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INVITED PAPER

Energy efficiency trends in the Greek building sector: a participatory approach

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Abstract

Energy efficiency (EE) is one of the most effective ways to reduce energy consumption, secure the energy supply and achieve a country's environmental targets while preserving business as usual in most economic sectors. In order to achieve efficient energy use, updates to industrial processes, building stock and other sectors are needed, and, thus, capital should be redirected to energy efficiency investments. Nevertheless, project developers usually struggle to find finance for their project ideas since there is a knowledge gap between them and financing institutions, who, most of the time, have no technical background to assess the profitability that emerges from the multidimensional benefits of energy efficiency measures. An analysis of the current situation, while also identifying the main barriers and difficulties that policymakers and EE professionals are facing, is crucial to developing a feasible plan for increasing EE measures in the building sector. The aim of this study is to analyse the EE situation in the Greek building stock by utilizing a stakeholder engagement approach involving highly relevant key actors, gathering their input, and depicting it in statistical analysis. The results of the study reveal that the building's EE profile is considered an asset for long-term capital investments, while a lack of capital, high costs and the pandemic of 2019 compose some of the major factors that hinder the implementation of EE measures.

Keywords Energy efficiency · Building sector · Stakeholder involvement · Participatory approach · Semi-structured interviews · Greece

Introduction

Increasing energy efficiency (EE) is assumed at the European level to be a cross-cutting strategic objective for protecting the environment and reducing the impact of climate change, improving the quality of life, and reducing the European Union's (EU) dependence on external oil and gas suppliers (Cooremans and Schönenberger 2019).

The building sector is considered of substantial importance in Europe, as it is responsible for 40% of the energy consumption and 36% of greenhouse gas emissions (GHGs), which can be predominantly ascribed to the construction, usage, renovation, and demolition of buildings (EC 2019). These trends are expected to evolve, assuming that the energy demand from buildings and their construction rate continue to follow the current trajectory, thus creating an enormous untapped efficiency potential (IEA 2020, 2021).

EE investments in buildings have a direct effect on reducing energy consumption, which contributes towards achieving the EU's energy and climate objectives for 2030 and 2050, while also driving economic growth (Mexis et al. 2021). In this respect, nowadays, more than ever, boosting the implementation of energy efficiency measures (EEMs) in buildings and subsequently mainstreaming EE financing are of significant importance for the EU in respect to achieving its ambitious goal of carbon neutrality by 2050 (Doukas 2018; Papapostolou et al. 2020a).

Greece, in particular, has set ambitious objectives in the National Energy and Climate Plan (NECP) (Greek Ministry of Environment and Energy 2019), while the budget for energy efficiency for the period 2020–2030 is estimated to be 11 billion euros. At the current stage, Greece is concerned with identifying the best ways to promote actions

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and support the necessary processes using both national budgetary resources and the financing framework available from the European Green Deal and the EU Recovery and Resilience Mechanism. Green investments and the digital transition are the two key drivers of Greece's recovery plan. Of the €30.9 billion in grants and loans earmarked to Greece through the EU's pandemic recovery package, approximately 20% of this amount has been assigned to green power projects, equivalent to some €6 billion. When private investments are factored in, the budget for clean energy projects increases to more than €10 billion.

However, according to the latest report of the European Investment Bank (EIB 2021), Greece ranks together with Cyprus and Ireland in the top three EU countries with the lowest private investments in 2021 in energy efficiency, while Greece also has a low share with regards to plans to make investments in energy efficiency. The current levels of investment in sustainable energy are not sufficient to meet Greece's 2030 climate and energy targets (Theodoridou et al. 2011). For this reason, smart financing mechanisms are needed to support large-scale and long-term investments, especially in buildings and industry.

Energy efficiency investments include complex procedures and are subject to various risks and uncertainties, which may affect involved entities' profitability, and so there is a need to examine different an approaches and tools to support their decisions. Coordinated efforts are required, with multiple stakeholders from various sectors and target groups, to contribute to the development of innovative and sustainable solutions. On the other hand, stakeholder engagement is considered a crucial component of all decision support processes (Phillipson et al. 2012).

Dialogue or exchange with stakeholders is a very enriching experience, as it allows scientists or researchers to be exposed to different views, approaches, and expectations for project results (Karakosta and Fujiwara 2020). The involvement of key stakeholders is considered necessary in order to obtain an alternative perspective which stimulates the scientists or researchers to shift the focus from related activities to intended results at an early stage (Karakosta and Papapostolou 2020).

A participatory approach can be used in various sectors as a key instrument to gather input, and with quantitative and qualitative data. However, the type and level of stakeholder involvement will necessarily vary between different types, ranging from the provision of information to co-creation and genuine collaboration and proactive involvement in outcome delivery and decision-making processes (Haddaway. 2017). In this respect, it is important to consider the purpose of involving stakeholders, and how and which stakeholders should be involved, in order to maximize the effectiveness of the approach.

The present manuscript aims to propose a methodology that may boost the implementation of EE investments in the building sector. This study aims at analysing the Greek building stock situation with respect to EE implementation by utilizing a participatory approach involving gathering the input of highly relevant stakeholders and depicting it in statistical results. It also explores the current EE conditions of the Greek building stock, along with the latest updates and trends regarding the policy framework and market architecture that support the implementation of potential investments in the building sector. The results of the research point to the main barriers and difficulties that policymakers and EE professionals are facing when developing a feasibility plan for increasing EE measures in the building sector.

Current status of the Greek energy efficiency market

The present section presents the current EE market structure for Greek buildings in order to give a good overview of the strengths and weaknesses of the sector.

The Greek Ministry of Environment and Energy indicated that 55% of residential buildings in Greece were constructed before 1980, i.e. they have no thermal protection, and due to the economic recession of 2007–2008, the number of buildings built after 2010 in accordance with the minimum requirements laid down in the national Regulation for Energy Performance in the Building Sector (KENAK) represents only 1.5% of the total stock of ordinary residential buildings used by households (Greek Ministry of Environment and Energy 2010). KENAK outlines the general calculation method and overall approach that is in accordance with European standards. It introduces the use of a reference building for benchmarking, the requirements for energy performance certificates (EPCs) based on an asset rating accounting for heating, cooling, ventilation, SHW and lighting, the minimum energy performance requirements, and thermal envelope heat loss constraints. It should be highlighted that the Greek regulation introduced mandatory thermal insulation of new buildings after 1980, and this is one of the main reasons for the poor EE of older buildings (CRES 2018; Theodosiou et al. 2020). Furthermore, just a minor change in EE in buildings has been observed, while the building sector, which consists of the residential and tertiary sectors, consumed 44% of the final energy in Greece in 2019 (Pallis et al. 2021).

Greece has legislated various laws, strategic plans, and actions for increasing the country's EE in buildings, small and medium-sized enterprises (SMEs), industry, and other sectors. The existing framework for mandatory energy audits on large enterprises will promote similar audits on SMEs and households (Greek Ministry of Environment and Energy

2018). Furthermore, incentives for large enterprises, SMEs, and households to implement the energy-saving measures proposed through energy audits will be established. New measures will be developed to support the implementation of energy management systems in SMEs in order to keep improving their EE, including the design and implementation of EE auctions, a measure which was foreseen in the National Energy and Climate Plan (NECP). This measure is expected to focus on achieving final energy savings, thus making a significant contribution to achieving the objective of Article 7 of Directive 2012/27/EU to improve EE. It will also provide financial support for energy-saving technical interventions in sectors with high potential, such as the industrial and tertiary sectors.

The Long Term Renovation Strategy (LTRS) for the renovation of the building stock aims to ensure the technical-financial analysis and determination of optimally efficient measures for attaining the high renovation rate set for the building stock (Greek Ministry of Environment and Energy 2019). Similarly to the NECP, the latest edition of the LTRS was submitted in March 2021, and it suggests that the financing programmes for the renovation of both residential and tertiary sector buildings in the context of the new programming period will be implemented by adjusting and improving the existing financing model, with a view to increasing the existing leverage levels by beneficiaries.

The current situation for the Greek building stock and the insufficiency of its performance with regards to EE demonstrates a wide absence of a common framework for the design and standardization of such measures (Mexis et al. 2021). The main risk that halts EE measures from being implemented is the financial risk, followed by the energy market and regulatory risk (Kleanthis et al. 2020; Karakosta et al. 2021). Additional risk factors constitute the absence of proper education, technical expertise, adequate certification of the technicians and blue collar workers involved in the construction, and the consent of building property owners for these developments, the lack of appropriate works certification, and the frequent defects in constructions (Manoloudis and Papadopoulou 2020).

Another important factor that affects a significant proportion of the stakeholders in the EE market is the impact of fluctuating energy prices on the profitability of energy efficiency investments (Koutsandreas et al. 2022; Loureiro et al. 2020). The latest energy crisis has augmented this issue, creating uncertainty in the estimated cashflows of EE projects and perturbing the profitability of these kinds of investments (Bagaini et al. 2020; Karakosta et al. 2021).

More active involvement of stakeholders at local and regional levels will be ensured. Initially, this could be done by drawing up both Action Plans for Sustainable Energy and Action Plans for Energy Efficiency of Buildings under the responsibility of regions and municipalities. Then, a second step is to implement the proposed interventions with support from targeted financing programmes under regional operational programmes Karakosta and Papapostolou (2020). The focus should be given to actions aimed at ensuring that the energy communities scheme contributes to both the use of waste (electricity) or biomethane (transport) and the implementation of energy-upgrading projects by the use of recyclable materials.

Analysis of the participatory approach

Stakeholder engagement approach

To ensure the effectiveness of EE financing in the building sector, it is important not only to identify all the relevant target groups, but also to understand what type of effort and messages should be used to reach each one of them (Papapostolou et al. 2020b). In that regard, well-defined consultation activities should be proposed, including specific and concrete actions, in order to ensure the active participation of the identified stakeholders. This section provides an overview of the stakeholder engagement approach that was followed in order to obtain the research results, as well as the implementation of a dedicated survey in order to achieve it.

The key stakeholders that participate in the entire EE investment value chain are the ones that may provide the knowledge required to achieve the objective of implementing EE investments in the building sector (Haddaway et al. 2017; Karakosta et al. 2021). The aim is to identify all the relevant groups, organizations and experts in the building sector's EE financing. This list was developed with a view to providing a balanced professional, institutional and geographic representation of stakeholders.

For the purposes of the particular stakeholder consultation process, a three-step methodological approach was followed in order to ensure the active engagement of all the involved parties (Fig. 1).

Step I: stakeholder identification

In this step, a list of relevant groups is compiled. The identification procedure uses basic information about the entity, its role and a short description of activities relevant to the topic, and its range of energy EE activities (experience with various types of EE projects—financing schemes, technologies, etc.). In this way, a balanced professional, institutional and geographical representation of each stakeholder is ensured.

The stakeholders are categorized into (A) investors, (B) project developers, (C) policy makers, (D) research and academia in business and techno-economic fields, and (E)

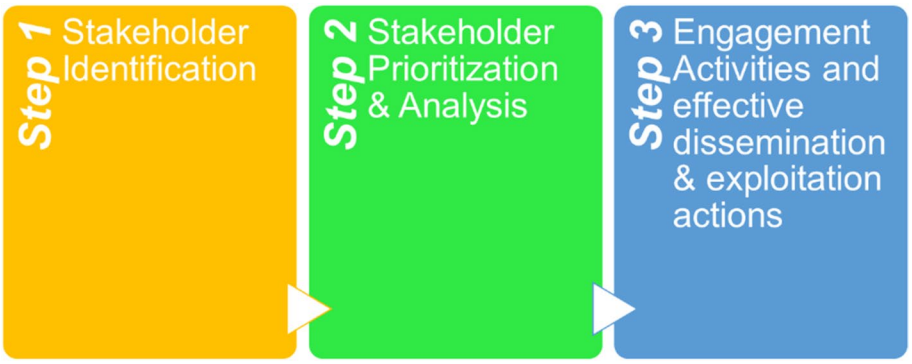

Fig. 1 The three-step participatory approach

Table 1 Stakeholder prioritization scale

		Interest		
		Low	Medium	High
Power	Low	I	I	II
	Medium	I	II	III
	High	II	III	III

other bodies such as technology suppliers, real estate agents, technical chambers, etc.

Step II: stakeholder prioritization and analysis

Ranking stakeholder relevance according to their expertise, interest, power, influence and commitment helps to ensure proper engagement. Stakeholder interest relates to the capacity to contribute inputs focusing on EE financing. Power is associated with the stakeholder's ability to overcome barriers in EE projects, particularly in terms of policy, financing and project implementation (Hujainah et al. 2018).

Within the two categories of power and interest, stakeholders are ranked as either "low", "medium" or "high". The three levels of power and interest are assigned, and their combination determines their overall importance: either I (low importance), II (medium importance) or III (high importance) (Table 1).

Step III: engagement activities and effective communication

The stakeholder engagement activities are designed to allow a continuous exchange of information and to pave the way for cooperation and exploitation opportunities. Their goal is to collect information, share experience, provide guidance, exploit results, and review tools and methodologies.

The engagement activities for the Greek case have been differentiated and adjusted according to key messages and target groups, and they vary from bilateral consultation to dissemination actions. They can be classified into exploitation and dissemination activities. The exploitation activities focus on active stakeholder engagement and continuous cooperation via the utilization of targeted outcomes and the incorporation of feedback for further enhancement of the outcomes. On the other hand, dissemination activities focus on publishing and promoting outcomes (Table 2).

Stakeholder identification and prioritization

The basic steps of the stakeholder engagement approach facilitate the identification and prioritization of the key Greek actors that are involved in and benefit from EE investment promotion. These stakeholders should be engaged through the various predefined activities. In this context, an extended stakeholder list was examined, including 136 Greek stakeholders relevant to the fields of energy, climate and sustainable finance from different kinds of institutions.

The list with the identified stakeholders consists of Greek key actors that may benefit from the study and should be contacted and engaged accordingly (Fig. 2). It is obvious that investors and project developers are the major recipients in the field of EE financing. Additional target groups—which focus on different levels of the EE financing concept—include policy makers, research and academia, and other groups, whose main goals are to build more certain, efficient, and stable conditions and guidelines and to design innovative financing tools and methodologies for the implementation of EE investments. After identifying the key professionals to be engaged, they are prioritized according to their power and interest (Fig. 3). Prioritization indicates that the overall importance (which corresponds to the combination of power and interest) of more than half of the stakeholders identified is either "high" or "medium".

After identifying and prioritizing the most relevant Greek stakeholders, several dissemination actions from the previously presented list were reviewed in order to pinpoint the

Table 2 Identified stakeholder engagement activities

Type	Action	Target groups
Disseminations	Online and printable material: brochures, factsheets, leaflets, posters giving basic and general information about the project methodology, objectives, contact details, etc.	A, B, C, D, E
	Media coverage: videos, infographics, helping stakeholders and the wider public to focus on the key information and save time needed for reading	
	Online presence (website, social media): use of official website, Twitter, LinkedIn, Instagram and YouTube in order to raise awareness, communicate project advances on a daily basis, and enhance web publishing actions for non-technical users in an efficient way	
	Newsletters/press releases: released and distributed to project subscribers in order to promote project technical outcomes and promotional activities, such as events, media presence, etc.	
	Publications: articles in blogs, online platforms and magazines, scientific papers, conference proceedings	D, E
	Organization of and participation in training workshops/webinars/conferences: targeted events are organized in order to raise awareness, further disseminate project outcomes and encourage stakeholder participation in the exploitation of the project outcomes	A, B, C, D, E
Exploitations	Bottom-up consultation process: this action includes questionnaires, bilateral meetings and interviews performed in order to extract valuable knowledge and input	A, B, C
	Capacity-building webinars: implementation of capacity building webinars to share knowledge relevant for financing EE projects in Greece and in Europe	
	Regional training workshops: regional training workshops to exchange experience, stimulate the interest and participation of key stakeholders, and facilitate a dynamic dialogue so as to share common tools and instruments for EE investments	
	Standardized tools: tools facilitating the assessment of EE project ideas for the identification of feasible and sustainable EE investments, with the aims being to reduce the respective time and effort required as well as to increase the transparency and efficiency of the respective decision making	A, B, C, D, E
	Knowledge database: integrate and illustrate (through interactive maps, graphs, etc.) the results from the status quo analysis and the elaboration/categorization of the financing instruments and risk mitigation strategies in Greece, thus allowing stakeholders to find the information they need in one place	

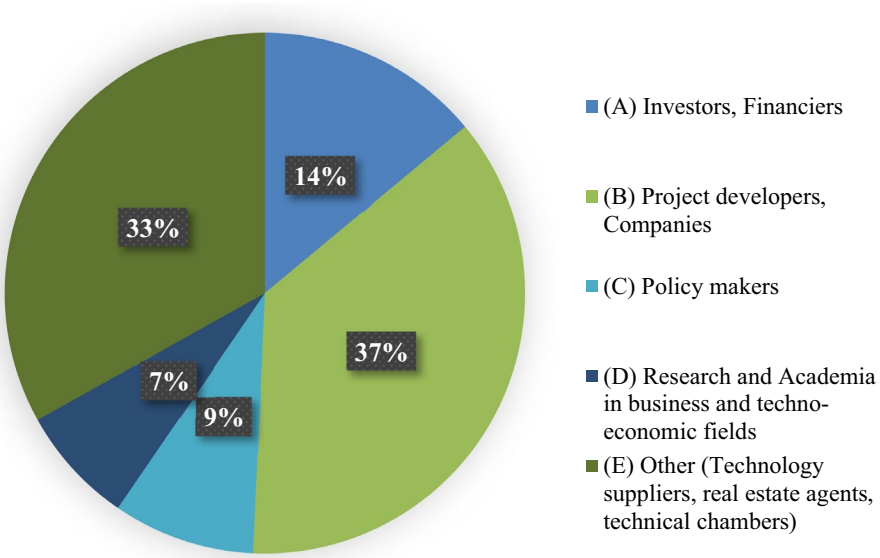

Fig. 2 Greek Triple-A stakeholder categories and shares

activity that could assist in deriving fruitful outcomes related to the implementation of EE investments in the Greek building sector.

Engagement activity: survey of the energy efficiencies of buildings

In order to extract specific input on the EE trends in the Greek building sector, the primary tool of the proposed methodology utilized in the present study is an online survey

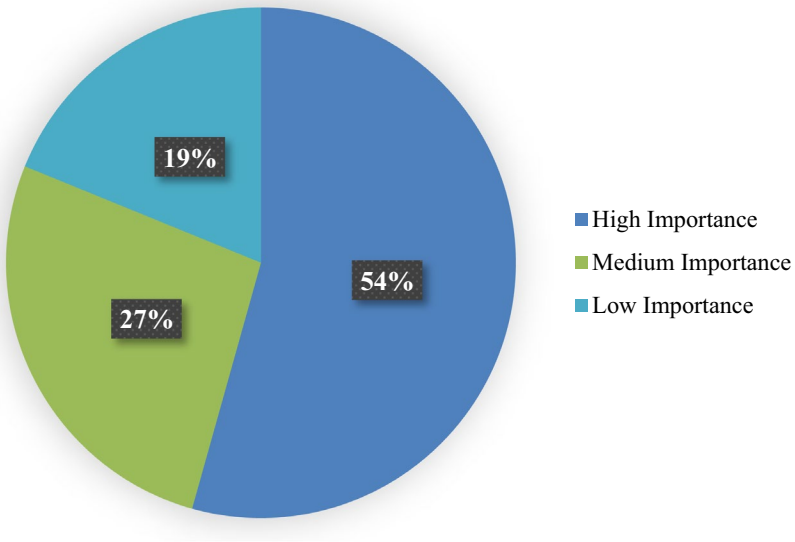

Fig. 3 Greek Triple-A stakeholder prioritization

designed and developed to gather feedback on EE and market-related aspects of the Greek building sector. This online questionnaire was disseminated to Greek stakeholders after a personal invitation, and 77 replies were gathered. The participating stakeholders are Greek energy associations, bankers, members of the Association of Greek Valuers, project developers with building stock portfolios, property valuers, real estate agents and notaries.

The questionnaire's main objective was to outline the link between a building's EE performance and its value in the real estate market and to evaluate the added value of implementing EE investments in the building sector. Also, part of the questionnaire was dedicated to receiving input regarding existing state-of-the-art energy efficiency financing tools. The study results can be exploited to fine-tune and advance existing EE financing online tools and help them extract accurate results that are in accord with stakeholders' needs and priorities.

The survey gathered the target stakeholders' points of view about:

- The current building stock situation in their portfolios;
- Their behaviour towards EE upgrades in buildings;
- The correlation between EE upgrades and the value of property;
- The risks that could affect the successful implementation of EE projects in the building sector;
- The contribution of the projects' risk assessment and benchmarking tools to the real estate sector;
- The functionalities and specifications of those tools;
- The areas in which the tools could create added value compared to the current tools utilized in the real estate sector.

Results and discussion

This section provides a discussion of the results of the survey along with a comparative analysis using related studies in the field.

Survey results in the Greek building sector

An analysis and graphical visualization of the data and information collected by the survey were conducted, providing useful insights into the impact of EEMs in the Greek building sector.

The first section of the survey was related to the behaviour of the stakeholders towards EE in buildings. Questions focused on the attitude of people that are interested

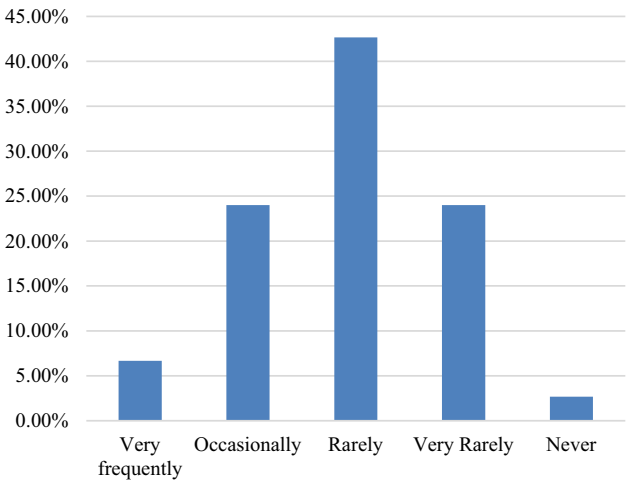

Fig. 4 Willingness to pay a higher price for efficient buildings

in buying or renting a property. As displayed in Fig. 4, a buyer or renter is rarely willing to pay more for an upgraded building with EE measures. These measures include efficient framing of windows and doors, modern oil burners, insulation, etc. Also, the results show that, although clients are aware of EE in buildings, they are willing to pay more for other aspects of an asset, such as its location or age. Moreover, the clients are split approximately half-and-half between those who express that they are in favour of EE measures in a building and those who have no interest in such measures. This result could explain the poor efficiency of most Greek buildings, as shown. As long as there is a limited percentage of highly efficient buildings, clients from the general public have no option and/or find no reason to pay more for an EE building, as the available stock pertains from low to deficient EE categories.

With regards to the increase in property values that EEMs provoke, envelope retrofits constitute the highest EE upgrade correlated to an increase in property value, followed by lighting appliance retrofits (Fig. 5). On the contrary, measures related to district energy networks have the lowest correlation to the asset price, most probably due to the low popularity of such infrastructure in Greece.

Concerning the main risks that could affect the successful implementation of EE projects, the financial risk was recorded as the most critical, followed by the energy market and regulatory risk (Fig. 6). The absence of proper education, technical expertise and adequate certification constitute the most important risk factors, which are mainly classified into the "technological, planning and operational" risk category.

Another topic covered through the questionnaire was the major factors that discourage building owners from implementing EE measures. As illustrated in Fig. 7, the most significant obstacles are linked to financial aspects of the implementation of EE measures. Based on the answers, the main factor is a lack of capital (40%), followed by the high cost of EE measures (37% of the sample). The final factor was a lack of knowledge (15%). These results confirm the EE gap phenomenon and the necessity of mainstreaming EE financing, as the financial difficulties (high cost and a lack of capital) are invoked in 77% of the responses. A lack of standardized EE finance pathways and underwriting procedures combined with a lack of knowledge are the primary reasons for the EE gap, as identified in plenty of scientific publications and EU project reports (Cooremans and Schönenberger 2019; EEFIG 2017; Karakosta et al. 2011).

Stakeholders were also asked for their opinion regarding the impact of the pandemic of 2019 on the real estate sector. Most of the responders expressed their belief that the pandemic imposed an impact on the real estate sector and affected it to some (47.4%), a moderate (21.1%), a small (18.4%), or a large (10.5%) extent. An absence of negative results of the pandemic of 2019 was observed by a relatively low share (2.6%) of the responders (Fig. 8).

The final stage of the survey was related to the responders' beliefs regarding the presence of state-of-the-art financing platforms, which were significantly positive. Around 75% of the participants stated that they found the related platforms extremely or very useful. Moreover, moderately positive responses were expressed by almost all of the rest of

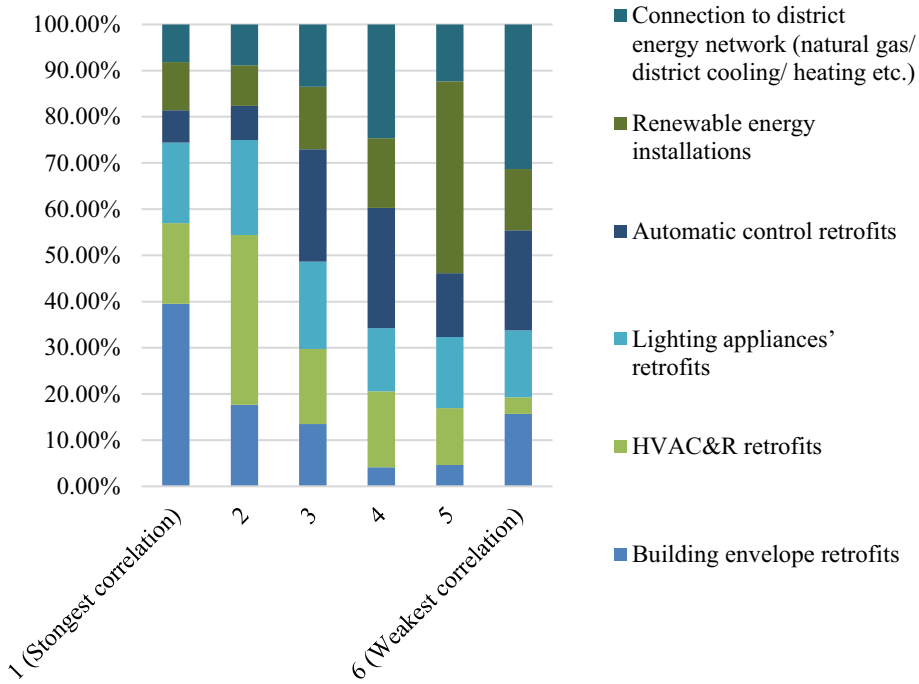

Fig. 5 Correlation between EEM and the asset price

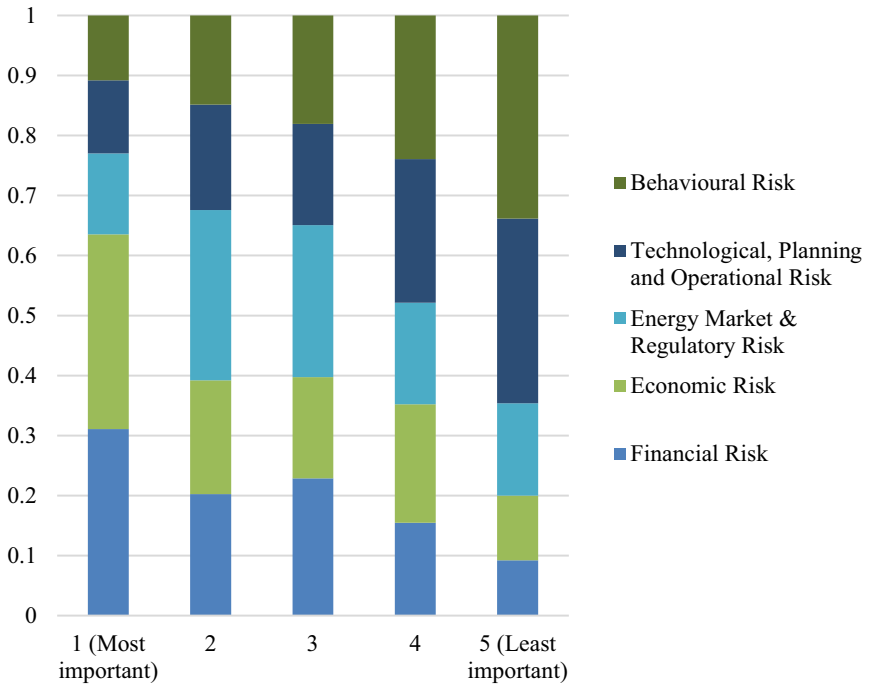

Fig. 6 Importance of the most popular risk categories in EE financing

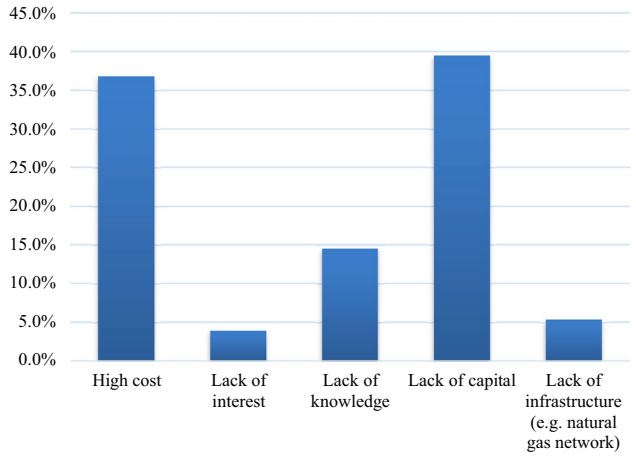

Fig. 7 Key barriers hampering the implementation of EE measures in buildings

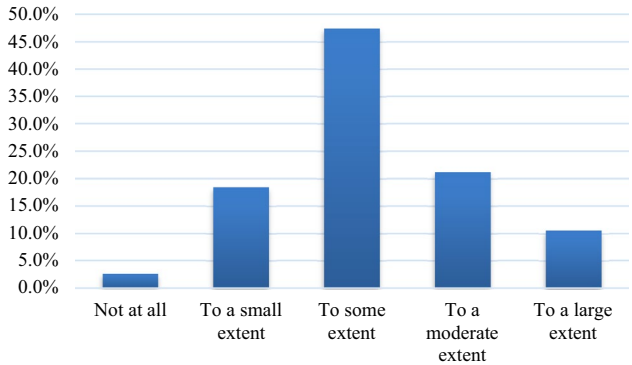

Fig. 8 The impact of the pandemic of 2019 in the real estate sector

the responders (24%), excluding a minor proportion (1.3%) who did not find them useful at all (Fig. 9).

Comparative analysis

In the literature, several studies have been conducted to explore the factors that affect or hinder the implementation of EE measures in the building sector, along with the strategies to be followed to encourage their adoption. However, to the best of our knowledge, and based on the research conducted with regards to the Greek case, there are relatively few studies that discuss EE in the Greek building stock. The

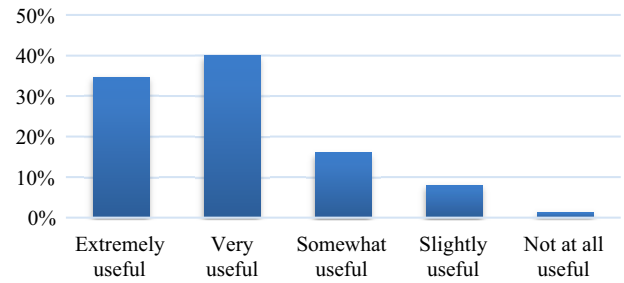

Fig. 9 Respondents' perceptions of state-of-the-art financing platforms

most relevant studies are elaborated in this section, and their highlights are compared with our study results.

Pallis et al. (2019) examine the interdependence between cost optimality and the energy performance of nearly zero energy buildings (NZEB) by calculating the investment as well as the operating and maintenance costs for a wide range of EE measures. According to the results, while some intervention packages involving heat pumps have the lowest energy consumption, their payback periods and life cycle costs range from medium to very high. It can be, thus, concluded that the high initial capital costs of these measures constrain their cost effectiveness, despite their high efficiencies, and this may hinder their implementation. In our approach, and in order to examine the EE measures more deeply, we also tried to correlate them with the property value. From our survey, it is clear that building envelope retrofits constitute the EE upgrade with the highest correlation to the increase in property value, followed by HVAC&R and lighting appliance retrofits. On the other hand, the outcomes of our study show that a poor EE class of a building (i.e. the building has only minor EE upgrades) is not considered a decisive factor for rejecting a property (to buy or rent).

Focusing on the regulatory framework, Gaglia et al. (2017) studied how the implementation of the new energy performance regulation of buildings (REPB) has resulted in increased building construction. According to their findings, the implementation of this particular regulation imposed improvements in the thermal protection of the building envelope and the performance of the electrical and mechanical systems. Meanwhile, according to our study, it could easily be observed that the vast majority of Greek building owners would not assess their asset's energy performance by having an energy performance contract (EPC) if they were not obliged to by law.

With regards to policy-related parameters, Kerr et al. (2017) demonstrated that the design and adoption of strategies regarding the energy upgrading of buildings can be successful under certain conditions. However, although a variety of different interventions exist, they are still at an experimental stage, while impact assessments of EE programmes and relevant financing tools, in general, are rarely directly comparable. Criteria and measurement indicators for evaluating the results of the programmes are neither uniform nor adopted with strict acceptance criteria. This fact is in accordance with our responders' perspective, since they declared that they rarely use relevant tools in the building sector due to their limited usefulness. However, if a well-designed platform existed, the majority of them would be willing to use it. Within the same framework, the findings of Tziogas et al. (2021) revealed that a financing tool and energy-saving programme need precise targeting of eligible potential beneficiaries. Financing tools targeting non-carbonized households and buildings require management skills and appropriate policy support.

Examining the risk dimension of EE implementation in building, Bagaini et al. (2020) assessed the main economic, institutional, and behavioural barriers through a survey. According to the results, economic barriers are the most relevant in limiting the development of technologies and interventions, while behavioural barriers have a high relevance to limiting technology diffusion. This result is in accordance with our study's outcomes, which revealed that among the main risks that could affect the successful implementation of EE projects, the financial risk was recorded as being the most critical, while a lack of capital and high costs comprised the major factors that hinder building owners who wish to implement EE measures.

Conclusions

Within the framework of the present study, an approach based on a stakeholder engagement process was developed and applied in order to explore opportunities that promote and barriers that hinder the implementation of EE investment in the Greek building sector, and to provide recommendations for promoting them to the key actors involved, such as the financing community, real estate sector, energy sectors, etc.

After identifying and prioritizing the key players in the Greek EE market, several engagement approaches were explored in order to elicit their knowledge and make use of their experience to derive tangible results. A survey was conducted, the results of which provided important information on the key drivers of the adoption of the relevant investments, the types of investments that increase the value of a property, how the pandemic of 2019 has affected the real estate sector, risk and barriers that hinder the implementation.

Based on the research conducted, it seems that the potential for energy savings in the Greek building sector is quite high, while—based on the responses—the EEMs implemented in a building are a crucial influence on the property value. For instance, a building's EE profile is considered an asset for long-term capital investments, while EE upgrades result in a price increase in the case of selling or renting a property.

However, EE is rarely identified as a specific priority by investors in the country, as it is often just one element within the wider scope of green, sustainable financing, and thus receives insufficient attention. According to the stakeholder responses, some of the major factors that obstruct building owners from implementing EE measures are a lack of capital and the high costs involved, while the pandemic of 2019 has

affected the building real estate sector to a moderate extent. The analysis indicates that in Greece, although most companies view energy transition investments positively, they do not proceed to invest. Concerning the main risks that could affect the successful implementation of EE projects, the financial risk was recorded as being the most critical, followed by the energy market and regulatory risk. Furthermore, the analysis indicates that rising energy costs risk putting a brake on the broader EE investment plans of the private sector. The perception of energy costs as an EE investment barrier has increased over the years.

However, Greece's commitment to the green transition requires the implementation of EE investments: this is one of the two key drivers of Greece's recovery plan. To head in this direction, a large number of actions are needed that aim at raising the sustainable energy uptake, expanding investments and facilitating the transition to a sustainable future. Indeed, investments should be steered towards EE to mitigate the EE gap and enable the transition to a sustainable economy. In an effort to achieve this, confidence has to be built between investors and EE professionals while addressing both parties' needs and establishing a common language. The heterogeneity and the immaturity of the EE market are barriers to the entry of financial institutions into the market, even though EE projects may be profitable and secure investments. According to the analysis conducted, state-of-the-art financing platforms could be very useful for supporting and boosting EE investments in the field. To this end, a one-stop shop is proposed that could transform the complex set of decision-making actions for building renovation and implementing EE measures into a user-friendly and single-entry ICT-enabled solution.

Furthermore, some conclusions regarding the approach that was used: the participatory approach proposes concrete steps that could be used in several problems related to EE to gather stakeholders' insights, needs and feedback and to outline the current situation and analyze the market in a particular country and Europe.

Finally, further research directions and recommendations could include the replication of this approach in other European countries, while a comparison of results would lead to interesting highlights and implications not only per country, but also for Europe as a whole.

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Declarations

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