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D.1.4.2 Joint Strategy for transition towards long- term climate neutrality of buildings

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Content

0. Introduction

Buildings are responsible for approximately 40% of total energy consumption and more than half of natural gas consumption in the European Union, primarily due to energy use for heating, cooling, and domestic hot water production. They are also responsible for 36% of greenhouse gas emissions associated with this energy consumption.

Additionally, buildings contribute to half of the extracted and utilized natural raw materials, one-third of total water consumption, and one-third of the generated waste. These figures highlight the critical role of buildings in the energy transition, circular economy, sustainable development, and the achievement of climate neutrality.

With this in mind, the European Commission is actively working on enhancing standards for the renovation and construction of new buildings, as well as integrating circular economy principles and objectives. This commitment is reflected in the continuous increase in required standards and performance criteria for both the refurbishment of existing buildings and the construction of new ones.

The primary goal is to raise the building renovation rate from the current average of 1% to 3% and to transition new buildings from the current nearly zero-energy building (nZEB) standard to the zero-emission building (ZEB) standard.

Sustainable building design must prioritize the assessment of emissions and costs throughout the building's entire life cycle while utilizing natural, biodegradable materials with a low carbon footprint.

Buildings should be climate-resilient and energy-efficient, with low energy demand primarily met through on-site renewable energy sources. Where feasible, they should also be integrated into wider energy networks, enabling energy sharing within their local communities.

On April 12, 2024, the Council of the European Union officially adopted the revision of the Energy Performance of Buildings Directive, requiring all new buildings to be zero-emission buildings. Specifically, as of January 1, 2028, this requirement will apply to publicly owned buildings, while from January 1, 2030, it will extend to all other new buildings, with certain exemptions possible.

The transition towards climate neutrality of the building sector is a fundamental pillar in achieving national and international sustainability and climate goals. As one of the largest sources of energy consumption and greenhouse gas emissions, the building sector holds immense potential for contributing to decarbonization, improving energy efficiency, and fostering a more resilient and environmentally responsible built environment.

Recognizing the urgency of this transformation, this strategy provides a comprehensive roadmap that outlines the key policies, actions, and collaborative frameworks necessary to guide the sector through a effective transition.

The strategy also highlights the importance of cross-sectoral cooperation, engaging stakeholders at all level including public authorities, private investors, building owners, tenants, financial institutions to ensure alignment of efforts, mobilization of resources, and effective implementation.

Furthermore, this strategy sets clear long-term objectives aligned with the European Green Deal.

In essence, the strategy lays the groundwork for a systematic, inclusive, and forward-looking approach to achieving climate neutrality in the building sector, recognizing it as a key enabler of a sustainable and low-carbon future.

The strategy is made in line with D.1.4.1 and it is officially adopted/accompanied by letters of commitment.

D.1.4.3. Action Plans for long-term utilization of building stocks with summarized Visions (D1.4.1) will be based on a jointly developed template or incorporated into existing local and regional plans. The renovation plans will be aligned with the goals of the adopted Joint Strategy.

1. Purpose and objectives

The primary purpose of this strategy is to develop a comprehensive framework for the effective transition of the building sector towards long-term climate neutrality. It provides guidelines and policies aimed at reducing greenhouse gas emissions, enhancing energy efficiency, and promoting the use of renewable energy sources throughout all stages of a building's life cycle.

The core objective of this document is to improve the overall building stock management process by integrating sustainability principles into four key areas: planning, design, construction, and maintenance. Additionally, it aims to create the necessary preconditions and eliminate barriers to accelerating the building renovation process while strengthening and enhancing collaboration among all relevant stakeholders within its operational framework.

These objectives support the achievement of long-term climate neutrality in the building sector while simultaneously reinforcing sustainability, minimizing environmental impact, and improving the quality of life for all citizens.

2. EU framework

European Green Deal

The European Green Deal aims to ensure the green transition of the European Union, with the ultimate goal of achieving climate neutrality by 2050. This plan encompasses a range of initiatives across various sectors, including climate, environment, energy, transport, industry, agriculture, and sustainable finance.

The plan is built upon eight key elements:

- Enhanced EU climate ambitions for 2030 and 2050,
- Supply of clean, affordable, and secure energy,
- Mobilization of industry for a clean and circular economy,
- Construction and renovation with efficient use of energy and resources,
- Accelerated shift to sustainable and smart mobility,
- From farm to fork: designing a fair, healthy, and environmentally friendly food system,
- Preservation and restoration of ecosystems and biodiversity,
- Zero pollution ambition for a toxic-free environment.

A particularly significant aspect for this strategy is the fourth element, which focuses on construction and renovation with the efficient use of energy and resources.
The plan is supported by a financing system for construction and renovation projects within the InvestEU fund.

EPBD directive

The EPBD Directive aims to enhance energy efficiency and improve the existing building stock within the European Union, taking into account diverse climatic and local conditions. The fourth revision of the directive is strongly focused on buildings, and its significance has been further emphasized by the adoption of the European Climate Law in 2021, which legally binds all EU member states to achieve net-zero greenhouse gas emissions by 2050. This objective will not be attainable without the energy renovation of the existing building stock.
The primary focus will shift from energy consumption to CO2 greenhouse gas emissions. Instead of the current nZEB standard (Nearly Zero Energy Buildings), the new reference standard will be ZEB (Zero Emission Building). ZEB is expected to become the mandatory standard from 2028 and applies to buildings with exceptionally high energy performance, requiring zero or minimal energy consumption, producing zero on-site carbon emissions from fossil fuels, and generating zero or very low levels of greenhouse gas emissions.
Minimum energy efficiency requirements have been established for buildings undergoing major renovation. These requirements apply to the renovated building or structure as a whole and may additionally or alternatively be applied to individual renovated building elements. Furthermore, minimum energy efficiency requirements for building envelope elements that are newly installed, replaced, or upgraded are set with the aim of achieving at least a cost-optimal level.

Energy Efficiency Directive

The revised Energy Efficiency Directive (EU) 2023/1791 entered into force on October 10, 2023. The objective of the revised directive is to achieve key energy efficiency targets of at least 32.5% by 2030, thereby further enhancing energy efficiency across the European Union.
The core principle of the directive is "energy efficiency first", which takes into account the overall efficiency of the integrated energy system, security of supply, and cost-effectiveness, while promoting the most effective climate neutrality solutions. This approach encompasses energy generation, network transmission, and end-use consumption, to optimize primary and final energy consumption efficiency.
Since buildings contribute to greenhouse gas emissions before and after their operational lifespan, it is essential to assess carbon emissions over their entire life cycle. This should be done within the broader effort to focus on life cycle performance, circular economy aspects, and environmental impacts.
The Global Warming Potential (GWP) over the life cycle quantifies greenhouse gas emissions associated with a building at different stages of its lifespan. It is therefore a key indicator of a building's overall contribution to climate change-related emissions.
Member States should promote the circularity, durability, and adaptability of construction materials to enhance the sustainability performance of building products. The GWP indicator is expressed in $kgCO_2eq/m^2$ for each life cycle phase and is calculated as an annual average over a reference study period of 50 years.

3. The main barriers for transition towards long- term climate neutrality of buildings

1. **Technical Barriers**

   - Outdated building stock - Many buildings were built before energy standards were introduced. These buildings often have poor thermal insulation, inefficient heating and cooling systems, and rely on fossil fuels. Deep energy renovation is technically demanding and costly
   - Some buildings (protected buildings) face restrictions when installing new systems (solar panels, heat pumps…)
   - Skilled contractors and engineers - The labor market is not keeping pace with the growing demand for experts in energy efficiency and green construction

2. **Financial Barriers**

   - Lack of incentives and subsidies - In many regions, financial incentives are underdeveloped or unavailable, slowing down the transition
   - High upfront costs - Energy renovations require significant investments that are not always accessible to building owners
   - Return on investment - Owners often do not see immediate benefits, as the return on investment is long-term, which can discourage action.

3. **Regulatory and Institutional Barriers**

   - Unresolved property-legal issues
   - Slow administrative processes - Permitting, approvals, and inspections can be slow and misaligned with transition goals
   - Lack of coordination - There is often poor collaboration between different levels of government (local, regional, national) and sectors (energy, construction, environment)

4. **Social and Cultural Barriers**

   - Lack of awareness and knowledge - Citizens and building owners are often not well-informed about the benefits of climate neutrality or the options available to them
   - Resistance to change - Changes in lifestyle, space usage, and technology can meet resistance, especially among older populations
   - Shortage of professionals - The labor market often lacks enough qualified experts to design and implement energy-efficient solutions.

Operational Barriers

- Project management complexity - Energy renovations require complex project coordination, including contractors, suppliers, and users
- Lack of data - Many buildings lack accurate energy consumption data, making planning and monitoring difficult
- Maintenance and system management - After implementation, proper system management and regular maintenance are needed to preserve efficiency.

The following sections of the strategy provides a detailed overview of how to address and overcome the identified barriers in order to achieve climate neutrality in buildings.

4. Methodology for development and implementation of strategy

The methodology for the development and implementation of this strategy is based on three key methodological processes that ensure a systematic approach to improving energy efficiency and the renovation of the existing building stock. These processes are carefully designed to ensure coherence, continuity, and effectiveness throughout all phases of the strategy. They include:

- Process of analyzing the existing building stock

This initial step involves a comprehensive assessment of the current condition of buildings, with particular attention to their energy performance, age, typology, usage patterns, and construction materials. The analysis serves as a foundation for identifying buildings with the greatest potential for energy savings and prioritizing interventions. This stage also incorporates the collection of relevant statistical and spatial data, which is essential for evidence-based planning.

- Process of planning the necessary investments in the existing building stock

Based on the insights gained from the analysis phase, this process focuses on defining strategic investment priorities and setting realistic, measurable targets. It includes the development of investment scenarios, financial models, and timelines that align with broader national and EU climate and energy objectives. The planning phase also considers socio-economic factors, such as affordability, co-financing options, and potential social impacts of building renovations, ensuring that the strategy promotes inclusivity and long-term sustainability.

- Process of preparing and implementing investments in the existing building stock

This phase involves translating investment plans into actionable projects. It encompasses technical preparation, securing funding, obtaining necessary permits, and engaging stakeholders, including local authorities, building owners, and contractors. Implementation also requires effective project management, quality control, and monitoring mechanisms to ensure that renovations are completed on time, within budget, and to the desired energy performance standards. This process ultimately delivers the tangible outcomes of the strategy and contributes directly to achieving energy efficiency improvements and emission reductions.

Each of these three processes is indispensable to the overall success of the strategy. Their interconnection and mutual reinforcement ensure a holistic and integrated approach to the challenge of upgrading the existing building stock. Through this structured methodology, the strategy aims to maximize the impact of energy efficiency measures, support the decarbonization of the building sector, and contribute to national and international climate commitments.

The detailed elaboration of each process, including methodologies, tools, and key stakeholders involved, is provided in the subsequent sections of this document.

5. Analysis of the current state of the building stock

The analysis of the existing building stock encompasses a broad set of data categories that together provide a comprehensive understanding of the condition, performance, and renovation potential of buildings. This multifaceted assessment forms the foundation for strategic planning and decision-making regarding future investments and energy efficiency interventions. The analysis includes the following key components:

- **Building type** - Provides the basis for assessing specific energy efficiency requirements and potential improvements. Different types of buildings require different approaches to renovation and energy modernization.
- **Location of the building** - Crucial for understanding the climatic and environmental conditions, as different microclimatic zones can significantly affect energy consumption and the necessary energy efficiency measures.
- **Building history** - The construction date, any extensions, and previous renovations help understand the age of construction materials and technologies used, which is important for determining the current condition of the building and for planning future interventions.
- **Property and legal status of the building** - A detailed assessment of the building's property and legal status includes information on ownership, potential legal obstacles to renovation, and opportunities for private or public investment.
- **Building dimensions** (gross floor area, usable floor area of the heated part of the building, heated space volume) - Accurate building dimensions allow for precise calculation of energy requirements.
- **Building envelope** - The quality of the building envelope directly affects heat losses and the energy needed for heating and cooling. This analysis helps identify areas with the greatest potential for improving energy efficiency.
- **Building technical systems** - Analysis of heating, cooling, ventilation, lighting, and other technical systems. Evaluating the efficiency of these systems enables the identification of opportunities for modernization or replacement with more energy-efficient solutions.
- **Building energy certificate** - Provides basic information about the building's current energy status, including an assessment of energy consumption and CO2 emissions. This document also helps identify measures to improve energy efficiency and plan energy renovation.
- **Actual energy and water consumption in recent years** - An overview of actual energy and water consumption over recent years provides insight into the building's real energy habits and user behavior. These data enable precise consumption analysis and can serve as a basis for identifying areas where significant energy efficiency improvements can be made, as well as for setting targets for reducing energy and resource consumption.
- **Essential requirements for buildings** - Analysis of the fulfillment of essential requirements for buildings, such as indoor air quality, seismic resistance, mechanical resistance, and stability, fire safety, hygiene, health and the environment, safety and accessibility in use, noise protection, sustainable use of natural resources

Collectively, this in-depth analysis enables the formation of a holistic understanding of the existing building stock. It provides the essential technical, legal, and environmental basis for making informed

decisions on investment priorities, renovation strategies, and the formulation of effective, sustainable policies. The conclusions drawn from this analysis serve as the starting point for the investment planning process, as detailed in the next chapter of this document.

6. Planning the required investments in the existing building stock

Following the analysis of the current condition, buildings are then classified according to potential investment and renovation scenarios. This classification is based on a range of factors identified during the assessment phase, including the building's energy performance, structural condition, functional use, occupancy rate, and historical significance. By categorizing buildings in this manner, it becomes possible to tailor renovation approaches to specific building types and needs, thereby ensuring that interventions are both technically feasible and cost-effective.

The classification process enables the identification of priority buildings where investments will yield the greatest energy savings, financial returns, and environmental benefits. It also helps determine the most appropriate renovation depth—ranging from light improvements to deep energy retrofits—depending on the building's condition and strategic value.

Following the analysis of the current condition, buildings are then classified according to potential investment/renovation scenarios, which have been further detailed in D.1.4.1.:

NEW BUILDING - Construction of a new building - Owners' plans and needs indicate that a new building should be constructed and connected with the existing building on the complex site/same cadastral parcel.

RECONSTRUCTION - Upgrading and reconstructing the existing building - Owners' plans and needs indicate that the current building should be upgraded and reconstructed. Reconstruction of existing building implies that the function and/or dimensions, and/or design of that building will change, as well as that perhaps some building parts will be removed/demolished, and some new ones will be added/constructed/built.

NEW BUILDING AND RECONSTRUCTION - Construction of a new building and reconstruction of the existing building (combination of 1 and 3) - Owners' plans and needs indicate that a new building should be constructed and connected with the existing building on the complex site/same cadastral parcel. At the same time, the current building should be upgraded and reconstructed.

RENOVATION - Renovation of the existing building - Owners' plans and needs indicate that the current building should be energy or comprehensively renovated. Renovation implies improving the basic requirements for the building and applying energy efficiency measures to the building envelope and technical systems without changing the function, volume, or the net area of the building.

NEW BUILDING AND RENOVATION - Construction of a new building and renovation of the existing building (combination of 1 and 4) - Owners' plans and needs indicate that a new building should be constructed and connected with the existing building on the complex site/same cadastral parcel while at the same time existing building should energy or comprehensively renovated.

OPERATIVE INVESTMENTS - Operational maintenance of the existing building - no other investments are needed in the long-term period

NOT PERSPECTIVE - Building will be removed from the portfolio - Owners' plans and needs indicate that a new building should be removed from the portfolio, either sold or demolished.

Categorizing buildings into the previously mentioned categories helps the building owner with preparation and implementation of investments in the existing building stock as detailed in the following chapter.

7. Preparation and implementation of investments in the existing building stock

The final phase of the process, which is also the most time-consuming, involves the preparation and implementation of investments in the existing building stock. This phase includes a series of steps that ensure the successful realization of the project, from planning to the actual execution of the works. The status of each project may be in different stages, which include:

1) **Planning**

- Planning interventions – Identifying necessary interventions on the building and making the decision to initiate the investment. To facilitate intervention planning, it is advisable to use D.1.4.1. which contains explained and justified vision for long-term utilization of individual buildings in regard to their functionality, energy consumption, operation costs, resulting with defined plan for maintenance, renovation or annexing of building. Also, highly beneficial in the planning process can be Smart Data Hub because it consist building data, project documentation, certificates, building renovation passport, data from energy and water consumption database and others.

- Development of minimum output project specification as part of terms of reference – Defining the scope, objectives, and requirements of the project, which will serve as the basis for further development. At this stage, special importance should be given to criteria and indicators developed in the Sustainable Building Methodology.

How can a Smart Data Hub be useful in process of planning?

The Smart Data Hub is a digital platform created to promote sustainable building management by integrating data-driven tools for analysing and overseeing building performance. It allows users to assess renovation options, predict energy savings, and develop strategic plans for managing buildings.
The Smart Data Hub enhances resource efficiency, supports climate objectives, and facilitates well-informed decision-making.
As a major output of the MESTRI-CE project, the Hub is available for free use throughout the project duration and for five years after its completion, delivering lasting benefits to building owners, policymakers, and project developers.

To achieve the desired results, the following must be entered into the program:

- **General information** – building type, year of construction, number of heated floors, nr of residential units, residential / usage area…

- **Building geometry** – a map with the buildings, in some regions, where available, a 3D model is also calculated and depicted

- **Building envelope** – information of energy renovation / replacement, repair year and expected end of life for four measures (roof, wall, floor / cellar ceiling, windows).

- **Energy systems** – provide information on what heating systems exist within the building (e.g., heating system, DHW system, mechanical ventilation).

- **Emission factors** – provide information on operational emissions (kg CO_2-eq./kWh), primary energy factors for non-renewable energy sources (kWh/kWh), and details on the start and end years of grid decarbonization for electricity and district heating.

- Usage – provide information on how the building is being used, such as the availability of a basement, heating in the attic or basement, number of occupants, room temperature, outdoor air flow rate, and infiltration.

What is the program output?

- **Renovation potential:** overview of portfolio performance through a bubble chart, where the size and color of the bubbles indicate building conditions—red bubbles represent older components that need prioritization for updates.
- **Building performance insights:** insights into decarbonization pathways and climate alignment, allowing you to track their buildings' sustainability progress.
- **Before vs After comparison:** comparing the before and after renovation, while other important metrics provide a detailed snapshot of each building's status.

What are the benefits of using the Smart Data Hub?

- **Strategic planning and policy development:** With SDH you can integrate and better manage individual buildings and your entire building stock. Use SDH for evidence-based decision-making, leveraging real-time data on building stocks to develop sustainable renovation policies.
- **Investment prioritization:** Identify and prioritize buildings in need of renovations based on energy performance, CO_2 emissions, and financial feasibility.
- **Financial planning:** Utilize built-in tools to assess the economic viability of retrofits and align investments with EU Taxonomy and EU Green Deal objectives.

2) **Preparation of project-technical documentation**

- Procurement process for preparation of project-technical documentation - Conducting tenders, selecting designers, and signing contracts.
- Preparatory actions for project documentation – Collecting necessary data, analyzing the current condition, and preparing for the creation of project documentation.
- Development of conceptual design – Initial conceptual development of the project, providing guidelines for further creation of project documentation.
- Development of preliminary design – More detailed development of the conceptual design, which may include alternative solutions and technical specifications.
- Development of the main design – Precise project documentation required for obtaining permits and defining the cost estimate for works.
- Obtaining necessary permits – Acquiring construction and other relevant permits to enable the commencement of works.

3) **Preparation of budget for financing**

- The project is ready but awaiting securing of financial resources from various sources. At this step, it is necessary to use the tools and insights from WP3.

4) **Execution of works**

- Procurement process for execution of works – Conducting tenders, selecting contractors, and signing contracts for the execution of works.
- Execution of works – Realization of the project on-site, including construction, installation, and finishing works.

5) **Monitoring of renovation results**

- Tracking energy and water consumption after renovation, indoor climate conditions, air quality, heating and cooling system efficiency, and user behaviour.

Each of these phases is critical for the successful implementation of the investment and requires coordination among various stakeholders, from investors and designers to contractors and supervisory bodies.

8. Implementation and financing plan for strategy measures

Ambitious EU targets to achieve decarbonisation of building stock by 2050 will require significant investment. In the context of building renovations, EU member states have strong reliance on EU programmes.

The Recovery and Resilience Facility (RRF) and the Cohesion Policy 2021-2027 (PCC) are two key EU financial frameworks supporting building renovations, each playing a complementary role in achieving energy and climate targets across Member States. While RRF as a part of NextGenerationEU plan is temporary, performance-based instrument aimed to help EU member to recover from COVID-19 crisis, the PCC 2021-2027 frames the strategic use of structural and investment funds (ERDF, CF, SCF+)
to support long-term development and help achieve EU environmental and energy targets.

Despite political support and leveraged EU funding aimed to finance building renovations, a significant financing gap persists across EU Member States. The financing gap is most evident in residential and public building sectors where limited access to capital, lack of technical capacity, financial literacy and know-how hinder investments. To close this gap, the financial market should provide wide range of blended-finance and alternative and innovative financing models.

In order to support market ready public projects, European Commission followed by EU financial market stakeholders, developed wide-range of financial opportunities intended to upgrade investments in energy efficiency, renewable energy sources and other climate related projects.

- Financial instruments- play a key role in mobilising investments for revenue-generating and cost-saving projects, helping to achieve the Cohesion Policy's goals of economic, social, and territorial cohesion. The European Regional Development Fund (ERDF) and the Cohesion Fund support these efforts by providing financial products such as loans, principal write-offs, guarantees, and equity to projects on the ground.
- Alternative investment Funds - are provided by European Investment bank -EIB -European Investment Fund (EIF) targeting small, medium and large companies' projects, but not excluding public projects if the public administration responds to the requests of financial intermediaries.
- Green loans – were initially designed by EU and national development banks to align institutional investments with EU Green Deal targets. At a later stage, banks complied with standards and principles related to green loans in order to prevent greenwashing and track progress of sustainable investments.
- Green bonds – market of green bonds developed in parallel with sustainable finance market. The growing demand of ESG compliant institutional investors (ESG funds, banks etc) on the capital market has resulted in new standards and principles that apply to bond issuers. Considered as "high-level" financing instrument, green bonds require public projects to align with standards and principles equal or higher than green loans. The most demanding of these standards is certainly European Green Bond Standard (EUGBS).
- Citizens-led-initiatives – such as crowd-investment and crowdfunding campaigns – represent innovative financing approaches that actively engage individuals and communities in funding building renovation projects. These small-scale financing models not only help mobilise private capital but also increase public ownership, awareness, and acceptance of sustainable energy solutions at the local level.

The main feature of the innovative financing method are the new requirements that most public projects have not yet met. The main conditions are related to:

- Readiness to comply with EU Taxonomy - a classification system that defines which economic activities can be considered environmentally sustainable. It helps investors, companies, and policymakers identify green investments that significantly contribute to EU climate and environmental goals, while avoiding significant harm to other objectives. It is a key tool for aligning financial flows with the European Green Deal.
- Capacity to meet reporting standards – especially when it comes to financing through green loans and bonds. Financing beneficiaries are required to deliver periodic financial and ESG reports throughout the duration of the financing. Most private financing is associated with strict rules regarding the purpose (Use of proceeds) and monitoring (Progress and allocation reporting) of the investment.
- The level of project profitability - is crucial for certain types of financing such as bonds. In parallel, EU financial instruments increasingly aim for projects to demonstrate positive economic and financial indicators; eligible projects must also have a commercial component, thus proving the financial viability of the project.
- Risk assessment and management - innovative financing models, such as green loans, bonds, Energy Service Company (ESCo) contracts, and alternative instruments like crowdfunding or public-private partnerships—introduce specific risks that must be carefully assessed and managed to ensure project success. Key risks include financial risks (credit, liquidity, counterparty rating) and performance risk related to energy savings or renovation outcomes, regulatory uncertainty, and limited technical or financial capacity at the local level.
- Climate proofing –proofing is one of the key requirements in EU-funded projects, ensuring investments are resilient to current and future climate risks and aligned with the EU's climate goals. It involves assessing the vulnerability of projects to climate change impacts (e.g. floods, heatwaves, sea level rise) and integrating appropriate adaptation and mitigation measures into the design, implementation, and operation of the project. It also enhances the credibility and financial viability of projects by reducing future costs and risks, making them more attractive to investors and funding institutions.
- Organisational capacity and know-how – the ability of national and local authorities to adopt innovative financing models depends on their governance capacity to meet evolving financing and reporting standards. Historically, the dominance of grant-based funding has limited the public sector's familiarity with private financing mechanisms—such as loans, bonds, or ESCo models—and their specific requirements. Building institutional knowledge and technical expertise is therefore essential to enable the shift towards blended and performance-based finance.

To prepare public building renovation projects for innovative financing, a structured and comprehensive approach has been undertaken through several key activities. The process began with a **status quo analysis** to understand the current landscape of financing models and instruments across Central European countries. This included mapping existing practices, identifying policy frameworks, and evaluating the potential of different financing approaches. In parallel, successful case studies were analysed to draw lessons from proven green financing schemes, investment platforms, and compliance with EU standards. Country-specific gap analyses were also conducted to pinpoint barriers and opportunities for adopting innovative models, such as energy performance contracting, green loans, and bonds.
Building on these findings, a **green financing methodology** was developed, accompanied by a financial and economic evaluation toolbox tailored to building renovation projects. This toolbox incorporates green finance criteria aligned with the EU Taxonomy and Green Bond Standards, allowing project developers and public authorities to assess the financial feasibility and sustainability of their investments. Furthermore, supporting documentation and performance tracking models were created to guide the preparation, evaluation, and long-term monitoring of financed projects.
To ensure that public project promoters can effectively navigate these new financing models, practical **guidelines and capacity-building materials** were prepared, covering topics such as support schemes, risk-sharing instruments, and stakeholder engagement. Communication materials targeting citizens were also designed to encourage broader participation and promote the role of individuals as investors and prosumers.
A strong emphasis was placed on **stakeholder engagement and dialogue**, including national round-table sessions, bilateral consultations, and community open days. These activities brought together public

authorities, private investors, financial institutions, and citizens to align expectations and improve project readiness. Finally, peer reviews and joint strategy development were initiated to embed innovative financing models into local and national policy frameworks, ensuring that the enabling environment for sustainable building renovation is both robust and future-proof.

1) **National program for the energy renovation of public sector buildings until 2030**

The Energy renovation program for public sector buildings until 2030 (NN 41/2022), adopted in April 2022, is a continuation of the previous program for the 2016–2020 period. It focuses on buildings with the poorest energy performance and introduces the possibility of financing measures that do not necessarily result in energy savings. The program defines several renovation categories: integral, deep, and comprehensive renovation.
It provides non-repayable grants ranging from 60% to 80%, and 100% for earthquake-damaged buildings. The share of public funding from national, EU, and other international sources amounts to EUR 238–318 million by 2024 and EUR 876 million to 1.17 billion over the entire ten-year period.
The program is primarily financed through the Recovery and Resilience Facility (RRF) and the European Structural and Investment Funds (ESIF) to reduce energy consumption in public buildings.

2) **Development Bank Loans**

- **European Investment Bank (EIB)**

The EIB is a financial institution owned by EU member states, specializing in long-term financing of projects that support EU development policies. It promotes competitiveness, innovation, sustainable development, social and territorial cohesion, and climate neutrality.
The EIB provides both direct and intermediated loans through national development and commercial banks, depending on the loan amount. Individual loans are granted for infrastructure projects exceeding €25 million, with financing potentially covering up to 100% of the project's value. For urban and regional development, the EIB offers municipal loans to support green infrastructure investments and the improvement of public services.

- **European Bank for Reconstruction and Development (EBRD)**

The EBRD is a financial institution that supports transition economies in their shift toward market-based economies and democratic governance. It finances energy efficiency and local infrastructure projects through loans and securities ranging from €5 million to €230 million, while smaller-scale projects are financed indirectly via commercial banks. Loan repayment terms extend up to 15 years, with financing conditions adjusted based on the region and sector of the project.

3) **Bonds**

Bonds are long-term debt securities used by the public sector to finance infrastructure and green projects with greater flexibility than loans. Bond interest rates can be fixed or variable, with repayment either at maturity or periodically (annually/semi-annually). The maturity period ranges from 5 to 20 years and is directly linked to the purpose of financing, which may be for general or strictly designated purposes (e.g., energy renovation of public buildings).
Green bonds have the same structure as conventional bonds but must be exclusively allocated to financing existing or new projects with positive environmental and climate impacts. The Council of Europe has adopted a regulation establishing the European Green Bond Standard. Regulation (EU) 2023/2631 sets unified requirements for bond issuers who wish to use the "European Green Bond" (EuGB) label, while also defining voluntary disclosures for bonds marketed as environmentally sustainable or linked to sustainability objectives.
The issuance of green capital market instruments requires issuers to provide concrete evidence that the funds are used for the development of green and/or sustainable projects. Issuers must also publicly disclose their sustainability goals, strategies, implementation methods, and the financial impact of green or sustainable investments.

4) Alternative Procurement Models

Alternative procurement models are increasingly used in the implementation of infrastructure and construction projects in both the public and private sectors. Their purpose is to provide an efficient project delivery or financing model that ensures better risk management and optimizes total life-cycle costs.
These models include contracts such as Design & Build (DB), Design, Build & Finance (DBF), Design, Build, Finance & Maintain (DBFM), Energy Performance Contracts (EPC), Public-Private Partnership (PPP) agreements, Power Purchase Agreements (PPA), and other similar models. Fundamentally, they represent a form of performance-based contracting or service level agreements (SLAs) for project execution.
They differ in risk allocation between contracting parties. Unlike traditional procurement methods, where most risks are borne by the investor or contracting authority, alternative procurement models increasingly shift project risks to the contractor. The key principle is that risks should be assigned to the party best positioned to manage them. The applicability of a specific alternative procurement model is determined following a detailed project risk analysis.

In implementing this part of the strategy, partners will apply the tools and insights from WP3 in their respective countries.

9. Stakeholder collaboration

Achieving climate neutrality in the building sector requires the active involvement and alignment of a wide range of stakeholders. Collaboration ensures that technical, financial, regulatory, and social dimensions are addressed in a coordinated and efficient manner.

Identify key stakeholder groups

Stakeholders should be mapped and categorized based on their roles, influence, and interests:

- Public Authorities: Local, regional, and national governments responsible for policy, permitting, and public building stock
- Building Owners and Tenants: Both public and private, residential and commercial.
- Financial Institutions: Banks, development funds, and investors who provide capital for renovations
- Construction and Energy Sector: Architects, engineers, contractors, energy service companies (ESCOs)
- Civil Society and NGOs: Advocates for sustainability, transparency, and social inclusion.
- Technology Providers: Suppliers of smart building systems, renewable energy technologies, and digital tools
- Academia and Research Institutions: Providers of data, innovation, and training

Establish collaborative platforms

Create formal and informal mechanisms for dialogue and coordination:

- Local and regional working groups for building renovation planning
- Public-private partnerships (PPPs) for financing and implementation
- Stakeholder advisory boards to guide strategic decisions
- Digital tools (Smart Data Hub) to share data and monitor progress

Ensure transparent communication

- Organize public consultations and community workshops to gather feedback and increase buy-in.

Build capacity and knowledge

- Promote peer learning through study visits, webinars, and best practice exchanges
- Support certification schemes for energy auditors, green building professionals, and project managers

Monitor and evaluate collaboration

- Define KPIs for stakeholder engagement
- Conduct regular reviews of collaboration effectiveness
- Adjust governance structures based on feedback and evolving needs

10. Conclusions and recommendations

The transition of the building sector towards climate neutrality is crucial for achieving global sustainability goals, reducing greenhouse gas emissions, and combating climate change. Buildings, which account for a significant share of energy consumption, CO2 emissions, and natural resource use, must become the cornerstone of a sustainable future. The building sector must necessarily evolve to enable a more sustainable, energy-efficient, and environmentally friendly approach to construction and building management.

The key recommendations for achieving this strategy are as follows:

1) Strengthen legislative and policy frameworks - Align national regulations with EU directives to ensure compliance with climate neutrality targets.
2) Detailly analysis of the current state of the building stock
3) Planning the required investments in the existing building stock- based on the findings from the building stock analysis
4) Preparation and implementation of investments in the existing building stock - utilize Smart Data Hub for informed investment planning and building performance monitoring.
5) Implementation and financing plan for strategy measures - implement Smart financing models
6) Improve stakeholder collaboration: Foster cooperation among policymakers, investors, and the private sector to streamline the transition process.
7) Monitor and adjust strategies: Continuously assess the progress of energy transition initiatives and adapt to emerging technologies and challenges.

This strategy provides the foundation for achieving climate neutrality in buildings. If the key recommendations are followed, the transition to sustainable and climate-resilient buildings will be faster and more efficient.