

Housing, energy performance and social challenges in Greece. A quantitative approach.

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Abstract. The article investigates the current challenges households face in Greece with regards to the energy performance of their dwellings. We claim that unpacking households' experiences, practices, and perceptions could contribute to a deeper understanding of the social dynamics related with dwellings' energy performance; dynamics which are expected to expand in the context of the "green transition." Understanding these dynamics is also important for developing efficient national policies that respond to households' needs and problems. Our intention is to identify the potential implications renovations might have for households, including the role of energy retrofitting in addressing or increasing households' problems to deal with their energy needs and particularly energy poverty.

1 Introduction

The climate crisis, together with the energy crisis that started in 2021, have prioritized issues related with the improvement of dwellings' energy performance [e.g. 1-2]. Energy-efficient dwellings contribute to reducing greenhouse gas emissions, which is crucial for combating climate change. Sufficient thermal insulation, energy efficient window frames/ glazing, highly efficient heating and cooling systems, and energy-saving appliances help decrease energy consumption. Reduced energy consumption results in lower utility bills, providing financial relief and improving the affordability of energy for households. Also, energy retrofitting measures such as improved insulation, efficient heating and cooling systems and passive ventilation enhance indoor air quality, reduce the risk of respiratory problems and create healthier living environments. Furthermore, maintaining consistent indoor temperatures improves comfort and well-being, particularly for vulnerable households.

In the context of the "green transition" and the European Green Deal, the new cornerstone of EU policies aiming at achieving a sustainable future and transitioning to a greener economy, the importance of improving the energy efficiency of dwellings is of high importance. The Renovation Wave strategy [3], adopted by the EU in 2020, aims to accelerate the renovation of buildings, with a strong focus on energy efficiency of residential buildings. Also, decisive binding legislation is being adopted aiming toward a net-zero emission growth strategy in buildings. It contains several important initiatives such as the Fit for 55, the Energy Performance of Buildings directive (EPBD) revision and the Energy Efficiency directive.

Among the goals of the Renovation Wave strategy is tackling energy poverty. This is line with the recommendations many researchers have developed during the last years about the strategies and tools to eliminate energy poverty [4], alongside the achievement of environmental goals. Retrofitting residences can help to reduce energy consumption and associated costs, making energy more affordable to vulnerable households.

While energy retrofitting can benefit households, there is a risk that it may inadvertently increase social inequalities. Affordability barriers, such as the high upfront costs or lack of financial resources, can limit access to energy retrofitting for low-income households. In this context, during the last years concerns about the social side-effects of energy retrofitting of dwellings have been expressed, as rent increase due to retrofitting could lead to *renoviction*, namely direct or indirect displacement of low-income tenants to even more precarious and low-quality housing [5-7]. But even in the case of owner-occupied residences, low-income homeowners cannot afford the cost of interventions for energy upgrading, while at the same time they should respond to new costs that arise from the implementation of the green transition policies, as, for example, energy becomes more expensive. In other words, low-income households seem to be excluded from participating in low carbon transitions while disproportionately sharing the costs of these transitions [5, 8-9].

This article investigates the current challenges households face in Greece with regards to the energy performance of their dwellings. We claim that unpacking households' experiences, practices, and perceptions could contribute to a deeper understanding of the social

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dynamics related with dwellings' energy performance; dynamics which are expected to expand in the context of the "green transition." Understanding these dynamics is also important for developing efficient national policies that respond to households' needs and problems. Our intention is to identify the potential implications renovations might have for households, including the role of energy retrofitting in addressing or increasing households' problems to deal with their energy needs and particularly energy poverty.

In Greece, households face significant challenges when it comes to the energy performance of their dwellings. One significant challenge is the aging building stock in Greece with low energy efficiency standards. A large share of dwellings has been constructed before 1980 [10], in times when concerns about reducing energy consumption and energy saving were marginal in the processes of housing production [11]. Furthermore, the financial burden associated with improving the energy performance of dwellings presents another challenge for Greek households. Retrofitting measures, such as improving insulation, upgrading heating systems, and implementing renewable energy solutions, often require substantial upfront costs. For many households already grappling with economic difficulties and unaffordable housing [13], these expenses can be prohibitive, hindering their ability to invest in energy efficiency improvements. The energy crisis that started in 2021 skyrocketed energy costs, threw many households into a situation of energy deprivation [14] and posed new questions about interventions that would reduce energy consumption at home. As far as the funding programs of the state for improving the energy performance of dwellings are concerned, namely the successive versions of "Exikonomo" program, they have low total budget and require private funds to cover part of the investment; thus they do not respond to the problems of the housing stock and exclude low-income households [15].

During the last decade, there has been a major increase in publications related to energy poverty [16]. The present article is directly related to this issue. Hopefully, the increasing scientific interest and the better understanding of the various aspects of energy poverty will boost policies in the direction of alleviating this major social challenge.

2 Materials and methods

The analysis of this paper is based on the data collected using a structured questionnaire, addressed to households of Greece. The survey questionnaire consisted of closed-ended questions. The majority of the questions provided optional responses on a four-point Likert scale (ranging from 1 to 4: 1: not at all, 2: little, 3: moderately, 4: much) or were Yes/No questions. Only the heads of households, aged over 18 years old and living in Greece permanently, participated.

The survey was conducted from 17 to 27 May 2022, almost one year after the outburst of the global energy crisis. All in all, 1.061 valid questionnaires were collected from households living all over the country. The

questionnaire was designed by the authors, on behalf of Nicos Poulantzas Institute, and the survey was conducted by Kapa Research company. As far as the surveying technique is concerned, 516 questionnaires were collected with Computer Assisted Telephone Interviewing (CATI) and 545 questionnaires with Computer-Assisted Web Interviewing (CAWI). The survey was based on a stratified random sample, according to the 2011 Census of the Hellenic Statistical Authority. The desired margin of error of the sample was 3%, with an associated 95% confidence interval.

The questionnaire consisted of five parts. The first part included questions regarding perceptions and practices about energy consumption at home. The second part examined the energy efficiency of the dwellings, the third one focused on the costs of housing, including the cost of rent, energy bills, mortgage repayment and housing taxes, and the fourth one documented the general features of the dwellings of the respondents. Finally, the fifth part recorded the socio-demographic data of the respondents. This paper focuses on the findings of the second part of the questionnaire. The valid questionnaires were collected and analysed using SPSS (Statistical Package for the Social Sciences) software.

3 Descriptive analysis

3.1 Dwellings' energy efficiency

3.1.1 Energy Performance Certificates

Households were asked whether they hold an Energy Performance Certificate for their dwelling. Energy Performance Certificates provide information to consumers on buildings they plan to purchase or rent and include an energy performance rating and recommendations for cost-effective improvements. Just 13% of the respondents answered positively. Among those who hold an energy performance certificate, 39% of them stated that they live in a dwelling of A or B class, 28% of C or D and 27% of E, F and G.

According to our survey, there is a strong correlation (confidence level 99%) between dwelling energy class and households' problems to deal with their energy needs. As it was expected, our survey confirms that energy problems are higher for households that live in dwellings of low energy efficiency. In particular, 56% of the households that live in low energy class dwellings (E, F or G) declared inability to meet their energy needs, while just 40% of the households that live in energy high (B) class dwellings had problems with energy. Moreover, there is a strong correlation (significance level 99%) between energy performance class and indoor temperature during the winter. The lower the energy class the lower the average temperature in the house during the winter. Most households (82.5%) which stated that their winter indoor temperature is lower than 18o C live in houses with low energy class.

Considering that the Energy Performance of Buildings Directive is under revision and that, according to the

proposal of the European Commission, residential buildings would have to achieve at least energy performance class E by 2030, and D by 2033, improving the energy efficiency of dwellings must be prioritized. This would respond, not only to the goals of the “green transition”, but also to the goals to tackle energy poverty as a result of the (repetitive) energy crisis.

3.1.2 Thermal insulation

In the survey, the respondents were asked about the energy efficiency of their residence. As far as the insulation is concerned, the answers we received reflect the low energy efficiency of the housing stock. According to our findings, 67% of the dwellings have double glazing, just 29% of the dwellings have thermal insulation on the external walls since they were built, and 9% has external thermal insulation. Furthermore, 26% of the dwellings does not have any form of insulation, which may have negative impact on health and wellbeing.

Among other problems, people living in buildings without insulation are more vulnerable to extreme heat. Many households do not have an air conditioning system (19% in our survey) and many limit its use to reduce energy costs (51% according to our findings). Our survey indicates that 34% of the participants are not comfortably cool at home during summer. In this context, it is crucial to consider overheating risk and cooling needs.

Our findings, together with the findings about the Energy Performance Certificates, reflect the low energy performance of the housing stock in Greece and provide some reasoning for the problems households face to deal with their energy needs and secure thermal comfort at home.

3.2 Dwellings' Energy retrofitting

3.2.1 Owner-occupied dwellings

The respondents that own their home were asked whether they have implemented any energy retrofitting interventions at their dwelling during the last three years. The responds we received reflect the low rate of energy retrofitting of residences in Greece. In specific, according to our findings, 18% of the sample have invested on solar water-heaters, 14% have invested on a new heating system, 14% on new window frames, 13% on thermal insulation and just 2% on renewable energy sources other than solar water-heaters. The rates for improving dwellings' energy performance in Greece are low even in a longer term, as for example, according to Eurobarometer, 24% of the sample have insulated their homes to reduce energy consumption [17]. Low rates of energy retrofitting probably reflect lack of awareness, but mainly lack of private funds. Also, according to our findings, there is a slight correlation (at 95% confidence level) between households' income and the application of energy saving interventions. It is more likely that people with higher income apply energy saving interventions at their dwellings. In the same context, it is interesting that among households without any energy interventions in

their dwellings, just one quarter belong to the higher income classes.

Furthermore, we asked our respondents whether they plan to spend money on any sort of energy interventions at their dwelling and 62% of the sample replied that they do not intend to implement any intervention. Considering the low energy performance of the housing stock and the high energy costs for households, this finding shows that the lack of funding hinders renovations, as it is shown by other similar surveys [18, 19]. Apart from Greece, funding is the main barrier for energy retrofitting in other European countries [20, 21, 22]; a fact that highlights the importance of developing relevant policies, not only in the national, but also in the European level.

As far as the type of energy interventions that homeowners intend to implement, 46% plan to invest on insulation, 32% on new window frames and 29% on new heating system; interventions that require significant funds to be implemented and so reveal the willingness of households to improve the energy performance of their dwellings significantly.

3.2.2 Rented dwellings

The share of people renting their homes in Greece is 26,7%, slightly less than the EU average (30%) [16]. We asked the tenants of our sample to state the most serious problem of their residence regarding the energy performance. Our findings reveal that the energy performance and more generally the quality of the housing stock available for long-term rentals is low; a finding that is aligned with the situation in other European countries and reflects the *landlord-tenant problem* [23]. Just 18% of the tenants of our sample declared that there are no problems with the energy performance of their dwelling. On the other hand, 21% of the tenants of our sample identified lack or low-quality insulation as the main problem, 17% lack or low quality of the heating system and 17% low quality of the frames of windows. In this context, it is interesting that 26% of the tenants would like to change home due to the low energy performance of their dwelling. Taking into account the extent of the energy performance problems in the rental sector, we could assume that the intention for residential mobility would be higher if the prices in rental market were more affordable [12].

Moreover, according to our survey, homeowners invest less (by 30-40%) on rental than on owner-occupied properties. Usually, interventions of energy retrofitting on rental properties are less costly and so less effective. This means that rented dwellings often have lower energy performance than self-occupied ones and expose tenants to lower living conditions and higher energy costs. This is also reflected on the answers we received about the impact of the dwelling's energy performance on the decision to rent it. Almost 68% of the tenants of our sample replied that the energy performance of their residence did not have an influence on their decision to stay there.

According to the recent literature, tenants in Europe live in homes of worse quality and efficiency than

homeowners [4]. In Greece, we could assume that the limited investments on rental properties are related with the structure of the Greek homeownership system and the dominance of small ownership [24]. Landlords use the revenues from the rents mainly as a support to family budget, rather than as capital for reinvestment on renovation. However, low investment rates on rental properties might play a positive role in rent control in an era that rents have skyrocketed [12]. Evidence from the city of Thessaloniki shows that there is no significant impact of renovation on the rental price per square meter [15].

3.2.3 Apartment buildings

According to the official data, almost 45% of the housing units in Greece are flats in apartment buildings [10]. The majority of these buildings is old (more than 40 years old) and inevitably has low energy efficiency performance.

According to our survey, just 7% of the respondents that live in an apartment building declared that some sort of energy efficiency interventions that affect the entire building has been implemented. In specific, 67% of them stated installation of insulation, 37% replacement of window frames and 33% installation of a new heating system.

In many cases flat owners invest on the energy retrofitting of their homes individually (window frames replacement, installation of external insulation, individual heating system etc). However, the most effective way to improve the energy efficiency of flats and the social cohesion of the buildings is to make interventions on the entire building.

3.3 Policies about energy retrofitting

3.3.1 Access to subsidies for energy retrofitting

We asked our respondents to state whether they had access to the Exikonomo renovation programme promoted by the Greek government in the last two years. Just 3% of our sample declared that they benefitted from this programme in order to improve the energy performance of its dwelling. In any case, the vast majority of the households did not receive any support for energy retrofitting, despite the fact that the housing stock in Greece is old, with low energy performance standards.

Considering that very few of our respondents had access to renovation subsidies, we cannot draw firm conclusions about correlations with the social and financial profile of the beneficiaries. However, questions arise regarding the correlation between access to the subsidies of Exikonomo programme and households' annual income, as, in order to apply for a renovation subsidy, households must have secured funds to cover the rest part of the investment; a fact that could be a barrier for poor families.

3.3.2 Perceptions about energy policies

A large part of the respondents (67%) considers regulating energy prices as the most effective measure that could be taken by the state to support households to deal with their energy needs. Moreover, almost half of the respondents (52%) consider the benefits of the state for energy consumption and the discounts of energy providers helpful, as they reduce the pressure to family budget in an era of extreme increase of prices. On the other hand, just 31% of the sample considers subsidies for heating oil an effective solution to households' problems, as it is a measure with several deficiencies and weaknesses [14]. As far as the policies for improving the energy performance of residences is concerned, many households consider subsidies for energy retrofitting of dwellings (43%) and for acquiring domestic equipment of high energy class (40%) suitable measures during energy crisis. Although a large part of our sample is aware of the importance of developing policies about improving the energy performance of residential buildings, many do not acknowledge the benefits of energy retrofitting interventions; a finding that seems to be similar with the case of other South European countries [20]. This means that it is necessary to launch campaigns for informing households about the benefits of energy retrofitting and encouraging them to invest on energy saving interventions.

4 Conclusions

Climate crisis, together with the energy crisis that started in 2021, have highlighted issues related with the energy performance of dwellings in Greece. Our survey unpacks aspects of the challenges households face with regards to the energy performance of their dwellings and discusses crucial points that arise from the analysis of households' experiences, practices and perceptions that we collected.

The energy efficiency of a large part of the dwellings is low. This has an impact on the living standards and at the same time increases energy consumption and thus energy costs; a finding that is also related with the rise of energy poverty in Greece [14]. Considering the extent of the problems with dwellings' energy performance, interventions that improve the energy efficiency of residences are relatively limited, mainly due to lack of private funds and the unaffordable costs. Another important finding is that investments on improving the energy performance of apartment buildings are also very limited and this poses questions about the sustainability of this type of residential building. Finally, our survey shows that subsidies for improving the dwellings' energy efficiency do not have a big impact on the quality of the housing stock, but also that awareness about the benefits of improving the energy efficiency of residences could be higher.

Although most of our findings present a homogenous distribution in our sample, some were slightly or strongly correlated with the households' social profile and the tenure status of the dwelling. For example, households that face problems with covering their energy needs are

more likely to live in a dwelling of low energy performance than those who do not have problems; a finding that is in line with the outcomes of other research projects and policy reports [e.g. 25] and highlights the interrelation between energy deprivation and energy performance. Also, tenure status seems to be a crucial factor not only for the energy performance of the dwelling itself, but also for the interventions of energy retrofiting. In specific, homeowners invest more often on the energy retrofiting and implement more effective interventions on self-occupied dwellings than on rented residences; a finding that highlights the vulnerability of tenants and their exposure on the impacts of low energy performance buildings.

The results of the analysis provide useful information to policy makers and show that it is necessary to rethink policies for the energy efficiency of the housing stock in Greece in the context of the “green transition”. The extent of the problems stresses the importance of urgent action, while the interrelation with social and economic factors highlights the need to develop policies that respond to the particularities of the housing stock and climate conditions. Special emphasis should be given to measures that improve the energy efficiency of rental dwellings, while at the same time keep rents in an affordable level and prevent the so-called *renoviction*. Moreover, priority should be given to promoting the energy retrofiting of entire apartment buildings, rather than individual flats. In order to develop effective policies in this direction, it is important that policymakers consider thoroughly the particularities of the apartment buildings and especially multi-ownership, multifunctionality and social diversity [26]. The targets of European energy policy have become more ambitious regarding energy saving in the residential sector. Hence, considering issues highlighted in this paper is important for reaching these targets without increasing social inequalities and trigger negative side effects. Last but not least, policies for improving energy efficiency should prioritize low income and energy deprived households; e.g. households that suffocate the most due to the low energy performance of their homes.

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