An assessment of Energy Poverty in Greece

A comparative study regarding the phenomenon in Greece

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Solemn Declaration

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Abbreviations

EU	European Union
EU – 28	28 Countries within EU
NGO	Non Governmental Organization
UK	United Kingdom
IEA	International Energy Agency
LPG	Liquified Petroleum Gas
SDG – SDGs	Sustainable Development Goal(s)
EP	Energy Poverty
Eurostat	European Statistics Organization
Elstat	Greek Statistics Organization
DG Energy	Directorate-General for Energy
GDP	Gross Domestic Product
VOC	Volatile Organic Compounds
PPC	Public Power Coorporation
GENOP/DEI	General Federation of Employees in PPC
ADMIE	Independent Transmission System Operator (Greece)
RES	Renewable Energy Sources

Abstract

Energy poverty is a multifactorial problem that affects both developing countries as well as developed ones. In Europe, it is estimated that 1 out of 10 people is affected by energy poverty. According to the figures, 57 million people are unable to heat their homes in the winter, 104 million people do not have the ability to use air conditioners in their homes in the summer and 52 million people have arrears on their energy bills. These data, combined with the percentage of income that is exclusively dedicated in covering energy bills, makes energy poverty an actual problem within EU. In Greece, the phenomenon is more severe. Along with the huge economic recession between 2010-2018, when the GDP fell by 25% and fiscal measures were enforced during three different bailout programs, it is estimated that in Greece six out of ten households suffer from energy poverty.

In the context of this diploma thesis, the phenomenon of energy poverty was studied, along with its correlation to different macroeconomic aggregators' for the European Union, the EU-28 and Greece. Furthermore, its impact and the legislation existent for the combat against energy poverty were demonstrated while at the same time, different approaches that were studied are listed in this thesis. Given the fact that for Greece, there is not an official definition for energy poverty, these studies are important in order to assess this multidimensional phenomenon as accurately it is possible.

Simultaneously, different actions against energy poverty are analyzed in the following pages, thus indicating the different approaches that are followed between countries or organizations. This Thesis proposes potential actions that could be adopted from the State as well as from companies, other organizations and furthermore, lists already existent and successful ones that are imposed by countries within EU, other companies & NGOs.

1. Introduction

Energy poverty is a multi-level phenomenon that has a strong impact on developing countries as well as on developed ones. It is clear, however, that it has different characteristics and different tensions, depending on a variety of factors as well. Energy poverty can take various forms, including the lack of access to modern energy services, a lack of reliability when there are services and concerns about accessibility. Even in developing countries with universal and reliable access to modern energy, affordability can be a problem. Research regarding this phenomenon, is mainly recent, with the UK leading the way since the 70's. Concerning the so-called "developing" countries, energy poverty can be the lack of access to modern energy services, or the lack of access to electricity. Data from the IEA, indicate that over the past five years, the rate of new annual electricity connections has indeed accelerated and projections show that several developing countries are on track to reach electricity for all by 2030. For example, in India since 2000, half a billion people have access to electricity, with electricity now reaching 82% of the population, up from 43% in 2000. If this pace is maintained, India will achieve universal access in the early 2020s and is going to be a pioneer-country in the electrification history. Albeit the achievements, there are many obstacles along the way. Some progress has been made regarding the access to clean cooking facilities but projecting in 2030, 2.3 billion people will still lack access to clean cooking facilities, with an annual rate of 2.5 million premature deaths still attributable to household air pollution. If we are to witness the kind of progress on electricity that is expected, clean cooking must be placed high as a priority, on a par with electricity access. Women in developing countries, spend 1.4 hours a *day* collecting fuelwood and four hours of cooking while also suffering the most from household air pollution. Regarding the aforementioned problems, renewables play an increasing role in grid-based electrification as well as the expansion of decentralized technologies that are essential for remote rural areas in order to access electricity. LPG provides much of the access in urban areas for clean cooking, while progress in rural areas is largely achieved through improved biomass cooking. Despite the huge problem of lack in modern & clean energy services for the 1/3 of the world's population, energy poverty is also defined and existent for the "developed" countries, with different characteristics. After all, *"providing universal energy access for households, however, is not enough to ensure economic and social development. Energy also needs to be available for productive uses such as agriculture and industry to help achieve the SDG goal on poverty"*[1]. The problem of availability and pricing is the most common in developed countries, where the consumption is vastly larger than the one in developing ones. The cases where, in many European countries a big proportion of the population cannot obtain

[1] **Energy Access Outlook 2017:** From Poverty to Prosperity, available at: https://www.iea.org/publications/freepublications/publication/WEO2017SpecialReport_EnergyAccessOutlook.pdf

energy –in any of its forms- with a reasonable cost, depending on its income, are not few. Thus, many definitions have been given for the phenomenon of energy or fuel poverty. Since the great economic crisis of 2008, EP has become a subject of study for many researchers, non-profit organizations, universities, States and other institutions. The causes of the phenomenon, as well as the actions in order to address it have been a matter of great debate. In Greece, energy poverty can be confused with poverty. Although they have many similar characteristics they are not the same phenomena.

In the context of this Thesis and in order to assess the phenomenon of energy poverty, a variety of literature has been studied both for Greece as well as other countries within EU. Due to the fact that the objective of this Thesis is to highlight energy poverty in Greece, along with its unique characteristics, literature regarding EP in developing countries has not been assessed. More specifically, in the first chapter, an attempt to imprint the economic aggregates for Greece and the EU was made, roughly from 2000 until today. Data from the World Bank, Eurostat & Elstat were studied in order to assess the economic conditions and how they were affected by the economic recession both in Greece and EU. Furthermore, data from the EU Energy Poverty Observatory and DG Energy have been assessed in order to compare the characteristics of EP between Greece and other EU countries. Last but not least, all the European legislative acts in which energy poverty is mentioned or analyzed, are also included in this study.

After having assessed the economic situation of the country & the recession that occurred in Greece mainly in 2010-2018, the different characteristics of energy poverty were analyzed.

In order to provide essential data required to imprint the phenomenon and correlate it with the economic crisis in Greece different papers were taken into consideration. In order to assess the impact of the economic crisis in the phenomenon of energy poverty, especially in Greece, the Dagoumas et al. 2014 *"Assessing the impact of the economic crisis on energy poverty in Greece"* was studied. In this specific paper, GDP Data & electricity consumption are correlated (for Greece and EU) while at the same time power cuts in the Greek population are demonstrated. All these data, facilitate the decoding of vulnerable groups within Greece. Moreover, in the effort to imprint the phenomenon not only through its economic characteristics but with geographical ones, the paper by Katsoulakos et al. 2014 *"The problem of energy poverty in mountainous areas"* was studied. In this paper, the different characteristics of energy poverty are broken down based on geographical data. For a country like Greece this characterization is very important. Moreover, one of the most important sources of information regarding EP in Greece, was the paper by Papada et al.2016: *"Measuring energy poverty in Greece".* In this scientific paper, data on the financial situation, living conditions and the current situation of the houses of a percentage of the population are analyzed, highlighting interesting data regarding the phenomenon in Greece.

Furthermore, in this dissertation, an effort will be made in order to present the characteristics of energy poverty in EU & Greece, the approaches made in order to imprint it and moreover, present ways by which the State, European Union as well as many NGO's & companies have tried or will try to tackle the phenomenon. Last but not least, proposals will be presented in order to improve existing policies but also new ones aiming at the elimination the phenomenon.

2. The Phenomenon of Energy Poverty

Energy poverty is recognized internationally as a major socio-political problem of increased importance with severe consequences for million people, regarding their health. Although an upward trend was recorded, especially in the EU, the phenomenon was not officially designated within the borders of Europe for many years. There was not a formal definition or commonly accepted indicators for energy poverty while at the same time, it was explicitly linked to poverty, considered its consequence and many times it was not treated as an independent phenomenon. Some exceptions existed, such as Great Britain, where this phenomenon is recognized since the 90's and consequently it is being researched since. Within the EU, the Energy Poverty Observatory was launched in January 2018 in order to increase the awareness for this rising issue for all member-states and at the same time, identify the problem as a policy priority and promote public engagement for it.

The official definition for Energy Poverty is given by the International Energy Agency (IEA) and is defined as the *"lack of access to modern energy services. These services are defined as household access to electricity and clean cooking facilities (e.g. fuels and stoves that do not cause air pollution in houses)."*[2] In this direction, the IEA has been monitoring these aspects in order to assess the phenomenon worldwide. Over the last two decades, the percentage of the population living in the context of energy poverty has gradually declined. Since 2000, year in which 1.68 billion people were energy poor, the percentage of the population that lives under these circumstances has dropped by 50% and more specifically, in 2017 992 million people lived without access to modern energy services.[3] The aforementioned phenomenon, is more intense in Sub-Saharan Africa and Asia where in some cases, almost half of the population in these regions live without access to electricity.

[2] IEA, definition, available at: https://www.iea.org/about/glossary/e/
[3] IEA, Energy Access Deficit, Access to Electricity, available at: https://www.iea.org/sdg/electricity/

Fig.1 "Worldwide Access to Electricity, Source: IEA (2018)"

In the chart, shown above, the vast difference between Europe, North America and other continents such as Africa and Asia can be easily noted. In Europe and North America, the percentage of people with access to electricity is almost 100% in the last two decades.

In the EU, besides the fact that the problem of lack to electricity is almost absent and the phenomenon of energy poverty has different characteristics than the one of developing countries, EP is existent for 50-125 million people intra EU. This phenomenon is not identical to the one of poverty but actually these two are correlated, especially in developed regions such as the European Union. Economically unstable and poorer social groups cannot easily access clean energy, especially now with the rise of energy prices. More specifically, energy poverty could be described as a circular process. Initially, income poor can afford, at an economic level, only cheap, poor-quality housing. Due to the construction and energy deficiency of the dwellings, the cost to meet their energy needs is particularly high. Therefore, a large share of the low income tenants and house owners, is spent on the payment of energy services. Since the prices of energy services are rising, so is the percentage of the income that is spent on them. Trapped in this vicious circle, the initially poor end up also energy poor as they fail to save money in order to improve their housing conditions.

2.1 Definition of Energy Poverty at EU level and Member States

Until 2018, intra EU there was not a formal or official definition for Energy Poverty. According to the EU Energy Poverty Observatory, which was launched in 29/01/2018, "Adequate *warmth, cooling, lighting and the energy to power appliances are essential services needed to guarantee a decent standard of living and citizens' health. Furthermore, access to these energy services empowers European citizens to fulfil their potential and enhances social inclusion. Energy poor households experience inadequate levels of these essential energy services, due to a combination of high energy expenditure, low household incomes, inefficient buildings and appliances, and specific household*

energy needs. It is estimated that more than 50 million households in the European Union are experiencing energy poverty." [4]

In Great Britain, in 1979 Isherwood and Hancock[5] proposed a first definition of the phenomenon which was linked to the percentage that a household spends in order to meet its energy y needs. According to the aforementioned approach, a household is considered to be energetically poor if it spends more than the 10% of their annual income in energy bills. Various definitions have been proposed by many Member-States and by researchers. According to a DG Energy's study regarding EP, two kinds of energy poverty situations exist.[6] The first one, households that spend a high share of their income on energy and the second, households that have insufficient expenditure in energy. Briefly, the countries that do have an official definition of EP, are: Slovakia, France, Ireland, Belgium, England, Austria, Cyprus and Scotland, Wales and Northern Ireland and most of them base the definition they have given to the two aforementioned categories. Several definitions include the concept of energy expenditure while others base their definition on the broad concept of incapability to address one or more needs as it comes to energy. The definition of EP according to Ireland and Wales is worth mentioning, as it defines the concept of poverty for 10% expenditure and severe poverty for 20% or more.

Albeit, the effort to conceptualize energy poverty is becoming more and more advanced, the classic definitions given cannot describe the current situation in developed countries such as EU-ones. Many households that are in a state of general poverty, unemployment, etc. may reduce their spending to meet their energy needs to cover other needs such as diet, education, health, without this meaning that they do not experience or are not exposed to energy poverty. At the same time, quality of construction and the current state of the residence is an important aspect. An energy efficient building, for example, requires less expense for heating and cooling in relation with an identical but qualitatively inferior, i.e. lower energy class, which requires more energy for heating and cooling. Another important aspect, for Greece as well, are the special climatic conditions and microclimate of each area. I.e. in the northern areas of Greece, such as Kastoria, Florina, and Kozani etc. the expenditure for heating is significantly higher than the one at other Greek regions. Greece, on the other hand does not explicitly and quantitatively define the concept of energy poverty. Usually, the 10% of annual income approach is used as long as, some other social and geographical parameters in order to assess and define the allocation

[4] EU Energy Poverty Observatory, definition, available at: https://www.energypoverty.eu/about/what-energy-poverty

[5] Center for European Economic Research, EP Indicators, available at: ftp://ftp.zew.de/pub/zew-docs/dp/dp14037.pdf

[6] Selecting Indicators to Measure Energy Poverty, DG Energy, available at: https://ec.europa.eu/energy/sites/ener/files/documents/Selecting%20Indicators%20to%20Measure%20Energy%20Poverty.pdf

of social benefits. More specific details will be further analyzed in the next chapters of this thesis, together with data on the current situation as well as the policies to confront energy poverty.

2.2 The Impact of Energy Poverty

Without any doubt, the phenomenon of energy poverty has adverse effects on people's lives and wellbeing. Either it is caused by physical poverty or it is caused by other factors, EP leads to the deterioration of peoples' prosperity, economic development as long as their health. Social, economic and environmental impact is connected to energy poverty. The reduction of heating inside houses and low-quality housing can lead to discomfort conditions for people while at the same time, old and damaged insulation could lead to the appearance of damp inside the houses. It is prudent, that the diverse problems in housing as long as the effort to reduce the energy costs leads to the deterioration of life quality. Health issues could arise if something like this happens. Especially during wintertime, mortality rates augment and many studies correlate bad housing condition (and by extent the existence of energy poverty) with the increase in deaths. At the same time, in summer periods, due to a possible heatwave, bad insulation could lead to the rise of temperature inside the houses and thus, lead to increased deaths due to the heatwave. Especially in Greece, the impact of the crisis has redefined the individual and collective practices of households across the scale of income and social layers, generating multiple speeds in relation to heating and inequalities between households. The extra stress and difficulties that occur due to energy poverty lead, at societal level, reduce the life expectancy of the general population and increase morbidity and mortality of the weakest among the ones affected, leading to premature losses of the population. Energy poverty, among other effects, can damage fiscally a country. Population, in order to be able to maintain the best possible conditions within his house, tends to drawback from other obligations. The Greek case, is one of the best examples of energy poverty's effect on the economy. Due to the economic recession that started in 2009, the percentage of shade economy in Greece has augmented at 25% while at the same time increased illicit trafficking has been noted. Also, the inability of the majority of the population to pay on time energy utilities & the effort to obtain cheaper and of inferior quality energy products, except of health issues that may cause at the same time leads to the shrinking of economy. Almost half of the debt to the Public Power Corporation is household debt, which clearly indicates the existence of energy poverty in Greece. Moreover, gasoline product market in Greece experienced a dramatic fall (combined with the dramatic increase of crude oil prices (2011-2014)), more and more people tried to buy cheaper gasoline with no credentials regarding its origin and by gasoline stations with no guarantees.

Apart from societal & economic impact, one of the most important consequences of energy poverty is environmental impact. In Greece, especially during winter time of deep recession and very high oil prices (2012-2014), air quality decreased dramatically, with Volatile Organic Compounds (VOC's) increasing by 30% and the concentration of Particulate Matter (PM's) increasing up to 50% at urban centers. These two factors were responsible for respiratory and heart problems for the city's inhabitants.

All and all, energy poverty has adverse impact on societal, economic, health and environmental aspects of people's lives. Therefore, EU and by extension Greece tries to combat all these aspects with legislative (and other) measures. These will be presented in the further pages of this chapter.

2.3 European & Greek Legislation - Policies

At a European level, there are many mentions regarding energy poverty within Directives and Regulation but not an explicit and specific policy that has been formed. Official data, regarding this subject are in Eurostat and the newly formed EU Observatory for Energy Poverty. At the third energy package, there is a mention regarding the rising problem of energy poverty in Europe without though providing measures and policies. Each Member-State should ensure the necessary supply of energy to vulnerable consumers in order to reduce the number of people suffering from this situation.
In this context, energy poverty is mentioned in the following Directives:

2009/72/EC[7] **2009/73/EC**[8]	The two Directives setting the common rules for the internal markets of natural gas and electricity. In these two, it is demanded from Member-States to develop national strategies in order to combat energy poverty
2010/31/EU[9]	Regarding the energy performance of buildings, where it is stated that: "*Member States may include, in particular, measures that aim to reduce existing legal and market barriers and encourage investments and/or other activities to increase the energy efficiency of new and existing buildings, thus potentially contributing to reducing energy poverty"*
2012/27/EU[10]	This Directive addresses energy efficiency and within it obliges Member-States to: *"include requirements with a social aim in the*

7 Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009,available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32009L0072
8 Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009, available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32009L0073
9 Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010,available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32010L0031
10 Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32012L0027

saving obligations they impose, including by requiring a share of energy efficiency measures to be implemented as a priority in households affected by energy poverty or in social housing"

Besides the aforementioned EU legislation, European Parliament and the EU issue numerous reports, statements and documents concerning energy poverty especially since the establishment of the EU Energy Poverty Observatory. Through this observatory, EU aims to introduce a harmonized European definition and methodology for measuring energy poverty by identifying European indicators of energy poverty (in cooperation with Eurostat) and establish a European strategy and roadmap for the prevention and elimination of energy poverty. It is worth mentioning that the observatory offers guidance for policy making regarding, measuring EP, financing tools and policy examples for Member-States to follow.

In Greece, as it was mentioned in previous pages, there is not an official quantitative definition for energy poverty. The most common definition used is the one related to the expenditure of more than 10% of the annual income in energy bills. Along with this approach, geographical aspects are considered in order to assess the amount and the allocation of any social benefits regarding energy poverty. In the law n.4342/2015 it is stated that a "National Plan for Combating Energy Poverty" should be drafted and published. Albeit the reference in the law, it has not yet been implemented. As it is natural, energy poverty is often treated as a consequence of poverty, without this being a totally mistaken approach, especially for a country like Greece which is plagued by a profound financial recession. Due to all these reasons, in Greece nor does exist a specific definition and at the same time, the tools in order to evaluate energy poverty are not officially approved and legislated. Therefore, it is even harder to define a specific national strategy in the effort to combat energy poverty. Scatter measures exist which do not manage to tackle energy poverty 100% but are mainly focused in relieving economic burdens from poor and energetically poor households in Greece. Specific policies and measures that are in force, will be analyzed further in this essay but there is not a specific legal framework that addresses specifically energy poverty.

3. Measuring Energy Poverty in Greece

3.1 Energy Poverty Indexes in Europe & Worldwide

The attempt to imprint the energy poverty phenomenon in EU countries is more complex than in other developing countries. Intra EU, where GDP per capita is

high in relation to other countries, EP has different characteristics and expression. Europe is a fuel dependent continent[11], with the latest Eurostat data in 2016 confirming it. More specifically, the energy dependency of EU-28 has been steadily above 50% for a decade (from 2006 until 2016) with crude oil dependency being the largest one, from 85-almost 90% of consumption being imported. A large-scale dependency exists as well at natural gas, where the import rate has augmented from 60% to 70% from 2006-2016. EU has a smaller, but significant, dependency from solid fuels which has been around 40% for the decade 2006-2016. All the above can be presented at the following chart [12]

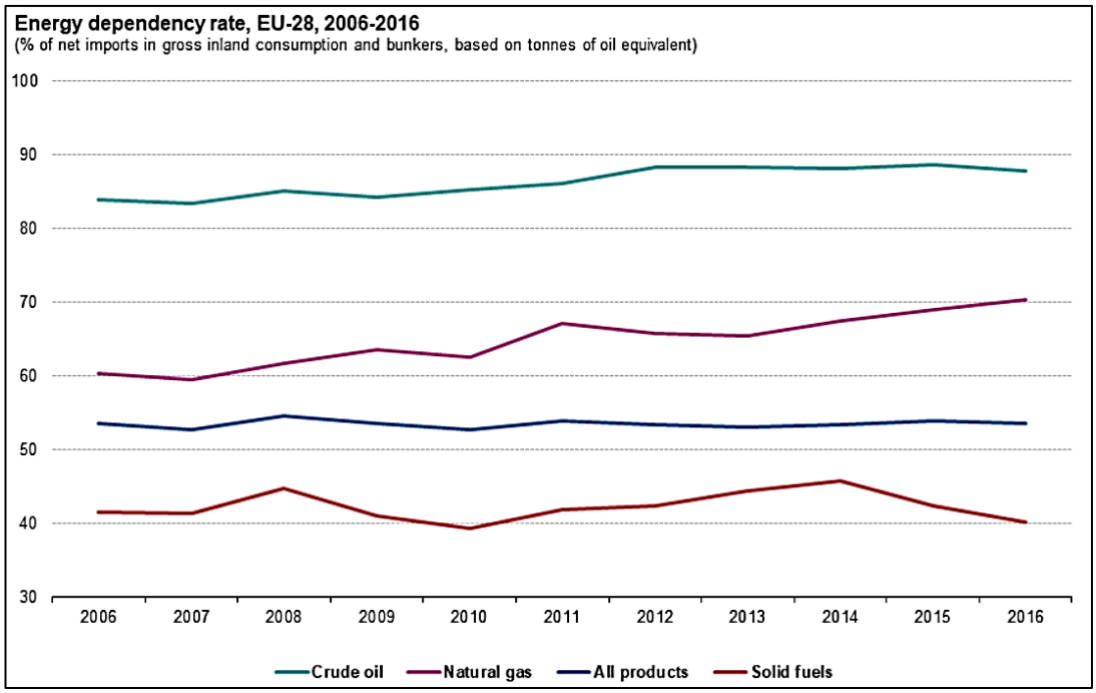


Fig.2 "Energy Dependency Rate, source: Eurostat, 2016"

It could potentially be argued that, since EU is a developed region with strong economy, the import rate of energy does not affect the access of energy to European citizens and thus has no effect on the energy poverty phenomenon. European countries, especially the ones that were severely affected by the economic recession of 2009 (with Greece being the most affected by the economic crisis, as it will be shown in the following pages), are in fact very much affected by the phenomenon of energy poverty. Although EU, is steadily decreasing energy consumption (as it will be presented in the chart below) the dissimilarity of income amongst European citizens and the fluctuation of energy prices has a severe impact on the phenomenon of energy poverty. Especially after 2009 and until 2014, oil prices fluctuated up to 130 $ per barrel. Along with measures for reducing energy consumption, environmental taxing and others, electricity prices as well have increased.

[11] EU Fuel Imports Dependency, available at: https://ec.europa.eu/eurostat/statistics-explained/pdfscache/1216.pdf
[12] EU Fuel Imports Dependency, available at: https://ec.europa.eu/eurostat/statistics-explained/pdfscache/1216.pdf

In the chart below[13], the stead decrease of energy consumption is presented in correlation with the electricity prices:

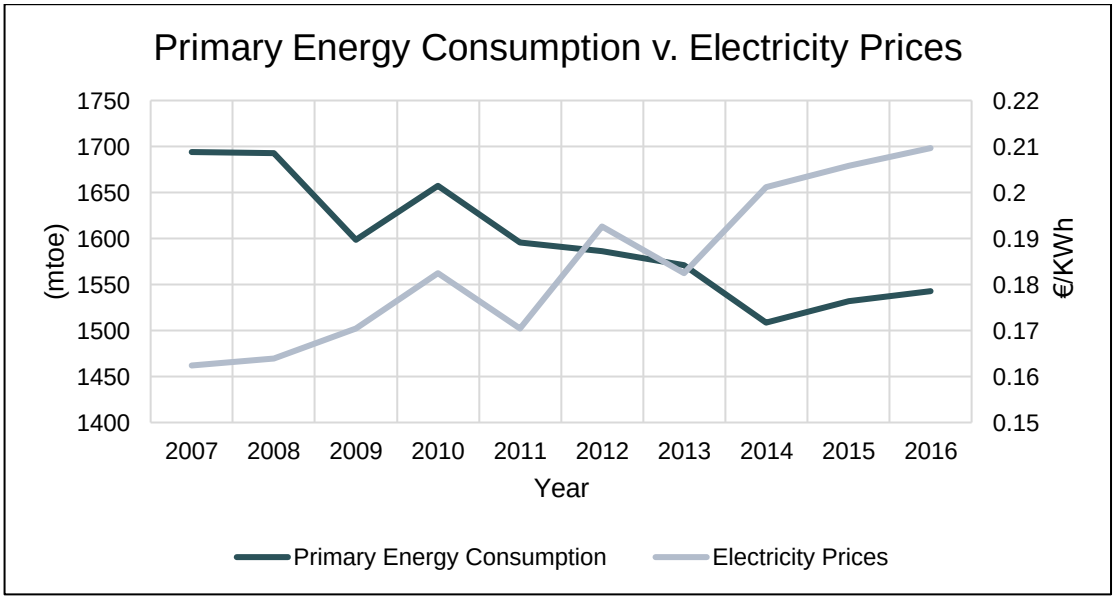


Fig.3 "Correlation of Energy Consumption & Electricity Pricing for the EU"

It is prudent, that during the last decade, the prices of electricity have been steadily increasing while at the same time, the primary energy consumption has been decreasing. The energy consumption, refers to the total consumption within the EU, household and industrial consumption. The electricity pricing, is regarding the consumers and it can be easily noted that the price has increased by 25%. At the same time, the correlation of Oil prices and electricity ones is shown at the chart below, in order to provide information about the huge increase that occurred from 2009-2014.

[13] Energy Consumption for the EU, available at: https://ec.europa.eu/eurostat/tgm/table.do?tab=table&plugin=1&language=en&pcode=t2020_33

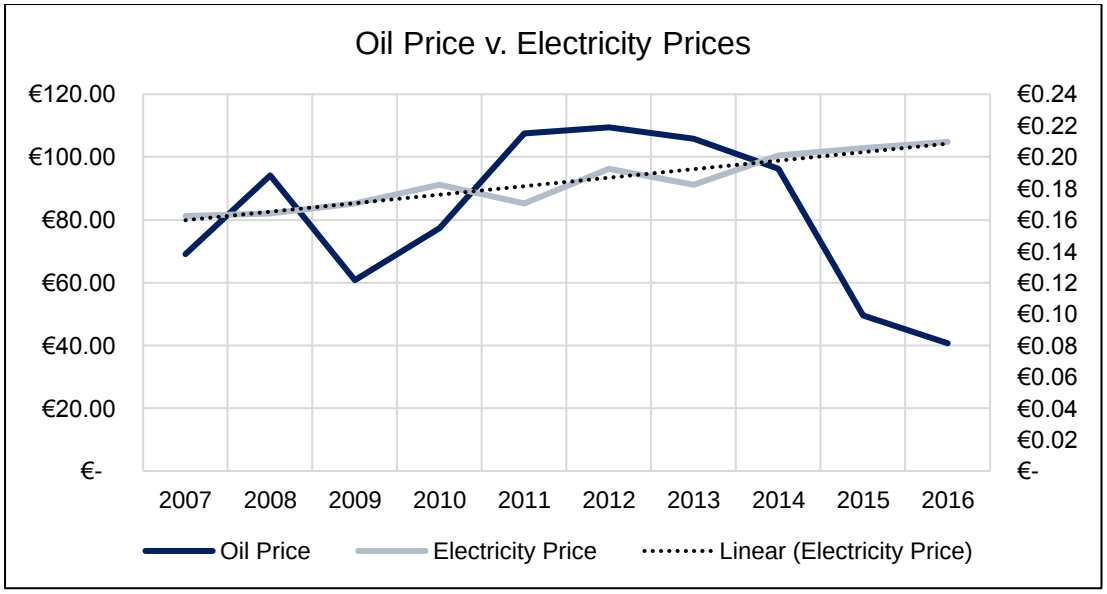


Fig.4 "Global oil prices, correlated with electricity prices in Greece"

During this decade, oil prices spiked at price levels that never had occurred before. Combined with electricity prices that augmented and the economic crisis that plagued these years, energy became not affordable for more and more EU population.

3.2 The Greek case

Especially in Greece, where the economic recession was the most severe from all EU countries (a recession that will be analyzed further in this thesis) , the fiscal measures led to a gradual financial weakening of the population and thus created arrears on energy bills, with the second being increased due to imposed taxes from the government. In this sub-chapter, general data will be presented regarding Greece's situation. It is useful to present the basic economic aggregates for Greece and some general information regarding the economic crisis in order to provide better understanding of the situation the country went through, in order to compare the country in relation to the EU and other countries and focus, finally, at energy poverty issues within Greece.

Greece, with a population of 10,816,286 residents[14] in the latest census of 2011 and 10,768,477 residents estimated in 2017 is a rather small country of 131,957 km^2 of total area and 82 residents/km^2. Due to the global economic crisis triggered in 2007 in the States combined with the country's structural weaknesses, monetary policy inflexibility and huge percentage of government debt in relation to the GDP, Greece suffered from a severe recession that lasted from 2009 until 2017.

[14] Population Data, available at: http://www.statistics.gr/

In order to maintain its position within the Eurozone, survive the recession and improve its growth potential after the crisis, the country entered three different economic reform programs. These three programs imposed major cuts in spending and taxes which resulted first of all in the 25% decrease of the GDP, huge cuts in wages and pensions as well as taxation in the energy sector (Heating oil tax, electricity tax, and property tax through the electricity bills).
Apart from GDP, there was a significant economic impact for Greece, which can be demonstrated through other aggregates as well. Some of them are, the Gini Coefficient [15](inequality measurement) which after a drop between 2006-2009 it had a huge increase during the recession years and at the same time, the government debt, being one of the most interesting aggregates to be demonstrated. Greece's debt was, and remains till today, very high as it can be shown from the following chart:

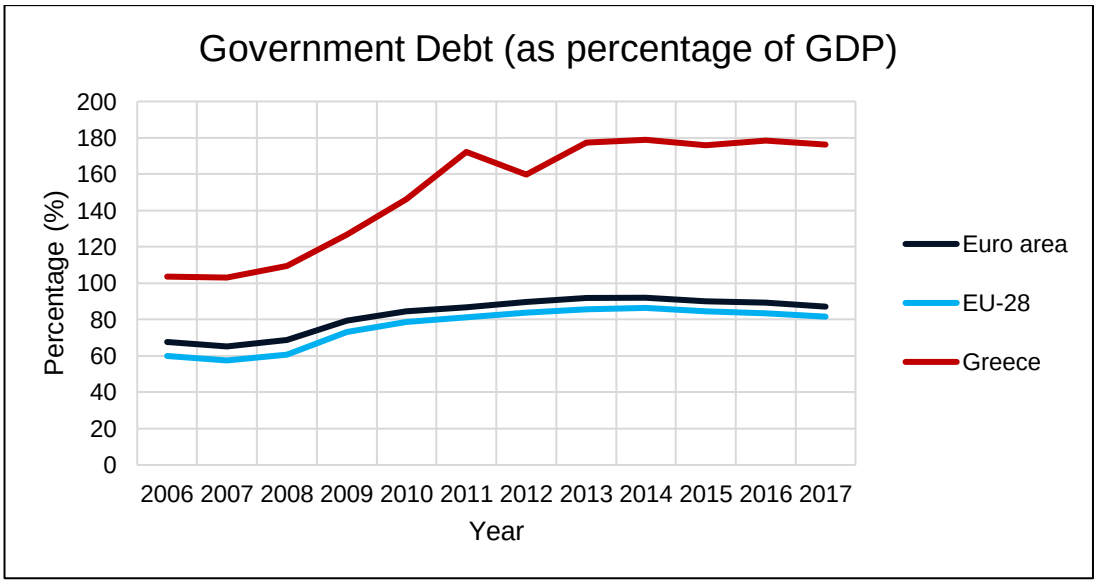


Fig.5 "Government debt of EU-28 and Greece, as a percentage of their GDP"

It is prudent, that the government debt being very much higher than the average EU-28 and held by foreign governments and banks, led the Greek economy to be downgraded by rating agencies and interest rates rose. Thus, Greece was obliged to seek funding from the International Monetary Fund and the Eurozone member-states since it could not obtain funding from the markets.
During the crisis years, the Gini Coefficient [16](being the inequality aggregate) had a major increase, which absolutely correlates to the undertaken measures by the Greek governments in order to obtain the financing by the IMF. More specifically, the Gini Coefficient ranged as shown at the following chart:

[15] GINI index, World Bank, available at: https://data.worldbank.org/indicator/SI.POV.GINI?locations=GR

[16] GINI index, World Bank, available at: https://data.worldbank.org/indicator/SI.POV.GINI?locations=GR

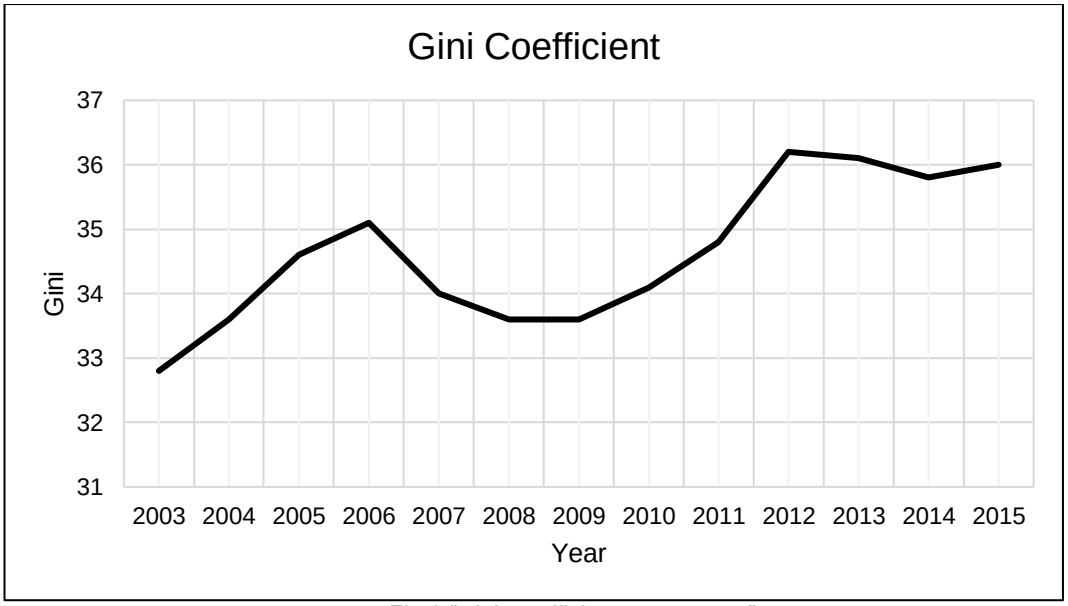


Fig.6 "Gini Coefficient, 2003-2015"

Data indicate, that especially in the years of the economic crisis, the inequality in Greece had a huge increase. This is a consequence of the fiscal measures undertaken by Greek governments. Due to Greece's paradoxes (meaning an economy with too many pensionaries, tax evasion in many professions, shady economy and others), the measures that were taken inevitably influenced middle class and inferior ones. Thus, inequality phenomena became more pronounced and often. Inequality phenomena are explicitly linked to energy poverty, as it will be explained later on.

Concerning energy utilities and its relations to the economic recession, the power cuts from the largest power supplier in Greece –Public Power Corporation- increased while at the same time petroleum products consumption dropped 38% (compared to 2009 levels) as it can be shown from the chart below:

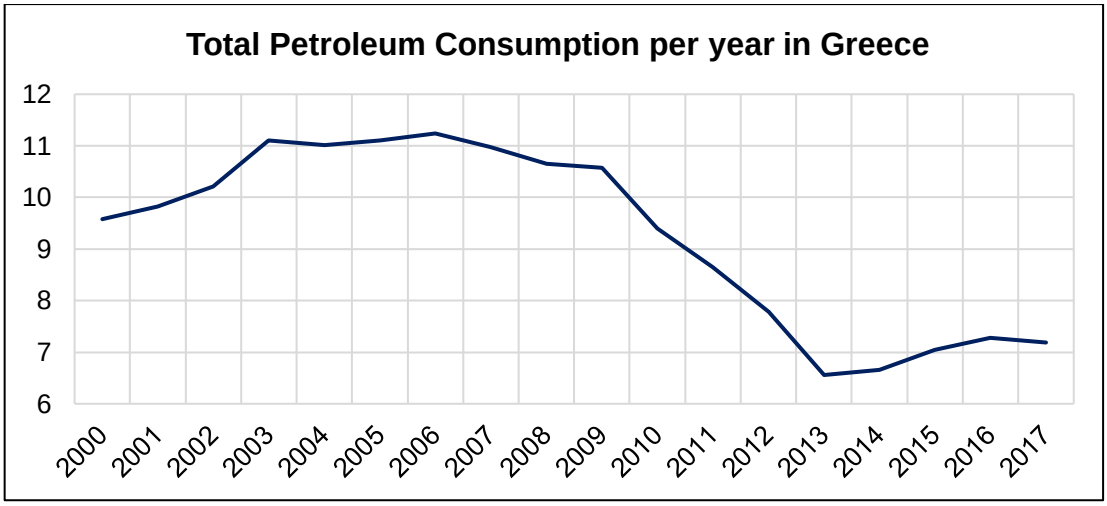


Fig.7 "Petroleum Consumption in Greece, 2000-2017"

As it was aforementioned, GDP per capita fell by 25% (in the chart shown below, in correlation with the petroleum consumption per annum). The drop of the GDP per capita is definitely correlated with a huge drop in petroleum products consumption, due to imposed taxes and minimization of the purchasing parity.

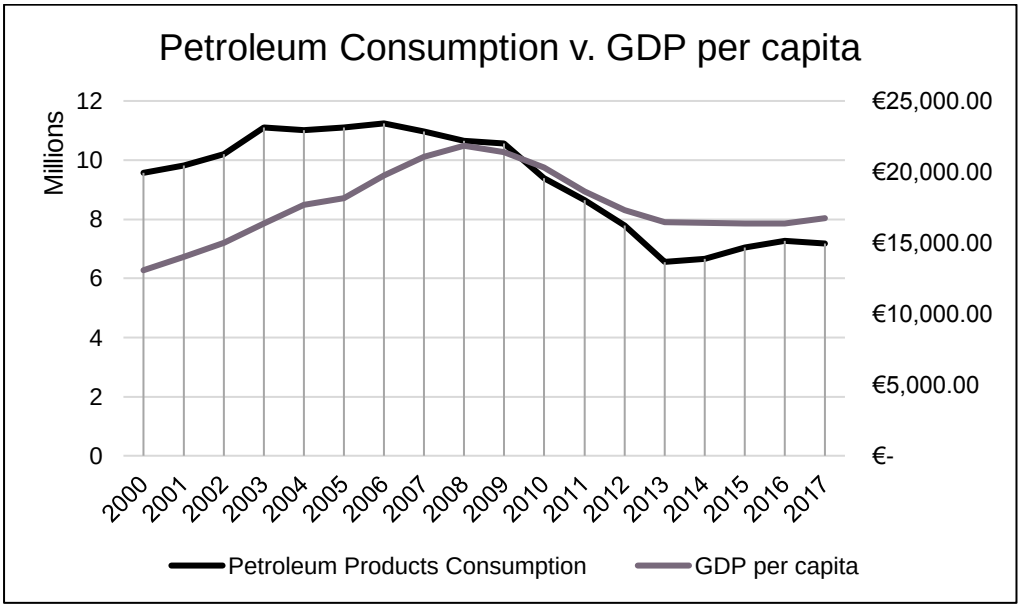


Fig.8 "Petroleum Products Consumption v. GDP per capita in Greece"

3.3 Assessing Energy Poverty in Greece

Regarding energy poverty and its impact, literature and research activity are limited. Before the economic crisis EP was not one the most pressing issues in Greece. Besides, as it is indicated in the chart above, petroleum consumption before the recession years was extremely high. In the first years of the economic crisis, with the parallel historic increase in oil prices, the consumption dropped up to 40% in relation to the previous decade. Since this rapid increase, energy poverty has been studied with a variation of methodologies. Mainly by correlating financial data as well as energy and social ones[17], collected by numerous households in Attica and northern Greece. Due to the fact that energy poverty is a complicated issue, as it was aforementioned, the approach is mainly the one based on the expenses made for energy bills as a percentage of the total income (10% of the total).This approach, being the most usual one, even though it models the energy expenditure it can be insufficient for countries like Greece. The percentage of people reducing energy expenditure as to cover other needs

[17] Santamouris et. al. 2007 "On the relation between the energy and social characteristics of the residential sector" available at: https://www.sciencedirect.com/science/article/pii/S0378778806002519

is not included in research of this type and thus, a large proportion of the country's population is not included. In an effort to include and properly record those affected by energy poverty, indicators such as arrears on energy bills, comfort within the houses, heating conditions and insulation are used. Inevitably, while assessing energy poverty as described above, subjective arguments and recordings may occur. Although objective indicators are the most important, these arguments are proved to be useful in order to assess and capture aspects that expenditure-based approach can not include.

First of all, two of the most important aspects regarding energy poverty in Greece, are petroleum consumption as well as electricity pricing. Regarding oil, in Greece due to the large consumption it used to have as well as the geopolitical location it possesses, the country does have a great refining capacity, with four refineries operating in the country. Petroleum prices have been fluctuating during the years of the recession. In 2009, crude oil prices started increasing and reached their peak in 2014 with an increase of more than 120%. Combined with the increase of the "Special Consumption Tax" introduced with the memorandums, heating oil rose up to 1.4 € per liter as well as, gasoline ranged from 1,70-2,2 € per liter depending on the area. After the oil peak in 2014, the price started to steadily decline reaching an outstanding low of 34 $ per barrel (Brent Price), making gasoline and heating oil prices more affordable for the Greek population. An increase was noted within 2017-2018 but after some months of increased crude oil prices, the price has stabilized at the levels of 60 $ per barrel. Regarding electricity prices, as it was aforementioned and demonstrated, they have been steadily increasing since 2007. In order to provide better understanding of the price increases, correlated with the annual income the following diagram is demonstrated.

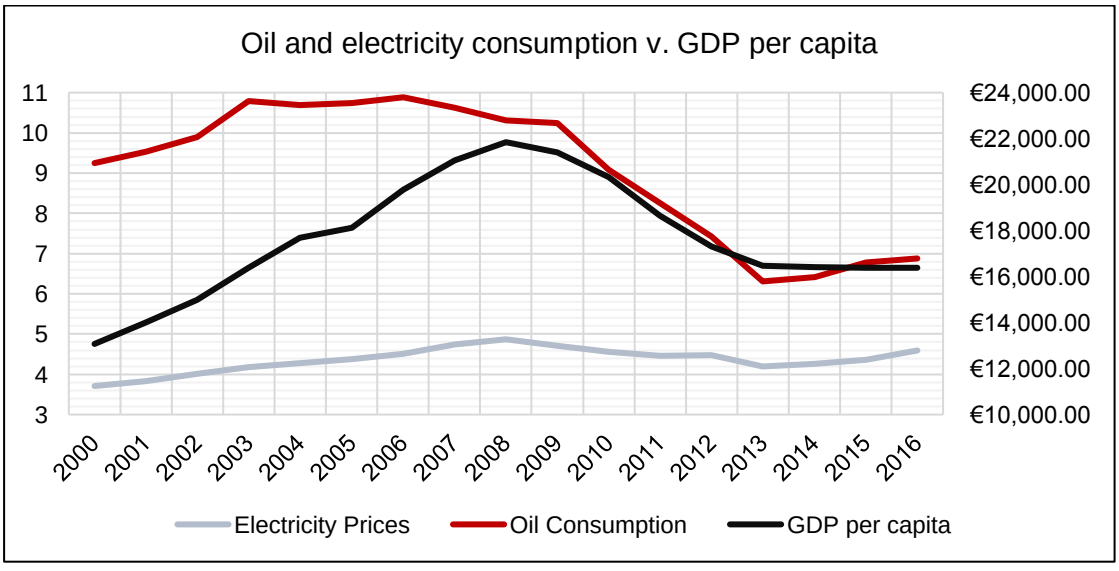


Fig.9 "Oil & Electricity Consumption v. GDP per capita"

Electricity, but more intensely, petroleum consumption are correlated with the GDP per capita. After 2009, there is a huge drop in oil products consumption in Greece- from 10 Million tons to 6 million tons while at the same time, GDP per capita dropped from almost 22.000€ to 16.000€. It is prudent that the correlation between petroleum and electricity consumption is existent and that, when economic recession struck Greece, a part of the population was not able to continue using petroleum for heating purposes or transport. On the other hand, regarding electricity, data demonstrates that arrears on electricity bills became more and more often. In the effort to systematically assess the energy poverty phenomenon, literature includes several approaches, some of which will be presented in the following subchapter.

3.3.1 Different approaches while assessing energy poverty in Greece

In the **first approach** that was studied[18], a telephone survey was conducted for a period of three months and with a sample of 400 households in Greece. The data that was requested from the interviewees, concerned various aspects like the typical monthly energy bills (electricity and heating), quantities of energy consumption (in liters or tons), housing conditions, infrastructure, insulation, heating systems as long as geographical data. At the same time, income data (before taxes) was collected. As it is described, "*energy poverty was assessed as the ratio of actual energy expenditure to before-tax household income*"[18] and if the ratio exceeded 0.1 then the household was considered to be energy poor.

The aforementioned study, while focusing in categorizing energy poverty based on the ratio described, it also took note of the geographical coverage and type of heating systems of the houses that took place in the survey. At the same time it also examined the so-called subjective and objective indicators of energy poverty, as they will be analyzed further on. The sample that was interviewed was "*proportionally distributed among the 13 regions of Greece, with 32% living in the Attica region, 17% living in the Region of Central Macedonia and smaller rates in the other regions of the country"*[18] . At the same time, the heavy oil dependency (that was demonstrated in the previous chapter) is prudent while examining the results of this publication: 42% of the sample interviewed was using oil as a primary heating system and at 12% as a secondary system for the households that cannot afford to use mainly petroleum due to its high price. The only type of heating that approaches the percentage of an oil heating system are electrical devices, with a share of 24%. As Papada et al. clearly state "*no other alternative heating system, except electrical devices, is able to threaten the use of oil as a primary source for heating. It should be noted though that the cumulative percentage of all other heating systems except oil exceeds the oil percentage, a fact that is directly related to the tax imposed on heating oil during*

[18] Papada et. al. 2016 "Measuring energy poverty in Greece", available at: https://www.energypoverty.eu/publication/measuring-energy-poverty-greece

the economic crisis and to the turn of population to various alternative heating systems" [18]

The aforementioned factors, high dependency on oil – increased oil taxes and prices – increase in electricity use for heating purposes – economic recession, are indeed causes and causation of the energy poverty phenomenon.

In the same study, subjective indicators of energy poverty are also assessed. The ability to maintain a house "*adequately warm*" is one of the aforementioned subjective indicators. Based on a survey of EU-SILC (2014) –that is being mentioned- the value of the indicator was 10.2% for the whole EU-28, with huge differentiations between countries while at the same time, a great percentage of the participants (30%) answered "No" when asked if they feel comfortably inside their home. A same number of participants answered "Yes", thus demonstrating the inequality phenomena arising.

In Greece, these percentages are expected to be different. Given the fact that the oil heating systems do hold a percentage of 42% and that the oil consumption in Greece has a dramatic fall, it is prudent that constantly less and less Greeks cease to enjoy warm housing conditions. At the same time, the other means of heating (besides electricity – a rather expensive way of heating) are cheaper but ineffective in adequately warming a house. Given the data of Petroleum Consumption in GR, the consumption is 50% less than in its peak. This finding is expected to have affected the percentage of population that can actually warm adequately its home. Another indicator as it comes to energy poverty, arrears on the energy bills was also studied by Papada et al. 2016.

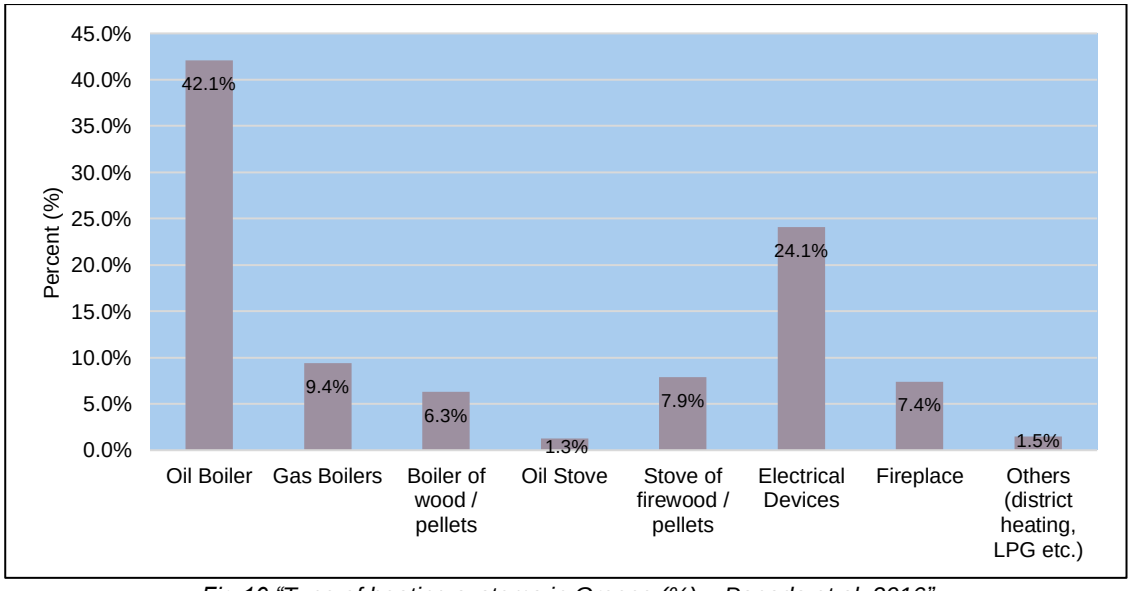
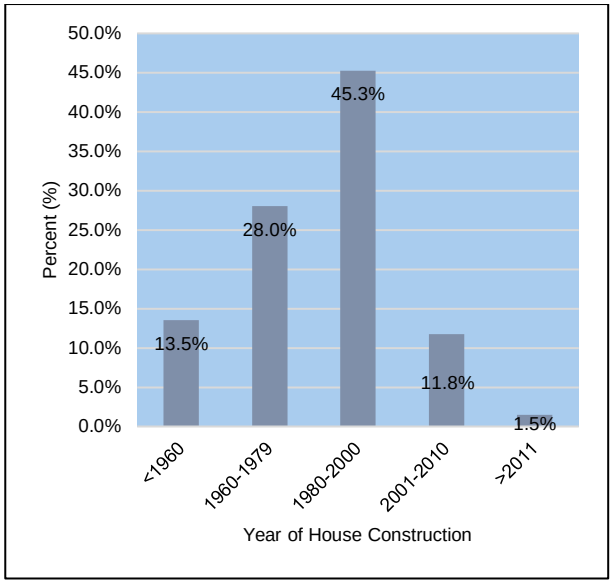


Fig.10 "Type of heating systems in Greece (%) – Papada et al. 2016"



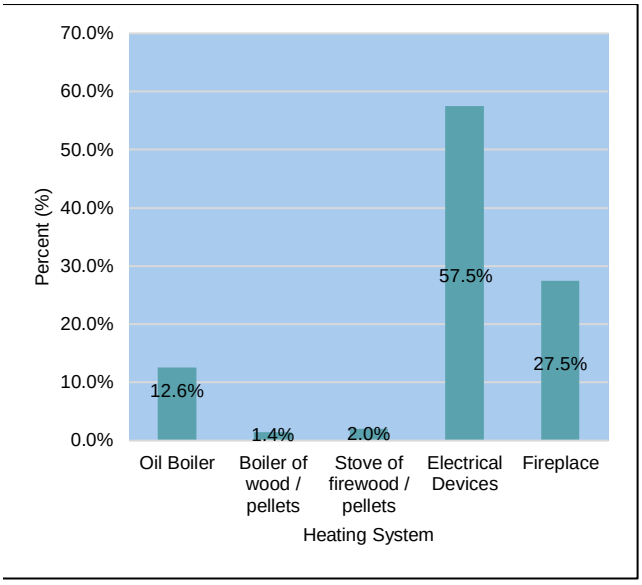


Fig. 11 & 12 "Year of house construction for Greece – Type of secondary heating systems – Papada et al. 2016"

Even though it is a subjective indicator, arrears on energy bills is a very important indicator as it comes to energy poverty. It is being widely used within the EU and according to the EU-SILC survey (mentioned above) the average percentage of1 citizens that do have arrears on their bills is 10.1%. It is worth mentioning that for Greece this percentage was found to be 37.3%, confirming the fact that almost 40% of the population is experiencing energy poverty in the form of cutting back on energy bills in order to cover other needs. *"Considering that electricity is a basic necessity, as well as that the payment of bills at the Public Power Corporation in Greece is a largely inflexible process leaving no room for postponement – a delay in repayment results in a power cut – it seems that the percentage of about 20% risking a power cut by leaving unpaid bills, is significantly high"* [18].Today, that PPC is experiencing vast liquidity problems, one of its strategic targets is to exercise pressure onto consumers and thus achieve the reduction of the huge debt claims the company does have –approximately- 3,5 billion€. [19] In that sense, if a household cannot respond to the payments required then it is possible that it is going to experience a power cut.

At the same time, two other indicators –*" Dwellings with leakages and damp walls" & "Health problems linked with poor heating conditions"* - are introduced by Papada et al. 2016. As it will be demonstrated in the following chart 37.5% of the respondents did report issues of this kind regarding their housing conditions while the 21.75% reported health issues that may have aroused due to bad housing conditions, bad insulation and defective heating. All the aforementioned indicators, are very important concerning the effort in order to capture the phenomenon of energy poverty. Nonetheless, the most important indicator

[19] PPC's debt claims and means to reduce them. Available at: http://www.kathimerini.gr/986088/article/oikonomia/epixeirhseis/safari-ths-deh-gia-tis-ane3oflhtes-ofeiles

(when it comes to subjective ones) is the "*restriction of other essential needs*" in order to cover energy utilities. All the other indicators «*cannot capture significant features, such as making painful expenditure cuts in order to achieve an adequate level of thermal comfort, which also constitutes energy poverty. Thus, a new indicator, including the restriction of other essential needs, namely, food, clothing, telecommunications etc., was introduced. The outcome was remarkable. Three out of four (75%) state that "they have been forced" to reduce other basic needs in order to cover their energy needs".*[18]

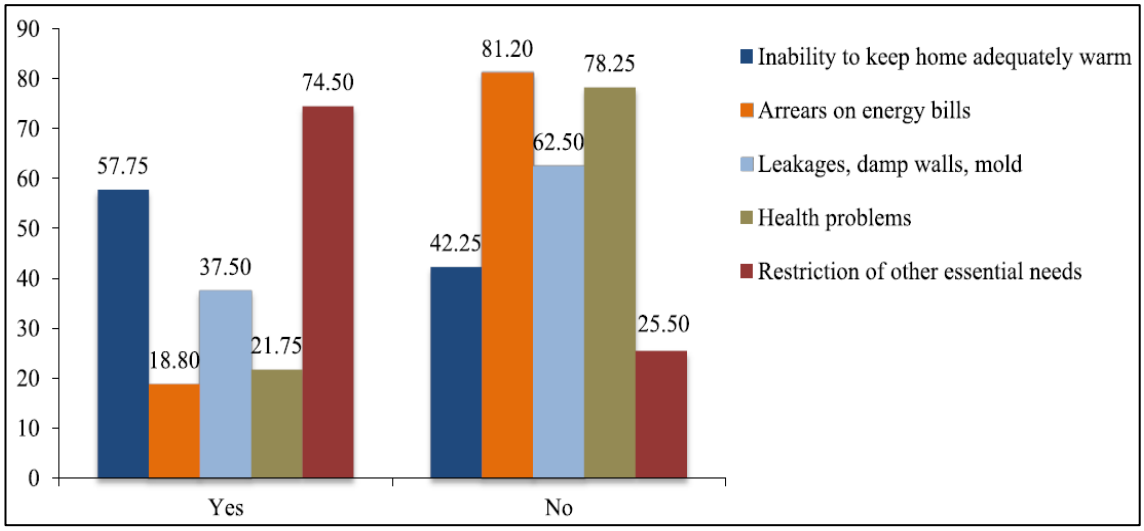


Fig. 13 "Subjective indicators of energy poverty – Papada et al. 2016"

In the effort to imprint energy poverty by an objective indicator and in a sense quantify the phenomenon, the percentage of expenditure for energy bills to gross income ratio is being examined. *"Regarding the energy expenditure of households, one out of two households (49.5%) spends 1000–2000€ annually for heating and electricity and nearly one out of four households (23%) spends 2000–3000€ annually for energy. As far as the total annual household income is concerned, 29% of the respondents have a significantly low annual income (below 11,000€) while 51% are placed into the category of 11,000€ up to 22,000€."* [18] Based on these facts, the average expenses made by the Greek population in order to cover their annual energy bills is the 14% of their total income or the 21% (of their income) if under- the-poverty-line population is examined. "*Using the 10% of income on energy as the threshold of energy poverty, it is found that 58% of households are energy poor. In other words, almost 6 out of 10 households are unable to meet sufficiently their energy needs, 6 years after the economic crisis first appeared in Greece."* [18] Energy poverty becomes significantly less when the income is higher but up to a specific extent due to the fact that it rises again when the energy expenditure becomes much higher. The two bar-charts shown down below, demonstrate how the energy expenditure to total income ratio emerged during the research made through telephone interviews. In the first one (left bar-chart), the frequency is demonstrated for the aggregate of the interviewees, while on the other hand

(bar-chart to the right), the low-income population is demonstrated. For the total sample, the percentage of expenses/income rarely exceeds 20%, with few cases being recorded. On the other hand, also demonstrated by the histogram, more and more interviewees from the poor income group appeared to exceed the 20% of their income and in some cases ranging from 40%-60% of their annual income.

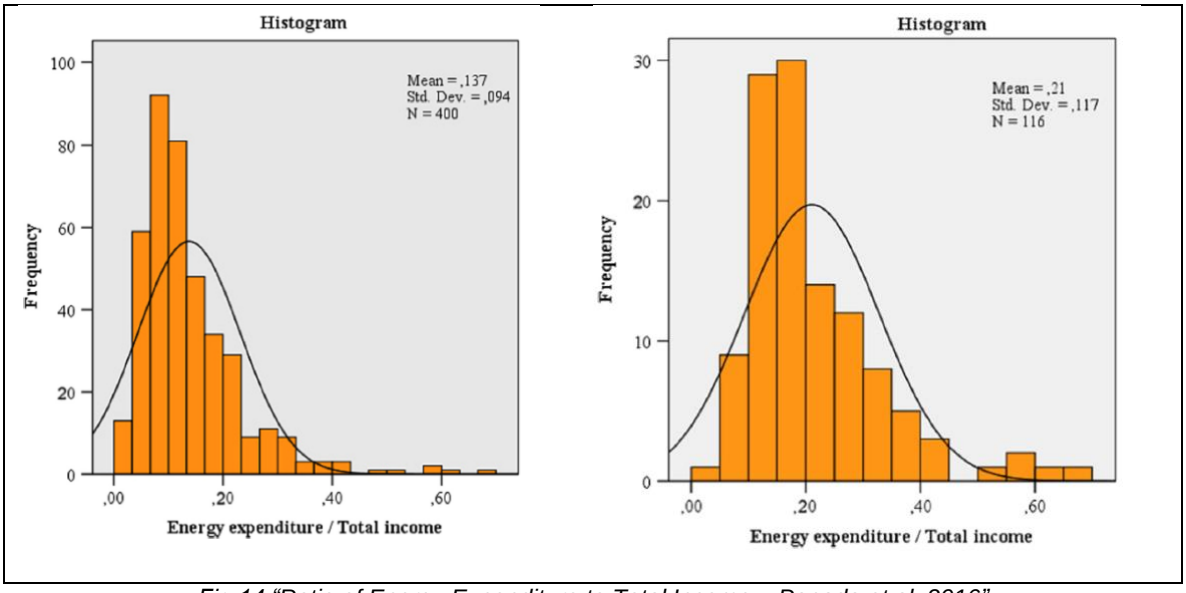


Fig.14 "Ratio of Energy Expenditure to Total Income – Papada et al. 2016"

As it was aforementioned, even though energy poverty is a phenomenon with bigger impact on income-poor households, it also has an impact when bigger expenses are needed.

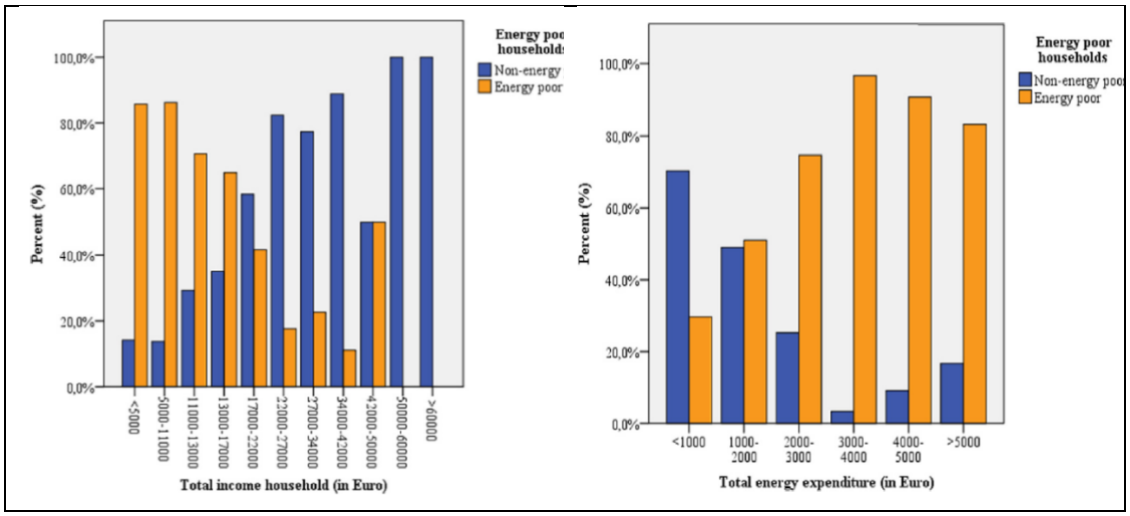


Fig.15 "Energy & non-energy poor households based on annual income – Papada et al. 2016"

Even though the energy poverty phenomenon is dominant on lower-income households, ranging from less than 1500 €/year to 17.000 €/year, the survey revealed that when annual income is more than double of the average

GDP/capita income in Greece, the percentage of energy poor households starts rising (due to the fact that energy expenses are increasingly high). For households having more than 50.000 €/year the energy poverty phenomenon is eliminated.

Ultimately, by conducting a survey based on objective and subjective indicators, an attempt was made in order to a systematically measure energy poverty in Greece. According to the official expenditure-based method, the population at risk of energy poverty in Greece reaches up to 58 percent (%). The more vulnerable households are the ones with low incomes, in detached houses, in colder climate zones and at higher altitudes. Regarding the subjective estimate of energy poverty, five subjective indicators have been examined, two of which are introduced for the first time, namely health problems linked to inadequate heating and the restriction of other essential needs. The latter actually captured an essential aspect of the problem of energy poverty. It has been shown that 3 out of 4 households have reported that they *"felt compelled"* to reduce other essential needs, such as more expensive food &raw materials, clothing, etc., in order to meet their energy requirements. The introduction of this additional indicator allows the results to be better interpreted. Regarding the connection between objective and subjective indicators, the objective indicator of energy poverty is significantly related to certain self-reported indicators (restriction of other essential needs and damp problems), while it is not related to other indicators (incapacity to keep the house warm, energy bills and health problems).

Albeit the effort to imprint energy poverty by using objective and subjective indicators, as it was done by Papada et al. 2015, that nonetheless does reveal many aspects of the phenomenon, it still remains as a static illustration of it. In order to assess energy poverty and most importantly the economic recession's consequences to it, **the second approach** [20] that was studied (Dagoumas et al.2014) does carry out a study and attempts to reveal the details of the economic crisis and their effect on the phenomenon of energy poverty. The results that will be discussed in the next pages are comprised by two parts. The first one, the monitoring of electricity consumption data as well as the effect of the economic recession's effect on energy poverty for the Greek population.

As it was aforementioned, this study was based on electricity data. Given the fact that electricity is synonymous with peoples' lives, any fluctuations in usage, debt or other factors, implies inability to cover basic energy needs and thus results to energy poverty. The increase in inability and purchasing power of the population is explicitly linked to the economic crisis. The aim is to provide evidence on energy poverty issues related to the overall consumption of electricity as a result of the economic crisis. To this end, the development of two

[20] Dagoumas et al. 2014 " Assessing the impact of the economic crisis on energy poverty in Greece", available at: https://www.energypoverty.eu/publication/assessing-impact-economic-crisis-energy-poverty-greece

other variables, the Gross Domestic Product and the population, is also used to link economic growth and consumption of electricity.

The following chart shows the evolution of per capita electricity consumption and per capita gross domestic product (GDP) in the period 1960-2012. Electricity consumption and economic growth are strongly correlated. However, the per capita sha pe of electricity consumption is more linear over the period examined until 2008, showing the relevant increase in people's well-being. The per capita GDP follows a similar trend, with the exception of the 1980s, where the rate of growth was more modest. The effect of the economic crisis is evident both in terms of GDP and electricity consumption. The effect of the economic crisis on electricity consumption appears to be lagging, as GDP has been declining since 2007, while electricity consumption has been declining since 2008.

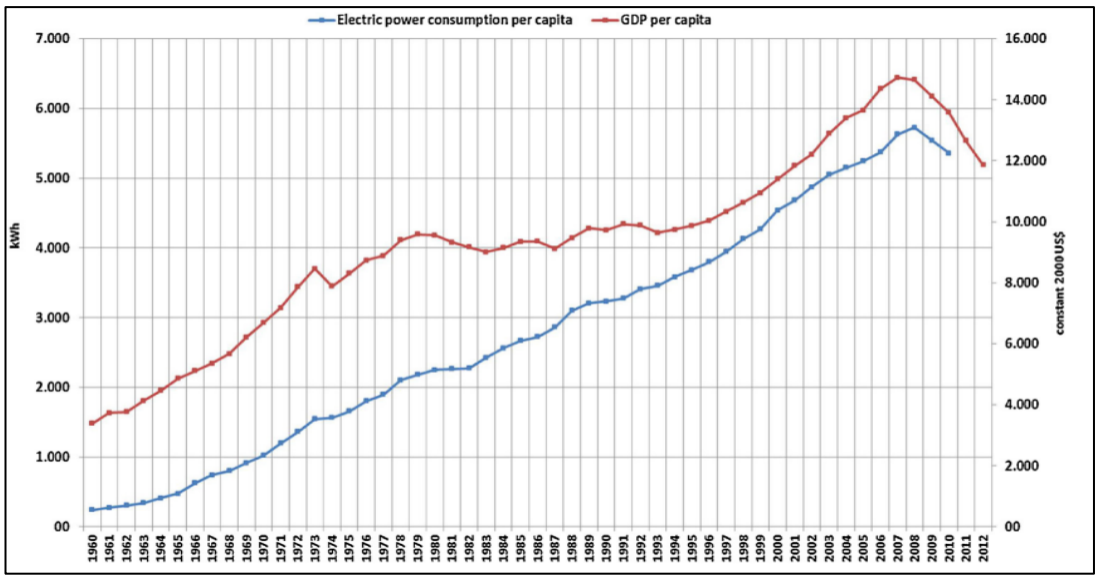


Fig.16 "Electric power consumption v. GDP (per capita) –Dagoumas et al.2014"

Even though the trend is recorded until 2012 –as presented at this paper, data regarding electricity consumption and GDP per capita up to 2016 are included in this aforementioned chart and demonstrate the declining trend for the electricity consumption (correlated with the GDP per capita) as it is also demonstrated in Fig.16 from year 2008 until 2012. An extra indicator, in order to assess electricity consumption, is by capturing the consumption in the interconnected system. Besides, *"The interconnected system is responsible for almost 90% of the electricity consumption of the whole country, which also includes the non-interconnected islands. Therefore the trend of the electricity consumption in the interconnected system can be considered indicative of the trend for Greece."*

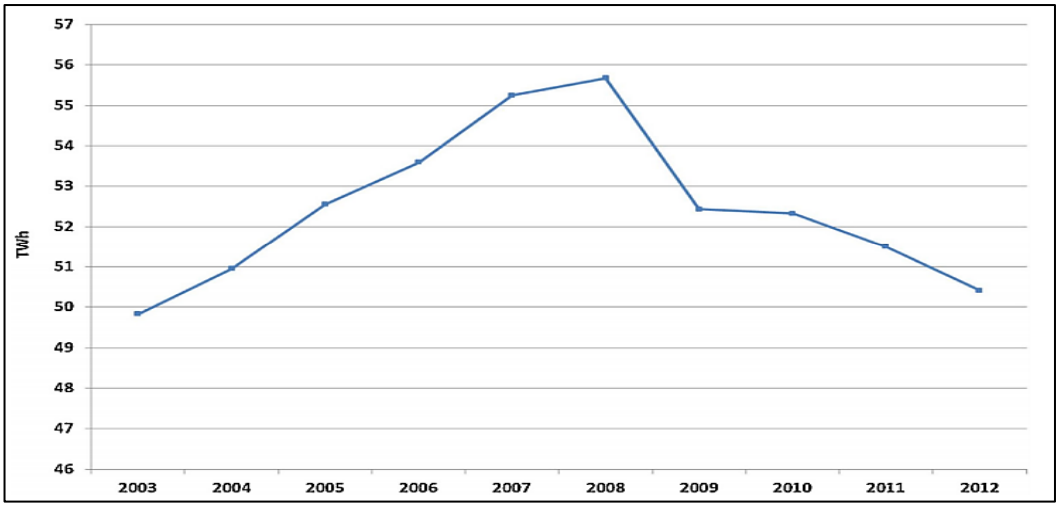


Fig.17 "Annual Electricity consumption (TWh) for the Interconnected System –Dagoumas et a.2014"

As it can be noted, the electricity consumption in 2012 dropped below the level of the one in 2004 indicating a severe drop in the population's and businesses usage of electricity. The drop in consumption, is not exclusively linked to the residential one. The largest drop, after Dagoumas et al 2014, was on the commercial and public services electricity consumption as well as on the industry's electricity consumption. At the same time, one of the main aspects – regarding electricity- that was considered, are the electricity bills in Greece. Arrears that emerged during the recession years and thus led to power cuts, resulting in augmenting the phenomenon of energy poverty. The "deprivation", even if it was for a short period of time, of modern electricity services could be considered as a heavy form of EP. In an effort to collect data regarding the power cuts, the sources used by Dagoumas et al.2014 were data from PPC[21], GENOP/DEI[22], ADMIE[23] as well as the Regulatory Authority of Energy. As it is demonstrated in the following chart, in a period of one year the power cuts doubled. If correlated with the severe fiscal measures, undertaken by the Greek Government, the inability to pay on time for many customers is prudent.

21 PPC: Public Power Corporation
22 GENOP DEI: General Federation of Employees in PPC
23 ADMIE: Independent Transmission System Operator (Greece)

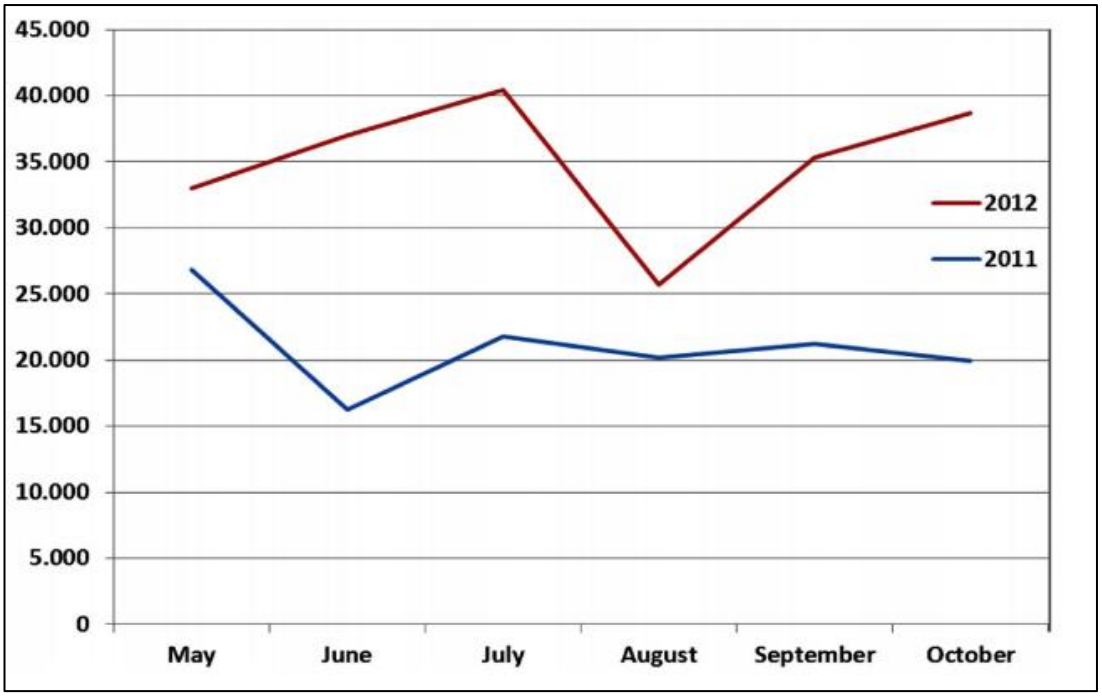
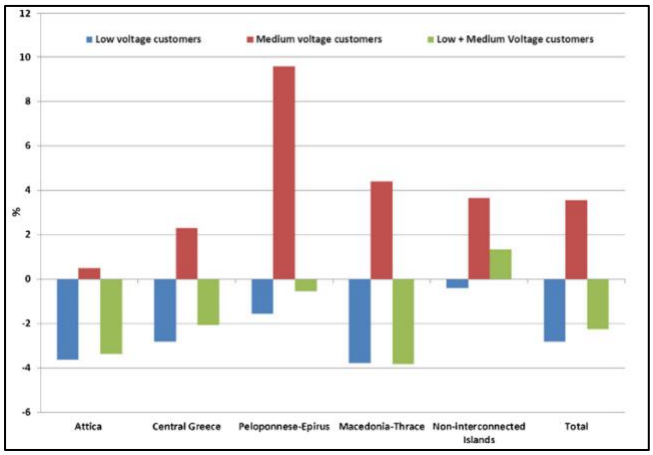


Fig.18 "Monthly power cuts of PPC Customers" – Dagoumas et al.2014

In 2012, power cuts were 300,000 compared to 100,000 in 2011, which shows the seriousness of the problem even more. Besides the huge increase in power cuts, one more founding related to energy poverty is linked to the electricity consumption. The total consumption for low & medium voltage customers as well as the decrease in the clientele over different regions in Greece can be demonstrated in these (2) following charts. It is prudent that despite the population that had to create arrears on their bills, in order to redistribute their income on other needs, a part of Greek population was forced to cut back on the consumption in order to spend less on electricity bills. This redistribution & the need to cut back on the consumption one used to have, indicates the presence of energy poverty in Greece, with different expressions throughout the population.



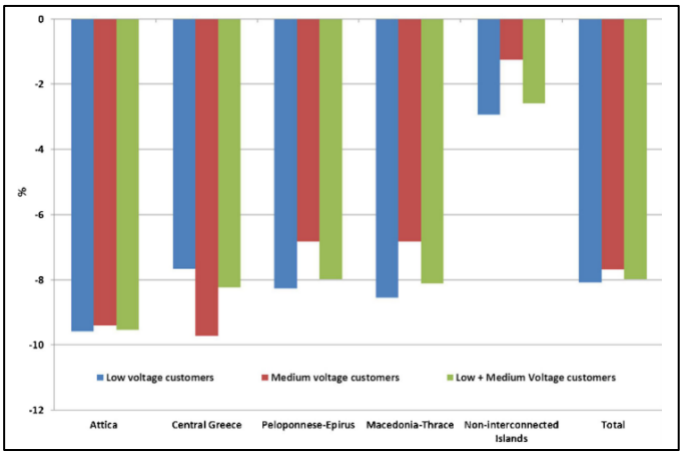


Fig.19 "Decrease (%) of low and medium voltage customers, over different regions"

Fig.20 "Decrease (%) of electricity supplied to low and medium voltage customers, over different regions"

All and all, the results have indicated that the effect of the economic crisis on electricity consumption –even though that sometimes it appears to be lagging, is present and severe. People need some time to respond to the new economic conditions and change their lifestyle and habits. The consumption of electricity in 2012 was lower than in 2004, when the Olympic Games were held in Athens. The impact of the economic crisis is evident for all the months, both for the peak as well as the low demand ones. A significant finding is that, although the winter of 2011-2012 was mild, the electricity consumption for November and December 2012 showed an increase compared to the previous months. This occurred due to the significant increase in the heating oil tax, which led to an increase in the use of electricity for heating purposes. This finding, is absolutely correlated with aforementioned charts which indicate dramatic fall in petroleum products consumption. Moreover, in larger cities, mainly in Athens and Piraeus, and secondly in Thessaloniki, the effect of the crisis on the reduction in electricity consumption and the number of customers, is more evident. The more remote areas are less affected, such as Peloponnese and Epirus. Lastly, customers' inability to pay their electricity bills created significant liquidity issues for the PPC by significantly increasing customers' debt to the PPC. This created a domino effect for the producers, the Natural Gas Corporation (DEPA), natural gas importers and transmission operators on the entire energy market, extending the energy poverty issue to an energy security one as well.

Based on the aforementioned data, energy poverty –as it has been indicated- could be interpreted as an equation with many variables. Some of them are, the energy expenditure and the extent up to which population reduces other expenses in order to cover it, the electricity and oil consumption within the country as well as the arrears on energy bills that were created during the years of the economic recession. Another important point regarding EP, that needs to be made, is the extent of the phenomenon, based on the geography of the country. Due to the country's geography: mountainous areas, plain fields, cities with great population and modern infrastructure as well as villages and smaller towns with little population and lack of infrastructure, energy poverty is existent up to a different extent in various Greek areas and with different characteristics in each and every one of them.

Despite their rich energy resources, **mountainous areas**[24] are particularly exposed to the energy poverty problem, mainly due to the above main characteristics*: cold weather conditions, higher energy requirements, and old buildings without isolation, high energy losses, low production base, low income and geographical isolation, high fuel prices***.** Mountainous areas have common

[24] Katsoulakos et al. 2014 "The problem of energy poverty in mountainous areas", available at: https://www.researchgate.net/publication/265476948_The_problem_of_energy_poverty_in_mountainous_areas

features that make them highly vulnerable to poverty from energy sources. Many mountain economies are not particularly robust, mountain settlements are generally far from major centers of energy production, and the need for thermal energy in mountain areas is significantly higher due to cold weather. In Greece in particular, both the global energy crisis and the economic crisis are threatening mountain communities. Incidents of illegal logging were recorded in mountainous areas of Greece between December 2010 and February 2011, as many people were unable to afford diesel oil costs and sought desperately ways to meet their thermal energy needs. With regard to the first factor of *cold climatic conditions*, temperature decreases significantly with regard to altitude (the average temperature decrease of 2-3 ° C occurs when the elevation increases by 300 m, in most cases) and thus thermal needs increase. For Greece, the demand for thermal energy is 270 percent higher at 1,000 m above sea level, resulting in an increase of over 80 percent in the corresponding energy consumption and energy costs. Furthermore, the problem worsens with the *income factor contribution*. Mountain population's income is usually lower than in urban areas. This is because productive activities are concentrated in densely populated areas and, consequently, employment opportunities. According to the United Nations Food and Agriculture Organization (FAO), around 35% of the world's mountain population is facing intense problems of poverty. The following table shows the percentage of income reduction in mountainous regional units compared to Greece's (Athens) capital for the fiscal year 2011. As it can be indicated, the percentage difference of income ranges from -21% to -41% in relation to incomes acquired in the Greek capital, Athens.

Regional Units	Average declared family income (€)	Percentage reduction compared to Athens
Achaea	16.929	-21%
Ioannina	16.756	-22%
Arcadia	16.502	-23%
Viotia	15.594	-27%
Evrytania	13.884	-35%
Grevena	13.639	-36%
Lakonia	12.659	-41%
Athens (center)	21.447	

Fig.21 "Distribution of income in Greece" Katsoulakos et.al 2014

Isolation is a significant geographical feature of mountainous areas with significant social impacts. With regard to the energy sector, isolation is a barrier to electrification and transfer of fuel. More specifically, a central electrification

network forms the major units of energy production and expands, first, to territories requiring the lowest per capita investment costs. Mountainous and isolated areas are therefore generally the last to be electrified and sometimes not electrified. The large distance between mountain areas and oil refineries, as well as the often poor road network conditions, lead to higher fuel prices in mountain settlements. According to the latest pricing recorded by Katsoulakos et. al in 2014, the following table shows the percentage of increase of unleaded gasoline and heating diesel oil in particular mountain settlements compared to their nearest urban centers. The prices today are lower than those of 2014, but the difference in percentage remains the same, if not increased. The percentage ranges above 10 %, up to 15-16 %, especially when compared with the prices in Athens. The above factors make mountainous areas vulnerable to poverty from energy sources. The impacts of the economic crisis in Greece have resulted in the expansion of problems of energy poverty. Energy poverty in mountainous areas, however, is a lasting phenomenon and not an issue that emerged in the recent years mainly as a result of the economic crisis. In the **island area** of Greece, as well, the aforementioned characteristics of mountainous areas remain almost the same. Isolation and bad insulation, are existent in the islands, with oil prices being high if not higher for mountainous areas.

	Major mountain settlements	Nearest urban center	Dist. (km)	Percentage increase of price
	Arachova	Patra	133	
Altitude (m)	1075	13		
Relative density (Inhabitants/km^2)[a]	27,85	639,03		
Unl. gasoline 95 (€/lt)	1,717	1,636		4,95%
Heat diesel (€/lt)	1,28	1,26		1,19%
	Karpenisi	Lamia	75	
Altitude (m)	980	143		
Relative density (Inhabitants/km^2)[a]	13,82	79,53		
Unl. gasoline 95 (€/lt)	1,739	1,652		5,27%
Heat diesel (€/lt)	1,31	1,27		3,15%
	Dimitsana	Korinthos	127	
Altitude (m)	950	14		
Relative density (Inhabitants/km^2)[a]	9,62	95,20		
Unl. gasoline 95 (€/lt)	1,700	1,652		2,91%
Heat diesel (€/lt)	1,30	1,26		3,17%
	Kalavrita	Patra		
Altitude (m)	750	13		
Relative density (Inhabitants/km^2)[a]	10,44	639,03		
Unl. gasoline 95 (€/lt)	1,767	1,636	88	8,01%
Heat diesel (€/lt)	1,31	1,26		3,97%
	Metsovo	Ioannina	52	
Altitude (m)	1240	483		
Relative density (Inhabitants/km^2)[a]	17,04	278,90		
Unl. gasoline 95 (€/lt)	1,839	1,667		10,32%
Heat diesel (€/lt)	1,34	1,27		5,51%

Fig.22 Gasoline & Heating Diesel difference between areas compared to the nearest urban center, Katsoulakos et al 2014

All and all, as it has been proven, energy poverty is severe in Greece, for many and different reasons. First of all, in the country's capital and cohesive city (Thessaloniki) energy poverty is existent due to the fact that the population being in a majority retirees, public servants and in a smaller percentage private

employees and freelancers, experienced the consequences of the economic crisis that led to the increase of population suffering from energy poverty. In the rest of Greece, due to the factors that were explained above, energy poverty is existent as well with different characteristics.

4. Existing Policies & Actions to Combat Energy Poverty

Addressing the phenomenon of energy poverty, is at the heart of interest at European level, and not only. Numerous studies record a difficult reality for a large number of Greek households and demonstrate the increasing trend of the phenomenon due to the policies adopted by the country and the serious challenges posed by the crisis in recent years. The Greek policy in order to tackle the problems associated with the lack of access to energy and, consequently, the fight against energy poverty, moves mainly on two axes:

1. **European legislation** and policy for the protection of vulnerable social groups, poverty reduction, energy and climate, etc.
2. **Policies** undertaken by EU Member States
3. **The Greek legislative framework** (weak in relation to the situation of energy poverty, which is mainly focused on benefits)
4. **Initiatives from Energy Companies in EU & in Greece**
5. **Initiatives & actions from NGOs and volunteers**

4.1 European Legislation

Concerning the European policy-making, it is structured through many, different actions and policies. Energy demand moderation is one of the five dimensions of the 2015 "*Energy Union Strategy"*. There are several positive effects of improving energy efficiency, including the alleviation of energy poverty. The EU building stock needs to be renovated in the long term, converted as much as possible to Nearly Zero Energy Buildings (NZEBs), and national renovation strategies should facilitate cost-effective transformation, considering that some households are suffering from a condition of energy poverty. With the "*Clean Energy for All Europeans"* package, through the Integrated National Energy and Climate Plans (NECPs), the European Commission has proposed a range of measures to address energy poverty through energy efficiency. As a consequence, several changes are taking place in the EU legislative context on energy poverty. The new *Directive on Energy Efficiency* (2018/2002), the *Directive on Energy Performance in Buildings* (2018/844) and the *Regulation on Governance* (2018/1999) mention energy poverty. The *Electricity Directive*

(2009/72) also refers to energy poverty, and its revised version was the outcome of the December 2018 political agreement. As specified in Directive 2018/2002, when addressing energy poverty at Member-State level, energy efficiency should be considered as complementary to social security policies. Particular attention should be given to the accessibility of energy efficiency measures for consumers affected by energy poverty, as well as the cost-effectiveness and affordability of both property owners and tenants ' measures. Albeit the initiative and progress is important, the current rates of building renovation are insufficient to meet the goals of the Paris Agreement. The most difficult apartments to reach are the ones occupied by consumers already affected by energy poverty. These are the reasons why the new Directive states that Member States should take into account the need to alleviate energy poverty in accordance with their criteria when designing measures to meet energy saving targets. In order for this to be achieved *"a share of energy efficiency measures under their national energy efficiency obligation schemes, alternative policy measures, or programmes or measures financed under an Energy Efficiency National Fund, to be implemented as a priority among vulnerable households, including those affected by energy poverty and, where appropriate, in social housing"*

The *EU Energy Union and Climate Action Governance* Regulation 2018/1999 provides that in order for Member States be able to participate in their National Energy and Climate Plans that they *"assess the number of households in energy poverty taking into account the necessary domestic energy services needed to guarantee basic standards of living in the relevant national context, existing social policy and other relevant policies, as well as indicative Commission guidance on relevant indicators for energy poverty".* In addition, mainly due to the Directive 2018/844, each Member-State could define its own criteria to assess energy poverty and thus determine which actions are relevant to its mitigation. Besides the vast importance of European legislation, also worth mentioning is the growing focus on the regional and local dimension of energy poverty. Specifically, both the Committee of Regions and the Covenant of Mayors emphasize on how important this attention is, in trying to develop targeted solutions. Very often, regions belonging to different countries have more similarities than regions in the same country.

All and all, as it will be analyzed further on; regional and at state-level solutions (and policy-making) are the most important aspect in the effort against energy poverty. Besides the philosophy and guidelines of European Regulations & Directives are embodied both locally and at country level.

4.2 Policies undertaken by EU-Member States

As it was aforementioned, the most important factor regarding the combat against energy poverty is the country/state-level policy making and initiatives. In

this subchapter, the policy-making of Member States will be analyzed (exempting Greece, where a full-scale report will follow in the next subchapter). The most interesting finding when imprinting policies, initiatives & measures regarding energy poverty, (for intra-EU countries) is that most of them (regardless of the percentage of the population that suffers from EP) do take measures and develop policies in order to combat the phenomenon. A series of measures will be presented in the next pages, in order to imprint the policy-making of European countries along with the mindset that these policies reveal.

Due to the fact that there are many policies developed or under development intra EU, the presentation of the basic and most important ones will be done in groups with geographical coverage. After this assessment is made, the presentation of the Greek policy-making will be done.

There are many measures and tools available in the United Kingdom to tackle energy poverty at a local level, and evidence suggests that this is more effective (implementing prevention measures) in order to counteract he phenomenon. These policies emerged after the "*Warm Homes and Energy Conservation Act*" was voted by the British and Wales Parliaments in 2000 in order to tackle energy poverty. This law adopted an energy poverty definition and thus required the government to publish a strategy that will set policies to ensure that there are no people living in energy poverty as much as possible. However, at the same time, a stakeholder side disputed these practices, as it claimed, the actions carried out locally fragmented the available funds and, as a result, funding would not be possible through a national strategic plan.

There are several measures available in France and Belgium using different measurement indicators-e.g. social and economic indicators, and already facing different sectors, committed to establishing a National Strategic Plan to tackle energy poverty. In Italy, the phenomenon is mainly addressed by a combination of tools and measures to increase the energy efficiency of buildings. While there are opportunities in Spain to reduce the phenomenon, there is a shortage of tools and measures to capture the phenomenon and, as a consequence, few tools to address it. In Italy, the phenomenon is mainly addressed by a combination of tools and measures to increase the energy efficiency of buildings. While there are opportunities in Spain to reduce the phenomenon, there is a shortage of tools and measures to capture the phenomenon and, as a consequence, few tools to address it.

There are many common points in the actions listed below. They have been built on and are based on collegiality, defining citizen-oriented goals, creating programs that focus on public health protection, creating jobs, and increasing economic indicators at community, municipal, regional, and country level. With the cooperation of municipalities and local actors to address the phenomenon, the **United Kingdom** has several good practices and good results in planning policies and actions. According to the results presented by the Association of Local Government, local schemes were created with the participation of

municipalities and local social actors who, after seeking the causes, designed solutions that helped to reduce energy poverty rates. Between 2008 and 2011, the municipality of Nottingham nearly halved the level of energy poverty in the city, from 12% to 7%. The goal was to reach below 4% by 2014, achieved through a team's concerted efforts set up for this purpose and called the Housing Strategy Team of the City Council. This team is responsible for monitoring and coordinating all projects, in cooperation with government agencies, energy providers and others, to improve energy upgrades in both private and social homes. The above result was the use of the financial tools available. The Bristol Energy Efficiency Scheme has insulated 10,000 homes across the city, with special emphasis on vulnerable groups such as the elderly, financial-problem families, etc. All homeowners, as well as tenants, were eligible to take part in the masonry and terraces ' free isolation program. The project was financed by the City Council of Bristol as well as a fuel supplier.

As the best energy scheme at local council level, the Kirklees Town Council has been awarded the Ashken Award for the Kirklees Warm Zone project. Owners / occupants facing energy poverty can isolate their homes free of charge through this scheme. So far, this translates into 51,000 homes. The project's goal is to improve the occupants ' thermal comfort and there are already measurable economic results, as more than £ 80 million has been saved, while the environmental benefit is huge due to the reduction in carbon emissions.

The *Arbed* program aims to reduce household energy consumption by funding residents, particularly low-income people, to act. The main goal is to reduce energy poverty levels while simultaneously boosting economic growth. Started in 2009, the *Arbed* program consists of two phases. In 2012, the first phase was completed and the second phase was completed in 2015. The government invested £ 36.6 million in the first phase, and further 32 million pounds were boosted, 20 million of which were made available by local authorities, while the remaining 12 million energy service companies were made available. More than 7,500 households benefited throughout the program. The funded actions were mostly changing the windows, roof insulation, as well as providing with tips for energy saving. This action resulted in a remarkable change in the dwellings' energy class. Before the action, 88% of the residences participating in the program were in category F and 91% of those residences went up to three classes after the interventions, i.e. they were in category C. Housing improvements not only affected the prices of real estate, but also had a positive impact on the environment, as CO2 emissions were significantly reduced by 3,025 tons per year. As far as households are concerned, energy bills were reduced by approximately € 248/household / year, while total savings were approximately € 328,000/year. Simultaneously, the occupants' thermal comfort increased while at the same time jobs were created for 1,704 people. The investment was worth 46 million pounds during the second phase of the project and more than 4,800 homes benefited while carbon emissions dropped to 2,540 tons per year. Alike the *Arbed* initiative, in Greece "*Exoikonomo kat'oikon I & II"*

where carried out by the Greek Government, as it will be analyzed further in the next sub-chapter.

4.3 Greek Legislative Framework & Policies

In Greece, the pressure from the rising energy prices, as well as the proliferation of households that were already or were in danger of falling into income poverty - and thus into an energy poverty situation - led to policies being adopted by successive Greek governments, summarized in specific allowances and a social invoice firstly by the PPC and latter from all the alternative providers, as listed below. For the protection of vulnerable groups, a decision of the Ministry of Environment, Energy and Climate Change, in 2011, introduced by Electricity Public Power Corporation (PPC) for household consumers –the Social Residential Tariff[25]. The range was 30-42 percent, with annual consumption up to 5,000 kWh, with nearly 7 percent of all households eligible to participate. Specific income and asset criteria (e.g. income less than € 12,000) clearly identified this target group. This measure was amended in 2016, and today the eligibility to join depend on the annual income (9.000-27.000€) as well as the number of members each family whilst the discount is set at 0.045 €/kWh. At the same time, households that receive the Social Solidarity Allowance, are entitled to a discount of 0.075 €/kWh. As mentioned before, with the market being liberalized (regarding electricity), each electricity provider has the obligation to comply as well as, cannot deny any customer to include him in its clientele.

Furthermore, in March 2015, the Greek Parliament adopted a law that allowed households -unable to pay their energy bills- for up to a 300-kWh consumption of electricity [26](for 2015) resulting in free consumption of electricity for more than 92,000 households.

Another policy indirectly linked to the energy poverty phenomenon in our country through the impact on household income is the statutory rent subsidy of € 70 - 200 per month to which about 30 000 Greek households are entitled, provided that they meet specific income and social criteria. In this manner, a percentage of income can be directed towards energy bills and utilities.

While many reports and legal texts state that energy upgrading is the most sustainable solution to address energy poverty, Greece had not developed, until the years of the crisis, an economic mechanism that would really help low-income households implement actions to improve their housing energy

[25] EU-Energy Poverty Observatory: **Social Residential Tariff**, available at: https://www.energypoverty.eu/measure-policy/social-residential-tariff
[26] EU-Energy Poverty Observatory: **Measures against the humanitarian crisis,** available at: https://www.energypoverty.eu/measure-policy/m easures-against-humanitarian-crisis

efficiency and address energy poverty. The country spent large sums on heating allowances in response to high fuel prices, contributing to oil imports and worsening the fiscal performance of the country, without even tackling energy poverty drastically. Albeit the criticism, this measure led to the distribution of 106 million euros to vulnerable customers, in order to cover a percentage of their annual oil consumption. The beneficiaries were calculated at 380,000 for a period of six months.[27]

The most important intervention – policy completed, as it is mentioned before, is *Exoikonomo kat'oikon I & II – or else, Energy Efficiency at Household Buildings Programme* that started in 2011 for the first time and was implemented for the second time in 2016. A Joint Ministerial Decision (JMC) in June 2016 ordered the renewal of program and the amendment to 'Home savings' program in order to include more beneficiaries. The funds came from the national budget, greenhouse gas emission allowances earnings and the interest on the Fund's capital. These are expected to cover the inclusion of another 8,000 beneficiaries who could not join the program in the previous period because of the exhaustion of the funds in 2014. Despite the bureaucratic procedures that exist with the program, more than "*406 million had been provided to approximately 40,000 beneficiaries"* [28] by 2013 and today, more than 548 million are secured for the progressive implementation of the second program. The two versions of the program include the energy upgrade of residential buildings. Given the fact that the majority of the Greek buildings were built before 1979, when the Building Thermal Insulation Regulation was published, they have an energy class below E or F. Thus, the renovation and thermal upgrade of buildings was and still remains the most significant measure regarding energy poverty since it will allow the deterioration of energy expenses, especially when in concerns low-income households. The two programs differ concerning the percentage of the grant awarded to the beneficiaries of the program (with the second giving greater percentages of support along with adjusted criteria in order to apply). Common characteristics are the no-interest loans that can be granted to the participants in order to make different renovation works. These are, 1) the installation of thermal insulation in the housing shell including the roof. (And additional work such as demolition and removal, roof operations such as tile replacement, etc.). 2) The replacement of frames and installation of shading systems (including building exterior, staircase enclosures, shutters, shutters, awnings, etc.) and the 3) upgrade of the heating and hot water supply system (including boiler and distribution system replacement, solar water heater, control and heating autonomy etc.). Furthermore, 4) the "Energy Efficiency Program" could potentially cover the expenses required for the replacement of the heating system, even with conventional energy sources (non-renewable) in order to

[27] EU-Energy Poverty Observatory: **Heating oil allowance**, available at: https://www.energypoverty.eu/measure-policy/heating-oil-allowance
[28] Energy Efficiency at Household Buildings Programme, available at: https://www.energypoverty.eu/measure-policy/energy-efficiency-household-buildings-programme

differentiate from oil, since it is one of the most expensive fuels in Greece, due to the taxes. The replace of conventional oil boiling systems, but only with natural gas ones, is the context of the program "*Replacement of heating oil boilers with natural gas boilers in buildings"* [29] which is completed with the cooperation of natural gas distribution system companies throughout Greece. This program started in 2015 and has been repeated every year since with specific amount of funds every year. The above two projects of renovation, were also carried out in buildings of the Attica Prefecture. In order to combat energy poverty, in relation to absolute poverty levels, the Greek government has or will complete two programs that combine these two criteria. The first one, *Green Neighborhood in Agia Varvara,* was a pilot program that started in 2012 and was completed in 2015, and carried out deep renovations in selected social housing buildings. The second one, announced in 2018, targeted at the full replacement of traditional oil boilers with new, natural gas ones, with full cost coverage for the beneficiaries. Along with the Home Savings program, the 'Building the Future' program also took place, which aimed at restructuring the market for building materials in order to ensure that any improvement in the energy efficiency of buildings achieved in 2020 will necessarily be accompanied by a reduction in energy consumption in all categories of buildings. Its design included a gradual implementation and provision to cover energy projects of over 25 million € over the first three years. In essence, the program concerned public-sector cooperation, the construction industry and citizens. The public sector was responsible for implementing voluntary agreements with the private sector in order to ensure significant reductions for citizens - at least 20% - for products and services. In addition, it would structure the market in such a way that there would be transparency about the certifications and technical characteristics of each product.

Last but not least, one of the most important aspects of energy poverty policies and measures, is the legislative act of 2018 regarding Energy Communities[30]. A legislative initiative aimed at boosting businesses, local authorities and individuals' use of Renewable Sources so that they become electricity producers in addition to consumers, either selling to the grid or offsetting the current they spend. Decentralized power generation from RES, as well as energy tools such as net metering and virtual net metering make this prospect possible. Small and medium-sized enterprises will thus be able to reduce their energy costs and even people – citizens will be able to cut their electricity bills drastically. In the meantime, municipalities and regions will be able to establish a local energy policy, such as tackling energy poverty or boosting electrical mobility. Energy Communities can be speculative or non-profit-making in any case. In the latter case, profits are not allocated to members but are used to fund new projects

[29] Replacement of heating oil boilers with natural gas boilers in buildings, available at: https://www.energypoverty.eu/measure-policy/replacement-heating-oil-boilers-natural-gas-boilers-buildings

[30] EU-Energy Poverty Observatory, **Energy Communities**, available at: https://www.energypoverty.eu/measure-policy/law-energy-communities

after being approved by the community's general assembly. An Energy Community will be able, to produce, sell or self-source electrical and thermal energy produced from RES, such as wind and photovoltaic projects, or biogas and biomass. It will also be able to operate in electricity and gas supply, install district heating systems and desalination plants, as well as install and manage alternative fuel and vehicle infrastructure. Even though it has many applications in all renewable energy sources, E.C. do not concern (as it was aforementioned) only municipalities or small companies. The right to participate in such a scheme will include persons (citizens), public & private law legal entities, as well as local authorities. For the creation of an E.C. in the case of private legal persons, natural persons and legal persons governed by public law (excluding local authorities), at least five members will be required. Instead, if they are only established by local authorities (and two in island regions), three members will be required, and if two municipalities want to join together, at least one other natural person or legal entity is required by public or private law. An important element, however, is the location of the majority of members, as at least 51 percent of members must be related to the location where the investment is located, so that local communities do enjoy the benefits. In fact, in order to avoid tendencies to concentrate, in addition to the compulsory cooperative share, a maximum of 20% is set for the cooperative capital that each member can obtain -with the sole exception of local authorities, for which the maximum is set at 40%. Since these joint ventures will move around the production of renewable energy, several incentives are specifically related to the installation and operation of RES and CHP units. Consequently, an important incentive is for the Energy Communities to be able to use virtual net metering, which is currently only permitted for professional farmers and legal entities governed by public or private law for the purposes of public interest. For example, the house-owners of a block of flats, or some residents along with the municipality they live in, have the right to form such an Energy Community. They could install a wind turbine or a PV solar park in order to reduce their cost of energy spending. Such a community catalyzes the reduction of both risk and investment costs. In that sense, one of the most important policies formed in order to reduce & combat energy poverty as a phenomenon is the formation of E.Cs. In order to enhance and facilitate the formation of such E.Cs, they are eligible for funding up to 40% of the total, from the NSFR (or else *"ESPA"* as it is called in Greek).

All and all, as it can be noted, a shift regarding energy poverty policies is existent. More specifically, the direction of the policies pursued is not in the occasional relief from energy poverty but in the gradual disengagement of an increasing proportion of the population from this phenomenon. Nonetheless, there are still many problems that have to be resolved in order for the State to progress significantly when it comes to the relief from the phenomenon.

4.4 Initiatives from Energy Companies in EU & Greece

The whole aforementioned policy-making is designed and implemented directly by the State. On the other hand many companies, as part of their Corporate Social Responsibility (CSR) strategy, create and implement actions that not only temporarily relieve a potential situation of energy poverty but most importantly, set the foundation in order for a situation to be resolved and create a sustainable future for citizens, institutions, hospitals and other bodies that often do not enjoy full state aid due to the lack of the latter's resources. These strategies being implemented, are many times aligned with the UN'S Sustainable Development Goals.

Intra EU, there are many cases that companies, potentially with the State's contribution, take action in order to tackle energy poverty. One of the most profound measures that are taken from energy and industrial companies throughout EU and Greece, is through fostering local communities. In numerous occasions industrial complexes are located outside city centers, and thus employ and finance population from nearby villages and small towns. Especially, nearby Athens, cities like Aspropyrgos, Elefsina, Megara, Corinth and Mandra, are placed many industrial complexes. Three out of the four Greek refineries are located in the aforementioned areas. Moreover, cement industries, water refineries and other industrial complexes are also located in the area. All these companies, finance the population that resides near them, directly (by employing them) or indirectly through Corporate Social Responsibility strategies.

Outside Greece, British energy and gas companies are obliged to actively participate in the CO_2 reduction targets of the country, helping households to implement energy-saving measures. Two programs, the Community Energy Saving Program (CESP) and the Carbon Emission Reduction Target (CERT), achieved the goals in 2008-2012. The CESP program mainly concerned vulnerable social groups, but also the second program set these groups as a priority. The CERT program began in 2008 and finished in 2012. The figures are impressive, as the program aimed at reducing carbon emissions by 40 %. The decrease achieved was 41.3 %. At the same time, 27,000 new jobs have been created in the area of buildings energy upgrading. UK energy companies in particular should fund or support households in order to achieve energy consumption reduction. Another described practice is to cooperate with local authorities to recognize socially excluded groups. Funds are then sought from other sources and volunteers are mobilized to help complete the projects. In 2013, the Energy Company Obligation (ECO) was created to replace the two above-mentioned programs with a primary duty to help households achieve a reduction in energy consumption. The ECO is developed in three axes, two of which concern economically vulnerable groups and energy poverty-affected households. Furthermore, in France, in coherence with the Energy Solidarity Pact, energy suppliers have the obligation by law to help with a certain level of

energy savings, offering the renovation or installation of insulation in low-income population, with the cost of only 1€. In Germany and Belgium, through "*Green-Loan"* or else "*Prêt Vert Bruxellois"* and *"IBB Wohnraum modernisieren*" banks provide zero-interest loans in order for low-income population to renovate their house and upgrade it, thus reducing its energy needs.

In Greece, during to the economic crisis, many of the initiatives undertaken by Greek companies were mainly focused in relieving some of the economic burden for a percentage of the population. Regarding Energy needs, the efforts were mainly focused in providing heating oil for very-low income families, schools and other institutions. At the same time, during the peak of oil prices, diesel fuel was provided for cars of public institutions, ambulances, etc.

4.5 Initiatives & actions from NGOs and volunteers

In EU & Greece, some initiatives have been undertaken by volunteers and NGOs. For example, "CAMEL", a non-profit organization, provides consulting services, know-how and support for household energy upgrades, and has a holistic approach to energy poverty. The main purpose of the organization is to mobilize companies (social or otherwise), employees of the public sector, energy service companies, etc. to solve economic, social and technical problems in order to help the people affected by energy poverty. The most important aspect of "CAMEL" is the development of new financial instruments such as social loans or third-party funding, as well as the strengthening of the skills of civil servants in these social enterprises to address the energy poverty phenomenon. The organization's creators want to be a key link to energy efficiency development in order to protect vulnerable social groups. Furthermore, "Eco-Habitat" has as its main objective to provide information and free access to financial tools and schemes for households in order to tackle energy poverty. Eco-Habitat helps and supports the choice of the right financial and technical tools for these households. To make this possible, the club is accompanied by a group of workers and volunteers who invest their personal time in the best possible way to help these households renovate their homes while protecting the environment by using biological materials. In Greece, the goal of "Solarize Greece", of "Greenpeace Hellas" initiative, is to promote solar energy as the Greek economy's driving force against dependence on fossil fuels. The campaign includes the installation of photovoltaic systems, among other things, and has started pilot projects in the field of rosters, especially in families facing energy poverty. Citizens and businesses sponsor this action through a crowdfunding platform. "Greenpeace Greece" recently completed other similar campaigns, including installing solar panels and heat pumps on a female accommodation that was unable to meet winter heating needs, and upgrading a school in a mountain village in Greece two years ago. Furthermore, the same organization published a detailed report called *"Solar Social Policy in Greece"* in continuity

with the aforementioned Solarize Greece initiative, proposes the gradual depletion of the Social Residential Tariff through investments made in Solar PV's in low-income houses. This way, as it is reported, almost the ½ of the population already integrated in the Tariff, could use the same amount of subsidy given in order to install an amount of Kw of power in their houses. This way, or by forming energy communities (based on the aforementioned "Energy Communities legislation") they could gradually detox from energy poverty. Given the fact, that the price of solar panel installation has dropped in the recent years, such a policy could in fact be formed and reduce drastically the 680.000 vulnerable customers of the Social Residential Tariff using the same amount of money every fiscal year.

5. Potential Actions in order to reduce the phenomenon of Energy Poverty

The Energy Poverty combat proposals outlined below are based on the multifactorial nature of the energy poverty issue. As discussed in the previous chapters, energy poverty is inextricably linked to the economic strength and income level of some vulnerable social groups, high energy consumption due to low household energy efficiency, and energy and fuel costs but is largely determined by national energy policy (energy mix, imports, island interconnection, etc.). The particularly adverse economic conditions prevailing in Greece today, as well as the undertakings stemming from its status as a member state of the European Union, have played a catalytic role in shaping the following proposals. Consequently, there are no advantage-like proposals aimed solely at boosting the income of citizens, on the one hand, for reasons of financial sustainability, and on the other, because it has been established that they put the citizen in a passive position without addressing the essence of the problem. Instead, sustainable solutions emerge that indirectly increase household income while contributing to national environmental and climate change targets as well as other challenges such as high unemployment rates. The combination of the above-mentioned policies and actions may be one excellent tool for restarting the Greek economy in construction-related areas as well as other sectors and economic sectors, opening up new business horizons and prospects for young people. Moreover, while the proposals focus on alleviating households that are affected by or at risk of energy poverty, they could be adapted to be more widespread, benefiting a larger part of society.

The current social policy to relieve households affected by energy poverty (heating allowance, social home tariff) has two major disadvantages: it is

inconsistent with the objectives and commitments of Greece as an EU member state in relation to climate change and, on the other hand, prevents consumers from being actively involved in being informed and educated in environmentally friendly practices. At the same time, the energy policy implemented, with energy saving schemes in buildings and promoting renewable energy sources (RES), does not consider the specific characteristics and difficulties faced by the poorest households in pooling the resources needed to invest in sectors. It is important, therefore, to develop a new coherent and integrated strategy for the eradication of energy poverty, which will tackle holistically the problem through a single social, environmental and energy policy that will combine to achieve, a) the true relief for many households from the energy poverty phenomenon, not with temporary measures b) the improvement of the environmental conditions with the mitigation of emissions and reduction of air pollutants & c) the reduction of energy consumption, higher RES contribution in electricity production as well as, the enhancement of the energy communities legislation for better coherence of the aforementioned necessary measures.

5.1 Statewide approach in the combat of Energy Poverty

One of the necessary steps in order to tackle energy poverty, is to establish a formal definition. Establishing such a definition that clearly describes what energy poverty means, taking into account the multifaceted nature of the phenomenon, as well as the relevant European experience is the first step towards the solution. Given that the 10% approach is undoubtedly problematic, it is proposed that the institutionalized definition be a combination of the "low income - high costs" and "minimum income threshold" approaches in relation to the energy classification of the dwelling. In particular, if the energy expenditure indicator in relation to income is considered, residual income in relation to the poverty line and the energy efficiency of household property, in order to provide a scale of assessment of energy poor, preferably by ranges for more effective implementation of priority measures. Based on the definition of the phenomenon, it is prudent that suitable indicators should be identified for recording and monitoring the problem, as well as for enhancing the coherence between the individual policies in each of the axes mentioned above, incorporating both quantitative and qualitative criteria. The Energy Poverty Reduction Roadmap should outline the steps required at national, regional and local level. A key element is the gradual shift from a bonus-based social policy to an innovative, investment-based, green policy. It should therefore go hand in hand with other strategies within an integrated national policy, such as achieving energy saving and renewable energy goals, climate goals under the Paris Agreement, and so on. It is crucial that the road map considers the needs of the various affected social groups and includes the views of all stakeholders through

a process of consultation to develop solutions and to develop appropriate legislative, regulatory and support tools. The involvement of all stakeholders in developing and implementing such proposals can be achieved through information, awareness, monitoring, information, education and training structures, coupled with a favorable incentive environment, innovative financial tools and ambitious goals to dramatically reduce energy poverty by upgrading energy to 1,000,000 homes over the next 10 years. Finally, this roadmap should include not only actions that can directly (by 2020) build on existing capacities (financial instruments, legislative framework) but also medium and long-term actions (by 2030 and in 2050) that require wider institutional and administrative changes, the creation of alternative financial instruments and a wider incentive and disincentives packages.

Furthermore, the Energy Poverty Observatory` was established in our country under the supervision of the Renewable Energy Sources Center (CRES). The core competencies of the Observatory as presented on its official website are:

Researching the real energy poverty levels in Greece through representative indicators and monitoring their development over the years

Recognizing the conditions under which the energy poverty phenomenon intensifies

Pursuing a more efficient energy policy to achieve economic and social cohesion.

Albeit the effort is important, the Observatory in 2019 is obsolete, with data being not updated since 2011. It is more than important, that this observatory, should be reinforced and employ staff with deep knowledge of the country and its problems in order to form policies that deeply tackle this phenomenon.

5.2 Additional distinct actions

Different fields of cooperation as well as opportunities, are emerging in the context of designing and implementing innovative social policies in order to relieve vulnerable households from energy poverty while at the same time meeting the goals and obligations of institutions and the state. For example, a public-private partnership could be formed based on the following actions and tools to design and implement a long-term and systematic citizen-consumer information campaign for energy savings:

First and foremost, the training of young unemployed graduates and scientists as energy advisers with knowledge of energy poverty issues is a very important aspect. A potential action, drafting a legislative proposal, in which, only certified engineers and professionals of any kind could be involved in actions and initiatives against energy poverty. This way, not only the phenomenon could be

alleviated but at the same time, the unemployment rate could be reduced. The companies and institutions of any kind that would be involved in such projects could select through a catalogue such trained professionals in order to employ them and combat the phenomenon. Such a scheme, could lead to the employment of different types of professionals, not only engineers. Furthermore, the pending installation of smart meters in the biggest cities of Greece, Athens & Thessaloniki, could be beneficial for the customers, since it will lead in the better overall performance of the electricity producing companies in Greece and thus, it could lead to the deterioration of charges. Along with the installation, energy consultants could be hired (from the aforementioned catalogue) in order to inform consumers about the best available technologies regarding energy savings and give advice in this direction.

In order for the success of such actions to be ensured, the cooperation of a large number of organizations and factors is crucial, with local governments having a leading role because of their proximity to the target group. Partnerships between local government and organizations such as consumer organizations, energy companies, electricity providers, network operators, etc. can be extremely positive. Such partnerships present mutual benefits for both the state as well as the private sector, and of course for the local communities. They are especially favored in Greece during this time period, as the Greek electricity market is changing rapidly and along with legislations like the one of energy communities, many benefits could arise for vulnerable customers. For example a pilot plan of the municipality of Larisa, which can benefit up to 400 vulnerable households, is the formation of an energy community with all the legal entities of the municipality participating in order to produce renewable electricity and provide free-of-charge electricity to vulnerable customers. All and all, it is very important to ensure the full cooperation of all the bodies involved.

More specifically, the most important bodies involved are:

The Ministry of Energy and Environment, which must de facto have an important role to play in the implementation of the European directive.

The Ministry of Labor, to develop a framework of calls for relevant programs that will encourage both the educational part of the action and the job creation potential in the relevant fields.

Municipalities and regions to identify citizens experiencing energy poverty and take advantage of the program by acting to meet the savings targets they have set at local level.

Energy market operators, such as the network operator and electricity providers, who will offer internships to the beneficiaries of the training party and will use the action to meet their statutory energy saving obligations, but also to build their corporate social profile.

Academic and research institutes in collaboration with the relevant ministries to develop the training material and to process the data collected during the campaign.

Consumer organizations, environmental organizations with valuable experience in disseminating such actions.

The aforementioned actions as well as the bodies mentioned, have every reason to want to move on to these changes and actions. Apart from the economic relief of energy-poor households based on energy savings, have significant additional benefits if they are properly designed and implemented. Opportunities to enter or re-enter the labor market for the unemployed and young people after training in order to be able to provide personalized counseling through visits to low-income households, as shown by the experience of programs such as **Reach**[31]

The promotion of new technologies that visualize energy saving and the economic benefit of potential interventions and as a result encourage further investment in saving measures, exemplifying the implementation of the **Achievement**[32] program. The development and provision of innovative services for the adaptation of market players to the new requirements for increased energy efficiency and optimization of the distribution network operation in the direction of the **Empowering**[33] program.

Along with the aforementioned programs and actions, two distinct actions are of crucial importance towards the solution of the problem of energy poverty, intra EU. The first one, the increase of energy efficiency of buildings, is one of the most important actions. Addressing homes of low energy efficiency, is a strategic issue in addressing energy poverty, as reducing energy waste involves a reduction in energy expenditure, among many other positive effects. The following proposals are aimed at promoting investments in the energy efficiency of buildings through the efficient use of financial resources, as well as proposals for drawing up schemes and tools to address the greatest obstacle to their implementation. Many "risk analyses" have led to the conclusion that energy upgrading of housing reduces the risk of "red loans", as with the reduction in energy costs, borrowers retain a higher percentage of their income to meet other needs, but also for the repayment of their loan. Achieving energy upgrading could be combined with lowering the interest rate and monthly installment of the mortgage loan, rewarding the borrower for energy upgrading, but also reducing the bank's risk. At the same time, a recent European Mortgage Federation (EMF) initiative in consultation with other institutions aims to strengthen the provision of housing loans for energy efficiency. Such loans could provide microeconomic benefits to all actors in the chain: borrowers, lenders, investors, governments, from the point of view of preserving wealth, mitigating the risk of non-repayment of the loan, securing capital and of saving energy, i.e. a win-win situation. In

[31] See Annex 1, for an explanation of the program **Reach**
[32] See Annex 1, for an explanation of the program **Achievement**
[33] See Annex 1, for an explanation of the program **Empowering**

order to combat energy poverty as well as dangerous loans in the market, a funding scheme could be set in motion in order to connect house renovations along with the obligation of paying electricity and/or natural gas bills. For example, along with “Exoikonomisi kat’oikon II” funding scheme, the proportion that must be covered by individuals could be funded through a joint venture of 3 partners. The state, electricity provider companies as well as economic institutions (banks etc.). This way, the risk could be hedged and along with a small low-interest from the companies-side, the majority of houses in Greece could be renovated. These renovations would be targeted in the upgrade of the housing conditions, but only targeting in the deterioration of the energy expenses and not in aesthetic actions.

Simultaneously, combined with energy upgrade projects, the use of renewable energy sources can contribute to tackling energy poverty by providing citizens with stable, affordable energy. Investments in renewable energy sources (solar, geothermal, wind, etc.), through the development of appropriate financial instruments and in various scales and scales (individual level, neighborhood level, etc.) and their participation and energy-poverty households could improve the quality of life of these households by providing:

Long-term free energy or fixed energy for lighting, air conditioning and equipment operation (after a short payback period)

Additional revenue from the sale of excess energy to cover other people's needs such as diet, education, debt settlement, etc.

The generation of energy from renewable sources by households, as well as its supply, individually or collectively (through cooperatives or other social enterprises), as well as its direct exchange and/or sale, should be building blocks of the Greek energy policy.

Strengthening existing policies that enable self-production and self-consumption of energy from RES, increasing incentives for households experiencing energy poverty by securing resources for the necessary investment, education and support by relevant supportive bodies (within social policies).

A favorable framework for the installation of RES for self-consumption and self-consumption through low-interest borrowing, as well as through a combined red debt adjustment program, including a reduction in interest rates as a consequence of a reduction in electricity and heat bills for heating / cooling / hot water.

Modifying and adapting programs such as "Exoikonomisi kat’oikon II", including RES interventions in homes through Energy Efficiency Agreements.

Europe's energy sector is transforming, RES electricity production is increasing, but at the same time these changes do not always reach consumers in the form of lower prices or provider choice. This is due, among other things, to the lack of information / transparency, the increasing rate of network charges, taxes and

levies on the average final electricity bill, insufficient competition on energy services markets that restricts consumer choices, and the prevention of self-consumption that limits the potential profits they could make. Reducing energy costs can be attributed to the further penetration of RES in energy consumption and the strengthening of the applicable net metering legislation for the generation of photovoltaic electricity, which is expected to create a new purchase of small photovoltaic plants in Greece. All the above, in coherence with the "Energy-Communities"[34] legislation that is in force in Greece, could annihilate the energy cost for very poor households and simultaneously, reduce it for a percentage of the population with a low income.

All and all, it could be described as a mistake when comparing energy poverty and economic poverty, while at the same time linking these two phenomena. Energy poverty is a real problem in the EU & Greece, but the solution to it is existent and feasible. Greece, could apply the aforementioned guidelines and achieve at the same time, success stories in many areas. Reducing the carbon footprint of the country, reducing the emission factor in electricity production, provide more clean and less expensive energy while at the same time alleviating the energy poverty phenomenon. The funds that need to be spent are significant but the benefits that can be achieved are more important and affect the Greek economy much more than what is believed.

[34] 4513/2018: *"Energy Communities & other provisions"*

6. Conclusions

In the context of this Master's Thesis, an effort was made in order to imprint the phenomenon of Energy Poverty. This phenomenon has different characteristics between continents, countries as well as between different cities. For example, even though it is existent both in Europe & Africa, these two forms of energy poverty could never be compared with each other.

More specifically, energy poverty was studied for the Greek case. Except of its correlation with the macroeconomic aggregators for the country, geographical as well as statistical data were taken into account in order to imprint the phenomenon. Especially in the years of the economic recession of Greece, the data were evaluated and indicated that the majority of the population suffered severe energy poverty. Moreover to this finding, different papers were assessed in an attempt to analyze and quantify all the characteristics of energy poverty in Greece. Since the triggering of the economic crisis in US in 2007 and Greece's structural weaknesses the economic crisis was very severe. 25% drop in the GDP of the country within 4 years and huge increase in energy taxation – oil tax, electricity etc. resulted in the huge increase of the energy poverty phenomenon in the country. Because of the fact that an official definition does not exist, one of the major pillars in defining the phenomenon was the existence of subjective indicators that people surveyed answered. Inability to maintain their house "adequately warm", dwellings with leakages & health problems linked to poor housing conditions are some of the data that were collected. Furthermore, the extensive power cuts from the country's electricity provider as well as the huge drop in petroleum consumption indicated the problem. Despite the economic crisis, many other factors created the conditions for the existence of energy poverty. Islands and mountainous areas are characterized by rough roads, lack of infrastructure and adverse climate conditions. Thus, along with a potentially smaller economic development, energy poverty is existent as well. All of these factors have been taken into account in order to measure the percentage of the population suffering from energy poverty. Using the "official" definition, it was found that 58% were considered energy poor. The obvious statement, is that this percentage for the EU, is significantly less. Albeit the conditions that exist in Greece, the actions against energy poverty were found to be little and insufficient. European and Greek legislation was monitored along with initiatives from the State, EU and energy companies within the Eurozone. In order to properly assess the phenomenon and take actions against it, the first measure identified as a priority, was the formation of an official definition. The 10% approach was found to be insufficient. A potential definition, could be comprised through a combination of the following parameters. Low-income (based on statistical and country data) with high cost of living, correlated with the minimum income threshold for Greece. With such a definition existent, population within these boundaries could enjoy some tax breaks or be eligible for special subsidies. A parameter of paramount importance regarding to energy poverty,

is setting the foundation in order to fully relieve it and not temporarily relieving the phenomenon. In this direction, the publication of the “Energy Poverty Roadmap” for Greece is one of the most important steps towards the combat. A detailed map towards a sustainable solution to the problem will be analyzed in this roadmap and thus, public as well as private entities will be able to take actions against energy poverty. An existent measure regarding energy savings, the “Savings at home” Program, has been restarted and it is said that it will be active for a number of consecutive years in order for Greece to achieve its EU savings target. Despite it is a form of subsidy, it targets a significant problem of the Greek population – bad insulation in their homes (especially in Athens, where almost the 50% of the population resides) and gives a permanent solution to it. In this context, it has been found that a key-element for the proper combat against EP, is the gradual shift from a bonus-based social policy regarding energy to an innovative & investment based policymaking with always respect to the environment and climate change. In this manner, investments (with a potential contribution of the private sector) are possible with the involvement of entities other than the General Government (ministries, etc.) such as municipalities, NGOs etc. Furthermore, a legislative act with great importance has been introduced. The “Energy Communities” legislation, could potentially help with could help with the gradual “detoxification” of households from solid fuels and contribute to the expansion of RES while hedging their cost. These coalitions - communities, could work efficiently all over the Greek territory and especially in mountainous areas as well as islands. As it was demonstrated in this thesis, these areas suffer from energy poverty due to lack of infrastructure amongst other factors. Although they do have insufficient resources, they have some advantages when compared to the country’s capital city. High spatial availability, high wind speeds and sunshine facilitate the construction and operation of RES installations and thus, energy poverty in these areas could be eliminated through these investments.

Without a doubt, the severe economic crisis simultaneously with the lack of resources (natural and financial) and this unprecedented situation for the Greek state, resulted in the huge increase of the energy poverty phenomenon for the vast majority of the population. The aforementioned areas of improvement, along with legislative and strategic acts from the Greek government seem to be essential in order to combat the phenomenon. Examples from other states and foreign entities could potentially be beneficial, since the phenomenon is well-studied abroad and the guidelines for dealing with it have been laid down in great detail. Looking to the future with optimism, it is positive that steps have been taken to tackle energy poverty, and at the same time, with the improvement of the country's economic data it could be argued that the phenomenon will for sure be addressed at its highest rate in the years to come.

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