THE ENERGY POVERTY PHENOMENON IN GREEK REGIONS

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Abstract
The role of energy in our lives is very important, as we cover many of our basic daily needs with it. Among other, energy contributes to the improvement of people's quality of life, to economic development and to the well-being of society. However, not all people have access to basic energy services. Exclusion from them, due to inability to cover the energy costs, led to the appearance of the term "energy poverty".

Although there is still no officially agreed definition of energy poverty at the EU and Greek level, different approaches have been developed, with the main ones being the expenditure approach and the consensual.

This paper analyses the phenomenon of energy poverty and outlines its causes and consequences. Through the use of secondary data, the key factors leading to the emergence of energy poverty in Greece, such as employment, unemployment, percentage of households at risk of poverty, year of construction of buildings and climatic zones, are presented and compared both over time and at a regional level in Greece.

According to the survey results at the Greek regional level, inequalities can be observed, which vary depending on the respective indicator examined and between the years in question. The conclusions are presented both in tabular and visualised chart form.

The bibliography and internet literature used and on which the paper is based on include sources from books, studies and articles from reputable scientific journals. The statistical data for the comparison of indicators between Greek regions were obtained from the Hellenic Statistical Authority (ELSTAT).

Key words: *Energy Poverty, Greek Regions*

Introduction

Undoubtedly, energy consumption contributes to the improvement of living standards and human well-being. It serves as the driving force for the realization of most human activities, as it covers the needs of people and households for cooling, heating, lighting, operation of household appliances, movement of vehicles, etc. However, the rise in living standards results in an increase in energy consumed.

According to Eurostat's survey (2024c) on household expenditure by category for EU countries, in Greece in 2022 5.1% of household income was consumed to cover needs for electricity, natural gas and other fuels. Greek households' expenditure was equal to the EU average. The highest expenditure on electricity, gas and other fuels as a percentage of household income was recorded in Slovenia (8.5%) and the lowest in Iceland (1.9%).

1. Definition

There is great difficulty in defining the concept of 'energy poverty', as it is a multidimensional and complex concept. Isherwood and Hancock (1979) attempted to define energy poverty. For a household to be considered energy poor, it must spend more than 10% of its income to meet its energy needs (Halkos, 2021). At EU level, there is no official definition of energy poverty. The Energy Poverty Advisory Hub has created an official description of energy poor households. According to this description, energy poor households as those experiencing inadequate levels of basic energy services due to a combination of high energy costs, low household incomes, inefficient buildings and appliances and special household energy needs.

However, there are countries that have official definitions of energy poverty, such as the UK, France, Cyprus, Slovakia and Ireland (Trinomics, 2016). Cyprus has an official definition of the term energy poverty, published in Issue 4687/26-06-2013 of the Official Gazette of the Republic of Cyprus. According to this definition, as provided in Article 93(5) of the Law, recipients of public assistance from the Social Welfare Services of the Ministry of Labour and Social Insurance who are Cypriot citizens or citizens of another Member State or State of the European Economic Area or those who have same rights as the above, who legally reside in areas controlled by the Republic of Cyprus.

2. Measuring Energy Poverty

To measure energy poverty, two main approaches were developed, the expenditure approach and the consensual approach.

2.1. Expenditure Approach

The expenditure approach uses as a measure the high share of energy costs (a household has high energy costs), low disposable income, i.e. the minimum income, remaining in the household after subtracting energy costs and insufficient energy costs, identified when a household's energy costs are below a minimum level of basic and essential energy services (Halkos, 2021).

The primary measure of the expenditure approach in order to assess whether a household is energy poor is to set the threshold at '10% of income', i.e. a household is considered energy poor when its energy expenditure exceeds 10% of its total income.

The measures of the expenditure approach, in order to assess whether a household is energy poor, need to establish minimum thresholds. A fundamental choice for the minimum threshold is "10% of income," meaning a household is considered energy poor when its energy expenditures exceed 10% of its total income. Also, according to the minimum threshold "above median," a household is energy poor if its energy expenditures are above the national median (as a percentage of income) and if its income, excluding energy costs, is below the poverty line (Trinomics, 2016). Furthermore, the minimum income standard can also reveal if a household is experiencing energy poverty. This is determined if one's income is below the minimum income necessary to integrate into society or if one's income is lower than the necessary energy and housing costs. The minimum threshold for identifying an energy poor household is if a household's energy expenditures exceed twice the national median (as a percentage of income or in euros) (Bouzarovski et al, 2012).

The advantage of the expenditure approach is that it uses objective and measurable data, which can lead to comparable results across countries and over time. A significant disadvantage is that it uses only monetary indicators and does not take into account factors that express the complexity of energy poverty.

2.2. Consensual Approach

The consensual approach utilizes data on the household's energy situation, which collectively can assess whether a household is energy poor. Among the advantages of the approach is that it can include elements that express the multidimensional nature of the phenomenon of energy poverty. The disadvantages of the consensual approach include subjectivity in the selection of indicators to be used, as the wrong choice will lead to incorrect results. The problem of subjectivity can also be found in the data that will be used. This is because people have different perceptions of their living conditions among themselves, making their comparison very difficult (Halkos and Gkampoura, 2021).

3. Energy Poverty in the European Union

According to the literature at European Union level, the main indicators used in the consensual approach are the inability to keep the house warm enough, the delay in paying utility bills and the presence of leaks, dampness, or decay in the dwelling (Thomson and Snell, 2013).

Based on the survey conducted by Eurostat in 2022, 9.3% of the EU population reported that they were unable to keep their home adequately warm. Compared to 2021, there is an increase of 2.4%. in this percentage. There is a variation among EU Member States regarding the rates of inability to keep the house adequately warm, as a percentage of the population (Eurostat, 2024a) (Figure 1). The highest percentages of individuals unable to keep their home sufficiently warm were recorded in Bulgaria (22.5%), Cyprus (19.2%) and Greece (18.7%). On the contrary, the lowest percentages were found in Finland (1.4%), Luxembourg (2.1%) and Slovenia (2.6%).

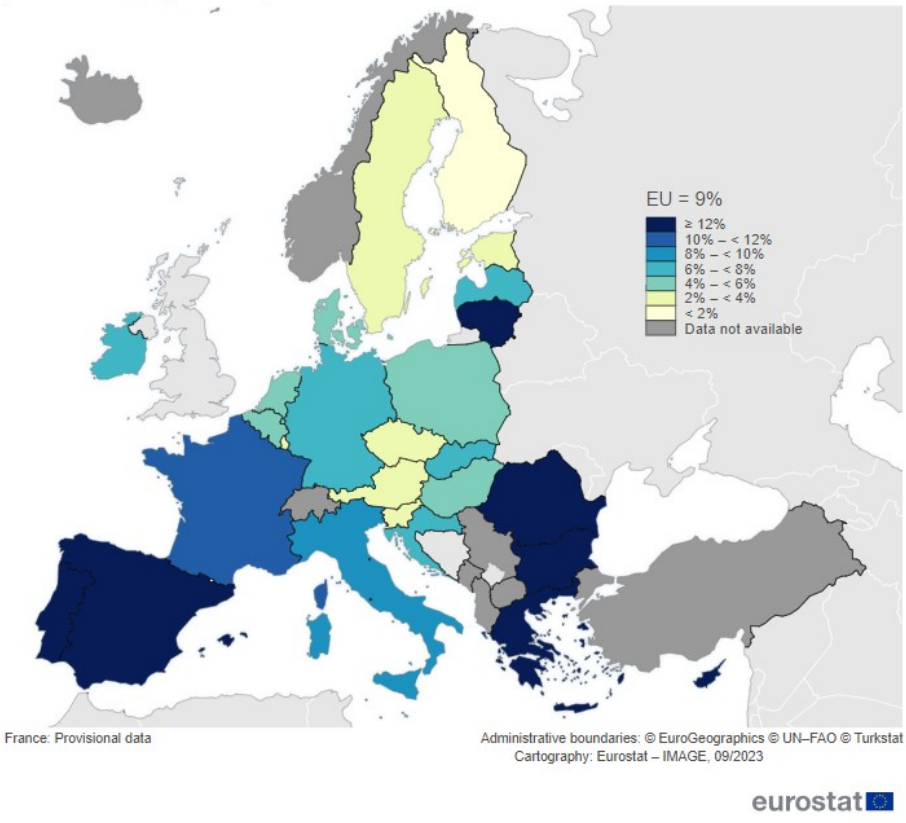

Figure 1: Inability to keep the house adequately warm, 2022 (% of total population)
Source: Eurostat EU-SILC survey, 2024d, own processing

In addition, at EU level the measure of energy poverty is the delay in paying utility bills. As shown in Figure 2, where, using maps is illustrated, households' inability to pay their utility bills for the years from 2019 to 2022. Countries with higher percentages of delays in utility bill payments are marked in bold orange, and the lighter the color on the map, the lower the percentage of delays.

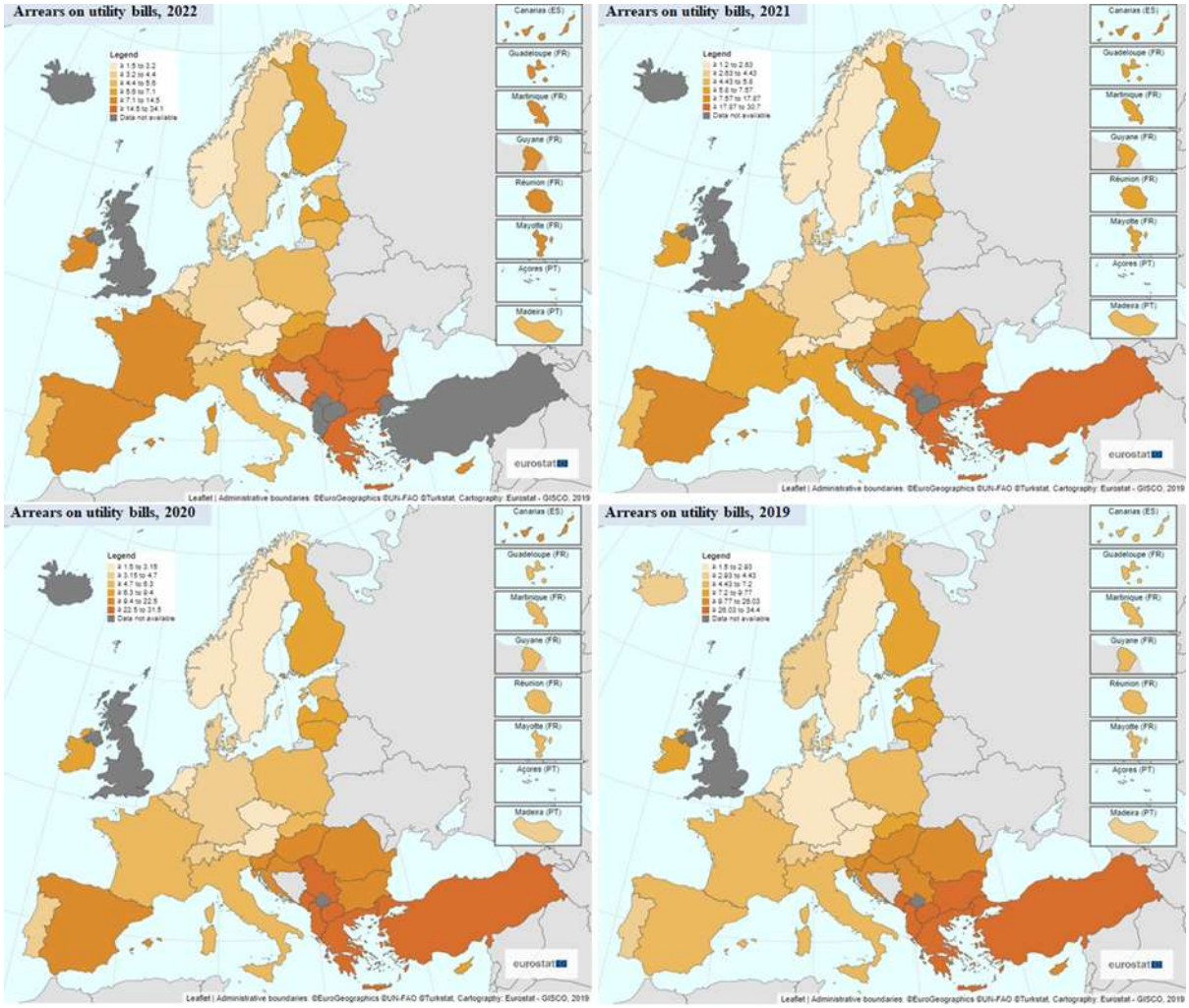

Figure 2: Delays in utility bills
Source: Eurostat EU-SILC survey, 2024b, own processing

It is observed that the highest percentages of utility bill payment delays are in North Macedonia, Montenegro, Greece, Bulgaria, Turkey, Albania, and Serbia. The lowest percentages are found in Italy, Switzerland, Portugal, Germany, Belgium, Denmark, and Norway.

The following table (Table 1) presents the percentages for Greece and the EU-27 member states for the years from 2019 to 2022.

Table 1: Percentage of utility bill payment delays at the EU-27 and Greece levels for the years from 2019 to 2022
Source: Eurostat EU-SILC survey, 2024b

	2019	2020	2021	2022
EU - 27 member	6.1	6.5	6.4	6.9
Greece	32.5	28.2	26.3	34.1

In all the years, Greece's percentage is much higher than the corresponding percentage for the EU. In 2019, 2020, and 2021, Greece ranks third in utility bill payment delays, while in 2022, it ranks first with a percentage of 34.1%, followed by Montenegro with 30.3%.

4. Energy Poverty in Greek Regions

There are several factors that contribute to the occurrence of energy poverty such as low incomes, employment, high fuel prices, inefficient energy efficiency of a house, partial use of the dwelling and the old age of the building.

Given that this article focuses on the occurrence of the phenomenon of energy poverty at regional level, employment, unemployment, population at risk of poverty, building stock and climate zones will be presented and compared both over time and at the level of Greek regions.

4.1. Employment

The percentage distribution of employed persons per region according to data from ELSTAT (2024) from 2008 to 2021 does not show significant changes (Delitheou V. et al, 2021) (Figure 3). The region with the highest number of employees is the Attica region, which gathers the most residents at regional level and the capital of Greece (Athens) is located in this region. In the second place is the Central Macedonia region, which is the second most populous region of the country, and it includes its second-largest city, Thessaloniki.

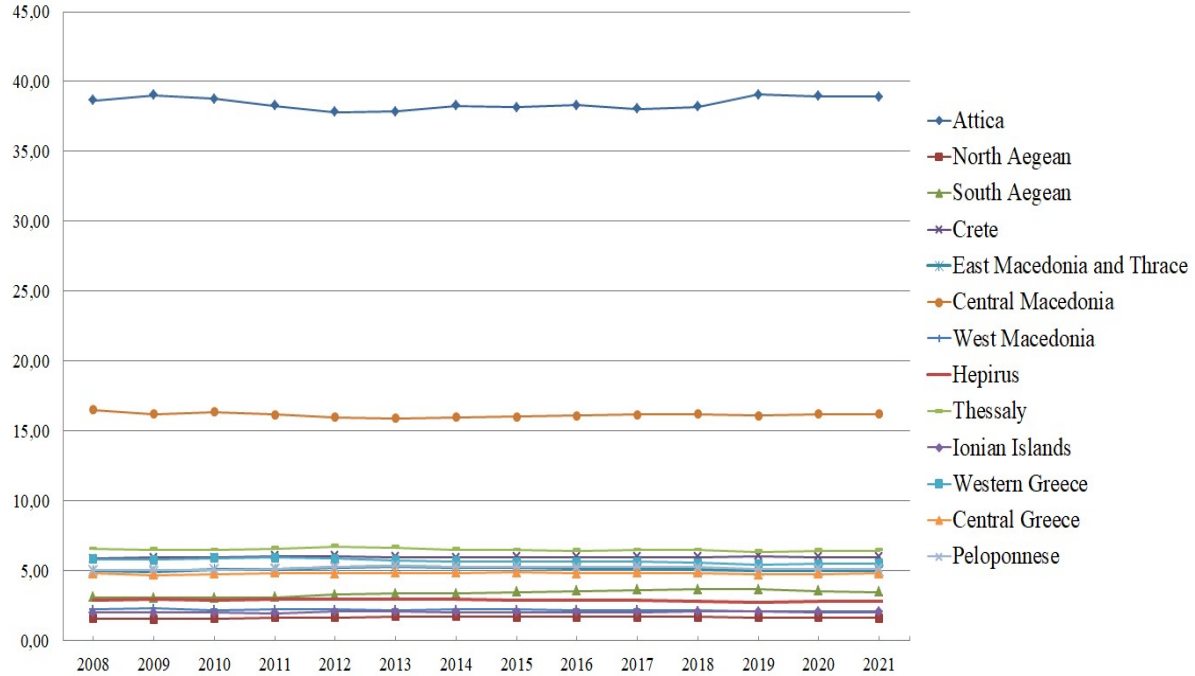

Figure 3: Percentage distribution of employed persons by region
Source: Hellenic Statistical Authority, 2024b, own processing

Indicatively, in 2021, the Attica region employed 38.9% of employees. In the second place is Western Macedonia region (16.2%), followed by Thessaly region, which employed 6.4% of the country's employees. On the contrary, the smallest percentage of employed persons in Greece in 2021 worked in the Ionian Islands region (2.02%).

4.2. Unemployment

According to Eurostat data, the Unemployment rate in Greece in 2022 was 12.5% and in 2021 it was 14.7%. For the year 2022, the highest unemployment rate in Greece was detected in the region of Western Macedonia (17.7%) followed by the region of Thessaly (16.4%). On the contrary, the lowest unemployment rate in Greece in 2022 was detected in the Attica region (10.0%), followed by the South Aegean region (10.7%) (Figure 4). It is observed that despite the fact that the unemployment rate in Greece has been decreasing every year since 2013 when it was 27.5%, it continues to remain at high levels compared to the EU average (Eurostat, 2024f).

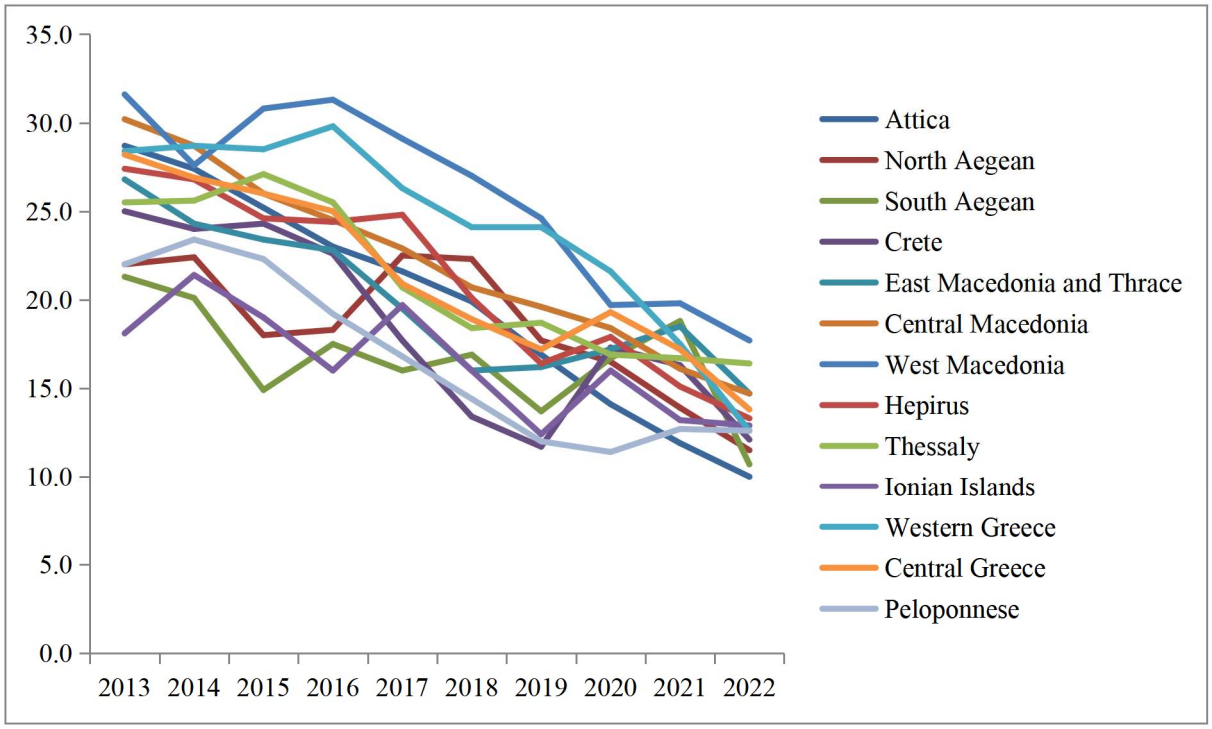

Figure 4: Percentage distribution of unemployed by region
Source: Eurostat, 2024f, own processing

4.3. Percentage of Households at Risk of Poverty

The at-risk-of-poverty percentage is considered to be the share of individuals with equivalized disposable income (after social transfers) below the at-risk-of-poverty threshold, set at 60% of the national median equivalized disposable income after social transfers (Eurostat, 2024d). More specifically, the indicator does not measure the wealth or poverty of residents, but compares their low income with other residents of the same country. It should be noted that the above comparison does not necessarily lead to the conclusion that the living standards of residents are low.

At EU level, the share of the population at risk of poverty or social exclusion in 2022 was 21.6%. The country with the highest percentage of the population at risk of poverty or social exclusion was Romania with 34.4%, followed by Bulgaria with 32.2% Greece ranked third, with 26.6% (Table 2 and Figure 5). Eight (8) countries are above the EU average (Eurostat, 2024d).

Table 2: Percentage of population at risk of poverty by region

	2019	2020	2021	2022
Attica	13.7	12.1	12.9	13.8
North Aegean	20.7	21.4	22.7	24.6
South Aegean	16.9	14	17.5	15.8
Crete	15.2	14.1	14.9	10.1
East Macedonia and Thrace	24.3	26.1	29	26.1
Central Macedonia	20.6	21.7	25.5	23.8
West Macedonia	21.6	25.3	21.5	25.4
Hepirus	17.4	17.4	21.1	15.8
Thessaly	19	19.1	19.7	18.7
Ionian Islands	13.9	10	20.1	22.6
Western Greece	23.8	27	28.5	26.7
Central Greece	20.3	19.9	24.2	25.4
Peloponnese	19.7	20.4	24.2	23.4
Greece	**17.9**	**17.7**	**19.6**	**18.8**

Source: Hellenic Statistical Authority, 2024a

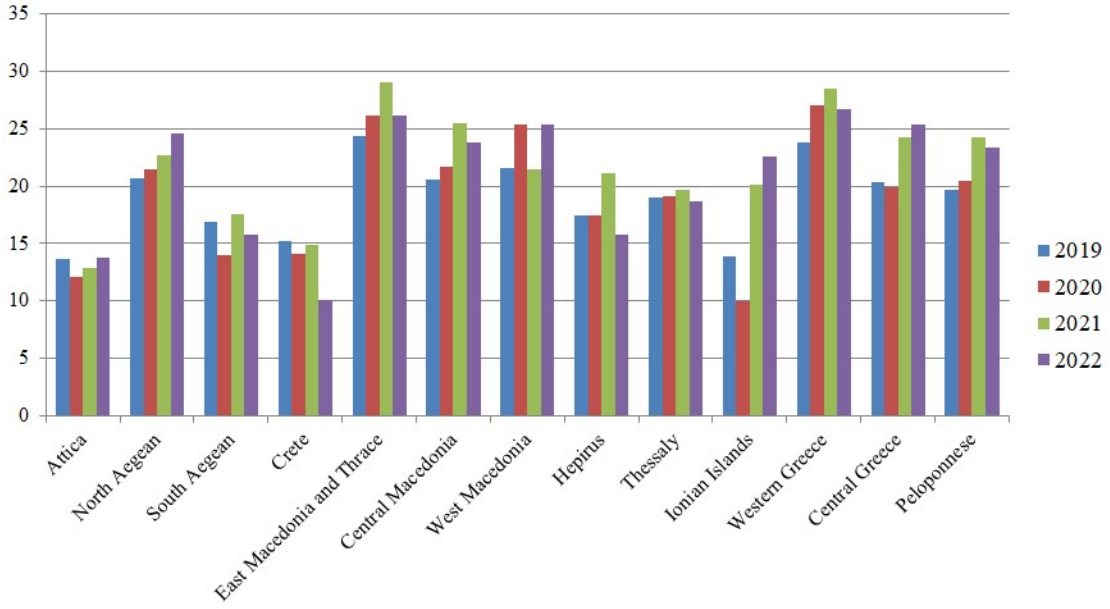

Figure 5: Percentage of population at risk of poverty by region
Source: Hellenic Statistical Authority, 2024a, own processing

According to surveys of household income and living conditions in Greece by ELSTAT, the percentage of the population at risk of poverty in 2022 was 18.8% and in 2021 it was 19.6%. In 2021, the region with the highest percentage of population at risk of poverty was the region of Eastern Macedonia, Thrace with a percentage of 29%, while in 2022 it was the region of Western Greece (26.7%). The lowest percentage of the population at risk of poverty in 2021 was in the Region of Attica with 12.9%, while in 2022 the lowest percentage of the population at risk of poverty was recorded in the Region of Crete (10.1%).

4.4. Year of Construction of Buildings - Residences

According to ELSTAT data from the 2011 building census, the largest percentage of buildings at country level was constructed before 1960 followed by the period 1971-1980 with a percentage of 17.2% and the period 1961-1970 with a percentage of 15.6% (Figure 6).

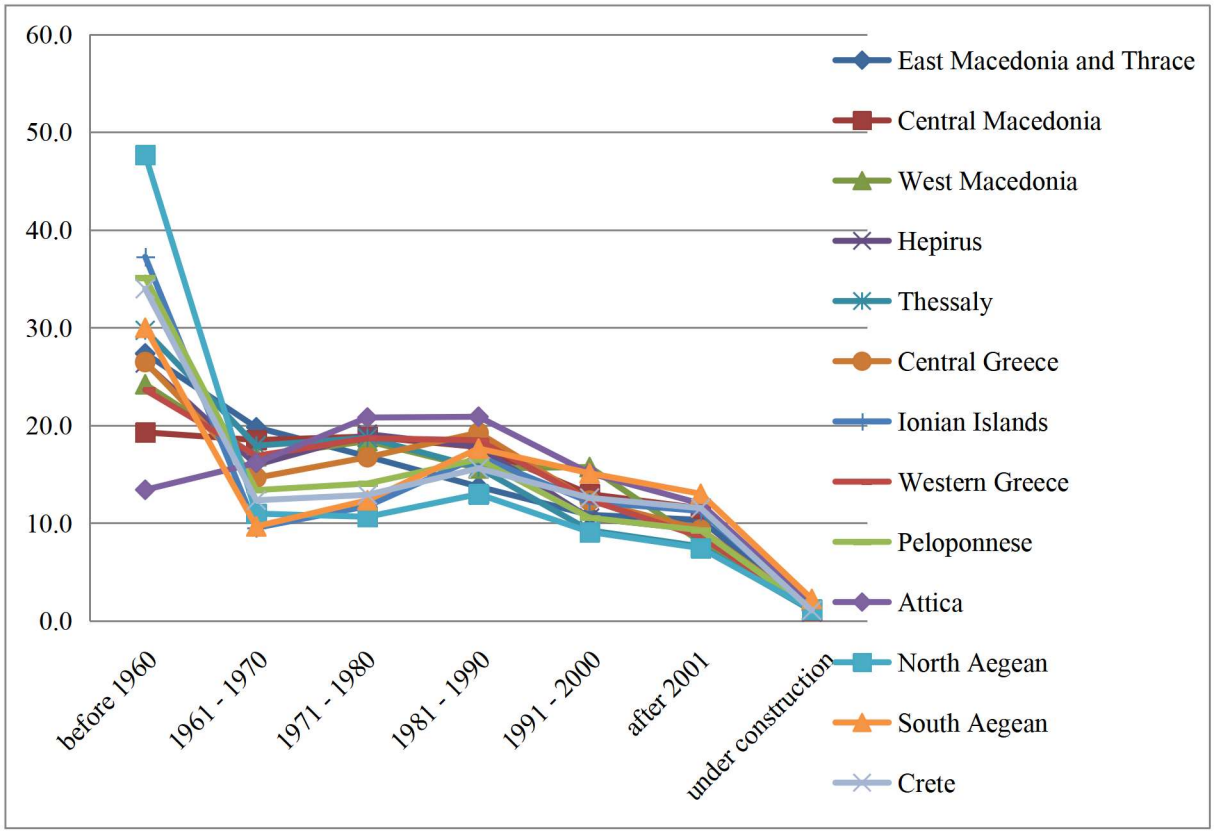

Figure 6: Percentage of buildings in construction period per region
Source: Hellenic Statistical Authority, 2024b, own processing

At regional level, the Region of Attica has the largest number of residences, i.e. 85% of buildings, most of which were constructed between 1971 and 1990. From the above data it is concluded that the building stock and the buildings used as residences in Greece are old.

Regarding the population's level of housing satisfaction, which was measured on a scale from 0 to 10, in Greece 29.7% rated their satisfaction with their housing conditions as low (0-5), while only 19 % stated high satisfaction with a score of 9 and 10. The average satisfaction of respondents was 6.6/10. Notice it is the second lowest after Bulgaria (6.0/10) and lower than the EU average. (7.4/10) (Eurostat, 2024e).

4.5. Climatic Zones

In addition, the location of a household can contribute to the occurrence of energy poverty phenomenon (Awaworyi Churchill et al, 2022). Greece, due to its geomorphological characteristics, its climatic features and the different altitudes it creates, has different energy needs. According to the Energy Performance of Buildings Regulation (Government Gazette 2367B/2017), Article 6 defines the four (4) Climatic Zones (Figure 7) and the prefectures that belong to them (Table 3). However, all areas with an altitude above 500 meters from sea level belong to the next colder climate zone, from the one they belong to according to the

regulation on the energy performance of buildings according to the Energy Performance of Buildings Regulation.

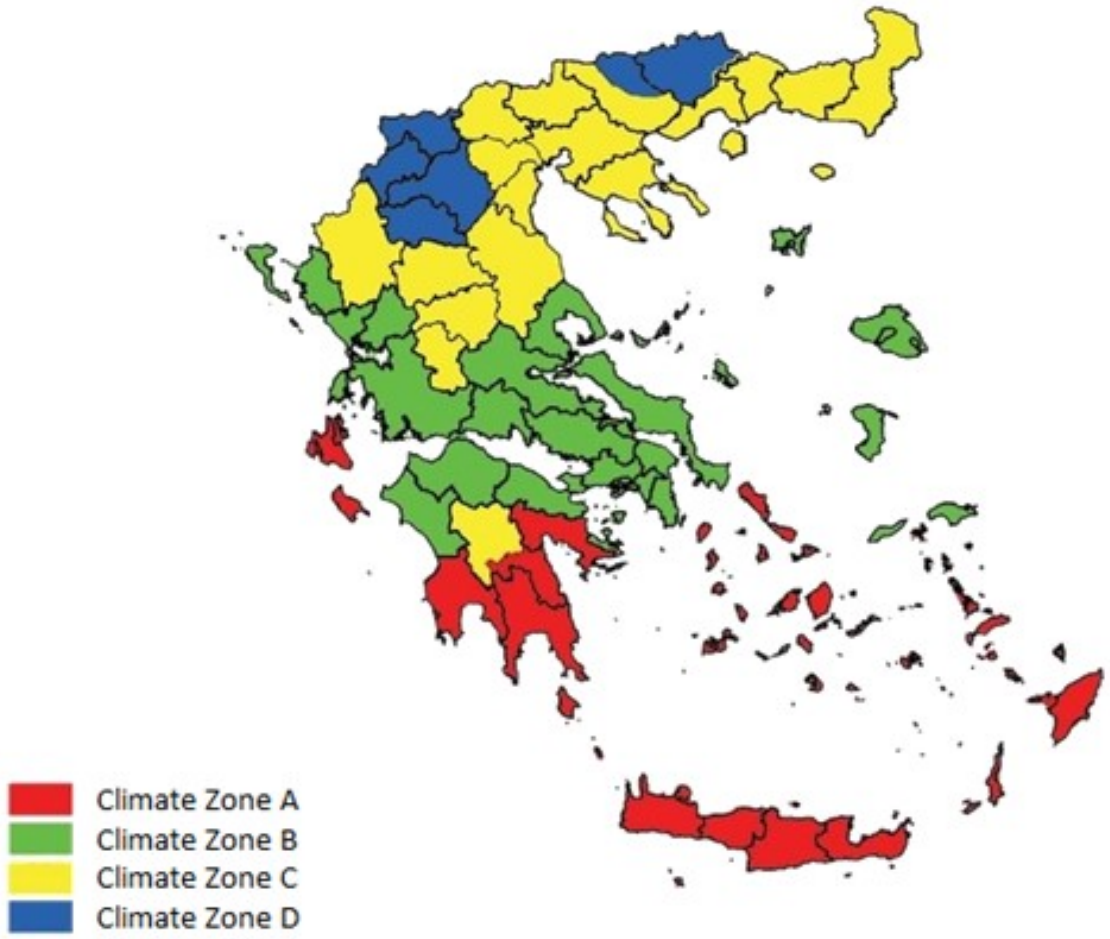

Figure 7: Climatic Zones in Greece
Source: Energy Performance of Buildings Regulation, 2017

More specifically, the warmest climate zone is Climate Zone A, which includes the entire region of Crete and South Aegean as well as the prefectures of Samos, Messinia, Laconia, Argolis, Zakynthos, Kefallinia, Ithaca and the Saronic islands and Kythira, which belong to the prefecture of Attica.

The rest of Attica belongs to Climate Zone B. On the contrary, the coldest climate zone is Zone D, which includes the entire region of Western Macedonia and the prefectures of Serres (region of Central Macedonia) and Drama (region of Eastern Macedonia - Thrace).

Table 3: Prefectures belonging to each Climate Zone

CLIMATIC ZONES	PREFECTURE
Zone A	Heraklion, Chania, Rethymno, Lassithi, Cyclades, Dodecanese, Samos, Messinia, Laconia, Argolis, Zakynthos, Kefallinia and Ithaca, Kythira and Saronic islands (Attica), Arcadia
Zone B	Attica (except Kythira and the Saronic islands), Korinthia, Ilia, Achaia, Aitoloakarnania, Fthiotida, Fokida, Viotia, Evia, Magnesia, Lesvos, Chios, Corfu, Lefkada, Thesprotia, Preveza, Arta
Zone C	Arcadia (mountainous), Evritania, Ioannina, Larissa, Karditsa, Trikala, Pieria, Imathia, Pella, Thessaloniki, Kilkis, Chalkidiki, Serres (except NE part), Kavala, Xanthi, Rodopi, Evros
Zone D	Grevena, Kozani, Kastoria, Florina, Serres (NE part), Drama

Source: Energy Performance of Buildings Regulation, 2017

From the above categorization we understand that not all prefectures and therefore municipalities have the same heating and cooling needs. Warmer climate zones use more energy for cooling in summer and less in winter compared to colder zones, where in winter they need more energy to heat their homes while their summers are cooler.

5. Impact of Energy Poverty

5.1. Environmental Impact

Energy poverty has an impact on the environment. It should be noted that the combustion of raw biomass and wood emits carbon monoxide (CO), carbon dioxide (CO_2), sulfur dioxide (SO_2) and nitrous oxide (NO_X), enhances the greenhouse effect and therefore contributes to climate change (Polyzos, 2022). The effects of burning unsuitable materials for heating include the creation of smog, which is a form of air pollution mainly in urban centers. Also, burning wood for heating and cooking increases illegal or legal logging, reducing the forest areas of Greece's regions. This reduction will have an impact on the ability to absorb CO2 and it will worsen the consequences of climate change (Belaïd F. et al, 2020).

5.2. Health and Standard of Living

The impact of energy poverty is also reflected in the health of those affected. Households that are not adequately heated may experience problems such as mold and dampness. However, using solid fuels to heat and cook in open hearths or stoves that are not adequately maintained cause indoor air pollution. Long-term exposure to such pollution creates health problems such as pneumonia, strokes, lung cancer and chronic obstructive pulmonary disease (Heinrich-Böll Stiftung, 2019).

In addition to physical health, mental health is also affected. People who live in an environment that is not adequately heated are more likely to experience depression and

develop negative emotions. The consequences of energy poverty are most strongly reflected in the psychology of children, adolescents and the elderly.

5.3. Economic Impact

The economic impact of energy poverty is reflected in the running costs of the health and care system. Energy poor households face increased health problems compared to those who do not experience energy poverty and these health problems occur more often, as the living conditions worsen them.

Particular attention should be paid to the fact that households experiencing energy poverty seek to purchase their energy products at the lowest price. This results in exacerbating the phenomenon of smuggling of fuel, wood and their derivatives, with a direct impact on the emergence of tax evasion and the inability to collect VAT.

Due to the high cost of energy, residents are unable to pay their debts on electricity supplies and VAT is not collected. The electricity bill also includes municipal taxes, which are a source of revenue for municipalities (Petrakos and Psycharis, 2016). If we take into account that some municipalities have residents of lower income, the inability to pay the fees limits the possibility of increasing the beneficiaries in social groceries, social pharmacies and other social institutes (Delitheou, 2018). These benefits could help affected households to increase the expenditure on meeting their energy needs.

6. Conclusions

The main short-term policies aimed at limiting heating expenses and indirectly limiting the increase in fuel prices are heating allowances. Heating allowance is provided to beneficiaries for the purchase of heating oil, lamp oil (blue kerosene), natural gas, LPG, firewood, biomass (pellets) and thermal energy through district heating. As far as the heating allowance for electricity is concerned, it is provided to households to heat their homes with electric stoves, convectors, air conditioners and other means that use electricity.

Additionally, an allowance that may help handle energy poverty is the housing allowance which provides financial assistance to vulnerable households to (partially) cover the cost of rent. With the amount of the allowance, the household can either seek a more energy-efficient residence, which it couldn't afford to rent without it, or save money from what it would have spent on rent to cover other energy or non-energy needs (Heinrich-Böll Stiftung, 2019).

The inclusion in the Social Residential Electricity Tariff helps in the immediate reduction of the price of electricity, with beneficiaries being vulnerable households, based on their income, family situation, and health status, such as people with disabilities (PWDs).

It is recommended to implement informative actions for households focusing on sustainable solutions, aimed at improving living conditions and indirectly increasing their income. Considering that informational campaigns are welcomed by both citizens and policy makers, environmental goals can be achieved at low economic cost (Bithas K. et al, 2022).

In our daily lives within the household, we often do not manage resources properly. It is proposed to inform household members on their proper usage and to limit wastefulness. Such useful tips are to turn off the lamps when there is no one in the room, turn off the appliances instead of leaving them on standby mode, shutting off taps when water is not in use, and removing clothes or obstacles from heating sources when they are in operation (Ministry of Environment and Energy, 2024).

Furthermore, households should be informed about ways to improve their energy efficiency. Upgrades such as replacing bulbs with LED lights, replacing appliances with other of higher energy ratings, installing solar collectors, placing external and internal shades,

installing double-glazed windows, and insulating roofs and walls can enhance energy efficiency (Ministry of Environment and Energy, 2024).

Informative actions should not only address ways to handle or reduce energy poverty but also inform and encourage beneficiaries to participate in subsidized programs for upgrading residential buildings and household appliances.

In addition, emphasis should be placed on the utilization of Renewable Energy Sources (RES) to combat energy poverty. The creation of incentives for households to self-generate and self-consume energy should be a priority of planned policies to handle energy poverty. By participating in RES utilization programs, households can have access to free energy, secure low energy prices for a long period, and even generate income from selling produced energy.

In conclusion, the creation of local energy cooperatives should be encouraged (Regulatory Authority for Waste, Energy and Water 2024). Energy communities are natural or legal entities whose objective to produce, store, self-consume, distribute, and supply electricity from renewable sources.

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