit of bioethanol production next to an industrial sugar unit can be w33w`3ww3qachieved, according to the directive 2003/30/EU/08.05.03 of the European Parliament.

2. Methodology

One of the most remarkable ideas for biofuel production in Greece is the idea of the establishment of an industrial unit of bioethanol production in the municipality of Apostolos Paul in Hmathia prefecture which is going to use sugar beet and corn as plants raw materials and forest biomass from reforestations of available extents.

The municipality of Apostolos Paul is located in Hmathia prefecture. According to the census of 2001, the population of the municipality consists of 3000 households. The municipality is nearby the capital of the prefecture in a distance of about 100 metres. The economy of the municipality is mainly based on agriculture. The usual cultivations are peach trees, sugar beet, corn as well as other cultivations in lesser extent.

The research was carried out with the application of personal interviews via questionnaires. An interview is the best way for statistical data collection (Kiohos 1993). The municipality of Apostolos Paul formed the research area. The applied sampling method was simple random sampling, due to its simplicity and the fact that it requires less possible knowledge about the population, compared to any other method (Freese 1984, Asteris 1985, Matis 1988, Damianos 1999 and Kalamatianos 2000).

"Population" under investigation is the total of the households of the municipality of Apostolos Paul in Hmathia prefecture. Simple random sampling presupposes the existence of a full catalogue (sampling frame) of the population data without deficiencies or reiterations (Filias et al. 2000). The applied sampling frame was the consumers' lists of domestic electricity, because 100% of the households in the research area have electricity.

Household use forms a classic case for using a group of people instead of persons as a sampling unit. This happens because in some cases it is more convenient and less expensive (Matis 1988). The process for the member selection (from the lists - random selected sample) was therefore organized this way in order not to select always the same member (Filias et al. 2000).

In order to estimate the population's proportion which is also the objective estimation of the real population proportion p, rendered from the formula:

$$\overline{p} = \frac{\sum_{i=1}^{n} (p_i)}{n} \quad (1)$$

The typical error of the population s_p proportion estimation, without the finite population correction, due to the fact that both the sampling fraction and the confidence interval are small, is rendered from given formulas:

$$s_{\bar{p}} = \sqrt{\frac{\bar{p} \times \left(1 - \bar{p}\right)}{n - 1}} \quad (2)$$

$$p = \bar{p} \pm t \times s_{\bar{p}} \quad (3)$$

where t = is the value of STUDENT's distribution for the probability (1-α) = 95% and n-1 degrees of freedom.

The size of sample was appreciated with base the formulas of simple random sampling (Freese 1984, Matis 1989, Kalamatianos 2000). Even if was used simple random sampling without replacement, the finite population correction can be ignored because the size of sample n is small concerning the size of population N (Freese 1984, Pagano and Gauvreau 1996). Because variables refer to proportions, the determination of the total size of the sample is given from the following formula:

$$n = \frac{t^2 \times \bar{p} \times \left(1 - \bar{p}\right)}{e^2} = \frac{1{,}96^2 \times 0{,}5 \times \left(1 - 0{,}5\right)}{0{,}05^2} = 384{,}16 \quad (4)$$

Where: t = is the rate (value) of STUDENT's distribution for the probability (1-α) = 95% and n-1 degrees of freedom. Because the sample's size is big (n is bigger than 50) value t is taken from the probability tables of normal distribution for the desired probability. In fact for the 95% probability value t is 1,96 (Matis 1988).
p = proportion estimation.
e = maximum acceptable difference between sampling medium and unknown population medium. We accept that it is 0,05% namely 5%.

In order to estimate the sample's size we had to carry out a pilot sampling, with sample's size of 50 people. Thereby for every variable the actual population proportion was estimated and based to that we estimated the sample's size for each one of those.

The sample's households are then traced with accuracy (that is full name and address) with the aid of random numbers taken from tables of random numbers. In the selected households personal interviews to a member of the family, randomly selected, were carried out. If we did not find anyone in the house or they refused to give us an interview we made two more efforts to get their viewpoints. If this was impossible, then we continued, by the same procedure to the selection of new sampling units. The collection data was carried out in 2007 and for their analysis the Excel of Microsoft was applied.

3. Results

3.1. Analysis of Questionnaires

The following results were obtained from the analysis of the questionnaires:
The analysis of the data is shown that the vast majority of the planters (73%) are between 25 and 40 years old (Figure 2).

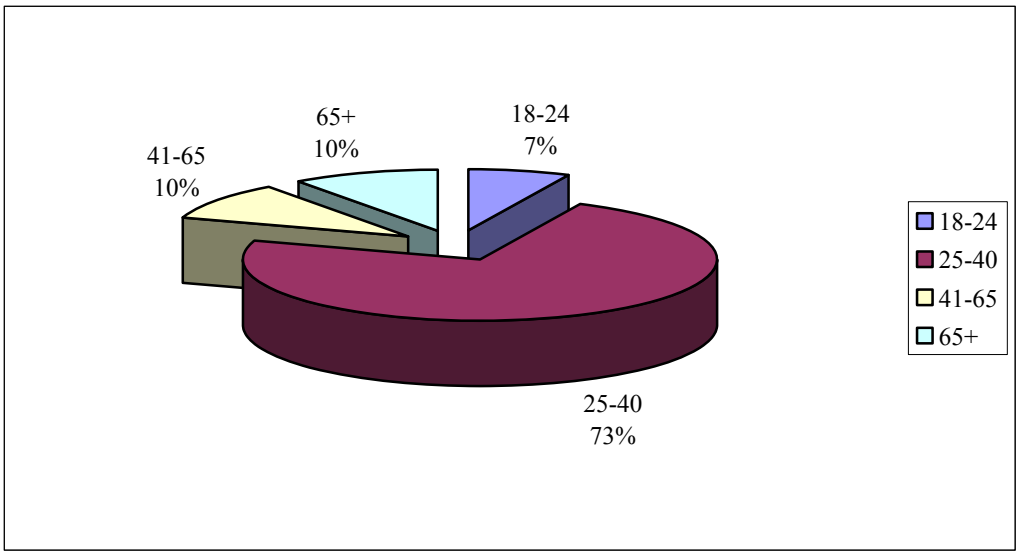

Figure 2: Distribution of the planters' age.

In the first question the majority of those who were asked (85%) believe that the young people abandon agriculture mainly due to the lack of economic amplifications and facilitations as well as the lack of vision which will give them motivation to turn to this specific section.

In the question that was placed to them whether they knew the meaning of biofuels, the results were 86% yes and 14% no. Those who did not know the meaning, asked to be informed about them and the annual income that they will bring in and further more what goals they serves (Figure 3).
Specifically, regarding the question "what biofuels do the planters know" - including wood, agricultural by-products, bioethanol and biodiesel – wood prevailed (100%) over the others because it constitutes the simplest and most familiar renewable energy source. The agricultural by-products are known at a percentage of 35%, while only 20% of those who were asked were aware of what bioethanol is and 6% of them knew about biodiesel.

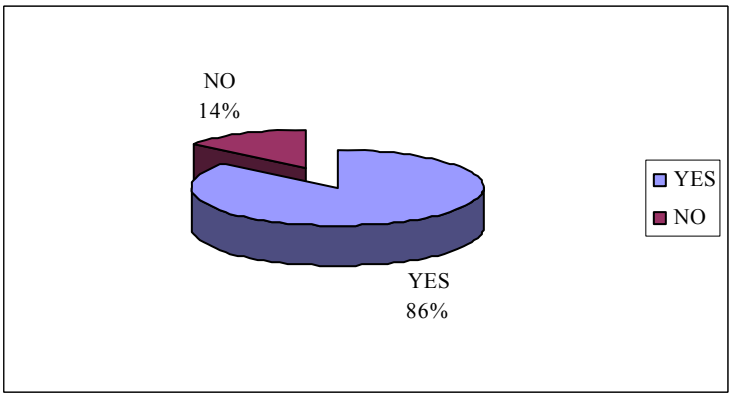

Figure 3: How many planters know the meaning of biofuels?

In the question relative to the income from the cultivation of sugar beet, corn and production of forest biomass from reforestration of extents that are today under the arrangement of set aside, comparably to any other agricultural plants, such as peach trees etc., 87% believes that it will rise than 23% which

believes that it will be decreased. The large difference between the percentage of those who believe that their income will rise from the cultivation of sugar beet, corn and production of forest biomass from reforestration of extents that are today under the arrangement of set aside and those who believe that it will be decreased, exists because of several factors such as their young age.

In the question relative to the public's opinion about the possibility for the construction of a bioethanol production industrial unit nearby the industrial unit of sugar in Platy - Hmathias, the positive answer prevails with a percentage of 90% over the negative the answer which touches the percentage of 7%, while the rest 3% choose not to answer this question. This great positive percentage can be partly justified because of the satisfaction and belief to the state and to the vast majority of the young planters (73%).

In the question relative to the contribution of this unit to local development, 90% of those who were asked, believe that this unit will comprise an important attraction pole for incoming planters considering the fact of the reduced taxes which will be paid by those who will take part in the bioethanol production program, the relatively higher bounties and the capability of the unit to employ a large part of the area's population. Besides, it is common conviction that the unit will constitute an attraction pole for the youth who left the area because of the lack of occupation. This is based on the fact that the unit will be able to absorb almost the total amount of the plant production of the cultivating area.

In the accompanying question following the one above, the citizens were asked to name the most important environmental problems that will be presented with the establishment of the factory. Here the planters replied: a) air pollution, b) water pollution and c) the degradation of environment with all the consequences in the mental and bodily health of citizens (Figure 4).

For the course of the problems such as mentioned above, results have shown that 60%, that is to say the overwhelming majority of planters believe that they will become worse, a 30% believe that they will remain the same and the rest 10% that they will improve (Figure 5).

4. Conclusions-Discussion

The establishment of a biofuel industrial unit in the municipality of Apostolos Paul will improve the greater region of Hmathia prefecture. This industrial unit will contribute to the local development as it can provide jobs so to the factory as for the cultivation of the energy plants.

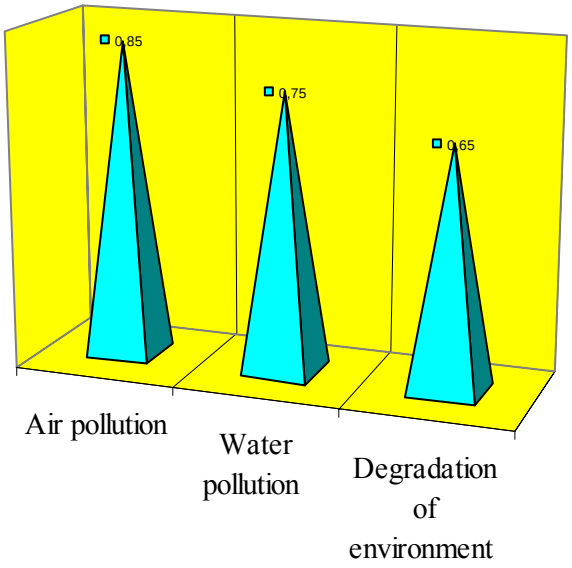

Figure 4: The most important environmental problems that will be presented with the establishment of the industrial unit.

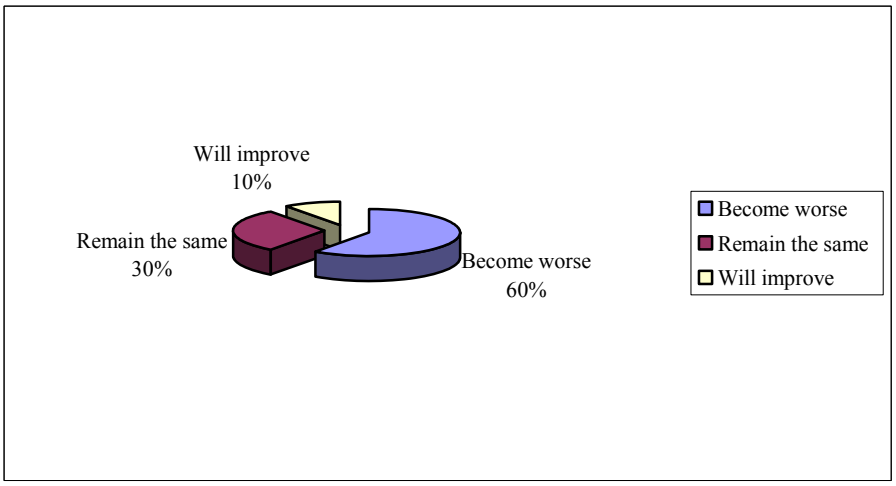

Figure 5: The course of the problems according to the planters.

Biofuels offer one of the few options to substantially mitigate climate change. Since the effects of global warming can be devastating to world agriculture, the ecological impacts of growing biofuel crops may be small compared to the potentially much larger impacts of unmitigated climate change.

Full of promise is the production of biofuels in the developing countries. Already in Brazil - where running 29.000 petrol stations that supply ethanol and where the cars which allocates engines that burns also ethanol, for the first time the sales of cars with purely conventional engines are over in 2005 - the cost of production of ethanol from sugar beets (method that promotes also in Greece, with the collaboration of Greek Sugar Industry) is almost the same with the cost of petrol. As long as a country has a hotter climate, so much is increased the productivity per acre for the plants that "give birth"

biofuels and the price of last ones fall proportionally. At the same time co-production's stations are developed of ethanol and electricity.

Forest biomass for biofuels cannot be considered a renewable energy source unless it is produced in an environmentally sustainable manner. All forest types provide opportunities for biomass production. Site characteristics affect the biomass opportunities that can be realized and management should be done with specific goals in mind.

The financial profits for the population of the region and the energy profit for Greece coming from the production of biofuels and the reduction of fossil fuels will be very important.

This is an initial investigation work about the enforcement of the European Parliament instruction 2003/30/EU/08.05.03 relative to the promotion of biofuels or other renewable fuels for transport usage, in which E.U. summoned all the European Union members to substitute conventional fuels at least 20% until 2020. From the answers of the questionnaires is being clear that Greece can catch the goal of the minimum percentage use of 5.75% until 2010.

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