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Abstract

Buildings in the EU consume around 40 % of energy and are responsible for 36 % of greenhouse gas emissions. This necessitates building energy renovations as a coping strategy for energy reduction. Residential buildings consume about 27 % of the energy use in Europe. Multifamily residential buildings, known as condominiums, feature individually owned apartments and are managed by Homeowners' Associations (HOAs). HOAs constitute a considerable percentage of the owners of the residential sector in Europe. However, the deep energy renovation rate is still low due to the complex process and the barriers faced by HOAs. There is a lack of understanding of the main barriers to undertaking deep energy renovation projects by HOAs and their potential solutions. Therefore, this paper investigates barriers, incentives, and possible solutions that motivate HOAs to undertake deep energy renovation projects. This study employs a combination of qualitative methods, including archival research, the gathering of information through observations at meetings organized by the EU, four interviews, and a workshop with eleven experts. This exploration was conducted from the perspective of three actors: home renovation providers, public authorities, and policymakers in the Netherlands and Flanders. The barriers are grouped under four categories, namely: financial, legal, social, and technical. The findings indicate that communication, cost, and legal structure are the most significant barriers. The incentives play a vital role only in the early phases of the renovation. The findings can inform policymakers, energy practitioners, and researchers in developing targeted strategies for successfully implementing deep renovation projects for HOAs.

Introduction

The European Union (EU) has set goals to reduce energy consumption and greenhouse gas emissions by 2050 (Tsemekidi Tzeiranaki et al., 2022). The European Commission has launched plans and strategies for boosting energy renovations for buildings to achieve the EU goals (EASME et al., 2023). About 75 % of buildings in the EU are energy inefficient, indicating that they require more energy than necessary for heating, cooling, and other functions when compared to buildings that comply with energy efficiency standards (Laffont-Eloire et al., 2019). The residential sector consumes about 27 % of total final energy consumption(Eurostat, 2021). Reducing energy consumption is crucial for the EU to achieve its carbon neutrality goal by 2050 (Fetting, 2020).

The undertaking of energy renovations to buildings has been recognized as a pivotal measure to address high energy consumption (Agliardi et al., 2018; BPIE, 2021). Energy renovations cover a wide range of building interventions, spanning from fundamental maintenance to comprehensive modernizations, aiming to improve energy efficiency (Bertoldi, Boza-Kiss, et al., 2021; Bagaini et al., 2022). Despite its potential, energy renovation's annual rate in the EU remains low at around 1 % (Tsemekidi Tzeiranaki et al., 2022). It needs to be increased to 3 % to reach the current EU goals (EASME et al., 2023).

Deep energy renovations often involve multiple tasks requiring coordination among stakeholders (Milin & Bullier, 2021).

Integrated home renovation services (IHRS) encompass a comprehensive approach that bundles various renovation services for homeowners (Cre et al., 2012; Milin & Bullier, 2021; Elgendy et al., 2023).

Across the EU, homeownership is prevalent, with 69.9 % of the population owning their homes (Eurostat, 2021). Acknowledging the diversity in regulatory frameworks and legal structures across different geographical regions in Europe, this paper specifically focuses on the Netherlands and Flanders. These regions are chosen due to their progressive policies in sustainable building practices (BZK, 2023; *Mijn VerbouwLening*), a high density of homeownership, and the regions' pioneering role in adopting energy-efficient practices making them ideal case studies for exploring, they are chosen for their similarities and proximity but distinct regulatory landscapes.

Homeowners in apartment buildings form legal associations responsible for building maintenance, often referred to as homeowner associations (HOAs), or in the Netherlands as VvE "Vereniging van Eigenaars" and in Flanders as VME "Vereniging van Mede-Eigenaars". These associations play a crucial role in decision-making for building maintenance and deep renovation projects (Feather, 1990). HOAs have specific decision-making structures led by an elected board and defined by bylaws, which dictate property use, maintenance, and voting rights for major decisions (Feather, 1990; Van der Merwe, 2016). Decision-making in HOAs often involves balancing the diverse interests of its members, with major resolutions requiring majority approval. This structured, collective decision-making process underscores the complexities of engaging HOAs in energy renovation projects. One of the key roles of a HOA, especially in larger complexes, is often managed by property managers also known as condominium managers that could be either a voluntary co-owner or a private individual who is hired by the HOAs. These managers represent the interests of all owners, dealing with issues ranging from property maintenance to communal decision-making. For smaller complexes, the HOAs might consist of just a few members who handle these responsibilities (Szczepańska, 2015).

In the Netherlands, about 125 000 HOAs are registered (CBS, 2023), while there are about 57 000 registered HOAs in Flanders (Syndi.be, 2023). The situation of HOAs there varies depending on the context and the legal framework. In the Netherlands, HOAs are legally required to have a reserve fund for maintenance and renovation and can benefit from subsidies and tax incentives for energy-efficient measures. In Flanders, HOAs are legally required to reserve a fund for maintenance and renovation, but HOAs can decide with a 4/5 majority not to create a reserve fund (Jalo, 2018; *Flanders – Building Renovation – Policies*).

Energy renovation projects hold great potential for reducing energy consumption, reducing energy bills, lowering greenhouse gas emissions, and improving the overall sustainability of buildings (Agliardi et al., 2018; BPIE, 2021; Končalović et al., 2022). Conversely, despite the evident benefits, HOAs often face numerous barriers that hinder their ability to undertake successful energy-efficient renovations (D'Oca et al., 2018; Mlecnik et al., 2019; Bagaini et al., 2020; Ebrahimigharehbaghi et al., 2022). IHRS providers with a clear understanding of project requirements can play a vital role in facilitating energy renovations for HOAs (Milin & Bullier, 2021; Elgendy et al., 2023; Mlecnik & Elgendy, 2023).

Several studies have uncovered barriers and drivers to energy renovations of residential buildings (D'Oca et al., 2018; Ebrahimigharehbaghi et al., 2019; de Koning et al., 2020; Bagaini et al., 2020; Pérez-Navarro et al., 2023; Prieto et al., 2023). Various European projects (Save the Homes, Padova Fit expanded, I-Heros, ProRetro, ACE-Retrofitting, Green Home) have also worked on identifying barriers and drivers for homeowners in the EU to undertake energy renovations (Luise & Vicentini, 2019; Eisermann et al., 2019; Estay et al., 2021; Passlack, 2021; Suerkemper et al., 2021; Kristina, 2022). However, there is a notable gap in addressing the barriers to energy renovations for HOAs from the perspective of IHRS providers. This oversight is significant, considering the pivotal role IHRS providers play in supporting HOAs throughout the entire renovation process.

Research question and problem statement

HOAs encounter a range of barriers when undertaking energy renovations for their buildings. While a substantial body of research has explored the barriers to energy renovations broadly, with a particular emphasis on individual homeowners, there is a notable gap in literature specifically addressing the unique context of HOAs. Given their distinct organizational structure and decision-making processes, HOAs represent a specialized group. This paper aims to methodically investigate and elucidate the specific barriers, incentives, and potential solutions that are pertinent to HOAs in the pursuit of energy renovations from the perspective of IHRS providers. Through this focused inquiry, the study seeks to answer the critical question: What are the main barriers, incentives, and possible solutions for HOAs in implementing energy-efficient renovations within their condominiums?

Data collection and Methodology

Data collection was carried out in stages. Initial assessments from project partners regarding stakeholders, their key barriers and drivers, combined with a literature review, revealed that while there is extensive knowledge, significant changes have occurred recently in various European countries. This implies that some information in the existing literature might be outdated. Consequently, we conducted an expert workshop to address the most crucial knowledge gaps. This study employed a systematic methodology to comprehensively investigate and categorize barriers to energy renovations for HOAs in Europe.

Firstly, a review of existing literature was undertaken to identify and map barriers and incentives for homeowners, encompassing both single-family and multi-family houses. Simultaneously, an in-depth analysis of relevant EU projects was conducted to augment the insights gained from the literature. This dual-pronged approach ensured a comprehensive overview of the identified barriers and incentives.

Our literature review used keywords like "barriers," "drivers," "homeowners," and "energy renovations" in a European context to find relevant studies. We focused on recent research and works cited by European reports, emphasizing their impact on understanding energy renovation barriers. The findings are detailed in Appendix 1.

Observations of renovation meetings and interviews with experts working on facilitating energy renovations for HOAs

were conducted to ask the experts about the most important barriers HOAs face and possible solutions.

To further validate and expand these findings, an interactive workshop was organized. As indicated by Storvang et al. (2018), workshops can be used as a qualitative research method to arrive at new ideas for improving a current situation. The workshop brought together IHRS providers and experts specialized in boosting energy renovations for HOAs in the Netherlands and Flanders. The participants were divided into two groups. The first group (G-1) involved six experts including a researcher, two project coordinators in a public organization and a construction association, an architect, and two renovation experts. The second group (G-2) involved five experts including two project coordinators in public organizations, a project coordinator in a public organization for property owners, a director of an IHRS organization, and an expert in setting up organizations. This collaborative approach brought together diverse perspectives and comprehensive coverage of potential solutions. The workshop concluded with a collective discussion, where both groups exchanged insights and reflected on the proposed solutions. This iterative process focused on identifying the most critical barriers that required immediate resolution. The outcomes of the workshop were sent to the participants to be validated.

In conjunction with the practical insights derived from the workshop, desk research was conducted on developing regulations and incentives in the Netherlands and Flanders to help HOAs renovate their buildings. This step was particularly pertinent as HOAs are increasingly gaining recognition in both regions. By considering both theoretical insights and practical considerations, the methodology adopted in this study ensures a robust and holistic exploration of barriers and drivers for energy renovations specific to HOAs.

Review of earlier studies on barriers and drivers for energy renovations for homeowners

We conducted research on the existing literature-related barriers faced by single-family and multi-family homeowners in performing energy renovations. The notion of "barriers" is based on the understanding of an energy efficiency gap. This gap signifies that investments in energy efficiency are persistently below what is considered needed, according to different technological or social benchmarks (Jaffe & Stavins, 1994). This exploration encompassed a range of scientific papers as well as EU projects, highlighting the multifaceted challenges in this field. Within this section, we present a consolidated summary of these barriers, offering a comprehensive overview derived from both academic and practical project-based insights. This synthesis aims to provide a clear understanding of the impediments homeowners face in adopting energy renovation measures.

Table 1. Attended meetings.

Code	Date	Title	Method
M-1	01-02/12/2022	LIFE/Horizon 2020 contractor workshop on integrated home renovation services	In-person
M-2	20/06/2023	How to set up an Integrated Home Renovation Service?	In-person
M-3	22/11/2023	Acceleration Workshop: Deeper Renovations for More Homeowner Associations	In-person
M-4	16-19/01/2024	Belgian Renovation Week	In-person

Table 2. Profile of the conducted interviews.

Code	Date	Type of organization	Position interviewee	Duration	Method
I-1	26/05/2023	Public actor (municipality)	Executive project manager	1h	Online
I-2	01/06/2023	Public actor (municipality)	Sustainability broker	1h 30 min	In-person
I-3	08/1/2024	Private organization	Director	2h	In-person
I-4	23/01/2024	Private organization	Project Coordinator	2h	In-person

Table 3. Phases of the workshop with the expert group.

Phase	Code	Task/Discussion
Validation & expansion	G-1	Validation and expansion of the technical and social barriers
	G-2	Validation and expansion of the legal and financial barriers
Possible solutions	G-1	Recommendations and possible solutions to overcome the technical and social barriers
	G-2	Recommendations and possible solutions to overcome the legal and financial barriers
Reflection	G-1	Reflection on the recommendations and possible solutions of G-2
	G-2	Reflection on the recommendations and possible solutions of G-1
Prioritization	G-1	Prioritization of the importance of solving each barrier
	G-2	Prioritization of the importance of solving each barrier

BARRIERS DERIVED FROM EXISTING LITERATURE

Homeowners face several barriers to renovating their buildings. A study by Matschoss et al. (2013) mentioned that financial barriers are among the most relevant barriers to energy renovations for HOAs due to low-income levels and the large share of pensioners. D'Oca et al. (2018) highlight the financial barriers homeowners face in energy renovations, including high upfront costs, long payback times, and insufficient funding. Homeowners with lower incomes face particular challenges due to unattractive financing options and ineligibility for regular loans. The high upfront costs are one of the main barriers mentioned by several scholars (Alberini et al., 2013; Wilson et al., 2018; Albrecht & Hamels, 2021). Additionally, there's a noted reduction in grants and an increase in the uncertainty of funding schemes, further complicating the financial landscape for energy renovations (Mahapatra et al., 2013; D'Oca et al., 2018). More recent studies, such as those by Ebrahimigharehbaghi et al. (2022) reinforce the financial barriers as one of the most important barriers as they mention that financial constraints limit the HOAs ability to maintain and improve common areas, causing homeowner dissatisfaction. Pérez-Navarro et al. (2023) identified that key economic and financial barriers including the high perceived costs of renovation, significant difficulties in obtaining subsidies, and the complex bureaucracy involved in accessing funds were the most important barriers. These issues are compounded by variations in how different stakeholders, like users and professionals, perceive these economic challenges. Again Szymańska et al. (2023) mention in their study that the financial barrier is the most significant barrier for homeowners.

Conflicts over property maintenance, noise, or animal policies create additional barriers, as do legal complexities and regulations related to community governance (Ebrahimigharehbaghi et al., 2022; Pérez-Navarro et al., 2023). D'Oca et al., (2018) mention that legal barriers to energy renovations include a complex legal framework and multilevel regulations. Bertoldi, Economidou, et al. (2021) highlighted that there is a lack of clear and consistent regulations for energy renovation of residential buildings and that there are some limited availabilities of legal mechanisms for financing programs for energy renovations. Other challenges are allocated to loans due to legal and administrative barriers (Ebrahimigharehbaghi et al., 2019; Bertoldi, Economidou, et al., 2021). Lujanen (2010) mentioned that one of the barriers is the non-existence of a proper decision-making organization as a registered HOA. Barriers such as insufficient regulations for energy renovations, restricted access to financing, limited enforcement of regulations, and complex ownership structures are also identified in many studies (Bertoldi, Boza-Kiss, et al., 2021; Papantonis et al., 2022; Bagaini et al., 2022).

There are barriers to HOAs related to collective decision-making (Lujanen, 2010; Wilson et al., 2015). Some challenges for HOAs can be the short decision-making timeframes, which can lead to choices that favour personal circumstances over the building's best interests, and exemplify these issues. This is particularly evident in cases like elderly residents reluctant to undertake renovations or tenants and owners planning to relocate soon, who may prioritize their immediate needs or convenience over long-term building improvements (Matschoss et al., 2013). Other barriers could be related to lack of awareness and interest from the homeowners (Uihlein & Eder, 2009; Ebrahimigharehbaghi et al., 2019). Homeowners may lack trust in professionals and struggle to find reliable experts and professionals for advice and assistance (D'Oca et al., 2018). Homeowners may also feel distrust towards new technologies and have a lack of knowledge about energy efficiency solutions (Bagaini et al., 2022). The disruption caused by renovation work can also be a barrier, as occupants may be reluctant to face the inconvenience and disruption (D'Oca et al., 2019). Decision-making in condominiums can be complex, requiring consensus among multiple owners and addressing concerns about the distribution of benefits and costs (Palm & Reindl, 2018; Biere-Arenas et al., 2021). lack of transparency and poor communication within the association leads to frustration and resistance among homeowners (Ebrahimigharehbaghi et al., 2022).

Few technical barriers have been mentioned in the literature, such as lack of consistent and standardized solutions, safety and seismic risks, complex installation systems, and lack of knowledge on innovative deep retrofit design methodologies (D'Oca et al., 2018; Palm & Reindl, 2018). Differences between predicted and actual savings after renovation is mentioned as technical barriers (Dowson et al., 2012; Palm & Reindl, 2018).

Other literature reviews also highlight barriers to energy renovations for homeowners, often echoing those we've identified or diverging to topics like social housing challenges. Our research specifically concentrates on the unique barriers HOAs face in pursuing energy efficiency.

BARRIERS DERIVED FROM EU PROJECTS

In this section, we conducted a thorough analysis of reports from ongoing and previous EU projects that focused on IHRS development (Save the Homes, Padova FIT Expanded, I-Heros, ProRetro, ACE-Retrofitting, The Green Home and IEA EBC Annex 75) focused on facilitating energy renovations for HOAs and individual homeowners. This approach ensures a comprehensive understanding that encompasses practical insights alongside existing literature findings, thus ensuring no significant barriers are overlooked.

From the "Save the Homes" EU project, several barriers emerged across financial, social, institutional, and business domains affecting home renovations. Financial barriers include the lack of affordable financing, high upfront and monthly costs, and the complex nature of arranging funding. Social barriers were identified as a disconnect between various collective and individual interests, fragmented information on renovation and financing options, and unclear data on building performance post-renovation. Institutional barriers involve challenges in assessing the real cost-benefit of energy-saving measures and difficulties for financial bodies in reliably evaluating deep renovation. Lastly, business barriers include the traditional construction market's misalignment, a fragmented renovation market, reluctance to see renovations as beneficial investments, and decision-making challenges in multifamily buildings. (Passlack, 2021).

From the "PadovaFIT Expanded" EU project, barriers to energy renovations were identified primarily affecting Condominium managers (CMs) also referred to as property managers and HOAs. For CMs, the challenges include a lack of necessary technical and legal knowledge, the complexity and time-

consuming nature of managing innovative procurement, and the requirement for extra effort in the initial and monitoring phases of innovative investment actions without additional remuneration. For HOAs, the primary barrier is the difficulty in achieving consensus among owners, which is often due to a general lack of knowledge and understanding of the economic benefits. Additional challenges include opposition to innovative contract solutions by the less informed, a lack of medium-term planning with a preference for immediate maintenance or urgent interventions, and a general reluctance to invest due to delayed or missing payments (Luise & Vicentini, 2019).

Another EU project called "I-Heros", focused on accelerating energy renovations for individual homeowners and HOAs in the Toulouse metropolitan area, identifying key barriers in process, regulations, financing, professional offerings, and information. It emphasized that decision-making is mainly hindered by issues in these areas. A significant lesson from the project is the importance of effective local communication networks, highlighting the success of establishing a local directory to facilitate overcoming these barriers. However, challenges persist, including the impact of national regulations, difficulties in recruiting advisors, and finding a business model that maintains neutrality and is free of charge (Estay et al., 2021).

Various insights and challenges were revealed in the "Pro-Retro" EU Project. Homeowners generally expressed positive opinions about One-stop-shops (OSS) service models, while CMs and HOAs faced challenges related to legal regulations and additional, uncompensated tasks. Some CMs proposed using OSS services for complimentary energy advice to encourage smaller HOAs toward energy renovations. These findings highlight the potential and challenges of OSSs in facilitating energy renovations (Suerkemper et al., 2021).

The "ACE-Retrofitting" project, aimed at supporting co-owners in retrofitting condominiums, identified several challenges in the process. These include the absence of a unique methodology for retrofitting, leading to varied approaches and contexts. The complexity and multitude of players involved in condominium retrofitting make coordination and decision-making difficult. Additionally, identifying and establishing contacts with condominiums is challenging due to the lack of an inventory and their cautious nature (Eisermann et al., 2019).

The "Green Home" project aimed to expedite energy renovations within condominiums across Germany. It highlighted several barriers and opportunities in the realm of CMs and HOAs. Key barriers include a prevalent financing gap, inadequacies in maintenance reserves, managerial challenges, and limitations in government aid and subsidies. The lack of proactive approaches by CMs was noted as a significant impediment to the advancement of energy-efficient renovations.

A range of barriers to energy renovations, encompassing policy, legal, economic, social, communication, technical, and knowledge domains were identified in the "IEA EBC Annex 75" project. Policy barriers include misaligned governance levels and limited municipal resources, while legal barriers span strict regulations and complex ownership structures. Economic barriers involve a scarcity of financial resources and incentives, alongside investor hesitancy. Social issues reflect the difficulty of engaging diverse communities and mistrust towards authorities. Communication gaps exist between stakeholders and residents, exacerbated by inadequate advice. Technical barrier are due to outdated infrastructures and resistance to new systems. Lastly, lack of expertise and knowledge among parties involved severely restricts progress (Johansson & Davidsson, 2023).

Barriers categorization

Several categories of barriers to energy renovations for buildings were identified in literature. Palm & Reindl (2018) categorized barriers related to the organisation of the market, information, behavioural barriers, technical, and financial barriers. Another categorization done by Uihlein & Eder (2009) divides barriers into uncertainties regarding cost-effectiveness, financial barriers, organizational problems, lack of information and skills, transaction costs, and other barriers that may be context-dependent. D'Oca et al. (2018) classify the main barriers related to deep energy renovations in the EU into 3 macro-groups which are technical, financial, and social barriers. While other scholars have not categorized barriers to energy renovations, we have chosen to do so to provide a more structured framework for discussion among experts in our study. This categorization approach, however, may result in certain barriers overlapping or being perceived within multiple categories.

As a result of the literature studied and EU projects, we have categorized barriers to energy renovations by HOAs into 4 macro-groups which are 1. Financial barriers, includes all barriers related to costs, 2. Legal barriers and those are barriers related to policy, laws, and regulations related to energy renovations for HOAs, 3. Social barriers, which include all barriers related to behavioural barriers, information, and communication barriers, and 4. Technical barriers, which include barriers related to digital, information, technological, and quality assurance. Table 4 summarizes the common barriers mentioned in the literature and EU projects studied in this paper.

Drivers and incentives

Understanding local and national incentives in the Netherlands and Flanders is crucial in this analysis. This knowledge is key for effectively exploring potential solutions to the identified barriers during discussions.

In the EU, many incentives and subsidies are being provided as financial instruments to overcome barriers. These initiatives are part of efforts like The European Green Deal, the Renovation Wave Recovery, the Resilience Facility, the European Regional Development Fund and Cohesion Funds, Just transition fund, LIFE clean energy transition, European Investment Bank for loans and grants, European Fund for strategic investments (Fetting, 2020; EC, 2022; EASME et al., 2023). The study by Bertoldi, Economidou, et al. (2021) offers an extensive examination of various financial instruments available in the EU for financing energy renovations in residential buildings. While their comprehensive analysis extends beyond the scope of this paper, a notable aspect of their research is the categorization of these financial instruments into distinct groups which are: traditional and well-established, tested and growing, and new & innovative. These groups encompass non-repayable rewards, debt financing, and equity financing instruments. This systematic classification provides a clearer understanding of the diverse financial options available for energy renovation projects within the EU.

Table 4. Summary of common barriers mentioned in literature and EU projects studied in this paper.

Category	Barrier	Derived from
Financial barriers	High-upfront costs	Alberini et al. 2013; Matschoss et al. 2013; D'Oca et al. 2018; Wilson et al., 2018; Albrecht & Hamels, 2021; Save the Homes
	Difficult collection of funds	Ebrahimigharehbaghi et al. 2022; Pérez-Navarro et al. 2023; Save the Homes
	Lack of sufficient funding	IEA EBC Annex 75; Save the Homes; Green Home
	Split incentives	Palm & Reindl, 2018; Biere-Arenas et al. 2021
	The financial burden for homeowners	Mahapatra et al., 2013; Bertoldi et al. 2021; Save the Homes
	CMs Business case	PadovaFIT Expanded; Green Home
	Investors hesitancy	IEA EBC Annex 75
Legal barriers	Complex ownership structure	Bertoldi et al. 2021; Papantonis et al. 2022; Bagaini et al. 2022; ACE-Retrofitting; Green Home; IEA EBC Annex 75
	Limited access to financing	Bertoldi et al. 2021; Papantonis et al. 2022; Bagaini et al. 2022
	Limited enforcement of regulations	Bertoldi Boza-Kiss et al. 2021; Papantonis et al. 2022; Bagaini et al. 2022
	Complex and multilevel regulations	D'Oca et al., 2018; Save the Homes; I-Heros; ProRetro
	Animal policies	Ebrahimigharehbaghi et al., 2022
	Unregistered HOAs	Lujanen 2010
	Limited municipal resources	IEA EBC Annex 75
Social barriers	Collective decision-making is complex and lasts long	Lujanen 2010; Wilson et al., 2015; Palm & Reindl, 2018; Biere-Arenas et al., 2021; ACE-Retrofitting
	Lack of awareness and interest	Uihlein & Eder 2009; D'Oca et al. 2018;Bagaini et al. 2022; PadovaFIT Expanded
	Homeowner's behaviour towards renovation (different interests)	Matschoss et al., 2013; Ebrahimigharehbaghi et al., 2019; Save the Homes; PadovaFIT Expanded
	Lack of transparency and pure communication	D'Oca et al., 2018; Ebrahimigharehbaghi et al., 2022; I-Heros; Prieto et al., 2023; IEA EBC Annex 75
Technical barriers	Lack of technical know-how	D'Oca et al. 2018; Palm & Reindl 2018: Save the Homes; PadovaFIT Expanded
	Lack of Consistent and standardized solutions	D'Oca et al. 2018; Palm & Reindl 2018; ACE-Retrofitting
	Safety and seismic risks	D'Oca et al. 2018; Palm & Reindl 2018
	Differences between predicted and actual savings	Dowson et al. 2012; Klöckner & Nayum 2016; Palm & Reindl 2018

There are recently and in the past years some notable efforts in the Netherlands to support HOAs in undertaking energy renovations. The Dutch Housing Minister Hugo de Jonge has highlighted several incentives to support HOAs (BZK, 2023). Milieu Centraal offers guidance on Dutch subsidies and loans for energy-saving measures, covering the ISDE subsidy for insulation, heat pumps, and other aids like the Heat Fund, Sustainability Scheme for HOAs, National Insulation Program, RVO, and the Green and Water Subsidy. Additionally, there are local incentives like the subsidy for sustainable Amsterdam buildings for HOAs. Homeowners can apply for an energy-saving loan at favourable terms or potentially include energy-saving measures in their mortgage. Since 2023, there has been no VAT on the purchase and installation of solar panels, offering a 21 % cost saving. More information on these subsidies and loans can be found on the Milieu Centraal website (Milieu centraal). These measures are part of a broader effort to encourage energy renovations for HOAs in the Netherlands.

The "VvE Versnellingsagenda" is a strategic initiative in the Netherlands aiming to accelerate the sustainability of buildings managed by HOAs. This agenda addresses and resolves issues in legislation and regulations, thereby aiding municipalities, co-owners, and CMs in the comprehensive approach to building sustainability.

In the Netherlands, various public and private IHRS providers offer support to HOAs to help manage and maintain their properties effectively (Mlecnik & Elgendy, 2023). IHRS providers like WNR, Energiesprong alliantie, VvE010, VvE Bond, VvE Belang, Creative City Solutions and others offer specialized services catering to the needs of HOAs. Additionally, Cities like Amsterdam, The Hague, Rotterdam, and Utrecht provide free sustainability advice to HOAs. This includes guidance on energy-saving measures, the feasibility of installing solar panels, and information about available subsidies and low-interest loans for sustainability projects. These diverse services and supports reflect the Netherlands' commitment to sustainable housing and efficient property management, aligning public and private efforts to meet both local and national sustainability goals.

The case in Flanders is similar to the case in the Netherlands, as in Flanders, there are several incentives and support pro-

grams available for HOAs and individuals looking to undertake energy-efficient renovations. The region has launched zero-interest renovation loans, specifically for middle- and low-income households. These loans, capped at 60,000 euros, are repayable within 25 years, with local 'energy houses' offering additional advice and support (VEKA, 2023). The "My Renovation Premium" program provides financial assistance for investments in energy efficiency and home quality improvements, accessible to both private individuals and associations. An online simulator helps applicants determine the funding they can receive, based on factors like joint income and property age (*Mijn VerbouwLening*).

In Flanders, there have been significant changes concerning the regulation of rent indexation in relation to the energy performance of rental properties, necessitating landlords to improve their properties' energy efficiency to a certain level before letting. Failure to meet these standards could lead to adjustments in rent indexation or restrictions on letting the property. The 2018 Flanders Housing Policy Plan requires all houses in Flanders to meet minimum quality standards, including optimal energy performance achieved through measures such as roof insulation and double glazing. The plan aims to encourage landlords to improve the energy efficiency of their rental properties. Under this policy, rent indexation is allowed only for houses with EPC labels A+, A, B, or C. Properties with an EPC label of D are subject to a 50 % limit on rent indexation, while those with labels E, F, or unknown cannot be subjected to any rent indexation. Buildings that don't meet these minimum requirements receive penalty points, and since 2020, if a building or apartment accumulates more than 15 penalty points, it becomes ineligible for renting (Beuselinck, 2023).

Additionally, there is a subsidy for building renovations, including energy efficiency improvements, available to low-income owner-occupants (*Flanders – Building Renovation – Policies*). Furthermore, there is a temporary VAT reduction for the installation of solar panels, heat pumps, and solar water heaters, from 21 % to 6 % VAT, applicable until the end of 2023 for homes under 10 years old. These programs collectively aim to promote sustainable living and energy efficiency in Flanders.

IHRS providers play an important role in Flanders in assessing HOAs to unburden decision-making to undertake energy renovations (Verberck et al., 2023). Private service providers offer administrative, financial, technical, and contract management to HOAs like Syncura, Homeland, RenoseeC and Renohub. Municipalities like Antwerpen, Mechelen, and Ostend offer free sustainability advice to HOAs in their cities as part of the local initiatives to upscale energy renovations.

The review of drivers and incentives as shown in Table 5 highlights their effectiveness in addressing certain barriers listed in Table 4, such as financial challenges and the need for technical guidance. However, it also reveals significant gaps, in addressing other barriers. These unaddressed barriers underscore the necessity for exploring additional solutions, which will be discussed in the next section to provide a more comprehensive approach to overcoming the obstacles faced by HOAs in energy renovation efforts.

Table 5. Linking the incentives and drivers back to the identified barriers.

Barriers for HOAs	Incentive/Support Mechanism	Critical Assessment
High-upfront costs	Non-repayable rewards, low-interest loans, VAT reduction	Non-repayable rewards, loans, and VAT reductions can lower initial renovation costs, but their effectiveness varies with eligibility and project size. Still, for some, these measures may not sufficiently address the burden of upfront expenses.
Difficult collection of funds	The EU City Facility Fund	European funding can ease funding issues, but complex applications may limit access for individuals and small HOAs, reducing its impact.
Lack of sufficient funding	European Regional Development Fund, Cohesion Funds	These funds typically support larger projects, so their direct effect on small-scale renovations can be limited, possibly not meeting all demands.
Split incentives	Sustainability Scheme for HOAs	Solving split incentives involves aligning all occupant's interests. Success depends on broad participation and whether the offered incentives motivate all parties.
The financial burden for homeowners	ISDE subsidy, Heat Fund	Subsidies and financial aids can reduce financial burdens but may not fully cover the costs of comprehensive energy renovations. Furthermore, the application and qualification criteria may limit accessibility for some homeowners.
CMs Business case	Free sustainability advice, specialized IHRSs	Advice and services may overcome the barrier of CMs business case, but adoption hinges on convincing homeowners and boards, often challenged by financial limits or differing HOA priorities.
Investors hesitancy	Just Transition Fund, European Fund for strategic investments	Funds offer incentives that could lessen investor hesitancy, but their effectiveness varies with investors' risk-reward perceptions and fund conditions, which may not meet all investment criteria.
Complex ownership structure	Specialized services catering to HOAs	Specialized services can simplify ownership complexities, yet their success depends on all parties' willingness to cooperate. Entrenched disputes or legal issues may not be readily resolved by advice alone.
Limited access to financing	Zero-interest renovation loans, Energy-saving loans	Accessible financial support aims directly at this barrier, but eligibility and limited funds may restrict access. Additionally, the perceived application and management complexity may deter applicants.
Collective decision-making complexities	VvE Versnellingsagenda, Specialized IHRS providers	Initiatives designed to streamline HOA decision-making depend on stakeholder engagement and issue complexity. In cases of divergent interests, these efforts might not adequately overcome the barrier.
Lack of awareness and interest	Milieu Centraal guidance, Local sustainability advice	Enhancing information and advice can reduce awareness gaps, but turning awareness into action also requires addressing financial constraints, complex HOA decisions, and varying homeowner priorities.

Results

In this section, we present the findings from the interactive workshop and discuss the identified barriers. Our focus is to determine the relevance of these barriers to HOAs and to explore whether the expert group has encountered additional barriers or solutions in their professional experiences. We will also discuss the strategies proposed by the group to mitigate some of these barriers. And propose stakeholders responsible for the actions.

BARRIERS VALIDATION, IDENTIFICATION OF NEW BARRIERS, AND POSSIBLE SOLUTIONS

Table 6 consolidates proposed solutions and recommendations from the workshop, interviews, and meetings. It features a 'V' column indicating the workshop participants' validation that each barrier pertains to HOAs. Additionally, it includes a prioritization column 'P', reflecting the group's consensus on the urgency of addressing each barrier (except the legal barriers due to the absence of a legal expert), with 5 denoting the highest priority. The Stakeholder column indicates the stakeholders who can be responsible for the actions suggested based on the stakeholder's roles identified from the CondoReno Project (Rose, 2024).

Discussion

This study critically assesses the barriers HOAs face in implementing deep energy renovations in condominiums, distinguishing these entities from individual homeowners or social housing sectors due to their unique organizational and decision-making frameworks. Our critical examination, supported by previous literature, EU projects, and expert consultations, highlights that while communication, cost, and legal structures are significant barriers, they are part of a broader, more complex matrix of challenges that include increased maintenance costs post-renovation, difficulties encountered by small, unregistered HOAs, and a shortage of qualified advisors. These findings not only corroborate previous research but also introduce nuanced obstacles that require tailored policy interventions.

Despite the wealth of financial incentives and subsidies, our analysis underscores a critical gap: the disconnection between available supports and the specific, often intricate, needs of HOAs. The challenges presented by regulatory frameworks, the division of deeds, and stringent voting requirements necessitate a refined approach. This suggests that current policies may be overly generic, lacking the specificity required to effectively cater to the diverse contexts within which HOAs operate.

The recommendations from experts, while insightful, reveal an uncertainty regarding their feasibility and broad applicability. The recurrent suggestion for dedicated expert guidance underscores a systemic issue in navigating the renovation process. It reflects a deeper, structural challenge within the sector: the need for a coherent, accessible framework that not only simplifies the process but also addresses the specificities of HOA-managed renovations.

To effectively tackle the complex barriers HOAs encounter in energy renovations, policies should focus on simplifying regulatory frameworks, creating financial instruments tailored to HOAs, building their management capacity, and enhancing support networks. This approach includes streamlining legal processes, offering specialized subsidies and loans, providing targeted training and resources for property managers, and establishing expert networks for guidance. By incentivizing professionals to work with HOAs and ensuring policies address their unique challenges, a collaborative and holistic strategy can significantly improve the success of energy-efficient renovations in condominiums.

Limitations and future research

The study has certain limitations. This study includes only the perspective of experts and IHRS providers. The expert insights obtained from the workshop and interviews are frequently founded on a restricted data set or experiences from a specific period, which may not be entirely representative. The results are indicative and require further exploration. Despite this, we believe that the results offer a more evolved perspective compared to the initial understanding, where all potential barriers for HOAs and all decision criteria were considered equally. Future research will include perspectives of HOAs, co-owners, and CMs.

Conclusion

This study aimed to identify barriers to energy renovations for HOAs and their possible solutions from the viewpoint of IHRS providers. Successful energy renovations in condominiums require a multifaceted approach, addressing financial, legal, social, and technical barriers. Innovative financial strategies and policy adaptations are crucial, considering local governments, and financial markets. Overcoming legal barriers necessitates regulatory reforms, integrating and simplifying financial incentives, and developing guidelines for HOAs. Effective communication and trust-building among various stakeholders are key to overcoming barriers. Addressing technical barriers requires implementing standardized solutions, quality assurance systems, and enhancing technical knowledge among craftsmen and end users. Overall, these approaches aim to align diverse interests, ensure quality and performance, and foster collaboration for effective and sustainable energy renovation projects for HOAs. Ultimately, the findings of this study provide additional knowledge that can contribute to informing all stakeholders working on accelerating energy renovation to HOAs.

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Table 6. Results of the workshop, interviews, observations, and stakeholder responsible.

Barrier	Code	V	Proposed solutions and recommendations	P	Stakeholder
Financial barriers					
High-upfront costs	G-2	✓	– Combination of Financial Instruments and Pre-Financing of High Upfront Costs – Creation of Collective Upfront Funds – Increasing Reserve Funds of HOAs – Clear Communication of Long-Term Benefits – Utilize Scale and Neighbourhood Approach (cost-effective strategies) – Planning and Support by Semi-Public Institutions – Reflection by G-1: – Clear living Costs and Maintenance Plans – Integrated Approach for Retrofit Projects – Coordination and Alignment of stakeholders is crucial to eliminate transaction costs	5	– Financial advisor – Building cost specialist – HOA Manager – Maintenance specialist – IHRS providers
Difficult collection of funds	G-2	✓	– Subsidizing or Pre-financing Process Guidance – Simplification of financing collection	3	– Financial advisor – Finance institutions
Lack of sufficient funding	G-2	✓	– Creation and stimulation of the financial market to offer an attractive offer – Offering governmental incentives for ambitious label improvements – Creating trust between financial providers and HOAs	4	– Municipality – National governments
Split incentives	G-2	✓	– Motivation of HOAs to increase the total building value – Exploration of legal options to combine subsidies	3	– HOA Manager – Legal expert
The financial burden for homeowners	G-2	✓	– Optimizing incentives to support small HOAs and vulnerable groups – Reflection: – Many existing policies and programs do not prioritize small condominiums (mostly managed by homeowners) – Importance to prioritize training for individuals – Raising professional awareness of retrofit project potential in small condominiums	4	– Municipality – Policy makers
CMs Business case	G-2	✓	– Revising the contractual agreements between HOAs and CMs – Including future renovation plans in the contracts with CMs	3	– Legal expert – HOA board – Sustainability commission
Investors hesitancy	G-2	✗	– The group mentioned that the reluctance of investors to engage in loans with extended payback periods is not a significant barrier for HOAs	2	–
Added barriers					
Higher service costs after renovation	G-2		– Paying special attention to vulnerable groups by providing additional subsidies Reflection: G-1 Considered this more of a social barrier	5	– National governments
Pre-existing Physical Defects in Buildings	G-2		– Conducting feasibility studies to assess the benefits of renovating such buildings – Integrating energy renovations in the infrastructure upgrade plan	1	– Architect/ construction engineer

The table continues on the next page . . . →

Table 6. Results of the workshop, interviews, observations, and stakeholder responsible (continued).

Barrier	Code	V	Proposed solutions and recommendations	P	Stakeholder
Legal barriers					
Complex ownership structure	G-2 I-3 I-4	✓	– Simplifying the deed of division and abolishing the quorum – Developing a recognized Multi-annual maintenance plan for every HOA – Adaptation of laws & regulations to lower the voting percentage for energy retrofits	–	– Legal expert – Maintenance specialist – HOA manager – Policy makers
Limited access to financing	G-2	✓	– Developing New policies to make financing more accessible and appealing	–	– Policy makers
Limited enforcement of regulations	G-2	✓	– Inclusion of comfort and health in Building codes – Integrating 2050 future-proof regulations – Early Communication of policy regulation updates to HOAs – Raising minimum standards for insulation – Setting clear periods/Mandate for CMs and ensuring proper handover to new CMs	–	– Policy makers – HOA manager
Complex and multilevel regulations	G-2	✓	– Including information and communication manager and a project implementation manager in HOA boards	–	– HOA board – Legal expert
Animal policies	I-3 I-4	✓	– The barrier, unaddressed in the workshop but noted by I-3 and I-4 as a significant delay factor in renovations, requires early local government interventions for a faster process with a provision of repayment after renovation completion	–	– Legal expert – Municipalities – Policy makers
Unregistered HOAs	G-2	✓	– Accurate Registration of HOAs in the chamber of commerce	–	– Municipalities
Limited municipal resources	M-4	✓	– Collaboration with public-private and private IHRS providers to join forces	–	– Municipalities
Social barriers					
Collective decision-making is complex and lasts long	G-1 I-4	✓	– Establishing a consistent narrative framework to guide all related communications – Step-by-Step roadmap clarification – Ensuring timely and sufficient information provision before decision-making – Allowing residents adequate time to process information, free from undue pressure	5	– Project manager – Social process supervisor
Lack of awareness and interest	G-1	✓	– Ensuring Multi-level information and communication by IHRS providers – Individual advice to residents – Emphasizing the role of public authorities in providing support to HOAs – Adopting a tailor-made approach to address the diverse needs – Recognizing the challenges faced by small condominiums – Providing a clear vision and engaging residents through meetings and workshops	5	– Municipalities – Project manager – Policy makers – HOA manager
Homeowner's behaviour towards renovation (different interests)	G-1	✓	– Emphasizing the advantages of renovation to homeowners – Aligning renovation quality with varied homeowner preferences – Classifying co-owners according to their specific motives for renovation and tailoring communication strategies to these segmented groups	3	– Sustainability commission – Social process supervisor
Lack of transparency and pure communication	G-1 I-4	✓	– Actively engaging municipal authorities in the dialogue and decision-making – Defining the specific roles and responsibilities of each stakeholder in each phase – Highlighting the importance of understanding that successful collaboration is critical	4	– Municipalities – IHRS ambassador – IHRS-acquirer

Barrier	Code	V	Proposed solutions and recommendations	P	Stakeholder
Added barriers					
Disturbance during renovations	G-1		– Emphasizing the long-term benefits of a complete renovation and exploring ways to minimize disturbance	2	– HOA manager – Construction worker
Management by volunteer co-owners	G-1		– Providing educational and training materials to inform co-owners – Financial compensation for time effort by co-owners serving the HOA	3	– HOA board – HOA members
Lack of trust	M-3 I-1		– Building trust through effective communication strategies – Delivering clear, unbiased information transparently	3	– HOA manager – IHRS-ambassador
Technical barriers					
Lack of technical know-how	G-1	✓	– Development of comprehensive technical training materials – Hands-on knowledge transfer through training sessions and workshops – Simplifying the technical details, making the information more accessible and easier	3	– Technical process supervisor – Communications officer
Lack of Consistent and standardized solutions	G-1	✓	– Ensuring Quality assurance by implementing a quality label system – Standardized solutions for building types – Conducting a large-scale study to compare various renovation processes	4	– Technical draftsman – Technical process supervisor – Quality coordinator
Safety and seismic risks	G-1	✓	– Informing the HOA about existing problems: assessment of the building conditions – Long-term and proper planning by the HOA – Reflection G-2: it is important first to ensure that the building can be renovated	1	– Architect/ construction engineer – HOA manager
Differences between predicted and actual savings	G-1	✓	– Adopting a new mindset towards quality and performance in renovations – Implementing guarantees for energy performance, and construction quality – Ensuring “Futureproof renovations” at low cost was suggested by I-3	5	– Quality coordinator
Added barriers					
Limited storage and power grids	G-1		– Increase the storage capacity through local and national initiatives	1	– Municipalities
Lack of qualified advisors	G-1		– Providing training materials – Tightening of legislation and regulations in the field of building management	5	– IHRS-ambassador

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project-search/accelerating-condominium-energy-retrofitting-ace-retrofitting/?tab=,undefined&page=3

Green Home, funded by the European Union's Horizion 2020 research and innovation programme under grant agreement no.101033878. https://www.green-home.org/en/what_we_do/projekt/

I-Heros, funded by the European Union's programme for SOCIETAL CHALLENGES – Secure, clean, and efficient energy under grant agreement no. 890598. https://i-heros.eu/

PadovaFIT Expanded, funded by the European Union's programme for SOCIETAL CHALLENGES – Secure, clean, and efficient energy under grant agreement no. 847143. https://www.padovafit.eu/home.html

ProRetro, funded by the European Union's programme for SOCIETAL CHALLENGES – Secure, clean, and efficient energy under grant agreement no. 894189. https://proretro.eu/en/

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Appendix 1

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