HeriTACE

Building users' needs and perspectives

Deliverable D5.3

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Executive Summary

This deliverable, **D5.3 Building users' needs and perspectives,** investigates building users' needs and perspectives in four European heritage townhouse contexts–Belgium, Estonia, Norway, and Italy – within the Horizon Europe project **HeriTACE**. It examines how cultural heritage values, energy efficiency objectives, and comfort requirements intersect in everyday decision making by owners, tenants, and neighbourhood users. The study integrates literature review, in-depth interviews, and street interview surveys, providing a multiscalar evidence base for designing heritage compatible, socially accepted energy efficiency measures.

The work aims to:

- Identify **residents' and users' perceptions** of cultural heritage, comfort, usability, and building performance.
- Understand **decision drivers, barriers, and motivations** for undertaking (or resisting) **energy efficiency renovations**.
- Document tolerance for physical change in **heritage buildings and neighbourhoods**.
- Provide actionable insights for the development of **HeriTACE retrofit strategies, Key Performance Indicators**, and the forthcoming **Multi Criteria Decision Making (MCDM) tool**.

A mixed methods design was applied, including:

1) a literature review, covering sociocultural factors, ownership structures, comfort expectations, behavioural drivers, technical barriers, and governance frameworks influencing heritage retrofitting;

2) in-depth interviews, displaying 15 interviews with homeowners, tenants, architects, and property managers of the HeriTACE case-study townhouses in Trondheim, Tallinn, Mantova and Ghent (as described in D5.1). Discussed topics include:

- heritage values & sense of place;
- technical conditions & building pathologies;
- comfort, energy use, and environmental concerns;
- decision priorities;
- acceptance of typical retrofitting measures.

3) street interview surveys in the HeriTACE case-study neighbourhoods in Trondheim, Tallinn, Mantova and Ghent, with 73 random interviews captured:

- purpose of visit
- perceived quality & enjoyment
- tolerance for change
- potential behavioural impacts
- open-ended responses explaining the closed answers.

Results were analysed with descriptive statistics, thematic coding of open answers, and exploratory regression.

The in-depth interview and the street-interview survey have been analysed and concluded individually, then subjected to a synthesising analysis across chapters, highlighting **key takeaways and recommendations.**

Key Findings cover thematically:

Heritage Values and Emotional Attachment: Across all contexts, heritage buildings and neighbourhoods are highly valued for authenticity, architectural character, and ambience. However: For **Belgium & Norway:** Heritage identity is strongly emphasised; residents often accept lower comfort to preserve historic character. For **Estonia & Italy:** Users balance heritage appreciation with a more pragmatic need for comfort and liveability. Even without formal listing (e.g. Belgium), informal appreciation leads to voluntary stewardship.

Technical and Comfort Challenges: Recurrent issues were observed across countries:

- moisture ingress (basements, attics, interfaces), but to various extent;
- cold surfaces & poor insulation;
- ventilation deficits and stale indoor air;
- energy inefficient, ageing heating systems.

These conditions affect comfort but do not automatically prompt high impact retrofits, given fears of harming heritage integrity and the disruptive nature of major works.

Acceptance of Energy Efficiency Measures: Users accept interventions when they:

- are reversible;
- are minimally visible (rear façades, attics, roof interiors);
- maintain proportions, materials, and architectural rhythm.

Decision Drivers: Across all countries:

- **Comfort, ecological motivation**, and **heritage protection** outrank **financial payback** in decision-making;
- Many owners renovate "for heritage and comfort", not for cost savings;
- Financial barriers still delay interventions.

Street Level Perceptions of Neighbourhood Change: Surveys show:

- High liking (≈73%) and high enjoyment (≈68%) of heritage areas.
- Strong reliance on aesthetic and atmospheric qualities.
- Low tolerance for change: most support no or only small alterations.
- Behavioural consequences vary:
  - Norway & Italy: changes in the neighbourhood risk reducing its use;
  - Estonia: changes are acceptable if enhancing greenery/functionality;
  - Belgium: reluctant to changes, but usage patterns remain stable.

Overall Conclusions cover:

Authenticity and experiential quality are decisive for both residents and visitors. Users strongly prefer incremental, reversible, low visibility interventions. Technical and regulatory barriers remain considerable, especially in Italy and Norway; financial barriers in Estonia; and knowledge gaps everywhere. Successful retrofits require context sensitive, heritage compatible, and user driven approaches. A one size fits all solution is neither feasible nor acceptable: flexibility is crucial.

Implications and recommendations for the HeriTACE project:

For Technical Development: Prioritise roof, attic, ventilation, and window strategies that maintain architectural character. **Emphasise** moisture safe, case specific solutions. **Provide** rear façade and interior insulation guidelines with heritage safeguards.

For Governance & Policy: Streamline heritage approvals for compatible measures. **Introduce** tailored funding schemes for heritage retrofits. **Strengthen** owner guidance and community engagement.

The holistic and multiscale decision-making model must:

- **allow variable weighting** of heritage, comfort, cost, ecology;
- **incorporate acceptability criteria** (visibility, reversibility, material compatibility);
- **reflect diverse ownership models** (private, cooperative, institutional);
- **include risk indicators** (moisture, ventilation, thermal bridges).

Key Takeaways:
People value historic areas, and value rises with quality of architecture, ambience, and coherence. Retrofit acceptance increases when heritage is visibly preserved. Energy efficiency must be pursued through low impact, reversible, and well communicated designs. A sustainable future for heritage homes requires balancing authenticity with comfort, supported by tailored incentives, clear guidance, and participatory governance.

Abbreviations and acronyms

Acronym	Description
EU	European Union
GDPR	General Data Protection Regulation
HBIM	Historic Building Information Modelling
HiBERatlas	Historic Building Energy Retrofit Atlas
IAQ	Indoor Air Quality
KPI	Key Performance Indicator
MCDM	Multi-Criteria Decision Making
PPP	Public-Private Partnership
PV	Photovoltaic (panels)
WP	Work Package

1. Introduction

This report presents an integrated approach to understanding how cultural heritage values intersect with energy efficiency and comfort requirements in historic buildings and neighbourhoods. The work combines three complementary components: a literature review, in-depth interviews, and a street-interview survey, each designed to capture different dimensions of user perspectives and technical challenges.

The overarching aim of the task (HeriTACE, WP5/T5.1.2) was to prepare and perform interviews and discussions with owners and users of specific historical buildings, alongside a survey in selected neighbourhoods. These tasks were conceived to collect insights on cultural heritage aspects, liveability, usability, comfort levels, and building needs/requirements. By incorporating these activities, the project ensures that technical solutions for energy efficiency and comfort improvements are grounded in real-world user priorities and heritage values.

Including this task adds significant value to the project because it provides qualitative depth to the technical developments, through interviews, revealing nuanced perceptions of heritage importance and retrofit obstacles; enables quantitative validation and generalisation via surveys, ensuring findings are representative beyond individual cases; and supports co-design and stakeholder engagement, anchoring research outcomes in user realities and fostering acceptance of proposed interventions.

1.1. Description of report layout

Chapter 1 Introduction gives an overview of the background for the report, literature review, and methodological approach and description. In **chapter 2 In-depth interviews - results**, the results from the in-depth interviews are displayed, first per country (Belgium, Estonia, Norway, and Italy) and secondly a cross-country analysis, discussion and conclusions. **Chapter 3 Street interviews/survey** begins with the cross-country findings from the survey, then presents country-specific results, followed by a discussion and conclusions. **Chapter 4 Discussion and combined conclusion** concludes the report with a synthesis across chapters, highlighting key takeaways and recommendations. Interview guide for the in-depth interviews and questionnaire for the survey are in **Annex 1 and 2**.

1.2. Literature review

Understanding how people perceive the importance of heritage, and which obstacles they weigh most when considering retrofitting, is essential to designing energy-efficiency measures that do not compromise cultural values. Recent work shows that decisions in historic homes are driven by a blend of technical, financial, and deeply founded socio-cultural factors, with residents' values and sense of place shaping acceptance of interventions (Fouseki & Bobrova, 2018; Fouseki et al., 2020). Surveys in England similarly indicate strong public support for protecting, restoring and reusing historic buildings, reinforcing the need to align retrofit strategies with public attitudes (Historic England, 2023).

A growing body of evidence highlights recurring barriers; regulatory complexity, high upfront costs and technical constraints, alongside proven enablers such as early collaboration with heritage authorities and context-sensitive solutions. An analysis of 69 European best-practice cases in the HiBERatlas demonstrates how projects succeed when energy savings are achieved while respecting significance, and when stakeholder

coordination and investment quantification occur from the outset (Herrera-Avellanosa et al., 2024; Lejonhufvud, 2021). Complementary reviews detail the feasibility and limitations of measures such as draught-proofing, secondary glazing and compatible insulation, emphasising case-by-case assessments over universal prescriptions (Lidelöw et al., 2019; Nair, Verde, & Olofsson, 2022).

Ownership structures further condition what is possible in practice. Private owners may have autonomy and emotional attachment but face financial strain and permissions hurdles; public bodies can mobilise expertise and systemic programmes yet sometimes lack flexibility; cooperative models share costs while adding decision complexity. Legal research in Sweden underscores that coherent frameworks and holistic planning are required to reconcile energy goals with protection of cultural values (Wu & Hou, 2021; Christiernsson, Geijer, & Malafry, 2021).

Behavioural research using the Theory of Planned Behaviour shows attitudes and perceived control strongly influence conservation decisions among designers and other actors, pointing to the importance of participatory approaches and targeted guidance to bridge the intention–behaviour gap (Gonçalves et al., 2021). Taken together, these insights justify asking people not only how important heritage is to them, but also which obstacles — cost, rules, technical fit, comfort — matter most, so retrofit pathways can be tailored to protect authenticity while meeting climate objectives (Historic England, 2023; Herrera-Avellanosa et al., 2024).

1.2.1. Homeowners' beliefs and understanding

Heritage buildings and domestic transformation

Recent international scientific literature examines how personal values, socio-cultural contexts, and urban development pressures shape decisions about heritage buildings. The findings highlight the importance of behavioural, environmental, and economic dimensions in sustainable heritage conservation.

Architectural heritage is not only a physical legacy but also a cultural and emotional one. As custodians of domestic heritage, homeowners play a critical role in shaping the future of historic buildings. Their decisions, whether to preserve, refurbish, or transform, are influenced by beliefs about identity, aesthetics, functionality, and sustainability. Architectural heritage extends beyond physical structures to embody collective cultural and emotional values, evolving from static conservation to dynamic, living approaches that reinforce shared identity and civic pride among residents (Liang et al., 2023).

Homeowners' beliefs about architectural heritage — including identity, aesthetics, functionality, and sustainability — critically shape their decisions to preserve, refurbish, or transform historic buildings (Gonçalves et al., 2023; Sinha et al., 2025). Emerging approaches to architectural-heritage conservation emphasise the shift from object-focused preservation toward broader, people- and environment-centred practices. Within this evolving framework, the everyday decisions of homeowners—balancing identity, aesthetics, functionality, and sustainability—form a vital part of contemporary heritage stewardship, reinforcing the role of local actors in shaping the future of heritage (Fayez, 2024).

Key Factors Influencing Public Opinion

Public participation is essential for sustainable heritage conservation. Factors such as science education, clear management structures, financial investment, and legal frameworks enhance public involvement (Han et al., 2024). Adaptive reuse of heritage buildings—repurposing them for modern use—has proven effective in preserving cultural value while meeting contemporary needs. Community engagement and collaborative governance are critical to overcoming challenges like regulatory barriers and funding limitations (Savoie et al., 2025).

Public Beliefs and Attitudes

Surveys show that people generally prefer old buildings over new ones, associating them with beauty, character, and historical significance. A majority believe that historic places should be treated as community assets and support restoration and reuse over demolition (Historic England, 2023). These attitudes are consistent across demographic groups, indicating a universal appreciation for heritage architecture (Mayes, 2015).

Recent studies from various European countries provide additional insights into public opinion and heritage management. In Italy, participation in cultural heritage is strongly influenced by education and social capital, with nuanced effects based on interpersonal relationships (Fiorillo & Ofria, 2025). In Belgium, adaptive reuse and inclusive heritage practices are being explored to enhance community engagement and sustainability (Augustiniok et al., 2023). Estonian research highlights the emotional attachment and sense of ownership communities feel toward archaeological and dark heritage sites, emphasizing the importance of participatory management (Kurisoo et al., 2024). Norwegian heritage policy reflects a shift toward participatory governance, although challenges remain in fully realizing shared responsibility models (Colomer, 2024).

Psychological and Socio-cultural Influences

Perception of heritage architecture is shaped by cultural background, personality traits, and cognitive schemas. The concept of 'sense of place'—a feeling of connection to a location—is enhanced by culturally resonant architectural features. Environmental affordances, or what a space offers its users, are interpreted differently depending on sociocultural and psychological factors (Khandan & Rezaei, 2023). These studies highlight that homeowners often feel a strong sense of responsibility and pride in maintaining heritage properties, but their actions are shaped by; personal values and cultural identity; regulatory constraints; economic incentives; and perceptions of heritage as both a personal asset and a public good.

Cultural and Emotional Dimensions of Heritage Stewardship - Beliefs and Attitudes

Understanding homeowners' beliefs, attitudes, and perceptions regarding the care, responsibility, and stewardship of heritage buildings is essential for effective heritage management. Recent academic and research-based publications have explored these dimensions across various cultural and geographic contexts.

Historic England's survey of listed building owner-occupiers revealed that 89% of respondents believed their home contributed to the character of the local area, and 86% reported regular maintenance. The study also found strong public support for restoration and reuse of historic buildings, linking heritage to civic pride and community identity (Historic England, 2022).

Wu and Hou (2021) examined two cases of private adaptive reuse of heritage properties. The study found that private ownership can foster innovation in reuse strategies but also highlighted tensions between public interest and private control. Clear property rights and access to technical expertise were identified as critical factors for successful stewardship.

Gonçalves, Mateus, Silvestre, and Roders (2023) applied the Theory of Planned Behaviour to analyse conservation decisions among architects and students. The study revealed that personal beliefs, perceived behavioural control, and social norms significantly influence conservation behaviour. Understanding these behavioural dimensions is key to designing effective heritage policies.

Bo and Abdul Rani (2025) conducted a systematic review of 260 publications on architectural heritage and sense of place. The review found that emotional attachment, identity, and belonging are central to homeowners' engagement with heritage buildings. The authors advocate for interdisciplinary approaches to heritage research. Bo and Rani (2025) emphasize that homeowners' attachment to heritage buildings is deeply rooted in a sense of place, which fosters memory, belonging, and identity. Gonçalves et al. (2023) applied the Theory of Planned Behaviour to heritage conservation, revealing that personal attitudes are stronger predictors of behaviour than external constraints. Francini and Rozochkina (2024) argue that the Historic Urban Landscape (HUL) approach offers an integrated framework for managing heritage within broader urban development pressures, emphasising the need to recognise historic environments as dynamic systems shaped by cultural values, everyday use, and contemporary transformation processes. Yarrow (2019) provides ethnographic insights into renovation practices, showing that conservation is a socially embedded process shaped by negotiations between homeowners, professionals, and institutions.

Norwegian studies, such as Godbolt et al. (2018) examined residents' experiences in a protected apartment building in Oslo and found that public sustainability measures were perceived as confusing, while heritage protection rules were seen as barriers to essential upgrades, particularly concerning windows. The SyMBoL project (Bertolin & Berto, 2023) highlighted significant gaps in heritage-management practices and underscored the importance of interdisciplinary collaboration and advanced digital tools—such as HBIM, digital twins, and machine-learning-based assessment—to support long-term stewardship.

Belgian research emphasises the integration of heritage values into adaptive reuse strategies. Augustiniok, Houbart, Plevoets, and Van Cleempoel (2023) examined projects in Mechelen and Genk, demonstrating how value-based design can support both conservation and sustainability. Their study highlights the importance of assessing tangible and intangible heritage values to guide architectural interventions that respect historical significance while enabling contemporary use.

In Estonia, heritage stewardship is shaped by post-Soviet transitions and regulatory challenges. Alatalu (2020) highlights how the cultural value of Estonia's transitional-period residential architecture is difficult to define and often contested, reflecting the rapid social and aesthetic shifts of the post-Soviet era. The Estonian National Heritage Board (2017) has similarly noted that private heritage ownership is frequently perceived as burdensome, with owners facing regulatory, financial, and informational challenges. Addressing sustainability in such contexts therefore requires tackling both technical and perceptual barriers among homeowners.

Italy's approach to resilience and sustainability in heritage buildings is deeply rooted in philosophical and technical traditions. Della Torre (2021) outlines the evolution of preventive conservation, drawing on Cesare Brandi's theory of restoration. Italian policy frameworks increasingly incorporate planned maintenance and risk assessment, promoting material authenticity and adaptive reuse as strategies for sustainable heritage management.

Technical and Sustainability Challenges in Energy Retrofitting

Over the past decade, academic literature has increasingly focused on homeowners' perceptions, decision-making processes, and the socio-cultural dynamics that influence retrofit choices in historic dwellings.

Fouseki et al. (2020) conducted a cross-cultural qualitative study involving 59 interviews with residents of historic buildings in Greece, Mexico, and the United Kingdom. Their findings reveal that homeowners' decisions regarding energy retrofitting are not static but evolve over time. Initial reverence for original architectural features may give way to comfort-driven interventions, only to be reconsidered when cultural or market pressures reassert the value of preservation. This underscores the importance of understanding heritage conservation as a lived and negotiated practice, rather than a fixed set of principles.

Lidelöw et al. (2019) reviewed over 70 peer-reviewed studies and found that while operational energy use in heritage buildings is well-documented, cultural heritage values are often marginalised in retrofit planning. The authors advocate for an integrated approach that balances energy performance with architectural integrity. They argue that best-practice models must be developed to guide interventions that respect both the technical constraints and the cultural significance of historic homes.

Herrera-Avellanosa et al. (2024) analysed 69 case studies from the HiBERatlas database, which documents successful energy retrofits in historic buildings across Europe. Their research identifies key barriers such as regulatory constraints, high costs, and technical limitations. However, it also highlights enabling factors including early collaboration with heritage authorities, tailored retrofit solutions, and active homeowner engagement. These findings suggest that context-sensitive approaches and knowledge-sharing are essential for scaling up energy retrofitting in heritage contexts.

Nair et al. (2022) provide a comprehensive review of energy-efficiency retrofit measures in heritage buildings, identifying significant technical challenges, including non-standard construction, incompatibility with modern technologies, and restrictive conservation regulations. The authors highlight that many retrofit options—such as insulation, window upgrades, and ventilation improvements—risk compromising historic character, making case-by-case assessment essential. They emphasise the need for stakeholder collaboration to balance energy goals with conservation priorities.

Low-impact interventions such as draught-proofing, secondary glazing, and internal insulation are generally more acceptable to homeowners, as these options are reversible and minimise changes to historic fabric. Historic England (2024) identifies draught-proofing and secondary glazing as among the least intrusive and most heritage-compatible measures, while studies confirm that concerns about damaging authenticity often steer owners towards such solutions. However, literature also highlights that the financial burden of retrofitting heritage buildings remains a major barrier, with higher upfront costs and longer payback periods than in conventional housing (Lidelöw et al., 2019; Nair et al., 2022).

Across the literature, there is a recurring call for improved education and guidance for both homeowners and professionals. Inconsistencies in conservation approaches and a lack of technical knowledge can hinder effective retrofitting. Frameworks such as the Italian Cultural Ministry guidelines in Italy are cited as valuable tool for aligning energy efficiency measures with heritage values, promoting informed and balanced decision-making (Buda and Pracchi, 2019).

Owners' and users' perceptions of refurbishment-related change

Acceptance for energy retrofit induced change in buildings with heritage value increases when visible changes (façades, windows) are negotiated early, reversibility or visual continuity is demonstrated, and authority coordination is clear. The HiBERatlas meta-review stresses heritage evaluation and early collaboration to reduce conflict (Herrera-Avellanosa et al., 2024).

Further, when retrofits make homes more comfortable (warmer, quieter, healthier), residents are more willing to support them. Whole-building, moisture-safe design and user guidance help avoid performance gaps and unintended moisture risks (Historic England, 2024).

Energy-efficiency retrofits in historic buildings frequently lead to perceptible improvements in thermal comfort, acoustic comfort, and indoor air quality (IAQ). Technical guidance emphasises that traditional buildings – often characterised by drafts, moisture variability, and uneven heating – typically show substantial comfort improvements once energy and ventilation upgrades are installed (Historic England, 2024). These comfort gains are consistently identified as major motivators for homeowner engagement in retrofitting, often outweighing purely financial motivations (Herrera-Avellanosa et al., 2024).

Research shows that realised energy savings after retrofit depend heavily on occupant behaviour (Historic England, 2024). The 69-case HiBERatlas meta-analysis demonstrates that even technically sound retrofits can underperform when residents operate buildings in ways that diverge from modelled assumptions such as heating to higher setpoints post-retrofit, ventilating through windows rather than using designed systems, or blocking airflow paths (Herrera-Avellanosa et al., 2024). These behaviour-dependent effects are well-documented in the wider energy-retrofit literature and are sometimes referred to as performance gaps driven by behavioural rebound.

Historic buildings add an additional layer of complexity. Because many use moisture-open construction (e.g., lime plaster, solid masonry, timber frames), energy upgrades can unintentionally trap moisture if not designed as part of a whole-building, moisture-safe strategy. The 2024 Historic England Advice Note stresses that retrofit measures must be assessed holistically—airtightness, insulation, ventilation, heating, moisture sources—because poorly coordinated interventions can create new moisture risks such as interstitial condensation, mould growth, and decay of heritage materials (Historic England, 2024).

Studies also highlight that occupant understanding and correct use of new systems are critical. Consistent with the findings of the HiBERatlas review, Historic England emphasises user guidance and post-retrofit support as essential mechanisms for avoiding unintended consequences and ensuring comfort benefits are realised without compromising heritage fabric (Historic England, 2024; Herrera-Avellanosa et al., 2024). Market research highlights a desire–action gap constrained by expense, underscoring the importance of public funding and co-operative facilitation (Kantar, 2023).

1.2.2. Ownership structures

Ownership structures are a key determinant of how domestic heritage buildings are conserved, adapted, and used. Within the HeriTACE framework, ownership is central because it defines the scope for physical alterations, decision-making authority, and access to financial, technical, and institutional resources relevant to energy-efficient refurbishment. Recent studies demonstrate that ownership is not merely an administrative category but a significant factor shaping the sustainability and long-term viability of historic housing in urban contexts.

Most immovable cultural heritage in Europe is privately owned, leaving individual households responsible for its conservation and energy upgrades (European Commission, 2019). Financial constraints, limited expertise, and complex regulations often hinder refurbishment, especially where heritage protections raise costs or procedural complexity (Herrera-Avellanosa et al., 2024).

Alternative ownership models—such as cooperative, community-based, public, and institutional arrangements—redistribute responsibilities and offer stronger governance and shared resources. Research shows these structures can ease coordination challenges, support whole-building energy strategies, and improve conservation outcomes, especially in multi-unit or mixed-tenure heritage buildings (Žuvela et al., 2023; Macdonald & Cheong, 2014).

Ownership also influences the values attributed to historic homes. Private owners may prioritise comfort, identity, aesthetics, or market considerations, and their interpretations of heritage significance can shift over time (Fouseki & Bobrova, 2018; Newton & Fouseki, 2018). Public authorities, by contrast, operate under statutory preservation mandates and must balance heritage protection with emerging climate objectives, often creating tensions between regulatory requirements and the need for energy upgrades (Christiernsson et al., 2021).

Ownership structures and retrofit capacity

Public or institutional ownership tends to enable whole-building, conservation-compatible retrofits by providing long-term planning horizons, procurement capacity, and access to funding streams. Guidance that operationalises EN 16883:2017, such as the IEA SHC Task 59 handbook, standardises heritage value assessment, building surveys, and measure selection, thereby reducing risk and transaction costs (Leijonhufvud et al., 2021; Historic England, 2024).

Multi-actor governance models, public–civil, public–private, and public–private–community, are increasingly used to reconcile energy goals with heritage constraints at neighbourhood scale. A 2023 review of heritage governance indicates these partnerships improve representation and implementation for complex urban settings (Žuvela, Šveb Dragija, & Jelinčić, 2023). Meta-evidence from 69 retrofits compiled in HiBERatlas shows that early collaboration among owners, planners, and heritage officers, plus transparent investment quantification, are key success factors for scalable retrofits (Herrera-Avellanosa et al., 2024).

Ownership Constraints and Enablers for Energy Retrofits in Historic Housing

Historic homes represent a unique subset of the housing landscape, where ownership structures are shaped by both market forces and heritage considerations. A recurring theme across all jurisdictions is the predominance of private ownership in historic housing stock. The stewardship of such homes intersects with heritage preservation, regulatory frameworks, and market dynamics, raising important questions about access, maintenance, and long-term sustainability. Historic homes – particularly those constructed between the late 19th and mid-20th centuries – are largely privately owned, reflecting broader socio-economic and cultural trends.

Home ownership remains a dominant tenure form across the selected countries, though affordability and housing quality vary. Ownership type influences decision-making, financial capacity, and regulatory flexibility for energy retrofits. Private owners often face high costs and complex permissions, while public bodies may have better access to funding and expertise (Herrera-Avellanosa et al., 2024; Fouseki & Bobrova, 2018; Christiernsson et al., 2021). Heritage values can shift over time: private homeowners initially prioritize aesthetics and cultural significance, later balancing these with comfort and energy savings (Fouseki & Bobrova, 2018; Newton & Fouseki, 2018). Public authorities must reconcile legal frameworks to allow energy upgrades without compromising heritage integrity (Christiernsson et al., 2021).

Herrera-Avellanosa et al (2024) found that private ownership often limits retrofit implementation due to cost and regulatory hurdles. Public ownership enables systemic approaches but requires legal harmonization for climate targets (Christiernsson et al., 2021). Heritage values evolve, influencing energy decisions in privately owned historic homes (Fouseki & Bobrova, 2018; Newton & Fouseki, 2018). Collaborative frameworks and PPPs (Public Private Partnership) are essential for balancing energy efficiency with conservation (Papapietro et al., 2024). A considerable portion of Europe's cultural property – including immovable heritage such as historic houses and urban buildings – is owned by private individuals, trusts, associations, churches, NGOs, or companies (European Commission, 2019).

Stewardship refers to responsible care and management of heritage properties. It intersects with preservation by requiring owners to act as custodians of cultural heritage, balancing personal needs with societal value. Effective stewardship depends on knowledge, resources, and regulatory flexibility. (Higueras, 2010). Ownership structures significantly influence the use, maintenance, development, and adaptive reuse of domestic heritage buildings. Private, cooperative, and public ownership models shape decision-making processes, investment capacity, and the balance between heritage preservation and modern living needs. Understanding these dynamics is essential for designing policies and interventions that support sustainable conservation while respecting cultural values. (Wu & Hou, 2021; Savoie et al., 2024). Private ownership often fosters emotional attachment and autonomy but can lead to financial strain and inconsistent maintenance. (Wu & Hou, 2021). Cooperative ownership enables shared costs and collective responsibility but introduces decision-making complexity and potential conflicts. (Savoie, Sapinski, & Laroche, 2024). Public or institutional ownership ensures formal preservation standards and access to funding but may limit flexibility and slow adaptive reuse due to bureaucracy. (Macdonald & Cheong, 2014).

Private ownership shifts financial responsibility for maintenance and restoration onto individuals, which can impede proper conservation efforts unless supported by public policies. Wu & Hou (2021) stress that private owners hold stronger rights to determine use and direction of their heritage buildings, underscoring the intersection between private decision-making power and heritage integrity.

Overall, the literature suggests that while home ownership remains a central pillar of housing policy and cultural identity in many countries, its accessibility is increasingly challenged by economic pressures, demographic shifts, and evolving housing markets.

1.2.3. User Perceptions of Change as a Key to Heritage Retrofit Decisions

Overall, the literature demonstrates that energy retrofitting in heritage contexts is shaped not only by technical and regulatory factors but, crucially, by how owners and users interpret change in historic buildings and neighbourhoods. While existing research offers valuable insights into barriers, enablers, and governance structures, relatively few studies examine how people make sense of physical alterations, shifting comfort conditions, neighbourhood transformation, and the evolving meaning of heritage in their everyday lives. This gap underscores the need for empirical work attentive to lived experiences, emotional attachments, and the negotiation of identity, place, and responsibility.

Task 5.1.2 directly responds to the literature's identified gaps by shifting the analytical focus from technical or regulatory barriers toward the lived experience of change in heritage contexts. The in-depth interviews and street interviews conducted in this study directly address these omissions by capturing user perceptions of what change feels like, how it is evaluated, and how these interpretations shape support for—or resistance to—retrofit interventions. In this way, the literature review provides a conceptual and contextual foundation, but the empirical material offers the essential perspective needed to understand how heritage values, expectations of comfort, and neighbourhood identities intersect with the practical realities of sustainability transitions.

While existing research extensively documents constraints, retrofit measures, and governance models, far less is known about how owners and users interpret physical alterations, neighbourhood transformation, or evolving comfort conditions—and how these interpretations shape acceptance, resistance, or ambivalence toward energy-related upgrades. Task 5.1.2 addresses this problem by collecting and analysing empirical data from in-depth interviews and street-level user interactions to capture how people understand, evaluate, and emotionally respond to changes in the heritage environments they inhabit. Through this approach, the task investigates how meanings of authenticity, responsibility, identity, and place are negotiated in practice, and how these perceptions influence willingness to engage in retrofit processes. By grounding the analysis in user narratives rather than purely technical assessments, Task 5.1.2 provides an essential complement to existing literature and generates insights that can inform more socially attuned retrofit strategies across differing ownership structures and heritage settings.

1.3. Methodological approach

1.3.1. Method overview

This chapter outlines the methodological approach applied in HeriTACE Task 5.1.2 to investigate how owners and users perceive changes in heritage buildings and neighbourhoods and inherent heritage values, and how the react to such change. In line with the project's objective to understand the social, experiential, and cultural dimensions of heritage transformation, the study adopts a mixed-methods design that combines qualitative in-depth interviews with short, street-level user interviews. This combination allows the project to capture both detailed narratives of lived experience and broader insights into everyday understandings of heritage change.

The mixed-methods approach was selected to address the complexity of the research topic. Perceptions of change in heritage contexts are shaped by overlapping factors—material alterations, comfort and usability, identity and attachment, regulatory conditions, and neighbourhood dynamics. No single method would sufficiently capture this range. The in-depth interviews enable participants to articulate how they experience and interpret change, while the street interviews provide immediate, context-specific reactions from a more diverse group of users.

To ensure the robustness of the findings, the study applies triangulation, systematically comparing insights across data sources and linking them to patterns identified in the literature review. This strengthens analytical validity and reduces reliance on any single viewpoint or method. Together, these procedures provide a comprehensive evidential base for understanding how users evaluate and respond to changes in historic buildings and their surroundings.

Case study areas and specifics

Figure 1: Map of Europe displaying the selected cities for the HeriTACE project, where the in-depth interviews and street interview surveys have been carried out: Ghent (Belgium), Trondheim (Norway), Tallinn (Estonia) and Mantova (Italy) (Maton et al., 2024).

Research samples

Descriptions of approaches to selections/research samples for a) interviews with owners and tenants/users; and b) street interviews with random people

	In-depth interviews with owners and tenants				Street-interviews
Case	**Owners**	**Property managers (prof. owner)**	**Architects**	**Tenants**	**Random passers-by**
Belgium/Gent	4				28
Estonia/Tallin	4				10
Norway/Trondheim	2	1			15
Italy/Mantova	1		1	2	20
Sum	11	1	1	2	
In total		***15***			***73***

Table 1: Overview of total number of conducted in-depth interviews and street-interview surveys, relative to country and neighbourhood

Research Design Overview and approach

The methodological approach is to perform a literature review, employ in-depth semi-structured interviews (Magaldi & Berler, 2020; Lobe, Morgan, & Hoffman, 2022) and street-interview surveys (Kajda et al., 2017; Basha & Sağdıç, 2025) to capture nuanced and generalisable data from owners and users of historical buildings, analyse the findings, and discuss them towards the findings of the literature review.

- Literature review: synthesize theory, map gaps, inform instrument design;
- Qualitative: surface mechanisms, narratives, and stakeholder perspectives;
- Quantitative: estimate distributions, associations, and segment differences;
- Integration: produce a coherent account that is both explanatory and generalizable within limits.

Objectives include eliciting perspectives on cultural heritage, liveability, usability, comfort, and building needs; validating interview insights through neighbourhood-level surveys; and informing the development of KPIs, interventions, and simulations in the HeriTACE project.

1.3.2. Method description

Literature review

The literature review synthesises current knowledge on:

- socio-cultural and behavioural drivers of decisions in heritage homes;
- emotional and identity-based attachments;
- ownership structures and their influence on retrofit capacity;
- regulatory, financial, and technical barriers;
- public attitudes toward heritage protection and reuse;
- comfort, indoor climate, and post-retrofit behaviour;
- tensions between sustainability objectives and cultural values.

The review provides the conceptual scaffolding for instrument design, sampling logic, and analytical categories used in the empirical phases.

Searches were conducted across academic databases (e.g., Scopus, Web of Science, Google Scholar), supplemented by policy reports (Historic England; Estonian National

Heritage Board; Italian Cultural Ministry), best-practice databases (HiBERatlas), grey literature from NGOs, heritage authorities, and municipalities, behavioural studies (Theory of Planned Behaviour applications).

Inclusion criteria emphasised relevance to domestic heritage, user experience, energy retrofitting, ownership, participation, and perceptions of change. Exclusion criteria removed studies without methodological transparency or without relevance to cultural-value impacts.

A thematic synthesis was used, producing conceptual domains that informed the empirical framework:

- Heritage significance, identity, and emotional attachment
- Stewardship, responsibilities, and ownership tensions;
- Barriers and enablers (regulations, cost, technical constraints, comfort);
- Perceptions of change (physical, social, neighbourhood, symbolic);
- Behavioural drivers (attitudes, norms, perceived control)
- User comfort and performance gaps

The topics were translated into interview prompts and survey topics and employed in the discussion of the findings after individual and cross-case/-country analyses.

Semi-Structured, qualitative in-depth interviews

The rationale and design cover semi-structured interviews (Magaldi & Berler, 2020; Lobe et al., 2022), allowing a consistent thematic framework while enabling exploration of emergent topics. In-depth interviews (Osborne & Grant-Smith, 2021) focus on subjective experiences, which are ideal for understanding perceptions of heritage, comfort, and usability. Interview Guide: Core themes include cultural value, liveability, usability, thermal comfort, spatial needs (Kvale & Brinkmann, 2015; Rubin & Rubin, 2012).

Purpose: To explore in depth how people:

- make sense of heritage in their living situations;
- perceive and evaluate physical changes and retrofitting interventions;
- experience comfort, authenticity, and tensions between preservation and modernisation;
- interpret responsibilities related to ownership or tenancy, and;
- understand regulatory processes and constraints.

This responds directly to literature identified gaps about lived experience, interpretive processes, and negotiation of heritage values. The interviews aim to capture lived experiences, perceptions, and decision-making processes related to heritage values, energy efficiency, comfort, and sustainability. Unlike quantitative surveys, these in-depth conversations provide nuanced insights into the motivations, priorities, and constraints that shape interventions in historic environments.

The interviews explore several interrelated themes:

- Cultural and heritage values: How residents perceive and prioritise heritage values such as architectural authenticity and neighbourhood character;
- Building condition and technical challenges: Experiences with structural integrity, insulation, ventilation, and energy systems;
- Environmental concerns and comfort: Balancing heritage preservation with thermal comfort, indoor air quality, and energy performance;
- Economic and regulatory factors: The influence of financial constraints, support schemes, and heritage regulations on retrofit decisions;
- Prioritisation of key topics: How residents rank heritage, comfort, energy efficiency, and sustainability in their decision-making.

By examining these dimensions, the chapter seeks to illuminate the complex interplay between cultural appreciation and practical needs. The findings reveal how emotional attachment to heritage coexists with concerns about cost, technical feasibility, and ecological responsibility. They also highlight barriers—financial, technical, regulatory, and informational—that impede the adoption of energy-efficient measures in heritage contexts.

The insights derived from these interviews are critical for informing policy frameworks, design strategies, and decision-support tools. They underscore the need for integrated approaches that respect heritage authenticity while enabling sustainable modernisation. Ultimately, this chapter contributes to a deeper understanding of user perspectives, offering evidence to guide interventions that reconcile conservation goals with contemporary living standards.

Data Collection: In-person or virtual interviews (60–90 minutes) were conducted in the autumn of 2024 and winter of 2024/-25, recorded with consent, and transcribed. Ethical Considerations cover an informed consent per interview, including confidentiality and sensitivity.

Data analysis: The data analysis was conducted using thematic coding and triangulation with field notes, following principles of case study rigor (Yin, 2018). Excel overview charts and NVivo coding has been employed.

Sampling: Purposive, maximum variation sampling is applied to capture:

- homeowners;
- tenants/residents;
- professionals (craftspeople, architects, property managers) when relevant.

Interviewee selection is a purposive sampling of building owners and users, an architect and a property manager, all directly linked to the domestic buildings in the case studies. The sample size is 15 interviews to reach thematic saturation, drawn from the selection of project archetypes (see figure 1.1.) established in task T5.0 and deliverable D5.1 in the HeriTACE project (Maton et al., 2024). All of the interviews either live in (as owners or tenants), have been involved in the design of, or work as property managers in buildings in the case areas described in

Street-Interview Survey (Neighbourhood Scale)

The street-interview survey was conducted to complement and validate qualitative findings by capturing perceptions, experiences, and attitudes among everyday users of heritage neighbourhoods across Belgium, Estonia, Italy, and Norway. Short, structured face-to-face interviews were carried out on-site using a random intercept sampling approach. All respondents were aged 18 or older. The survey combined closed questions (Q1–Q6) with three open-ended prompts (Q3, Q7, Q8), enabling mixed-methods analysis. Fieldwork followed GDPR-compliant procedures and informed consent was obtained verbally.

The street interview survey was designed as an on-site, face-to-face questionnaire targeting passers-by in selected urban heritage areas across four countries (Belgium, Estonia, Norway, and Italy) (Bryman, 2016). Respondents were approached at random to reduce selection bias and ensure a diverse sample of users (Dillman, Smyth, & Christian, 2014). Respondents were asked a series of structured questions addressing:

- Motivation for being in the area (e.g., passing through, shopping, visiting, or experiencing the atmosphere);
- Perceptions of the surroundings and level of enjoyment;
- Tolerance for physical changes to the area without losing its unique character;
- Potential impact of changes on personal use and activities.

Five quantitative questions were complemented by three open-ended prompts to capture qualitative explanations and reflections. The resulting data provide a nuanced understanding of how heritage environments are valued and used at a neighbourhood level, and how changes might affect users of these neighbourhoods.

The survey did not collect demographic identifiers (e.g., gender, age brackets, nationality) to minimise intrusiveness and ensure compliance with data protection requirements. The only criterion for participation was being over 18 years old. Although this limits demographic profiling, it ensures voluntary, low-barrier participation typical of street-intercept methodologies. The diverse mix of users within the sampled urban spaces—residents, workers, visitors, and passers-by—was captured through Q1 ('Why are you in the area today?'), which served as a functional proxy for user type.

Survey Design: Likert-scale items on comfort, liveability, trust in interventions, cultural appreciation; short open-ended prompts. The sampling strategy was to perform random passers-by in the selected neighbourhoods with heritage buildings, and the aim was to reach up to 100 responses (total number of interviews reached 73). The data collection was based on face-to-face surveys (5–10 minutes) by the researchers in each country respectively. The survey combined structured questions (Q1, Q2, Q4, Q5, Q6) with open prompts (Q3, Q7, Q8), allowing both quantitative analysis and qualitative interpretation. Q1 was also originally an open response. However, due to the answers being quite similar, the responses were grouped and converted to fixed answers during coding. Responses were compiled in an Excel dataset and cleaned according to a shared codebook; where ranges appeared (e.g., "2 to 3"), values were converted to the mean and rounded to the nearest valid integer, while invalid entries and "don't know" were treated as missing values where appropriate. Frequency counts were computed for each country, with stacked bar charts at country level and an aggregated cross-country chart for comparison. An overview of the number of respondents and neighbourhoods is provided in Table 4.1 (total n = 73 for all the investigated neighbourhoods).

Question	Options	Results
Q1: Why are you in the area today? **Responses: 73/73**	1=just passing through 2=to shop 3=live in the neighbourhood 4=Work here 5=looking for a job 6=visit a café/restaurant 7=parking 8=visiting someone 9=to see and experience the atmosphere	1 -> 20 1 -> 6 2 -> 16 3 -> 5 4 -> 2 5 -> 12 6 -> 1 7 -> 3 8 -> 8
Q2: How much do you like the surroundings? **Responses = 52/73**	1= poor; 2= slightly; 3= ok; 4= good; 5= very good; 0= don't know	1 -> 0 2 -> 0 3 -> 1 4 -> 27 5 -> 24 0 -> 0
Q3:	Qualitative/open answers	
Q4: How well do you enjoy being here? **Responses = 67/73**	1= poor; 2= slightly; 3= ok; 4= good; 5= very good; 0= don't know	1 -> 0 2 -> 0 3 -> 21 4 -> 22 5 -> 24 0 -> 0
Q5: How much change do you think the area can withstand without losing its character? **Responses = 72/73**	1= No change; 2= small changes like colour schemes, solar panels on the roof etc.; 3= slightly larger changes like small extensions, changing windows, solar panels on the wall, heat pupms, altering building details, etc.; 4= Major changes like demolishing and constructing new buildings in the same style and structure; 5= Very significant changes like demolishing and buildin something completely different/modern/parking lot etc.; 0= don't know	1 -> 23 2 -> 25 3 -> 15 4 -> 3 5 -> 4 0 -> 2
Q6: If the area is changed, will it affect how you use the area? **Responses = 68/73**	1=Yes 2=No 3=Don't know	1 -> 17 2 -> 38 3 -> 13
Q7: Why do you think potential changes might	Qualitative/open answers	

influence your activities or enjoyment of the area?		
Q8: How do you think potential changes might influence your activities or enjoyment of the area?	Qualitative/open answers	

Table 2: Overview of questions and results (quantitative questions Q1, 2, 4, 5, 6)

The survey included both closed-ended questions (Likert-type scales for Q2 and Q4 on perceived quality and enjoyment) and open-ended prompts (Q3 for qualitative explanations), enabling mixed-method analysis (Tuan, 1977).

The approach aligns with best practices for urban perception studies and heritage impact assessment, combining quantitative and qualitative insights for context-sensitive interpretation (UNESCO, 2011).

Country	**Number of respondents**	**Neighbourhood(s)**
Belgium	28	Vlaanderenstraat (17), Ghent Sint-Michielsplein (11), Ghent
Estonia	10	Uus-Maailm, Tallinn
Norway	15	Bakklandet, Trondheim
Italy	20	Via Montanara (3), Via Giulio Romano (4), Piazza San Leonardo (6), Piazza Sordello (7), Mantova
Total	***73***	**10**

Table 3: Overview of performed street interviews/surveys performed per country, including numbers and neighbourhoods

The total number of respondents to the survey was 73. However, not all respondents answered to all questions. Also, the number in each case area was limited, and might tend to prove not significant because the variation in answers is too big to yield a clear picture. However, a few answers and regressions do give significant values when analysing the findings and indicate trends of people's perceptions and impressions when spending time in the area.

Key sections

- **Survey Questions (Q1–Q6)**: Quantitative results on motivations, perceptions, enjoyment, tolerance for change, and behavioural impact.
- **Cross-country synthesis**: Highlights patterns and differences between countries.
- **Explanatory Analysis (adding Q3, Q7, and Q8)**: Linking quantitative and qualitative responses.

The data analysis covered both quantitative (descriptive statistics) and qualitative (thematic analysis) questions. To aid interpretation, the enjoyment of being in the area (Q4) was modelled as an outcome and examined its relationship to: reason for presence (Q1), liking of surroundings (Q2), tolerance for change (Q5), and whether changes would affect use (Q6). Given the sample size and uneven item response rates, these models are exploratory; results are best understood as indicative trends rather than definitive causal claims. Also, an interpretation of Q2–Q6 by Residency (Q1) was performed, as an analysis focusing on potential differences between respondents who live in the area (Q1 = 3) and all other users of the area.

Data preparation and coding

Responses were compiled in a shared dataset and cleaned according to a common codebook. Q1 was used to classify respondents as Residents (Q1=3) or Others (all remaining categories). For Q2, Q4, and Q5, values of 0 ('don't know') were excluded; for Q6, only valid codes (1=Yes, 2=No, 3=Don't know) were retained. Open-ended responses (Q3, Q7, Q8) were processed through structured binary thematic coding, including the presence/absence of themes such as heritage character, ambience, noise/traffic, greenery, functional use, and change-related concerns. Multiple themes could be assigned to each response.

Analytical Approach

The analysis consisted of four components: (1) residency-based comparisons, (2) cross-country comparisons, (3) cross-variable analysis, and (4) regression modelling. Residency comparisons applied descriptive statistics, Welch's t-tests for Q2, Q4, Q5, chi-square tests for Q6, and thematic contrasts from open responses. Country-level analyses replicated this structure within each national subsample, followed by between-country comparison using one-way ANOVA. Cross-variable analysis examined structural relationships among Q1, Q2, Q4, Q5, Q6 via cross-tabulations and statistical tests. Regression models (OLS for Q2, Q4, Q5; logistic regression for Q6) assessed multivariate relationships using Q1, area-level identifiers, and coded themes as predictors.

Software Tools

All data processing, coding, statistical analysis, and visualisation were conducted using Python (pandas, numpy, scipy.stats, statsmodels, matplotlib, seaborn) with python-docx used to generate report outputs.

Limitations

With a total of 73 respondents and uneven subgroup sizes across countries, results should be interpreted as indicative. The thematic coding of open-ended responses supports quantitative integration but does not replace full qualitative analysis.

2. In-depth interviews - Results

This chapter presents findings from qualitative interviews conducted with homeowners and residents of heritage buildings across four European countries: Belgium, Estonia, Norway, and Italy. The interviews aim to capture lived experiences, perceptions, and decision-making processes related to heritage values, energy efficiency, comfort, and sustainability. Unlike quantitative surveys, these in-depth conversations provide nuanced insights into the motivations, priorities, and constraints that shape interventions in historic environments.

2.1. Belgium

2.1.1. Background information about the residence

All the interviewees have been living in the buildings for a long time and are attached to their homes. Length of ownership and/or residency vary. One resident has been living in the building for 41 years but owned it for 5.

Interview	Length of ownership (years)	Ownership structure	Number of residents	Number of dwellings
Occ_A	5 (lived there 49 years)	Full ownership	3	1
Occ_B	41	Full ownership	2	2 (1 rental unit)
Occ_C	32	Full ownership	6	1
Occ_D	12	Full ownership	1	1

Table 4: Overview of interviewees' length of ownership, ownership structure, number of residents in apartment and building, and number of dwellings.

None of the case-buildings in the project are listed as protected monuments, however, they are on the Flemish inventory for ascertained built heritage. In the Belgian case study, none of the owners perceive any particular restrictions as a result of the high heritage value of the buildings they own. This might be related to the fact that these buildings are not protected by the highest protection level. Nor do the owners experience that their desires and possibilities to make changes or implement measures are obstructed because of heritage concerns.

2.1.2. State of building and building measures

Three of four buildings were in a worn-down to very bad situation at time of take-over. They have all done energy efficiency measures to a certain degree, mainly to increase the liveability and comfort levels. See overview of state of the buildings at the time of takeover and performed measures during the current owner's regime in table 5. The value of the terms *"very bad"; "worn down"; and "OK"* derives from the interviewees and is thus subjective and vague.

Interview	State of building at takeover	Measures performed after takeover
Occ_A	Very bad. Attic not in use, needed refurbishment, gas convectors	Refurbishment, installed central heating, roof renewal
Occ_B	Worn down.	Replaced kitchen, new windows in back façade, roof renovation (added insulation), Replaced 2 bathrooms and kitchen
Occ_C	OK. Gas stoves in all rooms.	A lot of renovation measures have been performed after takeover. Central heating installed, heat pump in basement, new windows according to original, air-condition in bedrooms.
Occ_D	Very bad.	Removed walls/doors ground floor. Installed floor heating and roof in the courtyard. Opened first floor by removing walls, installed new doors + flooring. New bathroom second floor (in previous bedroom). Later insulated and replaced roof (structure remained).

Table 5: Overview of the state of the building when the current owner/interviewee took over the building, and which measures have been implemented during their ownership of the building.

2.1.3. Cultural heritage- and heritage environment values

Reasons behind choosing to live in the building vary between the four. For all of them, location and accessibility (to work) were key features. For two of the owners, heritage values, historic details, and aesthetics were important factors for choosing the building.

One of the homeowners replied that choosing the particular house was *"actually more coincidence than with a purpose. I needed a new house. The façade was nice, but I was not especially attracted to it. An important requirement was space for a practice room. And this building was big enough for all of this. My new house had to be in the centre of Ghent, but not especially in this neighbourhood. Also, it needed to be easily accessible by bike and foot"* (citation from interview with Occ_D/Belgium). Thus, in this case the reasoning for selection of a new home was not linked to heritage values.

When describing the significance or attractiveness of the neighbourhood, the accessibility and closeness to the city centre is emphasized as positive by all interviewees. The heritage value is highlighted as an important asset and valuable factor by three of the four, and one of the interviewees explain how they appreciate it: *"The entirety of all the facades are very nice, also there is a positive evolution in the neighbourhood of owners who are restoring their facades to a better condition, with respect for the heritage"* (citation from interview with Occ_D/Belgium).

The interviews display that although heritage features are not equally important to all four homeowners, the heritage values of the buildings are highly appreciated as a factor contributing to well-being. Also, the fact that increasing refurbishment of buildings in the neighbourhood is noticed and highly regarded. Other esteemed factors are potential in the building plans and structures, and the value of having a garden.

If parts of the building would be remodelled/changed without attending to the heritage values of the building (entailing new windows, new panelling, etc.), all four homeowners reply that it would affect the attractiveness of living in the building in a negative way. One would consider moving, another owner replies that "*Changing the front façade is no option*" (citation from interview with Occ_B/Belgium). They pronounce a feeling for the heritage and explain that it has grown throughout the years. Further, the interviewee explains that some changes and measures could be ok: "for example, changing for PVC windows would not directly affect their appreciation" (citation from interview with Occ_B/Belgium). All four emphasizes similar changes and devaluation of the heritage values of the neighbourhood as a pity, although one maintains that as long as the buildings remain, it is ok.

The willingness to endure inconveniences to maintain the building's heritage and authenticity is described as highly present in all four interviews. They all describe how they appreciate the heritage values, and that it is prioritized. One of the homeowners replied that "I would much rather live in an old, stylish house with slightly less comfort than the other way around. Also, ecological thinking is important. Colder is not really a problem" (citation from interview with Occ_A/Belgium). However tolerant, one owner expresses that they are actually quite satisfied with the present comfort level, after having performed extensive measures in their home (façade insulation, changed windows, insulated roof).

The interviews show that heritage values, both in one's own building and in the surrounding neighbourhood, are important to those interviewed, albeit to some extent in varying degrees. It appears that the idea of preserving the historic building stock has become more important to them over time.

2.1.4. Building Technology and installations

The proposed retrofit measures were met with a range of responses from the interviewees. Interior insulation was generally viewed as problematic, primarily due to concerns about thermal bridging and the potential loss of original architectural proportions.

	Occ_A	Occ_B	Occ_C	Occ_D
Exterior insulation front facade	If façade is not that valuable. For a valuable unique façade, not a good option. The windows will lie deeper in the façade.	No, limited gain	Would be terrible, is not admitted.	No
Exterior insulation back facade	Fine		OK if plaster pattern can be replicated and cornice preserved	OK
Interior insulation	Risk of thermal bridges, and of losing original proportions	Walls are thick enough to insulate adequate.	Not on ground floor, applicable on other floors. Walls are thick enough. Building physics must be checked.	No

Windows	Replace single glazing with double glazing in the original frames.	No completely new windows in front facades. Technical issues for replacing glass. Replacing with new replica windows according to original seen as okay	Replaced by new wooden ones according to original models is preferred. If replacing the glass: cost relative and if the condition of wooden frames is sufficient.	Replacing glazing in existing frames = lot of effort for the gains. Replacing with new windows according to original model is OK
Open chimneys for technical measures	Convenient way to integrate ducts, without cutting through floors or walls.	Yes	OK	Good idea
Floor heating	OK	Difficult, OK on all floors. Visually small impact and floor height difference is limited.	Don't see the benefit, too slow system. Difficult with wooden flooring.	No
PV panels	OK, normally not visible and an easy energy source, although a pity on this sort of buildings. PV cells in a foil OK.	OK if not visible from street. A pity if only one roof in a row of historical buildings. Either all or none.	OK on the roof. Not possible in this dwelling. Question of cost.	Ok, but it disturbs me.

Table 6: Owners/users opinions about a diversity of retrofit measures

Photovoltaic (PV) panels were accepted among the four interviews, although some expressed reservations about their visual impact on historic buildings, particularly if they were seen from the street. The visual impact seen from a neighbourhood level was noted as important; either one or all: *"OK if not visible from street. A pity if only one roof in a row of historical buildings. Either all or none." Citation from interview with Occ_B.* Floor heating was considered suitable by only one respondent, with others citing technical limitations, such as incompatibility with wooden flooring or insufficient performance. The use of existing chimneys for technical installations was positively received by all four, seen as a practical solution that avoids invasive structural alterations.

Exterior insulation on rear façades was deemed acceptable by three of the interviewees, provided that architectural details could be preserved. In contrast, the application of insulation to the front façade was renounced in most cases. Exterior insulation was strongly rejected by three interviewees because visual degradation. For the fourth interviewee, it would be acceptable as the original plaster was already replaced (this building was the only one that was not on the Flemish inventory of ascertained heritage). Interior insulation was treated with more nuance: it would be possible in places where valuable interiors wouldn't be harmed. For both applications, the added value of insulation was questioned. Window replacement was considered acceptable by all homeowners, when aligned with original design features. Replacing of glazing within existing frames could be an acceptable strategy, but was met with doubt, largely due to the perceived effort relative to the benefits.

The current condition of the buildings was described as generally good by three respondents, with one considering their property to be in near-perfect condition. Nonetheless, issues such as local water leakage, moisture, and mould were reported to a minor extent in three of the four buildings. One owner noted minor problems with foundation moisture and basement dampness, while another highlighted draughts at the front door.

Regarding energy use, two respondents believed their consumption to be low, one reported high usage, and the fourth considered theirs to be average. Traditional heating sources such as fireplaces remain in use in two of the buildings. Additionally, all properties have rooms or entire floors that are not heated.

2.1.5 Environmental concerns, comfort, economy, and energy efficiency measures

When asked to reflect on the financial benefits of implementing energy-efficient measures – both immediate and long-term – the owners provided notably varied responses. One resident emphasised that it was not solely a matter of cost; the heritage aspect of the building was clearly significant. The availability of subsidies played a key role in enabling the improvements they carried out. For a second interviewee, ecological motivations outweighed economic ones. Their changes were primarily driven by a desire for increased comfort and reduced energy consumption. They expressed a wish to act now, with respect for heritage, to avoid future generations making irreversible mistakes. Although a potential increase in property value was seen as a benefit, they did not expect to recoup the investment. A third owner highlighted savings on heating costs as a major factor. Heating the entire building was expensive, and the long-term impact of replacing the windows was their main motivation. For the fourth and final interviewee, financial considerations held little importance.

The owners' decisions to implement energy-efficient measures are influenced by a range of factors, such as heritage considerations, technical state, potential structural impact, personal knowledge and situation, comfort, financial viability, ecological responsibility, economic circumstances, and the availability of support schemes. In some cases, a short time horizon – such as plans to relocate – deters investment in substantial upgrades. Comfort enhancement seems to be a recurring motivation, though several barriers to adopting fossil-free alternatives (such as heat pumps, photovoltaic panels, and solar collectors) were identified. These include the continued functionality of existing systems, perceived imbalance between investment and benefit, and the disruptive nature of large-scale works, particularly following previous renovations. Stress and inconvenience associated with implementing such measures also play a role, as does the lack of infrastructure (e.g., charging points for electric vehicles). While financial and ecological considerations are important, they are often weighed alongside broader notions of comfort and lifestyle. Some respondents expressed scepticism regarding the efficiency of certain technologies, such as heat pumps, or cited practical limitations, such as roof suitability for solar panels. For others, ecological concerns – particularly the climate crisis – were the primary driver. Nonetheless, hesitation persists, sometimes attributed to inertia or the perceived burden of undertaking impactful renovations.

2.1.6. What matters most: Prioritizing key topics

Among the four interviewees, only two explicitly identified what they considered most important to prioritise in relation to the topics discussed. One emphasised comfort and heritage values, while the other highlighted heritage aspects alongside ecological motivations. When asked to rank the given topics, all four participants responded. Increasing the value of the property was generally regarded as the least important for almost all of them. Comfort – understood in a broad sense, including factors such as noise reduction – was also considered of secondary importance, alongside heritage values.

Energy efficiency measures were prioritised most highly by one respondent, whereas another placed them lower on the scale, expressing scepticism about the willingness of individuals to invest significantly for climate-related reasons. Reducing heating costs was seen as a primary concern by one participant, particularly in relation to investment costs, but was rated as moderately or less important by the remaining three. The notion of contributing to the preservation of the local environment's quality and experiential value received a range of priorities – first, second, fourth, and fifth – suggesting a nuanced appreciation of its significance.

This outcome is somewhat unexpected, given that heritage values were consistently ranked as secondary by all four respondents. It suggests that while heritage is acknowledged as important, it may not be the primary driver of decision-making. Instead, practical considerations such as comfort, cost, and ecological responsibility appear to exert a stronger influence.

2.1.7. Discussion

The interviews reveal a nuanced and multifaceted relationship between homeowners and their historic buildings. All four interviewees have long-standing ties to their homes, with ownership and residency spanning several decades. Despite the varied initial conditions of the buildings—ranging from worn down to reasonably well-maintained—each owner has undertaken a series of energy efficiency and refurbishment measures, demonstrating a commitment to improving both comfort and functionality.

Heritage values emerge as a significant, though not universally dominant, factor in decision-making. While only two respondents cited heritage as a key reason for choosing their home, all four expressed appreciations for the architectural character and historic environment of their neighbourhood. The aesthetic coherence of façades and the respectful restoration efforts by other residents/neighbours were particularly valued. Importantly, none of the buildings are formally listed as protected monument, but are on the Flemish inventory for built heritage, ascertained heritage. None of the owners reported experiencing regulatory constraints due to heritage considerations. This suggests that informal appreciation of heritage can be a powerful motivator, even in the absence of formal protection.

The owners' attitudes towards retrofit measures vary considerably. While photovoltaic panels and the use of chimneys for technical installations were generally accepted, interior insulation and floor heating were met with scepticism due to concerns about building physics, comfort, and heritage integrity. Exterior insulation on front façades was unanimously rejected, reflecting a strong desire to preserve the visual character of the buildings. Window upgrades were conditionally accepted, provided they respected the original design.

Environmental concerns, financial considerations, and comfort were all cited as influential factors in decisions to implement energy-efficient measures. However, the weight given to each varied. For some, ecological responsibility and long-term sustainability were paramount; for others, immediate comfort or cost savings were more pressing. Notably, one respondent expressed ideological motivations linked to the climate crisis, while another questioned the economic rationale of investing in energy measures solely for environmental reasons.

Heritage values were consistently ranked as secondary, despite being widely appreciated. Comfort and energy efficiency received mixed responses, with only one respondent placing energy measures at the top of their priorities. Interestingly, the value of contributing to the quality and experiential character of the local environment received relatively high rankings, suggesting that collective heritage and neighbourhood identity may carry more weight than individual building features.

2.1.6. Concluding the Belgian in-depth interviews

The findings illustrate the complexity of homeowner motivations in historic buildings. While heritage values are clearly appreciated and respected, they are not always the primary driver of decisions regarding energy efficiency or refurbishment. Instead, practical concerns, such as comfort, cost, and ecological responsibility, tend to dominate. The absence of formal heritage restrictions allows for a flexible approach, enabling owners to balance preservation with modernisation according to personal values and circumstances.

The diversity of responses underscores the importance of tailored policy approaches that recognise the varied priorities of homeowners. Support schemes, technical guidance, and community engagement strategies should be sensitive to both the emotional and practical dimensions of living in historic buildings. Encouraging respectful interventions that align with both heritage and sustainability goals may be key to fostering long-term stewardship and climate resilience in historic urban environments.

The variation in prioritization responses reflects differing personal circumstances, levels of engagement, and long-term intentions, highlighting the complexity of motivations behind energy-related interventions in heritage buildings. This indicates that it is important that a Multi-Criteria Decision Making (MCDM) allows to account for varying objectives.

2.2. Estonia

2.2.1. Background information about the residence

All the interviewees have been living in the buildings for a long time. Length of ownership and/or residency vary. All of the case buildings are organised as apartment/housing cooperatives. The owners are fully able to implement measures if this is favoured by the other owners, permissible by the city government, and they are able to afford it.

Interview	Length of ownership (years)	Ownership structure	Number of residents in respondent's home	Number of dwellings
Occ_BrickA1	15	Full ownership	3	8 (3 rental units)
Occ_BrickB1	19	Full ownership	4	34 (number of rental units unknown)
Occ_WoodB1	12	Full ownership	5	10 (1 rental unit)
Occ_WoodC2	5	Full ownership	3	6 (0 rental units)

Table 7: Overview of interviewees' length of ownership, ownership structure, number of residents in apartment and building, and number of dwellings

2.2.2. State of building and building measures

During the Soviet era, the buildings were owned by the state, and their upkeep and refurbishment was generally lacking. After regaining of Estonian independence (1991), the dwellings were returned to their previous owners (before annexation of Estonia in 1939) or privatized. Works that mainly been performed after 1991 on the archetypical buildings studied here, include:

- New roof(ing);
- Attic conversion or attic floor insulation;
- Replacement/refurbishment of heating system;
- Replacement/upgrade of windows;
- Partial interior insulation of exterior walls (on wooden buildings).

2.2.3. Cultural heritage- and heritage environment values

The interviewed residents have chosen their homes based on a combination of historical significance, logistical convenience, and emotional attachment. The presence of heritage status may not be the initial motivator for residence, but it contributes to the perceived value over time. Central location, architectural features such as high ceilings and large windows, and access to gardens and parking are commonly cited as attractive elements.

The aesthetic and historical qualities of buildings and neighbourhoods enhance their appeal, especially when renovations are carried out respectfully. Authenticity and preservation of original features are considered important, and poor retrofitting practices are viewed negatively. Improvements that align with heritage values are generally seen as increasing attractiveness and real estate value.

Economic factors play a significant role in residential decisions. While some residents face high costs, others view their choice as economically sound within the context of the neighbourhood. Financial considerations influence the feasibility of renovations and the willingness to endure certain inconveniences for the sake of heritage preservation.

Proximity to city centres, workplaces, and educational institutions is a key factor in residential preference. The availability of various modes of transportation enhances the desirability of the location. Residents value the logistical advantages offered by central neighbourhoods, which contribute to their overall satisfaction.

The design and architectural quality of buildings and their surroundings are important to the residents. Authenticity, condition, and planning of the neighbourhood contribute to the overall experience. Changes that compromise the historical character of buildings are viewed unfavourably while respectful renovations are welcomed by three of four interviewees, although one of the interviewees highly welcome such changes.

2.2.4. Building technology and installations

The general condition of the buildings is perceived as satisfactory, with major renovations such as roofing having been completed prior to occupancy. Routine maintenance is deemed sufficient for continued functionality, although concerns regarding indoor air quality, mould, and heating costs persist in some cases.

Visible damage such as cracks and mould growth has been reported, particularly on facades and in cellars. Moisture infiltration through foundation walls and basement dampness are recurring issues, especially following heavy rainfall. Some buildings exhibit signs of wear on wooden boards and plaster, necessitating repair or replacement.

Instances of water leakage have been observed, notably in bathrooms located in converted attic spaces. However, buildings with newer roofing systems generally do not report issues with gutters or downspouts. Moisture stains and condensation are not widespread, though foundation-related water ingress remains a concern.

Thermal discomfort due to cold masonry walls and insulation deficiencies in attic conversions has been noted. Airtightness measurements and thermographic assessments have identified air leakages, contributing to reduced comfort. Cold surfaces and drafts are problematic in certain areas, particularly near corners and behind furniture. *"Walls are cold (on the floor with masonry walls), uncomfortable to stay nearby, especially in the corners. On the converted attic (timber frame structure under the roof) there seem to be insulation and airtightness issues"*. Citation from the interview with Occ_BrickA1. Here, air leakages have been determined by airtightness measurements and thermography by TalTech.

Ventilation challenges include the infiltration of cooking odours from neighbouring units and inadequate air exchange through window airing. High occupancy levels exacerbate the issue, resulting in stale indoor air. The current ventilation systems are considered insufficient for maintaining optimal air quality.

Heating costs are perceived as high in some buildings, although others report no significant issues. The technical infrastructure is generally functional, but the effort required for repairs and maintenance is considerable. Energy efficiency remains a concern, particularly in masonry buildings with limited insulation. Wood-burning stoves are present in several buildings and are reported to be in acceptable condition. However, their usage is mainly limited to a few dwellings where inhabitants prefer the "character" of stove heating, with the majority favouring alternative heating methods (gas boilers, district heating, air-air heat pumps).

2.2.5. Environmental concerns, comfort, economy, and energy efficiency measures

The responses highlight a range of experiences and perceptions regarding energy consumption, comfort, and energy efficiency in heritage buildings. Most respondents reported that their buildings are generally comfortable, with adequate heating systems. However, specific issues were noted, particularly in converted attic spaces, where heating is insufficient and insulation is poor. One of the respondents anticipates future challenges with cooling during warmer months. Heating practices vary slightly, with some residents opting for cooler temperatures in certain rooms for personal comfort or due to system limitations. Automatic energy measurement systems are in place in some buildings, but support schemes for energy-efficient upgrades are perceived as inaccessible or unsuitable for heritage properties. Financial constraints, lack of knowledge, and regulatory restrictions are common barriers to implementing energy efficiency measures.

2.2.6. What Matters Most: Prioritising Key Topics

The analysis of the prioritised topics indicates a pragmatic approach among residents. Energy efficiency and indoor comfort are top concerns, especially for those experiencing cold or poorly insulated areas. The emphasis on reducing heating costs aligns with earlier concerns about high energy expenses. One has a focus on a holistic renovation plan that includes ventilation, water systems, and insulation reflects a strategic and long-term perspective. The two owners of apartments in wooden buildings prioritised damage prevention, suggesting a proactive stance toward building maintenance. The responses from the four residents reveal a shared concern for improving energy efficiency, enhancing indoor comfort, and reducing heating costs. One explicitly prioritised these three aspects, while another emphasized a comprehensive renovation approach that preserves heritage values. The two last respondents did not provide detailed rankings but indicated priorities through earlier responses, particularly in preventing damage and maintaining heritage aesthetics.

2.2.7. Discussion

Cultural heritage and heritage environment values

The age and authenticity of buildings are valued to varying degrees. While some residents express a strong preference for maintaining original features, others are more pragmatic. Disrespectful alterations can lead to dissatisfaction, and there is a general desire to preserve the characteristic façades and architectural integrity.

Residents demonstrate a willingness to endure certain inconveniences, such as high heating costs and reduced comfort, in order to maintain heritage authenticity. However, there are limits to this tolerance, with issues like mould and poor air quality prompting the need for action. The balance between comfort and preservation is a recurring theme.

Heritage status influences the ability and desire to implement changes. While some residents feel restricted by regulations, others appreciate the role of heritage in maintaining the character of the neighbourhood. The status itself may be less important than the overall fit within the historical context.

Expressed challenges include high costs, coordination efforts for renovations, and technical issues such as ventilation and traffic design. Positive aspects include architectural features, reduced street congestion due to limited parking, and the overall charm of the neighbourhood. Residents express a desire for thoughtful solutions to modern challenges while preserving historical integrity.

The analysis reveals a complex interplay between heritage values, economic considerations, and personal preferences. While authenticity and historical depth are appreciated, practical factors such as location and cost also play a crucial role. Respectful renovations and community cooperation are essential for maintaining the attractiveness and functionality of heritage environments.

Building technology and installations

The buildings are structurally sound, with recent roof replacements and routine maintenance. However, issues such as moisture, mould, and ventilation problems persist, especially in converted attic spaces and cellars. Insulation deficiencies lead to cold surfaces and high heating costs. Ventilation is inadequate across all buildings, with cooking smells and stale air being common complaints. Heating systems are functional but vary in efficiency. Unused fireplaces and stoves suggest potential for alternative heating solutions. Overall, technical upgrades are needed but must respect heritage constraints.

A complex interplay appears, between structural integrity, energy efficiency, and occupant comfort. While the buildings are generally well-maintained, specific issues such as moisture ingress, insulation deficiencies, and ventilation inadequacies require targeted interventions. Future efforts should focus on enhancing building performance through respectful renovations that preserve heritage value while improving living conditions.

Environmental concerns

The findings reveal a pragmatic approach to energy use and comfort among residents of heritage buildings. While most participants are satisfied with their current living conditions, there is a clear recognition of areas needing improvement, particularly in terms of insulation and heating efficiency. The converted attic spaces, as noted by one of the interviewees, present unique challenges due to inadequate heating and insulation. One homeowner is concerned about future cooling needs, reflecting a growing awareness of climate change impacts. Despite the presence of energy measurement systems, the lack of tailored support schemes for heritage buildings limits the feasibility of retrofitting. Two of the respondents express frustration over the complexity and inaccessibility of existing financial aid programs, which are often designed for newer buildings. Knowledge gaps further hinder proactive energy efficiency improvements, as residents are unsure of what solutions are compatible with heritage preservation requirements.

Prioritising Key Topics

The prioritisation of energy efficiency and comfort over other factors such as increasing property value or switching to sustainable energy sources suggests that residents are primarily motivated by immediate liveability and affordability. This is consistent with earlier findings where financial constraints and practical limitations were cited as barriers to implementing energy-efficient measures. The lack of emphasis on sustainable energy solutions may reflect a perceived disconnection between available technologies and the constraints of heritage preservation. Moreover, the absence of responses regarding the quality of the local environment or structural repairs may indicate either satisfaction with current conditions or a focus on more pressing personal concerns.

2.2.8. Concluding the Estonian in-depth interviews

The analysis reveals a pragmatic approach to heritage living, where residents balance appreciation for authenticity with practical needs. While heritage status adds value, it also imposes constraints that affect comfort and affordability. Technical challenges such as insulation, ventilation, and moisture control require sensitive solutions. The lack of tailored support schemes and accessible information hinders progress. Future conservation efforts must integrate sustainability, liveability, and heritage preservation to meet resident needs effectively.

While the answers indicate that comfort levels in heritage buildings are generally acceptable, there is a strong desire among the answering residents to improve energy efficiency and reduce heating costs. The main obstacles include financial limitations, regulatory constraints, and a lack of accessible information and support. To address these challenges, policy makers and heritage conservation bodies should consider developing targeted support schemes and educational resources that cater specifically to the needs of heritage building residents. Such initiatives would empower residents to make informed decisions and implement sustainable improvements without compromising the historical integrity of their homes.

It seems that the most critical priorities for residents of heritage buildings are improving energy efficiency, enhancing indoor comfort, and reducing heating costs. While heritage preservation remains important, it is often considered within the context of broader renovation efforts. The findings underscore the need for integrated, resident-informed renovation strategies that address both technical and heritage considerations. Support mechanisms should be tailored to the unique challenges of heritage buildings to enable sustainable and comfortable living environments.

2.3. Norway

2.3.1 Background information about the residence

Two of three respondents are private owners, of which the interviews yield broad information. The third is a professional landlord, who does not share private thoughts, and does not answer to many of the questions asked.

All the interviewees have been living in the buildings for a long time and are attached to their homes. Length of ownership and/or residency vary. The two private owners have lived in the buildings for respectively 13 and 21 years.

Interview	Length of ownership (years)	Ownership structure	Number of residents	Number of dwellings
Occ_B	13	Full ownership	2 (1 in each unit)	1
Occ_D		Professional owner/property manager	2 (1 tenant in each unit)	2 rental units
Occ_F	21	Full ownership	1 in case unit 15 in remaining units	10 (full ownership) 9 rental unit

Table 8: Overview of interviewees' length of ownership, ownership structure, number of residents in apartment and building, and number of dwellings

2.3.2 State of building and building measures

All four buildings were in a worn-down to very bad situation at time of take-over. They have all been subjected to energy efficiency measures to a certain degree. See overview of state of the buildings at the time of take-over and performed measures during the current owner's regime in table 9.

Interview	State of building at takeover	Measures after takeover
Occ_B	Very bad - the building was in a very run-down condition. Windows from the 1950's are to be kept	Ground insulation, roof insulation. Some exterior wall insulation, needs to be changed.
Occ_D	Windows changed in the 80's needs to be changed, need insulation and upgrading of doors for better energy efficiency/lower energy consumption.	Present state is: Needs renovation, facing major renovation and upgrading. Tenants are moving out, but the cafe will continue renting after the renovation. Windows needs to be changed, need insulation and upgrading of doors for better energy efficiency/lower energy consumption.
Occ_F	Quite good, newly refurbished	Installation of heat-pump

Table 9: Overview of the state of the building when the current owner/interviewee took over the building, and which measures have been implemented during their ownership of the building

2.3.3 Cultural heritage- and heritage environment values

The responses reveal a strong appreciation for the cultural and heritage values embedded in the buildings and neighbourhood. The two private owners chose to live in the area due to its historical charm, architectural character, and proximity to city amenities. One of the private owners emphasised a personal passion for heritage and craftsmanship, while the other highlighted the importance of walkability and a car-free lifestyle. The attractiveness of the neighbourhood is closely tied to its preserved wooden architecture, balanced urban proportions, and pedestrian-friendly environment. The respondents expressed concern about remodelling and changes, noting that such interventions must be respectful of heritage values to maintain the area's appeal. Economic factors, such as limited access to support schemes and the cost of maintenance, were also noted. The heritage status influences the ability to make changes, with restrictions on visible alterations and infrastructure upgrades. Challenges include absentee ownership (the professional owner) and insufficient municipal support, while positive aspects include well-adapted new developments and a vibrant social environment.

The analysis indicates that heritage value is a central factor in residential satisfaction for the two private owners. Their responses suggest that the authenticity and historical integrity of the buildings and neighbourhood significantly contribute to their quality of life. Further, the first private owner's engagement with the City Conservation Officer and the other's awareness of conservation plans demonstrate a proactive approach to heritage preservation. However, the limitations imposed by heritage status, such as restrictions on external modifications and infrastructure upgrades, present practical challenges. Economic constraints further complicate the ability to implement necessary improvements, especially for individual owners. The lack of fibre internet and restrictions on solar panels illustrate the tension between modern needs and conservation requirements.

2.3.4 Building technology and installations

Also under this topic, the private owners' responses differ from the professional owners', in providing detailed insights into the current state and technical aspects of their heritage buildings. One of the private owners noted that the building is in relatively good condition but highlighted the need for roof and chimney repairs. The other emphasised the importance of indoor air quality and the use of a heat pump, noting that others in the joint ownership rely solely on electric heating. Both respondents identified issues such as rot, moisture accumulation , and insulation deficiencies. One of the private owners also mentioned subsidence in the backyard and water seepage into the basement during high tides or storm surges. One respondent reported poor insulation performance and draughts in staircases and hallways. Chimney use varied: One private owner had restored the chimney with a steel flue liner, while the other had disconnected theirs due to fire safety regulations.

The responses reflect a shared concern for maintaining the structural integrity and functionality of heritage buildings while navigating the challenges posed by their age and construction. One had experience with ineffective insulation and the need for a proper wind barrier underscores the complexity of retrofitting heritage structures. The other's proactive approach, including the installation of a heat pump and consideration of alternative energy sources, illustrates a forward-thinking attitude towards sustainable living. However, both

respondents face limitations due to the heritage status of their buildings, which restricts certain modifications and necessitates careful planning and consultation with conservation authorities.

2.3.5 Environmental concerns, comfort, economy, and energy efficiency measures

The responses from the two private owners/residents reveal a shared understanding of the limitations and opportunities associated with living in heritage buildings. One of them maintains a low indoor temperature to manage energy consumption, though acknowledges it could be improved. The other expresses an acceptance of the lower thermal comfort as a trade-off for living in a historic property, noting that the heat pump provides sufficient warmth. Heating systems are generally functional, but the first owner reports poor and unbalanced performance, with cold zones in staircases and hallways. The other private owner finds the system adequate and regulates temperature manually. Both respondents confirm awareness of the heating season and use their buildings year-round. One of them rents out the ground floor and lives on the second floor, while the other uses all rooms except the unheated storage space. Energy-efficient measures are viewed positively, though the second home-owner highlights knowledge gaps and the need for confidence in long-term solutions. Neither building has advanced energy monitoring systems beyond standard electricity meters.

Interpretation of the respondents' answers suggests that comfort and energy efficiency are important considerations, albeit secondary to heritage preservation. One respondent's experience with poor insulation and heat loss underscores the technical challenges of retrofitting older buildings. The second interviewee's reliance on a heat pump demonstrates a proactive approach to improving indoor climate while respecting the building's character. The lack of advanced energy monitoring systems indicates limited infrastructure for tracking and optimising energy use. Financial incentives such as ENOVA grants are acknowledged, but knowledge gaps remain a barrier to implementation.

2.3.6 What Matters Most: Prioritising Key Topics

The responses from the two private owners highlight a shared prioritisation of maintaining the heritage values of their buildings and neighbourhoods. Both respondents ranked the preservation of architectural and historical character as their top priority. They also placed significant emphasis on repairing major structural damages and improving energy efficiency. Other priorities included maintaining the quality of the local environment, preventing damage, and improving indoor comfort. While on interviewee placed a higher emphasis on reducing heating costs, the other acknowledged the importance of sustainable energy solutions and long-term value enhancement.

2.3.7 Discussion

Cultural Heritage and Heritage Environment Values

The discussion highlights the delicate balance between preserving heritage and accommodating contemporary living standards. The residents value the historical character of their environment and are willing to endure certain inconveniences, such as reduced comfort and limited technological access, to maintain authenticity. There is a clear desire for more supportive policies and incentives to facilitate responsible preservation efforts. The presence of absentee owners and inconsistent renovation practices might pose risks to the

integrity of the neighbourhood. Community engagement and municipal support are essential to sustain the heritage environment and encourage active stewardship among residents.

Building technology and installations

The findings highlight the tension between preserving heritage values and ensuring modern living standards. While both the private homeowners are committed to maintaining the historical character of their buildings, they also recognise the need for technical upgrades to improve comfort and energy efficiency. The presence of moisture ingress, inadequate insulation, and outdated heating systems are common issues that require attention. The lack of uniformity in heating solutions within shared buildings, as noted by the second private owner, further complicates collective decision-making. Moreover, the challenges of implementing changes due to regulatory constraints and financial limitations are evident. These factors necessitate a balanced approach that respects heritage while enabling necessary modernisations.

Environmental concerns, comfort, economy, and energy efficiency measures

Interpretation of the respondents' answers suggests that comfort and energy efficiency are important considerations, albeit secondary to heritage preservation. One respondent's experience with poor insulation and heat loss underscores the technical challenges of retrofitting older buildings. The second interviewee's reliance on a heat pump demonstrates a proactive approach to improving indoor climate while respecting the building's character. The lack of advanced energy monitoring systems indicates limited infrastructure for tracking and optimising energy use. Financial incentives such as ENOVA grants are acknowledged, but knowledge gaps remain a barrier to implementation.

The responses highlight the delicate balance between maintaining heritage values and achieving modern comfort and energy efficiency. Residents are willing to accept certain inconveniences, such as cooler indoor temperatures, in exchange for the aesthetic and historical benefits of their homes. However, technical limitations, such as poor insulation and unbalanced heating, present ongoing challenges. The importance of accessible information and reliable solutions is evident, as is the need for tailored support schemes that consider the unique constraints of heritage buildings. The use of alternative energy sources, such as heat pumps, reflects a growing awareness of sustainability, though broader adoption may be hindered by cost and regulatory factors.

Prioritising Key Topics

Interpretation of the respondents' answers suggests that heritage preservation is not only a cultural value but also a personal commitment. The two private owners' both demonstrate a strong alignment between their lifestyle choices and the architectural and historical significance of their homes. The prioritisation of energy efficiency and structural repairs indicates a pragmatic approach to maintaining comfort and functionality within the constraints of heritage conservation. The emphasis on sustainable energy sources and reducing heating costs reflects growing awareness of environmental concerns and economic sustainability.

The prioritisation patterns reveal a nuanced understanding of the challenges and responsibilities associated with living in heritage buildings. Residents are not only motivated by aesthetic and historical values but also by the need to ensure the longevity and usability of their homes. The responses suggest that while comfort and cost are important, they are

often secondary to the overarching goal of preserving the unique character of the neighbourhood. The lack of input from the professional owner limits the generalisability of the findings, but the consistency between the two other respondents provides valuable insights into the mindset of heritage property residents.

2.3.8 Concluding the Norwegian in-depth interviews

In conclusion, cultural heritage and heritage environment values are deeply embedded in the identity and appeal of the neighbourhood. The residents demonstrate a strong commitment to preserving these values, despite facing economic and regulatory challenges. To ensure the continued attractiveness and sustainability of such areas, it is crucial to provide accessible support schemes, promote responsible ownership, and balance conservation with modern living needs. Respectful adaptation and community-oriented planning will be key to maintaining the unique character of heritage neighbourhoods.

The responses from the two private owners underscore the importance of integrating building technology upgrades with heritage conservation. While the buildings are cherished for their historical and architectural value, they also demand significant maintenance and thoughtful interventions to remain habitable and energy efficient. The analysis of the respondents' responses indicates that future efforts should focus on developing tailored solutions that address the unique challenges of heritage buildings, including improved insulation, moisture control, and sustainable energy systems, all while preserving their historical integrity.

In conclusion, the most critical priorities for the interviewed residents of heritage buildings include the preservation of architectural and historical values, structural integrity, and energy efficiency. These priorities reflect a balance between cultural appreciation and practical living considerations. Support mechanisms and informed guidance are essential to empower residents in making sustainable and respectful improvements to their properties. The findings indicate that future policies should aim to align heritage conservation with modern living standards to support the long-term viability of such neighbourhoods.

2.4. Italy

2.4.1. Background information about the residence

Three of the four interviewees have been living in the buildings for many years (10+) and are attached to their homes. One resident has been living in the building for 3 years.

Interview	Length of ownership	Ownership structure	Number of residents	Number of dwellings
Occ_C	More than 10 years	Tenant	6+	Several
Occ_GR	3 years	Architect/owner's representative	0	1
Occ_M	More than 10 years	Full ownership	0	1
Occ_PV	More than 10 years	Tenant	0 (not in use, earlier 2)	1

Table 10: Overview of interviewees' length of ownership, ownership structure, number of residents in apartment and building, and number of dwellings

2.4.2. Cultural heritage- and heritage environment values

The respondents highlighted the significance of living in historically valuable buildings and neighbourhoods. Reasons for choosing these residences included proximity to work and family, the building's monumental status, and architectural uniqueness. The buildings are situated within UNESCO-designated areas, contributing to their cultural and historical importance. Respondents expressed appreciation for features such as frescoes, wooden trusses, and reed ceilings, which enhance the heritage value.

The findings suggests that heritage value is a central factor in the residential satisfaction in the Mantova case. While some respondents (three of four) are open to changes like window replacements and roof insulation, these are contingent upon preserving the building's authenticity. The fourth, however, maintains a stricter stance, opposing visible changes due to the building's monumental status. Economic considerations, such as maintenance costs and energy efficiency improvements, are also influential in shaping attitudes towards renovation.

2.4.3. Building technology and installations

The respondents generally consider the buildings to be in good condition, although specific issues were noted. Two interviewees, the owners' representative and the only full owner/resident, mentioned cracks in the plaster and mould growth in the backyard. One of the tenants reported previous water damage under the roof, which has since been repaired, and serious rising damp in the basement. The other tenant also noted salt efflorescence in the basement archive. The residing owner identified insulation issues in the attic, and two of the other residents reported ventilation problems from the roof. Heating systems vary, with the use of old gas boilers in two of the domestic buildings, while the owner's representative and the full owner reported six gas boilers in use. One of the rental houses also uses heat pumps with split systems. In two cases on four it is present an ancient ventilation wind tower, which is not more in use.

The findings suggest that while the buildings are structurally sound, they face typical challenges associated with historic properties. Moisture ingress in basements, cracks in plaster, and mould growth are common issues. Ventilation and insulation problems, particularly in attics and roof areas, indicate a need for targeted retrofitting. The reliance on older heating systems such as gas boilers suggests potential for energy efficiency improvements.

2.4.4. Environmental concerns, comfort, economy, and energy efficiency measures

The respondents in the Mantova case collectively highlight that energy consumption in their buildings is notably high, primarily due to the extensive volume that requires heating and the limitations of existing systems. While one of the rental buildings reports adequate heating and cooling, the three others express dissatisfaction with the heating systems, citing discomfort and inefficiencies. Temperature regulation is uneven, with unheated basements often being too humid. Usage patterns vary, with the one tenant using the building daily, while others report limited or no current use. Heating is generally applied during cold seasons, though some areas like attics and staircases remain unheated. Financial benefits of energy-efficient measures are acknowledged, with window replacements already implemented in some cases. However, none of the buildings have automatic energy measurement systems. Decision-making regarding retrofitting is influenced by heritage boards, church commissions, and economic planning.

Analyses of the respondents' answers suggest that while there is a shared recognition of the need for improved energy efficiency, the implementation of such measures is constrained by heritage preservation requirements and institutional decision-making processes. The tenant who is living in the building, stands out as the most actively engaged in daily building use and energy management, whereas the respondents of the three remaining residential buildings which are nowadays much less in use, tend to reflect a more passive or limited engagement.

2.4.5. What Matters Most: Prioritising Key Topics

The interview responses highlight a consistent prioritisation of both heritage preservation and occupant comfort across all four topics. Each topic emphasises the importance of maintaining architectural and historical integrity, with one interviewee focusing mainly on frescoes, two on building peculiarities, and the last mainly on authentic elements. Measures such as preventing damage, improving indoor comfort, and enhancing energy efficiency are universally prioritised, indicating a balanced approach to conservation and modernisation.

All four topics received equal prioritisation for maintaining heritage values, preventing damage, improving comfort, and increasing energy efficiency. The four uniquely prioritised repairing major structural damage, suggesting specific concerns in that context. Sustainable energy solutions were prioritised by the owner and owner representative, who also noted increasing property value high, indicating a potential link between preservation efforts and market value. The two tenants did not indicate these as a priority, they did however prioritise reduction of heating costs, possibly reflecting environmental or economic considerations.

2.4.6. Discussion

Cultural Heritage and Heritage Environment Values

The responses reflect a nuanced balance between conservation and modernisation. Residents value the historical depth and architectural integrity of their buildings yet recognise the need for practical upgrades. The presence of heritage boards and conservation plans imposes limitations but also ensures the preservation of cultural identity. There is a shared understanding that improvements must be compatible with existing structures and executed with expert guidance. The desire to maintain the experiential quality of the neighbourhood further underscores the importance of coherent urban development.

Building Technology and Installations

The responses highlight the balance between maintaining heritage integrity and addressing modern building performance needs. Moisture and ventilation issues are particularly concerning in historic buildings, as they can lead to long-term structural damage. The presence of multiple gas boilers and some conditioning split systems indicates a decentralised approach to HVAC, which may not be optimal for energy efficiency. Respondents appear aware of the limitations and are considering improvements, such as roof insulation and window replacements, within the constraints of heritage preservation. About ventilation systems, the two interviews involved were not aware of the possibility to recover this ancient system for passive cooling; this demonstrate the lack of awareness in users about historic buildings passive functioning.

Environmental concerns, comfort, economy, and energy efficiency measures

The responses underscore the tension between maintaining heritage integrity and achieving modern energy efficiency. While some improvements, such as window replacements, have been made (with copies of the originals on main façades or with different products in back façades), broader interventions are hindered by regulatory and organisational constraints. The economic implications of high energy consumption are acknowledged, yet the path to sustainable solutions remains unclear due to limited knowledge and support. The role of heritage boards and church commissions in decision-making introduces additional layers of complexity, necessitating collaborative approaches that balance conservation with comfort and cost-effectiveness.

Prioritising Key Topics

The consistent prioritisation across topics suggests a shared understanding of the importance of balancing heritage conservation with modern living standards. The absence of prioritisation for environmental experiential value may indicate a gap in awareness or a lower perceived relevance. The selective prioritisation of sustainable energy and heating cost reduction reflects varying local needs or resource availability. The emphasis on comfort and energy efficiency aligns with broader trends in sustainable architecture and occupant wellbeing.

2.4.7. Concluding the Italian in-depth interviews

The interviewees demonstrate a strong commitment to preserving cultural heritage while acknowledging the necessity of selective modernisation. Support from heritage authorities and access to expert advice are crucial for implementing acceptable changes. The integration of energy-efficient measures and structural repairs must be carefully balanced with the preservation of historical features. Overall, the cultural and architectural significance of these buildings and neighbourhoods remains a key motivator for residency and conservation efforts.

The buildings are generally well-maintained but require ongoing attention to moisture control, insulation, and ventilation. Energy systems are outdated and present opportunities for upgrading to more sustainable solutions. Any interventions must be carefully planned to respect the historical and architectural significance of the properties, with expert guidance and support from heritage authorities.

Further, the buildings under review face significant energy efficiency challenges, exacerbated by structural limitations and regulatory constraints. While there is a willingness to pursue improvements, success depends on informed decision-making, institutional support, and sensitive integration of retrofit solutions. Future efforts should focus on enhancing awareness of available technologies, streamlining approval processes, and promoting sustainable practices that respect the historical character of these properties. The interview responses reveal a strong commitment to preserving historical and architectural integrity while enhancing occupant comfort.

There is a clear prioritisation of practical measures such as damage prevention and energy efficiency, which support both conservation and sustainability. Future initiatives may benefit from increased focus on environmental experiential value and broader adoption of sustainable energy solutions. Overall, the findings underscore the importance of integrated strategies that respect heritage while addressing contemporary needs.

2.5. Comparative international analysis of in-depth interviews

The in-depth interviews explore cultural heritage values, building technology, environmental concerns, and prioritisation of key topics. The findings reveal both commonalities and differences across the countries, offering insights into the lived experiences and decision-making processes of heritage homeowners.

2.5.1. Summary of findings for each country

The findings reveal both commonalities and differences across the countries, offering insights into the lived experiences and decision-making processes of heritage homeowners. The interview findings from Belgium, Estonia, Norway, and Italy highlight the intricate realities of residing in and maintaining heritage buildings. While the cultural and architectural significance of these properties is widely cherished, occupants encounter considerable challenges in achieving contemporary standards of comfort and energy efficiency.

To facilitate respectful and effective renovations, it is essential to provide tailored support schemes, expert guidance, collaborative planning frameworks, and energy efficiency solutions that respectfully take heritage values and user priorities into consideration. Policymakers must take into account the specific limitations inherent to heritage structures and formulate integrated approaches that harmonise conservation objectives with modern living requirements.

2.5.2. Cross-Country Discussion

Barriers across countries

The analysis of the interviews indicates that owners' perspectives significantly influence heritage maintenance. While all countries show appreciation for heritage, practical needs often compete with conservation goals. Influence levels suggest Norway and Italy exhibit the strongest heritage commitment, followed by Belgium and Estonia. The analysis identifies four main barrier categories: Financial, Technical, Regulatory, and Knowledge. Severity varies across countries, with Italy and Estonia facing the most significant challenges due to regulatory complexity and financial constraints (see figure 2).

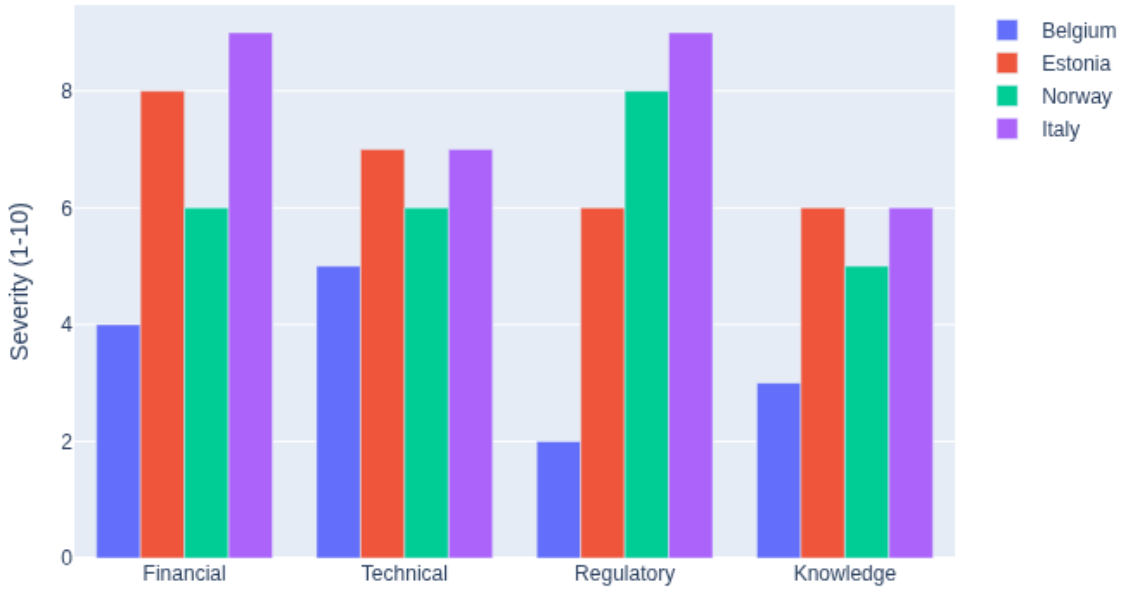

Figure 2: The analysis identifies four main barrier categories: Financial, Technical, Regulatory, and Knowledge

Emotional Attachment and Heritage Values

In all four countries, emotional attachment to historic homes is evident, though its intensity and role differ. Belgian residents value architectural coherence and express caution toward visual changes, while heritage appreciation is secondary to practical factors such as accessibility and location. Estonian homeowners adopt a pragmatic stance initially, with heritage appreciation growing over time as authenticity and respectful renovations enhance perceived value. Norwegian respondents exhibit the strongest commitment to heritage preservation, prioritising historical character even at the expense of comfort. Italians emphasise cultural and architectural significance, particularly in UNESCO-designated areas, reinforcing a deep-rooted conservation ethos.

Belgium and Norway: Residents exhibit deep emotional attachment to their homes and neighbourhoods. In Belgium, this attachment often develops over decades, while in Norway, heritage identity is central to residential satisfaction. Both countries prioritise architectural coherence and authenticity, sometimes at the expense of comfort.

Estonia and Italy: A more pragmatic stance is observed. Estonian residents often acquire buildings in poor condition, prompting immediate energy upgrades, with heritage appreciation growing over time. Italians emphasise cultural and architectural significance, particularly in UNESCO-designated areas, but balance this with practical needs.

Comfort and Energy Efficiency

While universally valued, these aspects are prioritised differently:

Figure 3: Visual comparison of comfort vs. heritage prioritisation

Belgium and Norway: Heritage Over Comfort

Residents tolerate lower comfort levels to preserve authenticity. Retrofit measures such as insulation of the front facade or heat pumps are cautiously adopted.

- Residents prioritise authenticity and architectural integrity over modern comfort.
- They are willing to live with lower thermal comfort (e.g., colder interiors, less efficient heating) to maintain historical character.
- Retrofit measures like interior insulation or heat pumps are approached cautiously, only if they do not compromise heritage aesthetics.
- This suggests a cultural value system where heritage identity outweighs convenience, even if it means higher energy bills or less comfort.

Estonia and Italy: Comfort and Functionality First
Comfort and functionality are key drivers. Energy efficiency is considered essential in Estonia, though hindered by technical and financial barriers. In Italy, high energy consumption and outdated heating systems prompt interest in sustainable solutions, but adoption is limited by cost and regulatory oversight.

- Residents seek practical improvements to make homes more liveable and energy-efficient;
- Estonia: Energy efficiency is seen as essential, but technical and financial barriers (e.g., lack of funds, complex regulations) slow progress;
- Italy: High energy consumption and outdated heating systems create a strong interest in sustainable solutions, but heritage boards and costs limit adoption;
- This indicates a pragmatic approach, where heritage is respected but not at the expense of comfort and functionality.

Retrofit Acceptance and Decision Drivers

Retrofit measures are generally accepted when perceived as reversible and respectful of heritage character. Belgian residents cautiously approve interior insulation and window replacements under these conditions. Estonians prioritise comfort and damage prevention, viewing energy efficiency as essential but difficult due to technical and regulatory barriers. Norwegians selectively adopt solutions such as heat pumps, often compromising comfort to maintain authenticity. Italians consider sustainable energy solutions desirable, but face adoption barriers linked to cost and institutional complexity. Across all contexts, financial motivations remain secondary to heritage values and comfort, though economic constraints frequently limit interventions.

Reversibility and Respect for Heritage Are Key
Across all countries, retrofit measures are accepted only when they do not permanently alter the building's character. This reflects a strong cultural and emotional value placed on authenticity.

Technical Challenges and Common Issues

Moisture and ventilation problems recur across countries, particularly in attics and basements, alongside outdated heating systems and poor insulation, indicating the need for targeted technical interventions. However, the severity of the problems vary greatly. Belgian homeowners worry about façade alterations, while Estonians and Norwegians struggle with regulatory and technical obstacles that hinder upgrades. Italians face high energy consumption and institutional constraints on retrofitting. These shared challenges underscore the need for tailored technical solutions that respect heritage integrity. Regulatory constraints and limited support schemes hinder progress, especially in buildings with formal heritage status. Residents express a willingness to preserve heritage but require accessible information and expert guidance.

Policy and Support Needs

Homeowners across all countries call for clearer guidance, financial support, and collaborative frameworks. Norwegian respondents advocate for community engagement and tailored assistance, while Italians seek expert advice to balance conservation with sustainability. Estonian residents highlight the lack of accessible support schemes, and Belgian homeowners emphasise the importance of maintaining architectural coherence through informed interventions.

Across all four countries, the interviewed residents of heritage buildings share an appreciation for architectural and historical values. However, the depth of the appreciation varies at an individual level. Further, practical concerns such as comfort, energy efficiency, and financial viability often take precedence in decision-making. The balance between conservation and modernisation is a recurring theme.

Prioritization of key topics – Common priorities

Across Belgium, Estonia, Norway, and Italy, residents of heritage buildings share a strong commitment to preserving architectural and historical integrity. However, the approach to modernisation and the flexibility in balancing heritage with contemporary needs vary significantly due to differences in ownership models, regulatory frameworks, and local contexts.

Aspect	Belgium	Estonia	Norway	Italy
Heritage Attachment	Emotional, informal	Pragmatic, grows over time	Deep, identity-driven	Strong, cultural significance
Comfort vs Heritage	Heritage over comfort	Comfort balanced with heritage	Heritage over comfort	Comfort balanced with heritage
Regulatory Context	Few constraints	Technical & financial barriers	Strict, limits modernisation	Complex, institutional oversight
Energy Efficiency	Secondary to heritage	Essential but challenging	Important but selective	Desired, limited by cost/ regulation

Table 11: Integrated strategies that respect heritage while addressing modern requirements are seen as essential for sustainable conservation. Yet, financial constraints, technical challenges, and regulatory complexity remain recurring barriers

There is a consistent emphasis on:

- Maintaining heritage values;
- Improving comfort;
- Enhancing energy efficiency.

Integrated strategies that respect heritage while addressing modern requirements are seen as essential for sustainable conservation. Yet, financial constraints, technical challenges, and regulatory complexity remain recurring barriers (see table 11).

Overview of priority ranking by country:

Belgium

- Highest Priority 1 counts: Maintain heritage values (2) and Improve energy efficiency (2).
- Average ranks (lower = higher priority): heritage (1.50), energy efficiency (1.75), indoor comfort (2.00).
- Interpretation: Balanced emphasis on heritage + energy; comfort secondary.

Estonia

- Highest Priority 1 counts: Prevent damage (3).
- Average ranks: Prevent damage (1.00), Energy efficiency (1.50); others unranked (0) or mid-priority.
- Interpretation: Strong focus on risk prevention and efficiency, less on value/market considerations.

Norway

- Highest Priority 1 counts: Maintain heritage values (2), Repair major damages (2), Energy efficiency (2).
- Average ranks: Heritage (1.00), Repair (1.00), Energy efficiency (1.00); comfort averages higher (3.00).
- Interpretation: Clear triad priority—heritage integrity, structural repair, efficiency; comfort and value are lower.

Italy

- Highest Priority 1 counts: Maintain heritage values (4) and Prevent damage (4); also Energy efficiency (3), Indoor comfort (3), with Increase property value (2).
- Average ranks: many categories at 1.00 (heritage, repair, prevent, comfort, efficiency, switching energy, reducing heating costs, property value).
- Interpretation: Broad front of high priorities across cultural, technical, and energy aspects—strong, multi-dimensional stewardship emphasis.

The prioritization of key topics reveals a consistent emphasis on maintaining heritage values, improving comfort, and enhancing energy efficiency. Differences in ownership models, regulatory environments, and local contexts influence the feasibility and approach to renovations. Integrated strategies that respect heritage while addressing contemporary needs are essential for sustainable conservation.

A common strategy for the HeriTACE project is the inclusion of case buildings within the HV_I – HV_III scenarios (Himpe et al, 2025), that are the most representative and replicable for the heritage townhouse archetypes. These scenarios include buildings with different levels of heritage values and display the range of heritage values included in this study. Buildings with very high level of heritage values (protected buildings) and buildings with an accordingly low level of heritage value, are not focused. Hence, all interviewees in the in-depth interview study live in buildings with high levels of heritage values, however none of the buildings have full heritage protection status.

Across all four countries, the interviewed residents of heritage buildings share a commitment to preserving architectural and historical integrity. However, the degree of flexibility and the prioritisation of modernisation vary. Belgian and Norwegian residents

emphasise emotional attachment and neighbourhood coherence, while Estonian and Italian respondents adopt a more pragmatic stance, balancing heritage with functionality.

Belgium stands out for its informal appreciation of heritage without regulatory constraints, allowing for personalised interventions. Estonia faces significant technical and financial barriers, with cooperative ownership structures influencing decision-making. Norway's strong heritage identity is coupled with regulatory limitations, requiring careful negotiation for upgrades. Italy's monumental status and institutional oversight create a complex environment for retrofitting, with residents relying on expert advice and formal approvals.

While comfort and energy efficiency are universally valued, their prioritisation differs. Belgian and Norwegian residents tolerate lower comfort for heritage preservation, whereas Estonian and Italian respondents seek practical improvements. Financial constraints and knowledge gaps are recurring themes, underscoring the need for tailored support schemes and educational resources. The role of community and municipal engagement is critical in sustaining heritage environments and enabling responsible stewardship.

2.5.3 Conclusion of in-depth interviews

The comparative analysis of Belgium, Estonia, Norway, and Italy reveals a strong commitment to heritage preservation, but practical needs such as comfort and energy efficiency often compete with conservation goals. Residents value the historical character of their homes, yet face technical, financial, and regulatory challenges when implementing upgrades. While heritage appreciation is universal, its influence varies: Norway and Italy exhibit the strongest heritage commitment, followed by Belgium and Estonia.

The analysis indicates that owners' perspectives significantly influence heritage maintenance. While all countries show appreciation for heritage, practical needs often compete with conservation goals. Influence levels suggest Norway and Italy exhibit the strongest heritage commitment, followed by Belgium and Estonia. Further, the findings reveal a nuanced relationship between heritage conservation and the demands of present-day habitation. Across all four countries, residents value the historical character of their homes yet face diverse obstacles in adapting them to meet current expectations. Policy responses must be context-sensitive, offering flexible, well-informed, and supportive mechanisms. Holistic strategies that respect cultural heritage while advancing sustainability are vital to ensuring the enduring viability of historic urban environments.

The comparative analysis of interview findings from Belgium, Estonia, Norway, and Italy reveals a multifaceted landscape of heritage building ownership and residency. Across all four countries, residents demonstrate a profound appreciation for the cultural, architectural, and historical significance of their homes. This intrinsic value is often a key motivator for long-term residency and stewardship, even in the absence of formal heritage listing or regulatory constraints.

Despite this shared appreciation, the practical realities of living in heritage buildings present considerable challenges. Issues such as inadequate insulation, moisture ingress, ventilation deficiencies, and outdated heating systems are recurrent themes. These technical shortcomings not only affect occupant comfort but also pose risks to the structural integrity of the buildings. The responses indicate that while residents are generally willing to tolerate certain inconveniences for the sake of heritage preservation, there is a clear demand for improvements that respect the historical/heritage character of the properties.

Economic considerations play a pivotal role in shaping renovation decisions. Financial constraints, limited access to tailored support schemes, and regulatory complexities often hinder the implementation of energy-efficient measures. In countries like Estonia and Italy, institutional decision-making processes and heritage board approvals add layers of complexity, whereas in Belgium and Norway, informal appreciation and local conservation plans guide interventions. These differences underscore the need for context-sensitive policy frameworks that accommodate national and local governance structures.

The prioritisation of key topics such as energy efficiency, indoor comfort, damage prevention, and heritage preservation reflects a balanced approach among residents. While heritage values are consistently acknowledged, they are frequently weighed against practical needs and ecological responsibilities. This balance suggests that future conservation strategies must integrate sustainability goals with heritage protection, ensuring that interventions are both respectful and effective.

To support residents in heritage buildings, policymakers and conservation authorities should develop comprehensive strategies that include financial incentives, technical guidance, and educational resources. These measures should be tailored to the unique constraints of heritage properties and promote collaborative planning among stakeholders. Enhancing awareness of compatible technologies, streamlining approval processes, and fostering community engagement are essential steps toward achieving resilient and sustainable heritage environments.

In conclusion, the findings from Belgium, Estonia, Norway, and Italy illustrate the complexity of heritage building stewardship in contemporary contexts. The interplay between conservation and modernisation requires nuanced, informed, and inclusive approaches. By aligning heritage values with present-day living standards, it is possible to ensure the long-term viability and cultural continuity of historic urban environments. Looking ahead, future initiatives should aim to raise awareness, simplify approval procedures, and encourage sustainable practices and energy efficient solutions that uphold heritage authenticity while enhancing building performance and occupant wellbeing.

Key Conclusions

- Owners' perspectives significantly influence heritage maintenance decisions.
- Heritage values are consistently acknowledged but often weighed against comfort and ecological responsibilities.
- Retrofit acceptance depends on reversibility and respect for heritage character.
- Financial motivations are secondary, yet economic constraints frequently limit interventions: People renovate for heritage and comfort, not primarily for cost savings.
- Technical shortcomings such as poor insulation, moisture ingress, and ventilation deficiencies are common, however differ in severity.
- Regulatory complexity and institutional oversight create major barriers, especially in Italy and Norway.
- Economic constraints still matter: Even if heritage values dominate, lack of funds often delays or limits interventions.
- Balance is hard to achieve: Residents want both authenticity and modern performance, but technical, financial, and regulatory barriers create tension.
- Policy and Support Needs: Tailored financial incentives and simplified regulatory processes could unlock energy-efficient retrofits without compromising heritage.

- Design Solutions: Innovations that are reversible, minimally invasive, and aesthetically compatible will gain acceptance.
- Development of MCDM-tool: Allow for varying objectives and sensitiveness towards individual needs and possibilities.
- Cultural Sensitivity in Sustainability: Energy transition strategies must respect local heritage values to succeed.

Implications for Future Work

- Develop context-sensitive policy frameworks that harmonize heritage conservation with modernization needs.
- Introduce tailored financial incentives and streamlined approval processes for heritage-compatible retrofits.
- Provide technical guidance and educational resources to address knowledge gaps.
- Promote reversible, minimally invasive, and aesthetically compatible design solutions.
- Encourage community engagement and collaborative planning to sustain heritage environments.
- Integrate sustainability goals with heritage protection to ensure long-term viability.

Key Takeaways per Country

Belgium

- Heritage appreciated but not primary motivator; comfort and ecological thinking matter;
- Retrofit accepted only if reversible and respectful;
- Few regulatory constraints; financial motivations secondary.

Estonia

- Pragmatic approach; comfort and damage prevention prioritized.
- Energy efficiency essential but hindered by technical and financial barriers.
- Cooperative ownership complicates decisions.

Norway

- Strong heritage identity; comfort often compromised;
- Selective adoption of retrofits; regulatory constraints limit modernization;
- Community engagement and tailored support desired.

Italy

- Cultural and architectural significance central;
- Energy efficiency desirable but limited by cost and institutional complexity;
- Expert guidance and balanced interventions needed.

Cross-Country Insights

- Common priorities: heritage preservation, comfort improvement, energy efficiency.
- Shared challenges: moisture, ventilation, outdated heating systems;
- Decision drivers: emotional attachment, ecological responsibility, financial feasibility;
- Retrofit acceptance only if reversible and respectful of heritage character.

Key Learnings / Requirements for Project

- Multi-Criteria Decision Making-models (MCDM) must allow parameter variation as priorities differ between owners;
- Most owners inhabit their heritage homes – solutions must minimize disruption;
- Owner restrictions often align with heritage restrictions, reinforcing limitations;
- Tailored support schemes and expert guidance are critical;
- Integrated strategies combining heritage preservation with sustainability are essential and needed;
- Community engagement is vital for collective decision-making.

Street interviews/survey

The chapter summarises findings from street interviews conducted in the four case countries (Belgium, Estonia, Norway, Italy). The aim was to understand how people perceive historic urban environments and their attitudes toward changes, especially those linked to energy efficiency measures. The street interviews are used for comparison with the in-depth interviews described in chapter 3, to identify differences and similarities in perceptions of heritage values and the threshold for change resulting from energy efficiency measures in individual buildings and how this affects the neighbourhood level. The survey included both quantitative and qualitative questions, with results visualised in charts and tables. See appendix 2 for survey sheet.

The street interviews serve a dual purpose: they capture *user perspectives* on the character and quality of selected urban areas and assess attitudes toward potential changes in these environments. This user-centred approach is critical because proposed technical measures must be both feasible and socially acceptable. By engaging directly with residents, visitors, and other stakeholders, the interviews provide insights into everyday use patterns, and the experiential qualities that contribute to the perceived value of these spaces. It should nevertheless be noted that the number of survey respondents is limited, and the responses should therefore be regarded as indicative. The findings are intended to support the in-depth interview analysis, and to confirm or refute the findings made there.

3.1. Survey analysis approach

3.1.1. Execution of survey

Respondents were asked a series of structured questions addressing:

- *Motivation for being in the area* (e.g., passing through, shopping, visiting, or experiencing the atmosphere);
- *Perceptions of the surroundings* and *level of enjoyment*;
- *Tolerance for physical changes* to the area without losing its unique character;
- *Potential impact of changes* on personal use and activities.

Five quantitative questions were complemented by three open-ended prompts to capture qualitative explanations and reflections. The resulting data provide a nuanced understanding of how heritage environments are valued and used at a neighbourhood level, and how changes might affect users of these neighbourhoods. Because the respondents were selected at random, the results are less likely to be biased and can be considered broadly representative of the wider population, within the limits of sample size. However, the sample size is rather small in each country. However, random sampling does not eliminate sampling error, so the findings should be interpreted with caution as confidence depends on the number of respondents and variability in their answers.

Further, the chapter summarises the distribution of responses to five survey items (Q1, Q2, Q4, Q5 and Q6) collected through street interviews in four countries: Belgium, Estonia, Norway and Italy. For each question, country-level counts by response option and an all-countries aggregated view are displayed. The analysis is based on an excel dataset compilation of the results from street interview surveys performed in each of the four case areas in Ghent, Belgium; Tallinn, Estonia; Trondheim, Norway; and. Mantova, Italy. Data values were cleaned to numeric categories according to the study's codebook; entries such

as '2 to 3' were converted to the mean and rounded to the nearest valid category, while invalid entries and 'don't know' were handled as missing when appropriate. The responses to the qualitative question Q3 are cross-analysed towards the quantitative questions Q1, 2, and 4, and the qualitative questions Q7 and Q8 are cross-analysed towards the quantitative questions 5, and 6, in the regression analysis and explanation of results.

Country	Number of respondents	Neighbourhood(s)
Belgium	28	Vlaanderenstraat (17), Ghent Sint-Michielsplein (11), Ghent
Estonia	10	Uus-Maailm, Tallinn
Norway	15	Bakklandet, Trondheim
Italy	20	Via Montanara (3), Via Giulio Romano (4), Piazza San Leonardo (6), Piazza Sordello (7), Mantova
Total	***73***	***10***

Table 12: Overview of performed street interviews/surveys performed per country, including numbers and neighbourhoods.

The total number of respondents to the survey was 73. However, not all respondents answered to all questions. Also, the number in each case area was limited, and might tend to prove not significant because the variation in answers is too big to yield a clear picture. However, a few answers and regressions do give significant values when analysing the findings and indicate trends of people's perceptions and impressions when spending time in the area. Key sections:

- **Survey Questions (Q1-Q6)**: Quantitative results on motivations, perceptions, enjoyment, tolerance for change, and behavioural impact.
- **Cross-country synthesis**: Highlights patterns and differences between countries.
- **Explanatory Analysis**: Linking quantitative and qualitative responses.

The street interviews provide critical insights into how residents and visitors experience historic neighbourhoods and respond to potential changes. This user-centred perspective ensures that technical interventions for energy efficiency align with cultural and social values. The analysis combines frequency distributions and regression modelling to identify patterns across four European case areas.

3.2. Statistical overview

3.2.1. Q1. Why are you in the area today?

Q1 captures the primary motivation for being in the area, ranging from practical reasons (passing through, shopping, work) to experiential ones (enjoying the atmosphere). The stacked bar chart displays how many respondents in each country chose each motive. The cross-country chart shows the aggregated distribution across all countries.

Respondents reported a range of motives for being in the study sites, spanning practical purposes – such as passing through, shopping, work, and parking – to residential and experiential activities, including living locally, visiting cafés or restaurants, social visits, and appreciating the atmosphere. The country-level distribution (Figure 4.1) illustrates the mixed-use character typical of historic districts. Notably, Estonia shows a high proportion of residents, emphasising the everyday dimension of its case area. In contrast, Belgium and Italy exhibit more diverse patterns, with leisure and social visits featuring prominently, while Norway reflects a combination of local presence and amenity use.

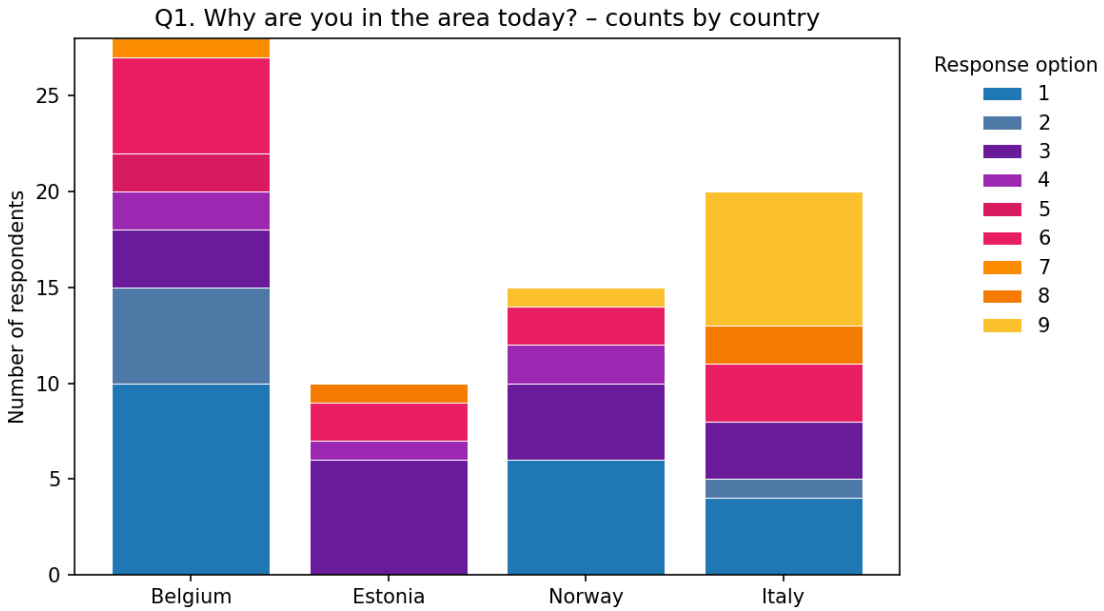

Figure 4: Q1. Why are you in the area today. Distribution of answers for each country. Response options: 1=just passing through; 2=to shop; 3=live in the neighbourhood; 4=Work here; 5=looking for a job; 6=visit a café/restaurant; 7=parking; 8=visiting someone; 9=to see and experience the atmosphere.

The responses were open and are coded into nine main groups when analysing the results. The aggregated results (figure 4) indicate that "just passing through" and "living in the neighbourhood" were the most frequent responses, followed by "visiting a café or restaurant." This pattern suggests that historic areas serve multiple functions: they operate as transit corridors, residential environments, and destinations for social and cultural engagement. Such multifunctionality has implications for planning and change management, as interventions must accommodate both transient flows and the needs of regular users. However, these distributions reflect the opportunistic nature of street-intercept sampling and should not be interpreted as representative of the entire population.

Country-level counts by response option:
The four larges response options are, in falling sequence: 1) just passing through; 3) live in the neighbourhood; 6) visit a café/restaurant; and 9) to see and experience the atmosphere.

For Belgium, Norway, and Italy, the biggest group of respondents are "just passing through", and for Estonia it is "live in the neighbourhood" , with a few visiting cafés or working nearby.

When cross-analysing with the responses in Q3 (including Q2 responses displaying the level of liking the area, the main positive explanation for those just passing by in terms of liking the area is linked to aesthetic/atmosphere and history/authenticity. For those living in the area, functionality and access is listed as the main reason for liking the area, followed by aesthetic & atmosphere.

A particular analysis to look into differences and likenesses between the opinions of the residents vs. all other categories of visitors in the neighbourhood reveals small to no differences.

3.2.2. Q2. How much do you like the surroundings?

Q2 measures general liking of the surroundings on a 0–5 scale, with the following response options: 1= poor; 2= slightly; 3= ok; 4= good; 5= very good; 0= don't know (0 = don't know; 1 = poor; 5 = very good. Country-level counts reveal the balance between neutral (3) and positive appraisals (4–5).

Responses to Q2 indicate a strong overall appreciation of the surroundings, with 72.9% of participants rating them positively (scores 4–5). Country-level patterns (Figures 4.3–4.4) reveal notable variation. Norway and Italy exhibit almost unanimous positive sentiment, suggesting high perceived quality of their historic environments. In contrast, Belgium shows a majority of positive responses but includes a proportion of neutral ratings, while Estonia leans towards neutrality and records the highest share of missing responses. These differences reflect contextual factors such as maintenance standards, traffic related issues, accessibility, or cultural attachment.

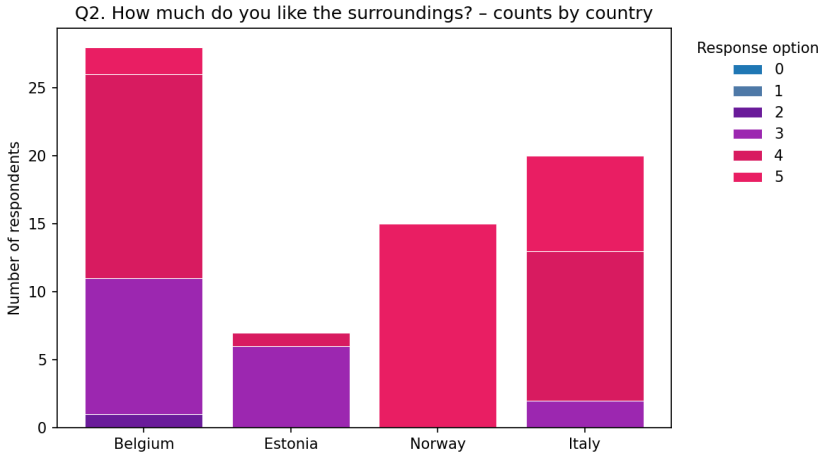

Figure 5: Q2. How much do you like the surroundings? Distribution of answers for each country. Response options: 1= poor; 2= slightly; 3= ok; 4= good; 5= very good; 0= don't know

The cross-country synthesis (Figure 5) consolidates these findings, confirming robust visual appreciation across the sample while highlighting contextual variation. Neutral ratings, in interpretive terms, may be influenced by conditions beyond architectural quality—such as traffic, seasonal factors, or urban management—whereas strong positive evaluations suggest environments that successfully integrate heritage value with contemporary functionality. Lower scores of liking the surroundings might reflect both positive and negative influences, such as liking the heritage aspects of the area, but disliking the impacts of traffic.

Country-level counts by response option, in falling sequence: 4) good; 5) very good; 3) ok; and 2) slightly.

Cross-country synthesis (see figure 6): Overall, positive appraisals are prevalent (aggregate positive = 72.9%), with particularly strong liking in Norway and Italy; Belgium shows majority positive sentiment, while Estonia exhibits a lower share of 4–5 responses.

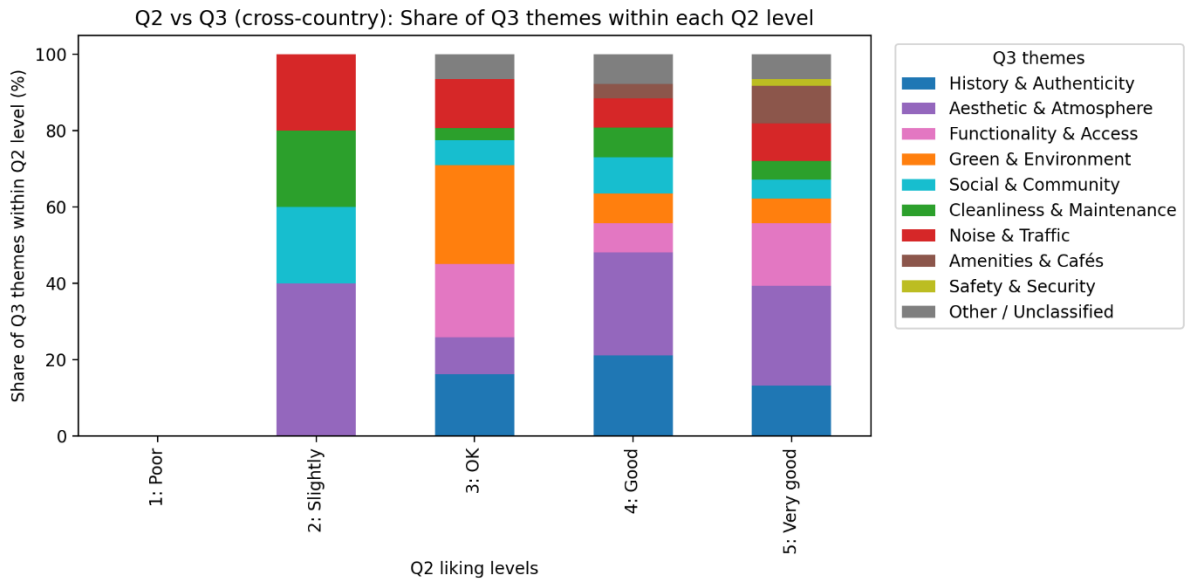

Figure 6: Q2 vs Q3. Overview of how much the surroundings are liked (Q2), linked to qualitative explanation (Q2). Cross-country overview with distribution of answers for each country.

Overview of the grade of liking the surroundings paired with reasons why (see figure 4.3):

- High liking (Q2=4–5) is driven by heritage, aesthetics, and ambience, supported by greenery and amenities.
- Moderate liking (Q2=3) is balanced between functionality and negative stressors (noise, traffic).
  Low liking (Q2=1–2) is dominated by environmental discomfort and maintenance issues, with minimal reference to charm or history.

Interpretation of Q2 by residency (Q1)

Both residents and non-residents report a consistently high level of appreciation for the surroundings. The majority of responses in both groups fall within the "good" (4) and "very good" (5) categories. Residents show a slight tendency toward choosing the top score, but the difference is marginal.

Both groups perceive the area as attractive and pleasant. Residence does not significantly influence overall liking, indicating that external visitors and people living locally share a similarly positive experience of the local environment.

3.2.3. Q4. How well do you enjoy being here?

Q4 assesses enjoyment of being in the area (0–5). The pattern by country highlights where respondents report greater experiential enjoyment (4–5).

Reported enjoyment (0–5 scale, response options identical to Q2) broadly mirrors the liking scores but introduces additional nuance regarding experiential quality. Aggregate positive responses (scores 4–5) reach 67.6% (Figures 4.6–4.7), indicating that most respondents find the study sites pleasant and engaging. Norway demonstrates uniformly high enjoyment, consistent with its strong ratings for surroundings. In contrast, Italy presents a more mixed pattern despite high levels of liking, suggesting that factors beyond visual appeal—such as amenity provision, crowding, micro-climate, or temporal rhythms of use—may influence

overall experience. Estonia and Belgium also show strong positive responses, though with slightly greater variation.

The distinction between "liking" and "enjoyment" is analytically significant: while liking reflects visual appraisal and perceived quality, enjoyment captures lived experience in situ. This differentiation underscores the importance of considering both aesthetic and functional dimensions when evaluating heritage environments.

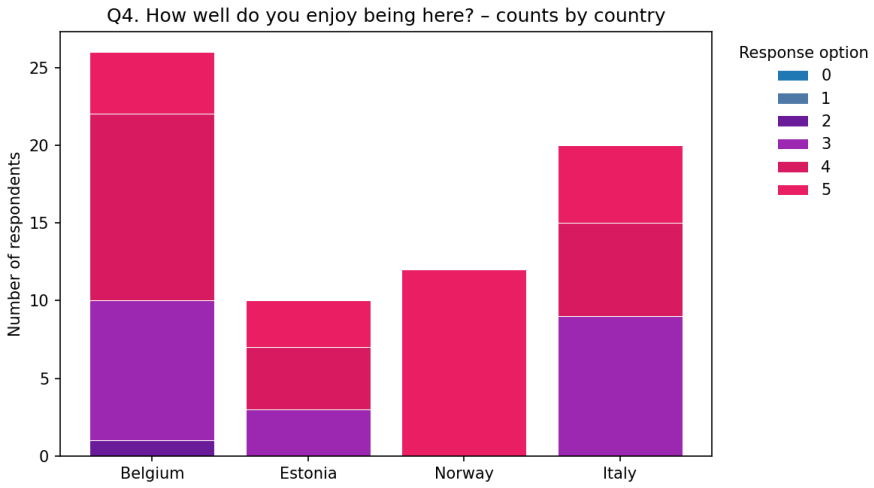

Figure 7: Q4. How well do you enjoy being here? Distribution of answers for each country. Response options: 1= poor; 2= slightly; 3= ok; 4= good; 5= very good; 0= don't know

Q4 ratings (1–5) reflect how well respondents enjoy being in the area, and Q3 themes explain why. The patterns of how Q4 (Enjoyment Level) connects to Q3 reasons are similar to Q2 but with subtle differences:

Q4 = 5 (Very Good Enjoyment)
Aesthetic & Atmosphere and History & Authenticity are the strongest drivers of high enjoyment. Respondents who truly enjoy the area emphasise visual charm and cultural depth—historic architecture, ambience, and beauty. Enjoyment is tied to sensory and experiential qualities, not just functional aspects. Amenities & Cafés and Green & Environment appear frequently as secondary reasons, suggesting that social spaces and greenery enhance leisure experiences.

Q4 = 4 (Good Enjoyment)
Aesthetic & Atmosphere remains key reason, but Functionality & Access gains importance. Those who enjoy the area "well" value practical convenience alongside aesthetics—walkability, connectivity, and ease of use. This indicates that comfort and usability complement visual appeal. Noise & Traffic and Cleanliness & Maintenance start to appear as minor detractors, explaining why enjoyment is not rated "very good."

When linking high enjoyment rates (Q4 = 4–5) to dominant Q3 reasons, Aesthetic & Atmosphere and History & Authenticity drive strong enjoyment, often reinforced by Amenities & Cafés and Green & Environment. Just passing through (Q1=1). See/experience atmosphere (Q1=9) dominate among those citing aesthetics and heritage. These respondents are typically leisure visitors who value cultural and visual qualities. Visit a café/restaurant (Q1=6) frequently appears alongside mentions of ambience and amenities, showing that social and culinary experiences amplify enjoyment.

High enjoyment is rooted in sensory and cultural appeal, and is most common among visitors and leisure users, not functional passers-by.

Q4 = 3 (Moderate Enjoyment)
Functionality & Access and Noise & Traffic dominate the reasons for the moderate rating, while aesthetic mentions decline as a factor for lower esteem. Neutral enjoyment often reflects mixed experiences (both positive and negative) of functional benefits offset by environmental stressors like traffic and noise. Respondents may still appreciate some charm but are hindered by practical discomforts.

When linking to Q3 reasons for the responses, Functionality & Access rises in importance, while references to visual and sensory qualities such as beauty, charm, ambience, or architectural appeal become less frequent as enjoyment when moving from high to moderate levels. Noise & Traffic and Cleanliness & Maintenance start appearing as dominant reasons for lower scores.

Linking to Q1 purposes, Live in the neighbourhood (Q1=3) and Work here (Q1=4) are more frequent in this group. These respondents appreciate practical convenience but note environmental stressors. Neutral/moderate enjoyment reflects mixed experiences: people value convenience, but problems like noise and poor upkeep reduce their enjoyment. Residents and workers tolerate flaws but lack the emotional uplift reported by visitors .

Low Enjoyment (Q4 = 1–2)
Dominant Q3 reasons: Noise & Traffic, Cleanliness & Maintenance, and sometimes Safety & Security dominate, while aesthetic mentions are rare.

Parking (Q1=7) and Functional errands (Q1=2 To shop) appear more often here. These respondents are task-oriented and highly sensitive to practical discomforts. Poor enjoyment correlates with negative environmental conditions—congestion, dirt, and perceived safety risks. Functional users rarely engage with cultural or aesthetic qualities.

Key Linkages

- Visitors (Q1=1,6,9) → High enjoyment when Q3 reasons highlight heritage, aesthetics, and ambience.
- Residents and workers (Q1=3,4) → Moderate enjoyment, balancing functionality with environmental drawbacks.
- Functional users (Q1=2,7) → Low enjoyment, driven by noise, traffic, and maintenance issues, with minimal reference to charm or history.

Interpretation of Q4 by residency (Q1)

The distribution of enjoyment scores (Q4) mirrors Q2 very closely. Most respondents in both groups select "good" or "very good", with residents showing a small but visible shift toward "good" (4).

Interpretation: The area offers a similarly enjoyable experience for those who live there and those who do not. This suggests that the area's qualities—ambience, design, atmosphere—have broad appeal that extends beyond local familiarity.

3.2.4. Q5. How much change can the area withstand without losing its character?

Attitudes towards physical change reveal a predominantly cautious stance. Most respondents favour either no change or only minor alterations, such as adjustments to colour schemes or the installation of rooftop solar panels. Openness to major or radical transformations is rare, with only 9.7% of responses indicating acceptance of substantial interventions (Figures 4.8–4.9). Norway emerges as the most conservative context, whereas Estonia demonstrates comparatively higher tolerance for larger modifications. Belgium and Italy largely support incremental measures, allowing for small to slightly larger changes.

Q5 addresses how much change the area can withstand without losing its character. The response options are: 1= No change; 2= small changes like colour schemes, solar panels on the roof etc.; 3= slightly larger changes like small extensions, changing windows, solar panels on the wall, heat pumps, altering building details, etc.; 4= Major changes like demolishing and constructing new buildings in the same style and structure; 5= Very significant changes like demolishing and building something completely different/modern/parking lot etc.; 0= don't know

The findings underscore a central challenge in heritage-sensitive climate action: implementing energy-efficiency upgrades without compromising perceived authenticity. The preference for small-scale, reversible, or minimally visible interventions suggests that public acceptance may depend on design quality, material compatibility, and careful integration at the level of architectural detail.

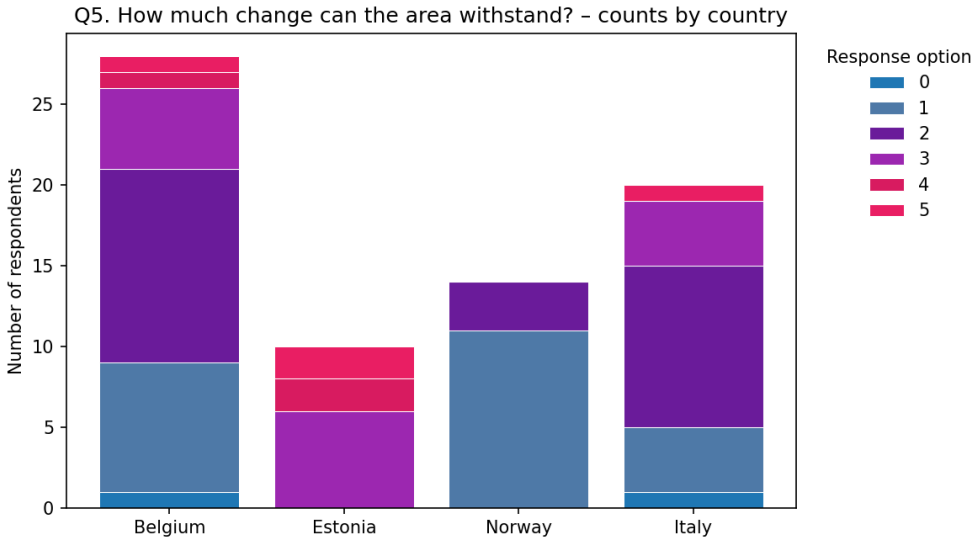

Figure 8: Q5. How much change can the area withstand without losing its character? Distribution of answers for each country. Response options: 1= No change; 2= small changes like colour schemes, solar panels on the roof etc.; 3= slightly larger changes like small extensions, changing windows, solar panels on the wall, heat pumps, altering building details, etc.; 4= Major changes like demolishing and constructing new buildings in the same style and structure; 5= Very significant changes like demolishing and building something completely different/modern/parking lot etc.; 0= don't know

Linking the Q5 responses to qualitative, open responses of Q7 and Q8
Q5 measures how much change respondents think the area can withstand without losing its character. Q7 and Q8 explain why and what respondents would do if changes occurred. The coded themes reveal clear patterns:

Q5 = 1 (No Change)
The most dominant Q7/Q8 themes are History & Authenticity and Aesthetic & Atmosphere. The respondents stress preserving heritage and visual identity. Those who reject change, value historic character and ambience above all. Comments often mention "old buildings," "authentic look," and "cultural heritage. Many respondents say they would stop visiting or reduce their use of the area if major changes occur, reinforcing the importance of conservation for loyalty.

Q5 = 2 (Small Changes)
The responses are still heritage-driven, but Functionality & Access and Green & Environment start appearing. The respondents allow minor upgrades (e.g., solar panels, colour adjustments) as long as the character of the neighbourhood remains intact. They often suggest adding greenery or improving walkability without altering the historic core. Most of the respondents indicate continued use of the area even if the character changes, but with caution – *"small changes are fine, big changes would ruin it."*

Q5 = 3 (Slightly Larger Changes)
Functionality & Access and Amenities & Cafés rise as the most dominant reasons, while aesthetic mentions decline. Moderate tolerance to change reflects a desire for practical improvements, implicating better facilities, increased accessibility, and social spaces, which are balanced against preserving the identity of the neighbourhood. Respondents often say they would still visit but note that too much modernization would reduce appreciation.

Q5 = 4 (Major Changes)
The themes Functionality & Access and Cleanliness & Maintenance dominate, with occasional Noise & Traffic concerns. Higher tolerance to change correlates with functional priorities. The respondents focus on comfort, upkeep, and usability, not aesthetics. Heritage is less critical for this group. Most respondents indicate continued use of the area, sometimes even increased use if improvements address current negatively reported themes.

Q5 = 5 (Very Significant Changes)
Functionality & Access, Amenities & Cafés, and Green & Environment dominate in the responses. Mentions of heritage are minimal. The respondents are open to radical change and prioritise modernization, convenience, and lifestyle enhancements over preservation. Recurring responses reflect that changes would not affect their use, and some even expect better experience after redevelopment.

Key Linkages
- Low tolerance to change (Q5=1–2) → Driven by heritage and aesthetics, linked to risk of losing visitors if character changes.
- Moderate tolerance to change (Q5=3) → Balances functionality improvements with identity concerns.
- High tolerance to change (Q5=4–5) → Focused on practical upgrades and modernization, heritage plays a minor role.

Interpretation of Q5 by residency (Q1)

When asked how much physical or aesthetic change the area can withstand without losing its character, both groups ("living in the area" an all the other replies) cluster strongly around "no change" (1) and "small changes" (2).

Residents, however, display a slightly higher acceptance of "slightly larger changes" (3) compared to non-residents. Conversely, a small share of non-residents selects "very significant change" (5), a category not chosen by residents.

Interpretation: The overall picture is one of cautious attitudes toward change, with both groups emphasising the importance of maintaining character. Residents' slightly greater flexibility may stem from practical experience of the area's evolving needs, while non-residents' stronger focus on appearance and ambience explains the small tail supporting more drastic interventions.

3.2.5. Q6. If the area is changed, will it affect how you use the area?

When asked whether changes to the study sites would influence their patterns of use, a majority of respondents (55.9%) reported no expected impact, while 25.0% anticipated behavioural changes and 19.1% were uncertain (Figures 4.10–4.11). Figure 4,10 display the huge differences between the countries when it comes to how changes in heritage values and appearance of the neighbourhood are likely to affect the use of the area.

Norway and Italy exhibit the highest sensitivity, suggesting that interventions in these contexts could disrupt established routines or visiting patterns. The presence of uncertainty is noteworthy; where respondents are unsure, targeted communication and participatory design processes may help clarify intentions and reduce apprehension. As for Belgium, a large majority respond that they will not be influenced in their use of the neighbourhood, even though they are reluctant to change.

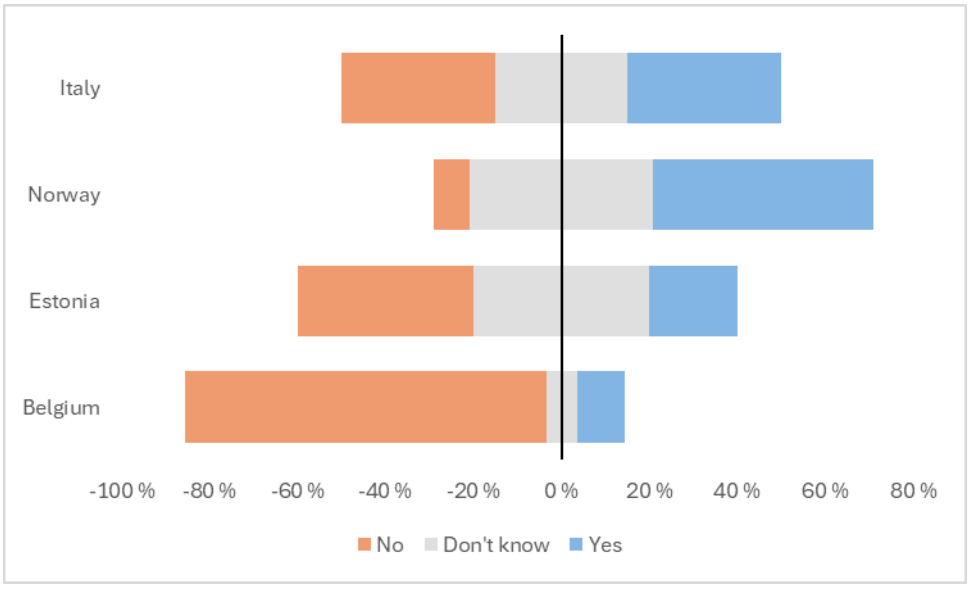

Figure 9: Q6. If the area is changed, will it affect how you use the area? Distribution of answers for each country. Response options: 1=Yes; 2=No; 3=Don't know

From a planning perspective, even a minority anticipating behavioural change is significant, particularly in historic environments where seemingly minor alterations can have disproportionate effects on comfort, legibility, and amenity. These findings underscore the importance of inclusive planning approaches to mitigate potential negative impacts on everyday practices.

Overview of how Q6 (Impact of Changes on Use) connects to Q7 & Q8
Q7 and Q8 provide context and reasoning behind the answers to the Q6 question of how the respondents' use of the area might be affected by changes to the neighbourhood. The coded themes reveal clear behavioural patterns.

Q6 = 1 (Yes, changes will affect use)
The dominant Q7/Q8 themes are History & Authenticity and Aesthetic & Atmosphere. The respondents emphasise loss of character as a deal-breaker. Those who say changes will affect their use are heritage-sensitive. They often mention "historic buildings," "authentic look," and "old charm." Many indicate they would stop visiting or reduce frequency if major changes occur. Comments like "If it becomes modern, I won't come anymore" are common.

Q6 = 2 (No, changes will not affect use)
Functionality & Access and Amenities & Cafés rise in importance and are the most dominant themes, while heritage mentions decline. Respondents who say changes won't affect their use are mainly function-oriented. They value practical aspects like ease of access, services, and amenities over aesthetics. These respondents often state they come for functional reasons (e.g., work, errands), so visual or cultural changes matter less.

Q6 = 3 (Don't know)
Dominant themes: There are mixed mentions of Green & Environment and Cleanliness & Maintenance, alongside an expressed uncertainty about extent of changes (the respondents who answered "Don't know" for Q6 often expressed hesitation because they don't know how big or what kind of changes are planned). Indecision reflects conditional tolerance, as the respondents express that they are unsure whether changes will improve or harm their experience. They often say: "Depends on what changes" or "Small changes are fine."

Key Linkages

- Impact-sensitive users (Q6=1) → Motivated by heritage and aesthetics, strongly linked to risk of losing visitors if character changes.
- Impact-neutral users (Q6=2) → Motivated by functionality and convenience, less concerned about cultural identity.
- Uncertain users (Q6=3) → Motivated by green improvements and maintenance, open to change if it enhances comfort.

Interpretation of Q6 by residency (Q1)

Responses to Q6 are almost identical across both groups. A majority answer "No", indicating that changes to the area would not affect how they use it. Approximately one quarter in each group answer "Yes", while the remaining respondents choose "Don't know".

Interpretation: Patterns of use appear very stable. For most people, daily routines, routes, and purposes of visit are consistent enough that even visible or functional changes would not meaningfully alter behaviour. This stability is important for planning: improvements or modifications are unlikely to deter use among either residents or visitors.

3.2.6. Overview per country

The following overview displays the results of the links between quantitative questions and qualitative explanations. A country-by-country textual overview displaying the cross-country analyses, covering the three linkages:

- Q2 ↔ Q3 (degree of liking the area and the reasons given)
- Q4 ↔ Q3 (degree of enjoyment of being in the area and the reasons given)
- Q5/Q6 ↔ Q7+Q8 (tolerance for change and impact on use, explained by the qualitative "why/what if" comments)

While sample sizes and missingness constrain inference somewhat, two indicative patterns emerge:

Liking and Enjoyment: Higher liking scores are positively associated with enjoyment. This is intuitive—visual and ambient qualities underpin pleasurable experience—but the relationship also suggests that stewardship of façades, streetscapes, and micro-public spaces contributes directly to experiential value.

Purpose of Presence: Respondents present for leisure or atmosphere often report higher enjoyment than those merely passing through, consistent with the idea that intentional engagement (e.g., visiting cafés or exploring) amplifies positive experience. Conversely, transit-oriented presence may dampen enjoyment if movement is constrained by congestion or if the route feels less inviting.

Belgium

The respondents were primarily in the area for functional reasons – shopping, passing through, or work. Despite this, the surroundings were consistently rated highly, with many giving scores of 4 or 5 for both liking the surroundings (Q2) and enjoyment of being in the area (Q4). Tolerance for change (Q5) was generally low to moderate. Most respondents preferred small or no changes, especially in historically rich areas like Vlaanderenstraat and Sint-Michielsplein. Impact of change on use (Q6) was mostly rated as 'No', indicating that while people value the character of the area, their usage is often driven by necessity or routine.

Interpretation of residency (Q1= live in the neighbourhood or other)
Belgium's resident and non-resident patterns are near-identical to each other, especially for Q2 (liking the neighbourhood). Appreciation (Q2)/enjoyment (Q4) are high but not maximal; change tolerance is conservative, centred on small adjustments. Q5 Tolerance for change is low (small changes) for both groups, with no difference between the two groups.

Q2 ↔ Q3 (Liking ↔ Reasons)

- Higher liking (Q2=4–5) is mainly explained by Aesthetic & Atmosphere and History & Authenticity (references to beautiful façades, historic streets, ambience). Amenities & Cafés is a helpful secondary driver.
- Mid liking (Q2=3) mixes Functionality & Access ("easy to pass through / central") with Noise & Traffic caveats.
- Lower liking (Q2=1–2) is linked to Noise & Traffic and Cleanliness & Maintenance concerns (busy flow, cyclists' speed, bins/litter), sometimes noting Safety in specific spots.

Q4 ↔ Q3 (Enjoyment ↔ Reasons)

- High enjoyment (Q4=4–5): the same Aesthetic/History pairing dominates, indicating enjoyment is pulled up by visual and heritage cues; Green & Environment adds to comfort where noted.
- Moderate enjoyment (Q4=3): Functionality helps, but noise/traffic reduce the uplift.
- Low enjoyment (Q4=1–2): Noise/Cleanliness outweigh charm; where safety is mentioned, it further depresses enjoyment.

Q5/Q6 ↔ Q7+Q8 (Change tolerance & Impact ↔ Explanations)

- Low tolerance (Q5=1–2): comments stress preservation of History & Authenticity; people often say changes would reduce use (Q6=1) if the character is diluted.
- Moderate tolerance (Q5=3): acceptance of small functional upgrades (walkability, seating) if aesthetics remains intact; many indicate use would continue.
- High tolerance (Q5=4–5): respondents prioritise Functionality & Access and Cleanliness; they expect equal or increased use post-improvement (Q6=2), provided practical challenges or annoyances are fixed.

Estonia

In Estonia, most respondents lived in the neighbourhood, with a few visiting cafés or working nearby. Ratings for liking the surroundings (Q2) and enjoyment of being in the area (Q4) were generally positive, though slightly lower than Belgium. There was a moderate correlation between Q2 and Q4, and a varied response to change tolerance (Q5), with some accepting small changes and others preferring preservation. Impact on use (Q6) was mixed, with some indicating changes would affect their use, especially if the area's character was altered. Green spaces and community features were frequently mentioned as important to the area's appeal.

Interpretation of residency (Q1= live in the neighbourhood or other)
In Estonia, In Estonia's subsample, non-residents are more enthusiastic and more open to change than residents. Treat as directional, due to few respondents. Combined, the "other" category also shows greater tolerance for change than the residents in the area.

Q2 ↔ Q3

- Higher liking is supported by Aesthetic & Atmosphere where present, but Estonia shows relatively stronger weight on Functionality & Access and Green & Environment (walkability, parks, playgrounds, bike lanes).
- Mid liking frequently balances Functionality with a need for more greenery; Noise & Traffic appears in certain streets.
- Lower liking: driven by Noise/Traffic and Cleanliness (especially at specific night-time locations).

Q4 ↔ Q3

- High enjoyment emerges when functional ease is paired with green amenities; aesthetic mentions help, but the "everyday usability" aspect is especially salient here.
- Moderate enjoyment: Functionality continues to matter, yet gaps in green/social facilities and traffic keep enjoyment from "very good".
- Low enjoyment: Noise/Cleanliness dominate; Safety is occasionally cited at night.

Q5/Q6 ↔ Q7+Q8

- Lower tolerance (Q5=1–2): where History & Authenticity is valued (older areas), respondents fear losing identity and say their use would be affected (Q6=1) by visible modernisation.
- Moderate tolerance (Q5=3): supportive of targeted upgrades—especially green/public space and cycling—if character is respected; many say use would continue/strengthen.
- Higher tolerance (Q5=4–5): Functionality & Access and Green dominate; changes seen as positive and unlikely to reduce use (Q6=2).

Norway

In Norway, the respondents expressed strong appreciation for the surroundings and enjoyment, with Q2, liking the surroundings, and enjoyment of being in the area (Q4) consistently rated as 5. There was a clear preference for preserving the area's historic character, with Q5 responses indicating minimal tolerance for change. Q6 responses showed that significant changes would reduce usage, especially among those who valued the pedestrian-friendly and aesthetic qualities. The area was described as peaceful, charming, and well-preserved, with many respondents highlighting the importance of maintaining its unique identity. Many came to "Experience the area" or visit cafés. Average rating ≈ 5 (Very good), showing strong appreciation for architecture and tranquility. Correlation between purpose and satisfaction is strongest here.

Interpretation of residency (Q1= live in the neighbourhood or other)
Norway stands out for very high liking/enjoyment and very low tolerance for change across both residents and non-residents. There is practically no measurable difference between the two resident/non-resident groups.

Q2 ↔ Q3

- Higher liking is clearly driven by Aesthetic & Atmosphere and History & Authenticity (wooden houses, cobbles, river views), plus Amenities & Cafés and benches for comfort.
- Mid liking: Functionality and traffic-calm charm help, but Noise & Traffic (especially fast cyclists / morning rush) is a recurring limiter.
- Lower liking: when present, mainly Noise and concerns about maintenance/cleanliness in pockets.

Q4 ↔ Q3

- High enjoyment: the strongest heritage + ambience signal of all countries; being able to stroll (car-light streets, benches) boosts enjoyment.
- Moderate enjoyment: Functionality helps but traffic (including bikes) and tourist pressure can hold back enjoyment from "very good".
- Low enjoyment: rare and typically linked to Noise/Traffic or fear of character loss.

Q5/Q6 ↔ Q7+Q8

- Low tolerance (Q5=1–2) is common where heritage is treasured; people explicitly state changes would make them come less (Q6=1).
- Moderate tolerance (Q5=3): support for small, sympathetic improvements (paving comfort, benches, pavements) without losing rustic feel; use unchanged or slightly improved.

- High tolerance (Q5=4–5): primarily tied to Functionality & Access; even then, respondents push back on radical modernisation that would erase the old feel.

Italy

The responses varied across the areas where the street interviews were performed. Surroundings (Q2) and enjoyment of being in the area (Q4) were generally rated positively, though with more variation than in Norway. Tolerance for change (Q5) was moderate, with some respondents accepting small changes and others expressing concern about losing the area's historic charm. Q6 responses indicated that changes could affect perception and usage, particularly in monumental or historic areas. The architecture and atmosphere were frequently cited as key reasons for visiting or enjoying the area.

Interpretation of residency (Q1= live in the neighbourhood or other)
In Italy's sample, the local residents appear more positive about current experience yet more protective of character than visitors.

Q2 ↔ Q3

- Higher liking is strongly tied to History & Authenticity and Aesthetic & Atmosphere (monumental areas, identity, architecture).
- Mid liking: Aesthetic remains relevant, but Functionality & Access and Cleanliness & Maintenance start to qualify the experience.
- Lower liking: mainly Cleanliness/Maintenance or Noise/Traffic in specific streets/edges.

Q4 ↔ Q3

- High enjoyment follows heritage + ambience; Amenities & Cafés further increases leisure appeal.
- Moderate enjoyment: Functionality and Cleanliness become make-or-break; where upkeep is patchy, enjoyment stalls at "OK/Good".
- Low enjoyment: Noise/Cleanliness rule; aesthetic value is recognised but overridden by practical discomforts.

Q5/Q6 ↔ Q7+Q8

- Low tolerance: strong emphasis on protecting the historic look; major changes would reduce use (Q6=1).
- Moderate tolerance: small/compatible interventions (maintenance, minor aesthetic repairs, limited modernisation) are acceptable; use likely unchanged.
- High tolerance: where present, it is linked to Functionality & Access and Amenities; respondents expect no negative impact on use or even improvement.

Cross-country contrasts at a glance (why these patterns matter)

Heritage-led enjoyment/liking (Q2/Q4): Norway and Italy show the strongest aesthetic/heritage signal; Belgium is similar in historic cores; Estonia layers more functionality/green into positive ratings.

Detractors (Q2/Q4): Noise & Traffic and Cleanliness depress scores everywhere, with cyclist speed/rush-hour stress noted especially in Norway and Belgium, and cleanliness/decay pockets in Italy. In Estonia, several respondents noted lack of green areas.

Change tolerance (Q5) and impact (Q6): Lower tolerance where heritage is core to identity (Italy's monumental squares, Norway's wooden quarters). Higher tolerance associates with functional upgrade demands and green/public-space improvements (notably Estonia), with Belgium in between depending on the neighbourhood where the interviews are performed.

3.3. Cross-Country Reflections

3.3.1. Cross-Country Reflections

Several cross-country themes recur:

Strong Baseline Appreciation: Historic areas are widely liked and enjoyed, suggesting that conservation of character is not only culturally important but also socially and economically valuable (e.g., through place attractiveness and local vitality).

Preference for Incremental Change: Acceptance centres on minor, compatible interventions. This points to an implementation pathway that privileges sensitive detailing, material consistency, reversibility, and visual discretion—particularly for energy upgrades.

Context-Specific Sensitivity: Norway and Italy show higher sensitivity to potential behavioural impacts, while Estonia signals more openness to change. In Belgium, the tolerance to change is moderate to low, although changes will not affect the use of the areas. Strategies need to be locally adapted, calibrated to local expectations and use patterns, and avoiding one-size-fits-all prescriptions. The differences between residents' responses and others'/visitors'responses vary only to a little extend.

Multifunctional Use: The coexistence of transit, residential, and leisure motives implies that changes must account for diverse user journeys and time-of-day dynamics. Small design decisions (e.g., surface treatments, lighting, signage) can meaningfully influence perceived quality.

Implications for Heritage-Aligned Energy Interventions

Translating these findings into action suggests three practical directions:

- **Prioritise Low-Visibility Efficiency Measures**

Start with interventions that preserve street- and façade-level character (e.g., internal insulation where feasible, window repair with thermal improvements, discreet rooftop solar with careful placement). Where visible measures are necessary, employ high-quality detailing and materials that harmonise with existing rhythms and proportions.

- **Strengthen Participatory Design and Communication**

Use visualisations, pilot installations, and material samples to demonstrate outcomes. Address uncertainty by making trade-offs explicit (energy gains vs. character impacts) and by incorporating user feedback from early design stages.

- **Small differences between perceptions of residents vs. visitors, unlike reasoning**

The analysis further highlights differences between residents and other users, although with small differences there are some to reflect upon. While both groups are positive toward the

areas, their reasoning differs: Residents emphasise daily-life factors such as noise, mobility, maintenance, and greenery. Visitors and passers-by focus more on heritage aesthetics, ambience, and visual impressions.

- **Protect the Micro-Experience**

Since enjoyment is closely tied to immediate experience—walking, sitting, lingering—prioritise improvements to micro-public spaces (seating, shade, soundscape) alongside technical upgrades. Small investments here yield disproportionate gains in perceived quality.

3.3.2. Limitations and Next Steps

The sample size per country is modest, and not all respondents answered all questions. These constraints limit statistical power and the generalisability of patterns, and and substantiates that the responses should be seen as indicative, only. Future work should increase the number of observations and ensure balanced sampling across user types. Longitudinal follow-ups—before and after specific interventions—would help distinguish perception shifts attributable to change from background variation. Furthermore, since the survey aggregates multiple areas within each country, local differences and context variations may play a role.

3.4. Conclusions of Street interview Survey

3.4.1. Conclusions and key takeaways

The findings reveal a strong attachment to historic environments, expressed through high ratings for visual quality and experiential enjoyment. However, attitudes toward physical change are cautious, favouring incremental, minimally visible interventions. This tension highlights the complexity of implementing energy-efficiency measures in heritage contexts.

Perceived environmental quality is decisive: liking strongly predicts enjoyment. Energy interventions should preserve or enhance this quality through discreet, compatible solutions that protect façades and streetscapes.

Historic urban areas are consistently highly valued for their cultural identity, architectural integrity, and experiential qualities. Respondents across all four countries expressed strong appreciation and enjoyment of these environments, with positive ratings closely tied to aesthetics, ambience, and authenticity. However, tolerance for physical change is limited: most favour no or only minor, visually discreet interventions, such as colour adjustments or rooftop solar panels. Where openness to change exists, it is linked to functional improvements and green amenities, not aesthetic alterations.

Behavioural sensitivity to change is context-specific. Norway and Italy exhibit the strongest preservationist attitudes and the highest likelihood of reduced use if character is compromised. Estonia shows greater flexibility, particularly for upgrades that enhance greenery and public space, while Belgium occupies a middle ground—moderate tolerance for small changes, but functional users often unaffected by visual alterations. Across all countries, an inverse relationship emerges between liking (Q2) and tolerance for change (Q5): the more people value and enjoy a place, the less they want it altered. Most respondents indicate that major changes would affect their use (Q6), especially in heritage-rich contexts.

Qualitative insights reinforce these patterns. Architecture and history dominate positive explanations, while detractors—noise, traffic, and cleanliness issues—depress enjoyment everywhere. Estonia additionally highlights lack of greenery as a critical gap. These findings underscore that perceived environmental quality is decisive: liking strongly predicts enjoyment, and interventions must preserve or enhance this quality.

Key Takeaways for the Project

- Prioritise low-visibility energy upgrades (e.g., internal insulation, careful solar placement) to maintain façade and streetscape character.
- Combine technical retrofits with micro-scale public realm improvements (walkability, seating, greenery) to strengthen everyday usability.
- Adopt context-sensitive strategies: Norway and Italy require preservation-led approaches; Estonia allows moderate functional upgrades; Belgium favours incremental interventions.
- Engage stakeholders early through participatory planning, visualisations, and reversible design measures to reduce uncertainty and resistance; monitor impacts longitudinally to track perception shifts and behavioural outcomes.
- The development of a Multi-Criteria Decision Making tool (MCDM) should open for considerations of varying settings, objectives, and needs.

General Insights

- Heritage matters for social acceptability: enjoyment and liking are strongly tied to authenticity and aesthetics.
- Incremental change is preferred: small, reversible interventions enjoy broad support; radical alterations risk alienating users.
- Detractors are universal and tractable: addressing noise, traffic, and cleanliness yields disproportionate gains in perceived quality.
- User diversity shapes priorities: leisure visitors value ambience; residents emphasise functionality—both perspectives must inform design.
- Communication is critical: uncertainty correlates with resistance; transparent processes and clear visualisation mitigate this.

Country-Specific Highlights

- Belgium: Historic charm appreciated; traffic and cleanliness issues reduce enjoyment. Moderate tolerance for small changes.
- Estonia: Functional ease valued; lack of greenery is a major gap. Slightly higher tolerance for change if improvements enhance liveability.
- Norway: Highest liking and enjoyment; very low tolerance for change. Pedestrian-friendly character and authenticity are non-negotiable.
- Italy: Strong appreciation for monumental heritage; extremely low tolerance for significant alterations. Cultural identity drives positive perception.

4. Discussion and Combined Conclusion

This integrated discussion synthesises evidence from three sources: the in-depth interviews with residents and owners of heritage townhouses (primary lens), the street-interview survey conducted across four case areas (secondary lens), and the state-of-the-art literature on ownership, stewardship, user perceptions and energy retrofitting in historic environments. The target audience comprises international researchers, public heritage management bodies, politicians, EU research funders, and industry actors across the building and heritage sectors. The objective is to triangulate user-centred findings with empirical and theoretical benchmarks to support policy, project and design decisions that balance authenticity, comfort and energy performance within European heritage neighbourhoods.

The discussion privileges the qualitative depth of the in-depth interviews, using them to articulate motivations, trade-offs, and decision mechanisms at household level. Street-interview survey data are used as a population-facing counterpoint—capturing indicative preferences, perceived environmental quality, and tolerance for change at neighbourhood scale. Literature is mobilised to frame and interpret patterns, including ownership structures, behavioural drivers, and retrofit acceptance. While sample sizes in the street survey are modest and responses are not complete for all questions, the convergence of signals across countries provides robust directionality.

4.1. Thematic Synthesis

4.1.1. Stewardship and Ownership Dynamics

Across contexts, owners act as custodians balancing private needs with public value. Interviewees commonly report long tenures and emotional attachment, but also heterogeneous exposure to formal heritage restrictions. In Belgium, none of the interviewed buildings hold the highest protection status, which fosters flexible, owner-led stewardship while an informal appreciation of façade coherence and neighbourhood character remains. Estonia's cooperative ownership shapes decision-making and cost-sharing, while Norway's conservation context and Italy's UNESCO-designations introduce more visible regulatory constraints. These patterns align with literature emphasising how tenure, governance, and protection levels mediate retrofit pathways and the capacity to mobilise funding, expertise and permissions (e.g., private vs public stewardship; evolving values; need for hybrid governance and PPPs).

4.1.2 Perceived Environmental Quality and Experiential Value

Street-interview respondents generally reported high liking and enjoyment of historic areas, with positive appraisals concentrated at the top of the scale. Qualitative explanations emphasised aesthetics, ambience, and authenticity as dominant reasons for high ratings, while detractors such as noise, traffic and cleanliness depressed enjoyment. Norway and Italy showed the strongest heritage-led enjoyment patterns, Estonia layered functional ease and greenery into positive experiences, and Belgium often combined high appreciation with functional use. The in-depth interviews corroborate these signals: residents value architectural character and coherent streetscapes, and many are willing to trade some

comfort to retain authenticity. The literature similarly documents broad public preference for historic settings, linking beauty, character and community identity to stewardship and place attachment.

4.1.3 Tolerance for Physical Change versus Authenticity

Survey responses indicate a predominantly cautious stance toward physical change: most participants favour no or only small, minimally visible interventions (e.g., colour adjustments, discreet rooftop solar), with openness to major alterations rare. Country contrasts are instructive: Norway emerges as most preservationist; Estonia exhibits higher tolerance when functional or green improvements are salient; Belgium and Italy largely support incremental adaptations. Interviews provide mechanism-level clarity: owners widely reject front-façade insulation, accept window upgrades when aligned with original design, and consider PV acceptable if not visible or applied consistently along roofscapes. Reversibility, visual discretion and material compatibility are recurrent acceptance criteria, echoing best-practice principles in the literature that advocate integrated approaches balancing performance with integrity.

4.1.4 Technical Performance, Comfort and Building Pathologies

Technical shortcomings recur in attics, basements and interfaces—moisture ingress, ventilation deficits, cold surfaces and draughts—though severity varies across countries and cases. Interviewees often manage energy demand through selective heating, accept cooler interiors, or retrofit cautiously (e.g., internal insulation limited to non-valued interiors; targeted roof works; use of existing chimneys for services). Heating systems range from legacy gas boilers to heat pumps; adoption is selective and mediated by cost, confidence, and regulatory visibility constraints. The street-survey's linkage between liking/enjoyment and micro-experience underscores that small public-realm decisions (soundscape, cleanliness, benches, shade) can disproportionately affect perceived quality even when building performance is unchanged. The literature identifies similar technical constraints (non-standard constructions, building physics risks, regulatory limits), advocating case-by-case assessment and early collaboration with heritage authorities.

4.1.5 Decision Drivers: Heritage, Comfort, Ecology and Cost

In-depth interviews reveal varied prioritisation: heritage values are widely appreciated yet often ranked secondary to immediate comfort, ecological responsibility or heating-cost concerns. Motivations include climate ethics, lived comfort, and pragmatic considerations (e.g., prior refurbishments, disruption fatigue). Financial motivations are rarely primary—even when cost matters, decisions are framed by comfort and heritage. The survey adds a behavioural dimension: users who come for leisure or ambience report higher enjoyment; transit-oriented users report lower enjoyment and are more sensitive to functional detractors. Together, these data suggest that interventions succeed when they protect experiential quality and authenticity while addressing tractable detractors. Behavioural intent—e.g., whether changes would alter use—skews toward 'no' in Belgium, is mixed in Estonia, and more sensitive in Norway and Italy, reinforcing the need for context-calibrated engagement and design. Despite the varied initial conditions of the buildings, several owners have undertaken a series of energy efficiency and refurbishment measures, demonstrating a commitment to improving both comfort and functionality. This might serve as a barrier towards further measures and improvements

When regulatory constraints due to heritage considerations are not present or perceived, informal appreciation of heritage can be a powerful motivator and driver for protection of heritage values, even in the absence of formal protection.

4.1.6 Governance, Approvals and Support Schemes

Constraints arise from institutional oversight (Italy), conservation status and municipal rules (Norway), cooperative coordination (Estonia), or; from the Belgian cases, relative freedom tempered by heritage norms. Interviewees across countries call for accessible guidance, tailored incentives and simplified approvals that reflect heritage-specific constraints. Literature similarly highlights the necessity of harmonising legal frameworks to enable climate targets without compromising authenticity, encouraging hybrid governance, PPPs and participatory approaches. An explicit implication for research and tooling is the need for Multi-Criteria Decision-Making (MCDM) instruments that accommodate differing owner priorities, regulatory contexts and technical boundary conditions.

4.1.7 Comparative Insights (Triangulation)

Convergence across sources is notable: (i) Baseline appreciation of historic environments is strong; (ii) Acceptance centres on incremental, reversible measures; (iii) Perceived environmental quality (facades, streetscape, micro-experience) underpins enjoyment; (iv) Detractors are universal (noise, traffic, cleanliness) and tractable through micro-scale interventions; and (v) Decision drivers intertwine heritage identity with comfort and ecology more than with direct financial payback. Divergences are context-specific: regulatory visibility raises caution (Italy, Norway); cooperative governance redistributes agency (Estonia); and lighter formal constraints enable personalised stewardship (Belgium). Literature provides explanatory scaffolding, linking behavioural norms, evolving values and stewardship models to national patterns. The analytical weight rests on interviews, with surveys providing corroboration and nuances at neighbourhood scale; both are consistent with the research canon on respectful retrofit and participatory conservation. A lacking insight might be noted, as an overview of the four countries' legal framework regulations would give valuable information to inform the conclusions. Such an overview is thus a suggestion for further work in the project and beyond.

4.2. Cross-Chapter Conclusion

The collective evidence points to a durable social licence for heritage-congruent energy action: owners and users value authenticity and experiential quality, prefer reversible and discreet measures, and accept functional upgrades when they preserve character. Retrofit strategies that respect rhythm, materiality and proportion—paired with micro-public-realm improvements—can deliver energy gains without eroding the identity that underpins liking and enjoyment. However, barriers persist: technical uncertainties (e.g., building physics for internal insulation), institutional complexity (approvals, heritage boards), financing and knowledge gaps. Success therefore demands integrated, context-sensitive approaches combining early collaboration with heritage authorities, tailored incentives, pragmatic staging to reduce disruption, and transparent communication that makes trade-offs legible. A MCDM tool should explicitly allow parameter variation, capturing owner priorities and local constraints, and should foreground reversibility, visual discretion and risk

management. In sum, conservation and sustainability are complementary when design quality and participatory governance anchor decision-making.

4.2.1 Key Takeaways

• Authenticity and ambience drive enjoyment; protect façades, streetscapes and micro-experience to maintain social licence for change.

• Acceptance is highest for incremental, reversible, and minimally visible measures (e.g., careful window upgrades, discreet rooftop PV, targeted roof/attic works).

• Users are sensitive to detractors (noise, traffic, cleanliness); small public-realm improvements yield disproportionate gains in perceived quality.

• Owners renovate for heritage and comfort more than for short-term cost savings—financial feasibility matters but is seldom the prime driver.

• Regulatory visibility and institutional oversight increase caution; approvals must be streamlined without diluting heritage safeguards.

• Cooperative ownership redistributes agency and costs; tools and incentives should recognise collective decision dynamics.

• Technical risks (moisture, thermal bridges, ventilation) require case-by-case diagnostics and early collaboration with conservation officers.

• A project MCDM tool should allow varying weights for heritage, comfort, ecology and cost, and encode acceptability criteria (reversibility, visibility, material compatibility).

4.2.2 Recommendations

Quick wins

- Prioritise low-visibility efficiency measures: repair and improve original windows (thermal glazing/secondary glazing where compatible), attic draught-proofing and targeted airtightness works in non-valued interiors.
- Protect the micro-experience: address cleanliness, noise hotspots and seating/wayfinding in heritage streets; communicate forthcoming changes with visuals and material samples.
- Enable early, briefings with conservation officers to de-risk design choices; agree principles for reversibility and visual discretion upfront.

Medium term benefits

- Develop context-sensitive retrofit packages per archetype (masonry vs timber; attic vs basement pathologies), including moisture-safe internal insulation details where appropriate.
- Launch a streamlined approvals pathway for compatible measures (e.g., window repairs, rear-façade insulation with preserved details, rooftop PV not visible from public realm).
- Build a neighbourhood-scale engagement plan: co-design small public-realm upgrades and test acceptance via pilot installations and pre/post surveys.

Strategic impact

- Create and deploy an MCDM decision-support tool that encodes heritage acceptability criteria, local regulatory parameters and owner priorities; integrate with guidance and case libraries.
- Establish hybrid governance and funding models (PPP, revolving funds, targeted grants) to enable heritage-congruent energy retrofits, with monitoring and learning loops.
- Commission longitudinal evaluation of perception, use and performance (e.g., energy, indoor climate, street experience) to refine strategies and sustain trust.

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Annex 1: In-depth interview guide

DD INDIVIDUAL LOGO

HeriTACE case study – Interview guide

Introduction

Project HeriTACE:
Future-proofing Heritage Buildings by Optimizing Comfort and Energy Efficiency

Who We Are:
Researchers: EACH TEAM edit with their names
Involved organisations: EACH TEAM edit with their organisation's name

Project Overview: *The HeriTACE project aims to enhance knowledge about energy-efficient and comfort-boosting measures to reduce climate impact while preserving the heritage value of individual buildings, neighbourhoods, and urban areas. These measures will be applicable to older buildings in general. This European research project is funded by the EU and involves research institutions, municipalities, and technical advisors from six countries. Various types of urban residences and their surrounding environments have been selected for detailed technical, cultural heritage related, architectural, and historical studies, as well as for interviews with users and owners. Four case studies are performed in Ghent, Belgium; Tallin, Estonia; Mantova, Italy; and, Trondheim, Norway.*
User Perspective: *With an aim in the project to propose feasible solutions for upgrading of the energy efficiency in the chosen dwellings, the user perspective is crucial. Together with building owners and users, we will examine decision-making processes for technical measures, and how buildings and their environments are perceived and used. Our goal is to identify sustainable energy efficiency measures for urban residences without compromising their heritage value. As a building owner and/or user, you have agreed to participate in this European study. The project team wants to understand how you, as owners and residents, relate to your homes, the local area, and potential measures to improve comfort and energy efficiency in a designated heritage area ("urban living lab"). In collaboration with you and other owners and users, we will identify the best feasible measures, focusing on heritage values, attitudes of owners and users, and possible technical interventions.*
Interview Process: *We would like to conduct this interview as a conversation around the topics and questions described in this interview guide. The conversation may also develop beyond the outlined topics (semi-structured interview).*
Recording and Privacy: *If you agree, we would like to record the interview. All information provided will be anonymized. Please see the consent form for details on privacy and your rights related to the use of recordings, citations, storage, and deletion of the audio recording. In addition to the recording, notes will be taken, and a standardized format will be used to register the information provided during the interview. You have the right to interrupt the interview and withdraw your consent at any time. Remember, there are no right or wrong answers.*
The main interview topics are:

- *Background information about the residence;*
- *Cultural heritage- and heritage environment values;*
- *Technical and comfort-related issues (your building);*
- *Environmental concerns, economy and energy efficiency measures.*

ADD INDIVIDUAL LOGO

Interview guide

Topic A *Background information about the residence*

1. What type of housing applies to you (owner/long-term renter/short-term renter)?
2. Are there one or more rental units in the building?
3. How many people live in your household (adults/children)?
4. How many people live in the entire building?
5. How long have you lived in the house/apartment (number of years)?
6. Can you describe the ownership structure of the building and your/the owners ability to influence and/or implement measures?

Topic B *Cultural heritage- and heritage environment values*

1. What are the reasons behind choosing to live in this building and its surroundings?
2. What, in your opinion, is the significance or attractiveness of the building and the neighbourhood?
3. If the entire building is remodelled/changed (new windows, new panelling, etc.), would it still be as attractive to live here (please explain)?
4. Would similar changes in the neighbourhood affect the attractiveness of the surroundings?
5. What is important to you about this particular building and neighborhood, for example (describe):
   - Historical depth and quality (heritage value, building/neighborhood)?
   - Economic factors?
   - Central location/proximity to city/work/study place, etc.?
   - The design and quality of the building and/or surroundings?
6. Can you describe the value you place on the building's age and authenticity, and how changes might affect your perception?
7. Can you please elaborate on your willingness to endure inconveniences to maintain the building's heritage and authenticity How much can you tolerate, and what kind of measures would be tolerable (extra heating/less comfort, etc.)?
8. Does the heritage status of the building and neighborhood affect your desires and possibilities to make changes or implement measures?
9. Can you identify any specific challenges or positive aspects of the building or neighbourhood?
10. Do you have the desire and/or ability to address these aspects and if so, what changes (if changes to the building are already made, please elaborate)?

Topic C *Building Technology and installations*

1. What are your considerations regarding the overall state of the building?
2. Do you experience any problems with the building (describe)? For example:
   - Damage and/or wear on facades, roofs, foundations, etc. (visible damage, cracks, growth, mold, rot, black fungus, etc.)
   - Water leaks (inside/outside): visible moisture stains, water on surfaces, condensation
   - Damage/water leaks in gutters and downspouts, damage to the facades
   - Foundation moisture and basement dampness
   - Insulation and sealing: drafts, cold surfaces, cold air currents, or similar issues
   - Ventilation and air exchange

ADD INDIVIDUAL LOGO

3. How is the building's functionality in terms of energy consumption, heating, and other technical or practical challenges for your use (elaborate)?
4. Can you please elaborate on the status and use of the chimney and fireplace, if you have/have had one?

Topic D Comfort

1. Do you have any considerations regarding the building's energy consumption, your energy use, and how comfortable the building is (describe)?
2. Are the heating systems and temperature control in the building adequate for your needs (elaborate)? For example:
   - The heating system's ability to maintain a consistent temperature?
   - Adequate heating and/or cooling?
   - Unbalanced (some places too cold, others too hot)?
3. How frequently do you use the building?
4. How frequently do you use the different parts of the building?
5. Is the residence usually heated during the day (in cold season)?
6. Are there any rooms in the house that you do not heat (basement, attic, bedroom, etc.)?
7. Do you find the temperature levels in the residence satisfactory (explain)?

Topic E Environmental concerns, economy and energy efficiency measures

1. Can you please describe your thoughts about the financial benefits of implementing energy-efficient measures, both immediate and over time?
2. Does the building have an automatic energy measurement system (elaborate), and if so, are we allowed to see the measurement data?
3. Can you to describe the factors that influence the decision to implement measures, considering various aspects like heritage, potential damage, knowledge, comfort/ discomfort, profitability, responsibility, economy, available support schemes etc.?

Topic F Summary

1. What do you consider to be the most important to prioritize regarding the topics we have discussed (describe)?
2. Prioritized measures under these topics (for example, please add):
   - Maintain the building's heritage values (architecture, aesthetics, history, etc.)
   - Contribute to maintaining the quality and experiential value of the local environment
   - Repair major damages to the building structure
   - Prevent damage
   - Improve indoor comfort
   - Improve/increase energy efficiency
   - Switch to more sustainable energy sources and solutions
   - Reduce heating costs
   - Increase the value of the apartment/home/building.

Thank you very much for your input to the research project. Your contributions are highly valued and are crucial in our efforts to preserve cultural heritage while also making the building stock more sustainable.

The Eu-project HeriTACE.

Annex 2: Street interview survey sheet

Cultural heritage values and experiences in the building environment and neighbourhood

The HeriTACE project aims to increase knowledge about energy-efficient and comfort-enhancing measures to reduce climate impact and achieve solutions that do not harm the heritage values of individual buildings, building environments/neighbourhoods, and urban areas. These measures will be transferable to older buildings in general. The project is a European research initiative funded by the EU. Research institutions, municipalities, and technical advisors from six countries are participating in this interdisciplinary project. Various types of urban housing and their associated building environments/neighbourhoods have been selected as the basis for detailed technical and architectural/historical investigations and analyses, as well as interviews with users and owners. The user perspective is crucial in the project because we aim to propose feasible solutions. Together with the users, we examine both the decision-making processes for technical measures and how the buildings and urban environments/neighbourhoods are perceived and used.

1. Why are you in this area today?

	Live in the neighbourhood		To shop
	Just passing through		To visit a cafe/restaurant
	Visiting someone		To see and experience the atmosphere
	Otherwise, describe:		

2. How much do you like the surroundings?

Rate your answer on a scale from 1 to 5:
1 = Poor; 2 = Slightly; 3 = Okay; 4 = Good; 5 = Very good; 0 = Don't know.

3. Please explain your answer.

4. How well do you enjoy being here?

Rate your answer on a scale from 1 to 5:
1 = Poor; 2 = Slightly; 3 = Okay; 4 = Good; 5 = Very good; 0 = Don't know.

5. How much change do you think the area can withstand without losing its unique character

(related to questions 2 and 3)? Rate your answers on a scale from 1 to 5:

1 = No change
2 = Small changes like colour schemes, solar panels on the roof, etc.;
3 = Slightly larger changes like small extensions, changing windows, solar panels on the wall, heat pumps, altering building details, etc.;
4 = Major changes like demolishing and constructing new buildings in the same style and structure;
5 = Very significant changes like demolishing and building something completely different/modern/parking lot;
0 = Don't know.

6. If the area is changed, will it affect how you use the area?

	Yes		No		Don't know

7. Why do you think potential changes might influence your activities or enjoyment of the area?

8. How do you think potential changes might influence your activities or enjoyment of the area?