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Possibilities of production and use of *wood pellets* in Greece from an economic and market aspect

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Abstract
A type of biofuels with a wide known use and a significant number of applications, are the biomass pellets of wooden form, known as *wood pellets*. The market of *wood pellets* in Greece has not been developed yet. The production and use are in extremely low levels, concerning small industries and residential users. The results of a market study in two regions of Greece with great energy and environmental problems (Western Macedonia and Peloponnesus), are quite encouraging for the development of *wood pellets* market in Greece, since 60-70% of the residents are positive to the use of *wood pellets*. Financing motivations such as tax exemptions or lower municipality fees seems to play a fundamental role to the use of *wood pellets* by the consumers. The total demand of the two regions is almost 160.000tonnes for residential use and 40.000tonnes for professional spaces.
Keywords: Wood pellets; biofuels; market study; pellets market.

1. INTRODUCTION

A type of biofuels with a wide known use and a significant number of applications, are the biomass pellets of wooden form, known as *wood pellets*. For their production as a raw material can be used the wood process residues, forest residues along with agricultural residues of wooden form [1,2]. Pellets are a standard cylindrical biological fuel with quality standards that are produced without the use of adhesives or chemical components – just high pressure and steam, a fact that constitutes *wood pellets* as an absolutely environmental friendly fuel [2]. *Wood pellets* as a product are characterized by high cohesion, low humidity percentage (less than 10%) and high density (>1.100kgr/m^3), a fact that allows their combustion and their high thermal performance. Furthermore, its small dimensions and geometric shape, allows their easy storage and handling. This can also be achieved by the capability they have to be packaged in bags of 15, 20, and 50 kgr. Biomass pellets are competitive against petrol, natural gas and electricity, not only for the lower energy cost but in relation to their easy use and the reliability of the applied technology [3]. A great number of different heating means and applications using *wood pellets* have been developed across Europe, mainly after 1999. After the rapid increase of oil prices and fossil fuels during 2006-2007, the demand of consumers for *wood pellets* has been increased significantly and a remarkable production industry and a dynamic market are developing across Europe and globally [4,5].

1.1 Environmental and economic approach of *wood pellets*

The great impression of *wood pellets* in European market is due to the fact that pellets are [3,6]:

- a practical product since they can be carried in packages and can be used with the help of automatic gauges for the flame feeding in combustion means

- a standard product, since sever technical norms have been developed for their maximum performance (density <1100kg/m, humidity <10%, ash 1% max.) and they can be stored easily without been degraded
- more efficient (it is estimated that one kgr. is equal to 5kWh) due to its stable density, low humidity and low transport and storage cost
- ecological (for pellets production we don't have to cut forest trees) since they are produced by residuals or recycled wood and their perfect combustion frustrates the produced ash
- *wood pellets* combustion helps in a fundamental way to the decreasing of forest residues, and the residues of wood processing and furniture industry
- pellets don't release dangerous gasses during their combustion since we don't use any chemicals for their production.

Furthermore, *wood pellets* are cheaper than petrol and electricity and they seem to have a more stable course of price fluctuation. No significant markups are expected to their prices, due to the fact that the internal procurement and the possibilities for imports of biofuels are great, contrary to the price of petrol and electric energy, which has been recently significantly raised [10].

1.2 *Wood pellets* industry in Europe. Production – consumption – prices

Available data concerning *wood pellets* production, consumption, trading and prices at a European level, shows that there is a significant variation between several countries [5,6,7,8]. In some countries pellets consumption concerns small scale residential users or small industries, in the contrary to other ones, where pellets are used as a supplementary energy source in big industries, such as electric energy plants. It is estimated that for *wood pellets* production units the cost of the raw materials constitutes a 30% of the total cost of wood pellets logistics, transport cost a 15% including storage, production cost a 45% and the cost of promotion and sales a 10% [4]. In Europe a significant number of production and trading units are established, showing increasingly developing figures. Southeastern Europe shows a definitely decreased number of figures concerning *wood pellets* industry and market, than the rest of Europe [5,7]. This fact shows the great possibilities of development of *wood pellets* market that exists in our region and in Greece specifically. Pellets production has an increasing course during last years. Total European production is over 4.500.000tons/year. Time series course of production shows that, the quantities have been significantly increased after 2005, mainly to the increasing demand, but also to biofuels production interest and oil's international prices. Consumption trends are also increasing all over Europe. In fact, consumption is higher than production and as a result the rest of the needed quantities are covered by imports mainly from U.S.A., Latin America and Asia. The main consumers, more than 2.000.000tons/year, are residential users that use pellets for the heating of houses [10].

A great variance is observed to *wood pellets* prices in European market. Recent data concerning prices and related to 5 tones of bulk *wood pellets* including VAT, shows that Scandinavian countries seem to have steady higher prices than other ones, where *wood pellets* market hasn't developed yet such as Greek market [10]. Generally, we can say that *wood pellets* prices have geographic fluctuations according to offer and demand in each country. According to several studies, prices will be fixed at a mean of 100-120 €/ton for wide range consumers (e.g. industries) and of 150-200€/ton for small scale consumers (e.g. residential users) [5,7,8].

1.3 Pellets market in Greece.

The market of *wood pellets* in Greece is still undeveloped. Production and consumption are still at very low levels, with the second one focused mainly to residential users [7]. Some interest in *wood pellets* production seems to be expressed in Greece by several private investors. Pellets production in general, was approximately 60.000 tons during 2007, much higher than the national existing consumption [10]. Quite interesting are wood pellets prices in Greek market, which are in relevant

low levels related to other European countries. During 2007, retail prices were approximately up to 171€/ton for bulk quantities, while in the beginning of 2008 this price seems to be even lower, reaching 168€/ton during April. Opposite course have the prices for packed *wood pellets*. Their price increased from 182€/ton during 2007 up to 189€/ton in 2008 [10].

2. MATERIALS AND METHODS

In order to study the possibilities of developing *wood pellets* market in Greece, a market study was conducted in two prefectures of Greece (Western Macedonia and Peloponnesus), with severe environmental and energy problems. The methodology that was applied for this research was concerning the completion of specially constructed questionnaires, which were selected as a mean to collect primary data. For the quickest and cost effectiveness way of the study, the use of telephone interviews was applied. For the determination of the sampling application of the study, the methodology of layered random sampling was selected. The total population of the two prefectures was ranked in homogeneous groups – layers, according to region and town and with the use of telephone catalogues the sample was selected from each town using systematic selection. The sample determination was based to the precision – significance rate that was necessary in order to have reliable results from the study. Thus, according to the next mathematical type [9] and for a significance level up to 10%, the size of the sample was determined in 333 persons in both prefectures.

$$10 = 3\sqrt{\frac{X.Y}{N}} \quad \text{ή} \quad 10^2 = 3\left(3\sqrt{\frac{X.Y}{N}}\right)^2 \text{ ή } \quad 10^2 = \frac{9X30X70}{N} \text{ ή N = 189 persons (W. Macedonia)} \qquad (1)$$

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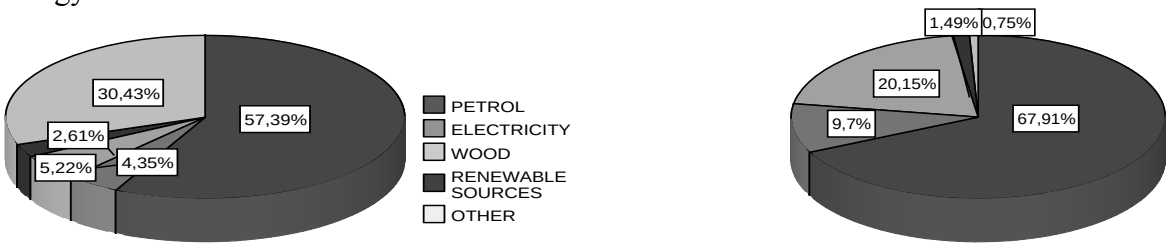
There were completed totally 249 questionnaires, 74,8% of the originally selected sample. Data were statistically analyzed using SPPS Ver.14.0 and all the relevant tests of Frequencies, Descriptive and Cross tabs were made.

3. RESULTS AND DISCUSSION

3.1 Use of existing fuels consumption

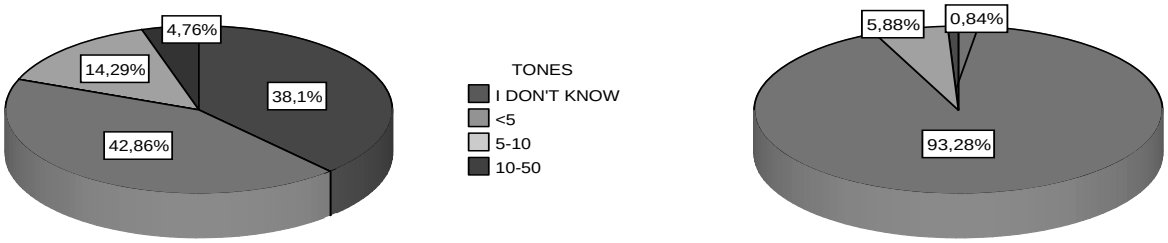
The first results of the study have to do with the existing situation in heating means and consumption of fuels. In figure 1 we see that the use of petrol is the main fuel for the heating of houses and professional spaces in both prefectures. A very small percentage uses several renewable energy sources such as biomass fuels.



I II

Figure 1. Uses of different types of fuels in W. Macedonia (I) and Peloponnesus (II).

In figure 2 is presented the average consumption of fuels (in tones) for each household or each business of the study area. This mean consumption is up to 2,5tons/year for each household and up to 2,8tones/year for each business respectively. Of course the major percentage of the consumers use quantities <5tones annually.



I II

Figure 2. Average annual consumption of fuels in tones of households – professional spaces in W. Macedonia (I) and Peloponnesus (II).

3.2 Aspects regarding use of biomass fuels

One of the main results of the study regarding the knowledge and information of the residents in relation to the meaning of biomass and its use, shows that in W. Macedonia the consumers have a significant knowledge about biomass in the contrary to the consumers in Peloponnesus, where the percentages are rather small. This can be explained by the fact that W. Macedonia is a region with great environmental problemsm, caused by the huge electric plants that are operating at the region using carbon.

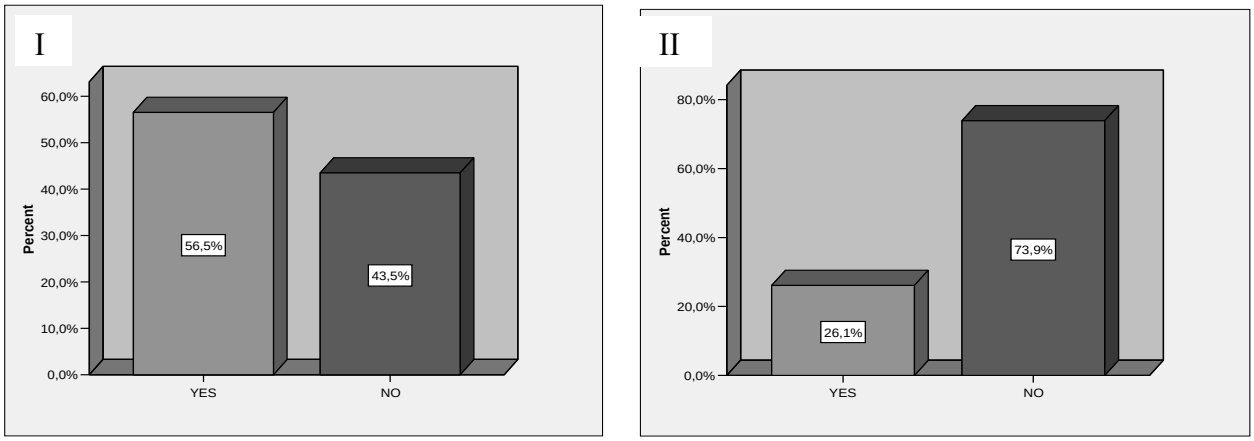


Figure 3. Knowledge regarding biofuels uses in W. Macedonia (I) and Peloponnesus (II).

One of the most important results of the study has to do with the nomination of the information sources regarding biofuels use. We can see that the importance of several sources of information is, different in the two prefectures. Very significant role seems to have press and TV in both regions.

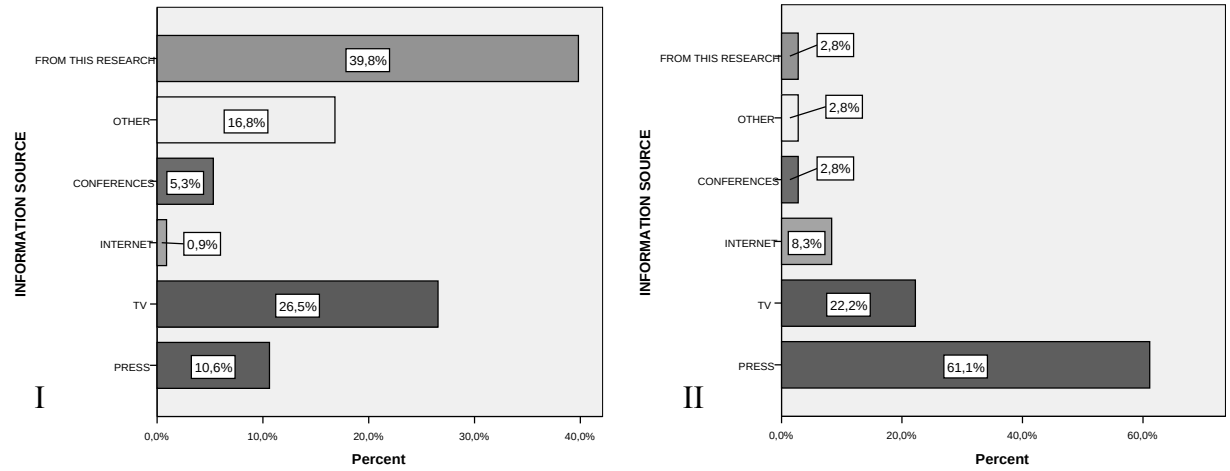


Figure 4. Information sources regarding biofuels uses in W. Macedonia (I) and Peloponnesus (II).

The knowledge of contribution or not, of biomass use as a burning material, to environmental protection and to money saving at a personal level, are presented in figure 5. As we can see in both prefectures, residents believe that the use of biomass fuels contributes positively under some conditions to environmental protection and to household's money savings.

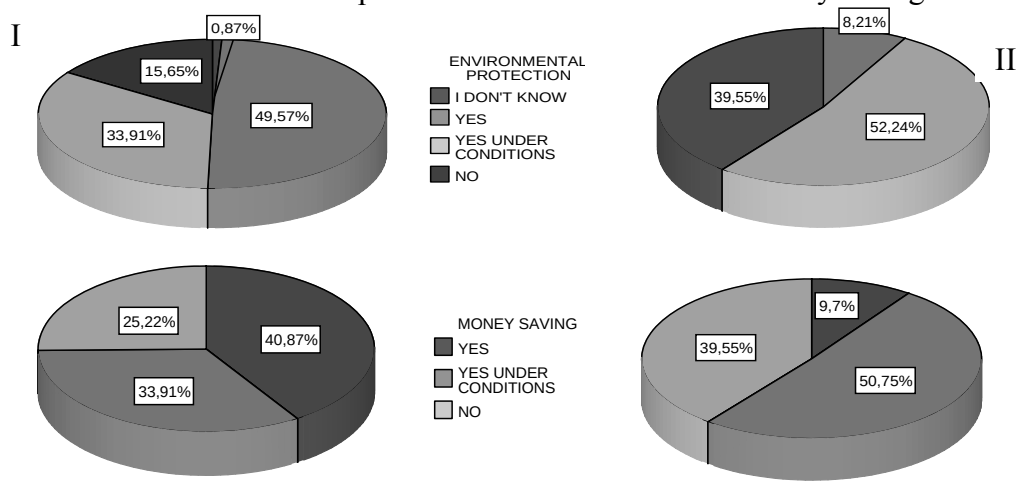


Figure 8. Opinion regarding contribution of biomass fuels in environmental protection and household's money savings in W. Macedonia (I) and Peloponnesus (II).

The most crucial answer of the study had to do with the existence of interest for direct personal use and application of *wood pellets,* for heating reasons in houses or in professional spaces. In both regions the majority of the population would use *wood pellets* for heating, under some conditions. These conditions have to do mainly with economic motivations and reduction of the total cost for the *wood pellets* heating system (Table 1).

Table 1. Conditions ranking for using wood pellets in both study regions.

CONDITIONS	RANKING					
	5	4	3	2	1	0
WESTERN MACEDONIA						
Free heating system installation	50,8%	20,6%	15,9%	1,6%	9,5%	1,6%
Deliverance of wood pellets to my space	18,0%	31,1%	23,0%	16,4%	1,6%	9,8%
Long term contract for use of wood pellets in prices lower up to 20% than petrol.	26,2%	18,5%	16,9%	20,0%	9,2%	9,2%
Funding, tax exemptions, lower VAT e.t.c. for using wood pellets	50,8%	13,8%	10,8%	13,8%	6,2%	4,6%
Personal promotion as a person with environmental concerns	1,6%	9,5%	7,9%	4,8%	15,9%	60,3%
PELOPONNESUS						
Free heating system installation	83,5%	8,9%	3,8%	0,0%	2,5%	1,3%
Deliverance of wood pellets to my space	73,1%	17,9%	6,4%	2,6%	0,0%	0,0%
Long term contract for use of wood pellets in prices lower up to 20% than petrol.	72,2%	16,5%	8,9%	2,5%	0,0%	0,0%
Funding, tax exemptions, lower VAT e.t.c. for using wood pellets	73,4%	12,7%	10,1%	1,3%	1,3%	1,3%
Personal promotion as a person with environmental concerns	16,5%	3,8%	10,1%	8,9%	11,4%	49,4%

Finally and after analyzing statistical data, it is estimated that the total number of households for direct use of *wood pellets* in both regions is up to 32.184. Based on the fact that the average

consumption of each household of heating petrol is 2,5tn/year and that the heating power of petrol to *wood pellets* is approximately 2:1, it is estimated that the total needed quantity of *wood pellets* is up to 160.920 tones. Furthermore and based on the same hypothesis, it is estimated that the total number of enterprises for direct use of *wood pellets* is 10.653and the quantity of *wood pellets* for the needs of the professional spaces in both regions is approximately 40.000tones.

4. CONCLUSIONS

The results of the study show that biofuels in general and *wood pellets* especially, constitute a solution for many of the energy problems of Greece, contributing simultaneously to environmental protection and to a cost effective way of heating. There is a quite developed market across Europe, while in Greece the possibilities for development are standing at a high level. The knowledge of the residents regarding *wood pellets* and their uses, in both study regions, is quite significant and encouraging for the development of *wood pellets* market in these regions and in Greece generally. Efforts should be focused to the ways of information, since a great percentage was informed about *wood pellets*, by this study for the first time. Concerning the use of wood pellets as a heating material in households and in professional spaces, financial motivations, tax exemptions and the cost of heating system installation seems to have the most significant role in consumer's decision. Finally, we can see that in absolute numbers the total demand for *wood pellets* can reach very high levels. Investments in producing *wood pellets* should be examined by investors in Greece.

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