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MESTRI-CE

D.2.4.1 Strategy for the enhancement of national and regional sustainable buildings standards

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1. Introduction

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2. Framework for Strategy Development

2.1 Methodological Framework

The Strategy for the Enhancement of National and Regional Sustainable Building Standards has been developed using a **structured, evidence-based, and transnational methodological approach**, building directly on the results of the MESTRI-CE Sustainable Building Methodology (SBM) and its associated Evaluation Toolbox (ET).

At the core of this approach lies the recognition that **sustainable building standards are not static regulatory instruments**, but evolving systems that must progressively respond to climate objectives, technological innovation, market maturity, and societal needs. The MESTRI-CE methodology, therefore, treats standards as **dynamic frameworks**, capable of gradual upgrading through tested metrics, feedback from implementation, and alignment with European policy objectives.

2.1.1 Evidence-based and comparative foundation with lifecycle-oriented perspective

The methodological framework of this strategy is grounded in:

- a comparative analysis of existing national and regional building standards and certification schemes in Central Europe,
- the development of a harmonised, EU-aligned **Sustainable Building Methodology (SBM)**,
- systematic testing through pilot actions in multiple countries,
- and structured evaluation using a shared **open-source Evaluation Toolbox (ET)**.

In this way, Strategy is **anchored in real regulatory contexts and implementation conditions**, reflecting both the diversity and the common challenges of Central European building systems.

The MESTRI-CE SBM adopts a **holistic sustainability framework**, extending beyond traditional energy-efficiency-focused standards. It integrates environmental, economic, and social dimensions across the entire building life cycle, including:

- operational energy performance,
- greenhouse gas emissions (operational and embodied),
- circularity and material impacts,
- water use and climate adaptation,
- health, comfort, and usability,
- cost, value, and long-term management.

This comprehensive scope enables the identification of **gaps in existing standards**, particularly in areas such as life-cycle emissions, climate resilience, adaptability, and cost-optimal performance, which are often underrepresented or inconsistently addressed at national or regional level.

A key methodological innovation underpinning this strategy is the **progressive compliance logic** embedded in the MESTRI-CE Evaluation Toolbox.

Instead of a binary compliant / non-compliant approach, the methodology introduces graduated levels of performance:

- *Not compliant*
- *Compliant* (meeting current national or regional targets)
- *Beyond compliance* (stepwise improvement beyond existing targets)
- *EU future-proof* (alignment with EU-level sustainability objectives and calculation methods)

This structure supports a **step-by-step enhancement of building standards**, allowing regions and countries to progressively increase ambition while respecting existing regulatory frameworks and capacities.

2.1.2 Adaptability to national and regional contexts with pilot actions

The methodological framework explicitly acknowledges the **autonomous evolution of building regulations across EU Member States**. For this reason, the MESTRI-CE SBM is designed to be **adaptable**, allowing national or regional metrics to be used where they are demonstrably analogous to the transnational reference metrics.

Through this adaptation mechanism:

- existing standards and certification schemes are not replaced, but enhanced,
- local targets can be retained while being benchmarked against EU objectives,
- differences in regulatory maturity are addressed without compromising long-term convergence.

This approach ensures that the strategy is both **implementable and scalable**, supporting gradual harmonisation rather than forced standardisation.

Pilot actions carried out in the partner countries play a central role in the methodological framework. They function as **real-world testing environments**, validating the applicability of the SBM and ET, identifying practical barriers, and generating evidence-based lessons.

Feedback from these pilots informs:

- the prioritisation of strategic actions,
- the identification of high-impact metrics,
- and the definition of policy pathways for enhancing standards.

Therefore methodological framework establishes a **continuous learning loop** between policy, practice, and evaluation — a prerequisite for effective and durable enhancement of sustainable building standards. This methodological framework supports policy makers and standard-setting bodies in:

- understanding current performance gaps,
- structuring progressive upgrades,
- aligning standards with EU climate and sustainability objectives,
- and ensuring that enhanced standards remain usable, credible, and investment-ready.

2.2 Policy and Planning Framework

The enhancement of national and regional sustainable building standards takes place within a **complex, multi-level policy and planning environment**, shaped by European legislation, national regulatory frameworks, regional strategies, and local implementation instruments. This strategy is positioned within that environment, aiming to strengthen coherence and effectiveness across levels while respecting the autonomy of national and regional standard-setting systems.

2.2.1 Policy contexts

At European level, sustainable building standards are increasingly influenced by a set of interconnected policy frameworks, most notably:

- the revised Energy Performance of Buildings Directive (EPBD),
- the EU Sustainable Buildings Framework Level(s),
- the EU Taxonomy for sustainable activities,
- and the broader objectives of the European Green Deal and the Renovation Wave (including initiatives such as New European Bauhaus).

These frameworks establish **common long-term objectives**, including climate neutrality, lifecycle performance, resilience to climate change, and improved transparency of environmental impacts. However, they do not prescribe uniform implementation pathways, leaving Member States responsible for translating these objectives into national and regional standards, regulations, and certification schemes.

The MESTRI-CE Sustainable Building Methodology (SBM) and Evaluation Toolbox (ET) are explicitly designed to **bridge this implementation gap**, operationalising EU-level objectives into measurable, assessable, and adaptable criteria that can be integrated into existing building standards.

Across Central Europe, national and regional building standards have evolved autonomously, reflecting:

- different climatic conditions,
- diverse building traditions and construction practices,
- varying regulatory maturity,
- and distinct institutional responsibilities.

As demonstrated through the comparative analysis and pilot testing of the MESTRI-CE SBM, many sustainability-related indicators are already present within national standards or voluntary certification schemes. These are particularly well developed in areas such as operational energy performance, indoor comfort, and basic environmental protection.

However, the policy analysis also highlights **structural gaps and inconsistencies**, notably in:

- lifecycle greenhouse gas emissions,
- circularity and material efficiency,
- climate risk and adaptation,
- adaptability and long-term value,
- and the integration of performance data into decision-making and financing.

These gaps limit the capacity of existing standards to fully support the transition toward climate-neutral and future-proof building stocks.

2.2.2 Planning instruments and implementation tools

Sustainable building standards do not operate in isolation. Their effectiveness depends on how they are embedded within broader **planning and implementation instruments**, including:

- renovation and climate action plans,
- spatial and urban development strategies,
- public procurement rules,
- funding and subsidy schemes,
- and advisory services supporting building owners and project developers.

The policy and planning framework underpinning this strategy, therefore, recognises standards as **cross-cutting instruments**, linking technical performance requirements with planning objectives, investment decisions, and long-term asset management.

Within this context, the MESTRI-CE Evaluation Toolbox plays a strategic role by:

- translating standards into measurable performance outcomes,
- enabling comparison across projects and territories,
- and supporting evidence-based policy adjustments.

One of the key challenges identified through the MESTRI-CE process is the **lack of alignment between different policy domains** affecting the building sector. In many cases:

- standards focus on regulatory compliance,
- planning instruments prioritise spatial or social objectives,
- financing mechanisms apply separate sustainability criteria,
- and data collection remains fragmented.

This misalignment reduces the effectiveness of standards as drivers of transformation and increases the administrative burden for stakeholders.

The strategy, therefore, seeks to enhance **policy coherence**, promoting the use of sustainable building standards as a common reference framework across planning, regulation, and investment.

Within the existing policy and planning landscape, the MESTRI-CE approach does not aim to replace national or regional standards. Instead, it provides a **harmonised reference framework** aligned with EU objectives and a structured mechanism for benchmarking and comparison.

By allowing the use of national or regional metrics where they are demonstrably analogous, the methodology supports **incremental upgrading** rather than disruptive reform. At the same time, the introduction of “EU future-proof” performance levels establishes a clear long-term orientation toward European climate and sustainability targets.

This policy and planning framework forms the basis for the strategic actions proposed in this document. It underlines the need to:

- embed sustainable building standards more strongly into planning and investment processes,
- improve coordination between regulatory, planning, and financial instruments,
- and ensure that standards remain adaptable to evolving policy requirements and market conditions.

By situating standards at the intersection of policy, planning, and implementation, the strategy positions them as **key enablers of the sustainable transformation of the building sector** in Central Europe.

3. Pilot Actions and lessons learned

3.1 Austria

1.1.1. Context and pilot scope

In Austria, the pilot action was implemented in the federal state of Styria, within the municipality of Bruck an der Mur, focusing on a portfolio of publicly owned municipal buildings. The city owns approximately 34 public buildings, including administrative facilities, schools, cultural buildings, and sports infrastructure.

Following an initial screening using the MESTRI-CE Smart Data Hub, seven buildings with the highest thermal weaknesses and renovation needs were selected for detailed analysis under the initiative titled *"The 7 Sins of Bruck an der Mur."* These buildings include the City Hall, Town Hall, Building Yard, Music School, Elementary School, Kindergarten, and the Hannes-Bammer Sports Hall.

The Austrian pilot context is characterised by:

- a well-established regulatory framework for energy performance (EPC system and nZEB requirements),
- the voluntary but widely recognised **klimaaktiv building standard** as a national benchmark for sustainable construction and renovation,
- strong alignment with Austria's Long-Term Renovation Strategy and NECP targets,
- and increasing attention to lifecycle and financing aspects, while broader sustainability dimensions (e.g. embodied emissions, circularity, climate adaptation) are not yet systematically embedded in mandatory standards.

The Hannes-Bammer Sports Hall was selected as the primary pilot case due to its exceptionally high electricity consumption (annual costs exceeding €60,000) and reliance on electric heating systems. Built in 1978, the hall represents the most energy-intensive municipal building and therefore a strategic priority for renovation planning.

1.1.2. Application of the Sustainable Building Methodology

The implementation of the MESTRI-CE Sustainable Building Methodology (**SBM**) in Austria demonstrated a high degree of compatibility with existing national frameworks, particularly with the Austrian Energy Performance Certificate (EPC) system and the **klimaaktiv building standard**.

As part of the pilot, the **SBM** indicators were systematically compared with the criteria of the **klimaaktiv standard**. The analysis showed that many energy-related and comfort-related aspects are already well covered under **klimaaktiv**, including:

- primary and final energy demand,

- quality of the building envelope,
- efficiency of technical building systems,
- indoor environmental quality, and
- integration of renewable energy sources.

However, the **SBM** extends beyond the existing **klimaaktiv** framework by introducing additional dimensions and a progressive compliance structure. In particular, the SBM strengthens:

- lifecycle-oriented assessment (including embodied emissions considerations),
- climate adaptation and resilience aspects,
- circularity and material efficiency,
- structured benchmarking through compliance levels (not compliant / compliant / beyond compliance / EU future-proof), and

For the Hannes-Bammer Sports Hall, the **SBM** was tested to assess the current performance and to structure renovation scenarios. Energy-related indicators could be quantified using existing Austrian calculation methods, while broader sustainability criteria required additional qualitative assessment and scenario-based estimation.

The Evaluation Toolbox proved to be a practical instrument for structuring the assessment and for identifying performance gaps.

1.1.3. Key lessons learned with implications for standard enhancement

The Austrian pilot generated several lessons relevant for the enhancement of national and regional sustainable building standards:

Austria already has a strong voluntary sustainability benchmark in the **klimaaktiv** building standard, particularly in energy performance and indoor environmental quality. This provides a solid foundation for further development.

The comparison between **SBM** and **klimaaktiv** demonstrated that enhancement does not require replacement of existing standards, but rather structured extension and alignment with EU-level objectives, particularly regarding lifecycle emissions, circularity, and climate resilience.

The progressive compliance logic of the **SBM** supports gradual ambition increases without regulatory disruption. It enables differentiation between baseline compliance and future-proof performance levels, which is particularly useful for public investment planning.

Overall, the Austrian pilot confirms that sustainable building standards can be effectively enhanced through a step-by-step integration of broader sustainability dimensions into existing frameworks such as klimaaktiv. The MESTRI-CE methodology provides a structured pathway for aligning national best practice with evolving EU requirements, while maintaining practical applicability at municipal level.

3.2 Croatia

3.2.1 Context and pilot scope

In Croatia, pilot actions were implemented across **four counties and the City of Zagreb**, encompassing a diverse portfolio of public buildings, including kindergartens, schools, healthcare facilities, and other public service buildings. These buildings were selected based on their **high renovation potential** and strategic importance for public investment planning.

The Croatian pilot context is characterised by:

- a strong policy focus on energy renovation of public buildings,
- established practices in energy performance certification,
- and increasing alignment with EU nZEB requirements, while more comprehensive sustainability dimensions remain at an early stage of integration into standards.

3.2.2 Application of the Sustainable Building Methodology

The implementation of the MESTRI-CE Sustainable Building Methodology (SBM) in Croatia demonstrated a **high degree of compatibility with existing national regulatory frameworks**, particularly in the energy-related domains.

Indicators related to:

- primary and final energy use,
- heating and cooling demand,
- airtightness of the building envelope,
- energy efficiency of technical building systems,
- and on-site renewable energy production

were assessed using **existing national calculation methods, EPC tools, and project documentation**, ensuring comparability and regulatory consistency.

At the same time, the SBM introduced **additional sustainability dimensions** that go beyond current Croatian standards, such as lifecycle thinking, climate adaptation, circularity, and broader environmental performance. These indicators were generally perceived as relevant and forward-looking, although their practical implementation often relied on qualitative assessment or proxy data.

The Evaluation Toolbox proved to be a **practical and user-friendly instrument** for applying the SBM in the Croatian pilot buildings. Stakeholders reported that:

- the structure of indicators is clear and intuitive,
- compliance levels support transparent communication of results,
- and alternative calculation paths allow flexibility in data availability.

The Smart Data Hub played a particularly important role in cases where **complete or harmonised building data were not available**, providing reliable estimates to support early-stage assessments and renovation prioritisation.

This combination of structured evaluation and digital support tools strengthened the analytical basis for **strategic renovation planning** at the county and city levels.

The tiered compliance system introduced by the Evaluation Toolbox was positively received by Croatian stakeholders. It enabled:

- clear differentiation between minimum compliance and higher performance,
- benchmarking against both national targets and EU-level ambition,
- and identification of "quick wins" versus long-term improvement areas.

Energy-related indicators frequently achieved **compliant or beyond-compliance levels**, reflecting the maturity of Croatian energy standards. In contrast, indicators related to:

- climate risk and adaptation,
- biodiversity and site impacts,
- and certain water and circularity aspects

often could not be fully quantified due to the **absence of nationally standardised methodologies**.

This contrast highlights both the strengths of existing standards and the areas where strategic enhancement is most needed.

3.2.3 Key lessons learned with implications for standard enhancement

The Croatian pilot actions generated several lessons relevant for the enhancement of national and regional sustainable building standards:

- **Energy performance standards are well established**, providing a solid basis for further sustainability integration.
- **Data availability remains uneven**, particularly beyond energy-related indicators, limiting comprehensive assessment.
- **Progressive compliance levels** are effective in supporting gradual ambition increases without creating regulatory disruption.
- **Digital tools**, such as the Smart Data Hub, are essential for scaling sustainability assessments in large public building portfolios.
- **Advanced sustainability topics** (climate adaptation, lifecycle emissions, circularity) require further methodological development and policy support at the national level.

The Croatian pilot confirms that enhancing sustainable building standards should build on **existing energy-focused frameworks**, while progressively integrating broader sustainability dimensions through adaptable methodologies and practical tools.

The experience demonstrates that a **step-by-step approach**, supported by the SBM and Evaluation Toolbox, can improve the quality, transparency, and future-proofing of standards without undermining regulatory stability or implementation capacity.

3.3 Germany

1.1.4. Context and pilot scope

For testing the MESTRI-CE sustainable building methodology and evaluation toolbox, three building projects were analysed. Those projects differ from the piots used for the testing of the smart data hub and the financial toolbox which are old buildings with a high need for renovation.

All three building projects used for the SBM are currently under construction or just finalized. They have recently undergone the DGNB certification process which means that the owners have laid a high focus on sustainability and that there is a very good availability of data. Moreover, the comparison to the DGNB results makes it easier to identify strengths and weaknesses of the SBN compared to the established framework. The experiences of the DGNB auditing and the expertise of the auditor have directly contributed to the toolbox evaluation.

The first building project consists of 5 building blocks with 116 residential units in total. The second and third building projects are both meant for mixed usage. On the ground floor of one building, there will be a business space whereas in the other building, there will be a kindergarden. The other floors will have 20 residential units each.

1.1.5. Application of the Sustainable Building Methodology

During the test phase in Germany, the SBM demonstrated its value as an effective tool for comprehensive building evaluation. By incorporating a wide range of indicators, it supports a holistic perspective on sustainability, addressing environmental, social, and economic dimensions. Its clear structure and well-organized layout also contributed to a positive user experience and an accessible overview of the assessment process.

Many SBM indicators—particularly those related to energy efficiency, greenhouse gas (GHG) emissions, thermal performance, indoor comfort, and life cycle analysis—show strong alignment with Germany's DGNB certification framework and national regulations. These indicators were therefore regarded as both practical and beneficial for application.

Current practices in Germany already include detailed assessments of aspects such as global warming potential (GWP), thermal comfort, daylight performance, and the use of low-emission materials. As a result, SBM indicators addressing these topics were considered highly relevant and readily applicable. Indicators covering primary and final energy demand, building envelope performance, and life-cycle emissions could be

supported by reliable data sources due to established national standards and building certification systems.

However, certain SBM indicators—such as those concerning greywater reuse, climate risk assessments, and biodiversity-enhancing vegetation—are less commonly implemented in German building projects. Although technically feasible, they were viewed more as forward-looking or dependent on specific project contexts.

For several indicators, especially those related to biodiversity and site quality, the German testing had difficulties in applying strictly quantitative evaluations. We suggested that more qualitative or context-sensitive assessment methods might be more appropriate in these cases.

3.3.1 Key lessons learned with implications for standard enhancement

Overall, the DGNB scheme is very well aligned with the SBM and provides a comparable width and depth of criteria. This leads to a profound evaluation that incorporates a holistic view on sustainability in buildings.

For the future, it should be discussed if it would be better to have one national certification scheme for Germany such as other countries provide. Right now, the German state uses a variety of systems. One scheme is used only for buildings owned by the federal government, several private schemes (such as DGNB) can be used in order to reach certain certification and some aspects are defined by law. This mixture of regulations and options can be confusing to building owners and does not always lead in the same direction.

Therefore, one official evaluation scheme directly linked to certain funding options could be a huge push for the sustainable building transition in Germany. It could provide clarity and safety to building owners and building experts.

3.4 Italy

1.1.6. Context and pilot scope

In Italy, the pilot action was implemented in the Autonomous Province of Bolzano (APB). The main scope was to test the alignment of the current regional building standards with the EU sustainability framework, using the MESTRI-CE Sustainable Building Methodology (SBM) and the Evaluation Tool (ET). The activity focused on the public building stock, where seven buildings were selected, including both schools and office buildings.

The regional pilot context is characterised by:

- A strong policy focus on energy efficiency and decarbonisation of public and private buildings, as set out by the South Tyrol Climate Plan 2040.
- A well-established regulatory framework aligned with EU requirements for the energy performance of buildings. The CasaClima certification is mandatory for all new buildings and major renovations.
- A rigorous and detailed quality control thanks to a certification process that evaluates both the design phase and the construction phase through mandatory on-site inspections and measurements for all the buildings.
- The national obligation for public buildings to apply the sustainability criteria of the "CAM EDILIZIA" for new construction, renovation and maintenance interventions.
- The availability of regional voluntary sustainability schemes tailored to specific functions, such as CasaClima Nature, Work&Life or School.
- Growing interest from public and private investors in EU Taxonomy compliance to streamline access to green financing and funding opportunities

1.1.7. Application of the Sustainable Building Methodology

The implementation of the MESTRI-CE SBM in Italy has shown a strong level of compatibility with the standards currently applied at both regional and national levels. It has also highlighted significant potential to further align these standards with the European framework, particularly regarding the evaluation metrics and the performance targets to be achieved.
Applying the SBM methodology to the pilot cases allowed for the classification of the proposed indicators based on their level of practicability:

- Easily applicable – Indicators for which assessment methodologies are well established and data availability is ensured. These include energy performance, building envelope quality, systems energy efficiency, use of renewable energy sources, water use, indoor air quality, acoustic comfort, green mobility.
- Feasible and often applicable – Indicators that can be assessed, although regional or national methodologies are not yet fully consolidated or are not aligned with the European framework. These include: GHG emissions, circularity, simplified LCA, and lighting/visual comfort.
- Difficult to apply – Indicators for which methodologies are not yet established on national/ regional level, data is lacking, or evaluation relies primarily on qualitative rather than quantitative approaches. These include SRI, climate risk and adaptation, adaptability, biodiversity, full LCA and LCC.

Testing the Evaluation Toolbox (ET) for assessing compliance levels has helped maintain a strong focus on EU standards while providing a clear overview of project deviations from both the EU framework and national/regional targets.

1.1.8. Key lessons learned with implications for standard enhancement

Pilot actions carried out in Italy have generated several useful insights for improving national and regional building standards.

- The comparison between SBM and the CasaClima standard proved particularly valuable in supporting the transposition of the new EPBD requirements at the regional level. This was especially relevant for defining indicators and setting new targets related to energy performance and decarbonisation.

- SBM can serve as an effective tool to promote harmonisation among the various mandatory and voluntary building sustainability standards currently applied at national and regional levels. Its step-by-step structure allows for different compliance levels, accommodating diverse priorities and levels of ambition in the various contexts.
- Robust and shared assessment methodologies are needed to facilitate the evolution of building sustainability standards, and further efforts are required to ensure data accessibility and adequate know-how for all operators in the sector.

- To facilitate the widespread adoption of advanced sustainability principles—particularly in building renovation and projects carried out by private operators—it is crucial to establish an enabling environment that extends beyond regulatory obligations. Aligning financial support mechanisms with progressive sustainability criteria can effectively steer market actors toward more ambitious performance choices and encourage future-proof solutions.

3.5 Poland

3.5.1 Context and pilot scope

In Poland, the pilot action was implemented in cooperation with selected units from Masovia Voivodeship (19 buildings), focusing on a portfolio of publicly owned municipal buildings with high energy consumption and renovation needs. Additionaly one building from Świętokrzyskie Voivodeship (primary school) was also tested by tools. The portfolio includes educational facilities (primary schools and kindergartens), administrative buildings, primary schools, kindergartens, vocational education facilities, municipal office buildings, healthcare centres and selected public service buildings managed at the municipal level. These facilities represent a significant share of local energy expenditure and play a central role in municipal investment planning.

The buildings are predominantly owned and managed by municipalities and counties. Most of them were constructed between the 1960s and 1990s, with several older facilities dating back to the early 20th century. They are characterised by:

- insufficient thermal insulation of external walls, roofs, floors and basement walls,
- outdated windows and doors with high U-values,
- inefficient heating systems based on coal- or oil-fired boilers,
- limited or no integration of renewable energy sources,
- high final and primary energy demand,
- and significant CO_2 emissions.

As a result, the portfolio represents a typical cross-section of energy-intensive public buildings in Poland that require comprehensive, deep renovation rather than partial thermomodernisation measures. Across the 20 analysed buildings, the proposed deep renovation measures consistently demonstrate: energy demand reductions between 46% and 90%, substantial CO_2 emission reductions (in several cases exceeding 50–60%), replacement of coal- and oil-based systems with cleaner or hybrid solutions, growing integration of photovoltaic systems and heat pumps, significant improvements in operational cost efficiency and long-term financial performance.

The Polish portfolio therefore provides a representative and scalable testing ground for the MESTRI-CE tools, demonstrating their applicability to diverse building typologies and supporting evidence-based renovation planning at municipal and regional levels.

3.5.2 Application of the Sustainable Building Methodology

The implementation of the MESTRI-CE Sustainable Building Methodology (SBM) in Poland demonstrated strong compatibility with existing national regulatory frameworks, particularly with the Polish Energy Performance Certificate (EPC) system, technical conditions (WT2021), and established energy audit methodologies used for public building renovation programmes. Energy-related SBM indicators were assessed using standard Polish calculation procedures and audit documentation. In particular, the following aspects were directly aligned with national practice:

- primary and final energy demand (EP and EK indicators),
- useful energy demand for space heating and domestic hot water,
- thermal transmittance (U-values) of building envelope components,
- efficiency of heating and DHW systems,
- share of renewable energy sources,
- CO_2 emission calculations based on national emission factors.

Because most buildings in the portfolio had up-to-date energy audits prepared for funding applications, the quantitative assessment of energy performance indicators was straightforward and consistent with regulatory requirements.

The Polish pilot context is characterised by:

a well-established Energy Performance Certificate (EPC) system and mandatory energy audits for public buildings, strong reliance on EU Cohesion Policy and national funding mechanisms for thermomodernisation, increasing pressure to phase out coal-based heating systems in public buildings, alignment with EPBD recast and long-term renovation strategy targets, and a growing – though still emerging – integration of renewable energy systems (mainly photovoltaic installations and heat pumps).

However, most renovation projects remain primarily energy-efficiency driven, with lifecycle assessment, embodied carbon, circularity and climate adaptation aspects not yet systematically integrated into investment decision-making.

3.5.3 Key lessons learned with implications for standard enhancement

The Polish pilot actions generated several lessons relevant for the enhancement of national and regional sustainable building standards:

- Energy performance regulations are well developed and operational. The Polish EPC system, technical requirements (WT2021), and established energy audit methodologies provide a strong and mature framework for assessing and improving energy efficiency in public buildings. This creates a solid baseline for further integration of broader sustainability aspects.

- Renovation practice is strongly energy-focused. Public investment programmes and funding mechanisms primarily prioritise reductions in final and primary energy demand, often measured through clearly defined quantitative thresholds. While effective in driving thermomodernisation, this approach leaves other sustainability dimensions less systematically addressed.

- Data availability is robust for energy indicators but limited beyond them. Most buildings included in the pilot had detailed energy audits, enabling reliable quantification of energy demand, system efficiency and CO_2 emissions. However, data related to embodied carbon, material composition, circularity potential, biodiversity impact or climate risk exposure were generally not available in standard documentation, requiring qualitative or proxy-based assessment.

- Progressive compliance levels support gradual ambition increases. The tiered structure of the SBM (not compliant / compliant / beyond compliance / EU future-proof) proved particularly useful in the Polish context. It allows municipalities to differentiate between meeting current regulatory minimum requirements and pursuing higher performance aligned with long-term EU decarbonisation goals—without creating regulatory disruption.

- Digital tools are essential for portfolio-level planning. The Smart Data Hub supported harmonisation of building data across multiple municipalities and facilitated benchmarking and prioritisation within the 20-building portfolio. For local governments with limited technical capacity, such digital support is crucial for scaling sustainable renovation planning beyond single-building assessments.

- Advanced sustainability topics require methodological and policy development. Climate adaptation, lifecycle emissions, circular material use, and resilience considerations are not yet systematically embedded in Polish building regulations or funding criteria. Their broader adoption will require clearer national methodologies, updated policy guidance, and integration into financial support schemes.

3.6 Common lessons and conclusions

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4. Actions for enhancement of national and regional sustainable buildings standards

The pilot actions carried out within the MESTRI-CE project demonstrate that sustainable building standards in Central Europe provide a strong technical foundation, but that their **transformative potential is not yet fully realised**. Fragmentation across policy domains, uneven integration into planning and investment processes, and limited consideration of lifecycle and future-oriented criteria reduce their effectiveness as drivers of climate-neutral and resilient building stocks.

This chapter translates the evidence and lessons generated through the Sustainable Building Methodology (SBM), the Evaluation Toolbox (ET), and the pilot implementations into a set of **strategic actions and policy pathways**. These actions are designed to support national and regional authorities, standard-setting bodies, and public building owners in progressively enhancing sustainable building standards while respecting existing regulatory frameworks and institutional capacities.

Rather than proposing prescriptive regulatory reforms, the strategy promotes a **step-by-step enhancement approach**, based on:

- integration rather than replacement of existing standards,
- alignment across planning, regulation, and financing,
- continuous learning through data and evaluation,
- and scalability beyond pilot territories.

The strategic actions presented below are mutually reinforcing and can be adapted to different national and regional contexts, supporting gradual convergence toward EU climate and sustainability objectives.

4.1 Integrated planning

Integrated planning is a **key prerequisite** for enhancing sustainable building standards and ensuring their effective implementation. Pilot experiences within MESTRI-CE show that building standards are often applied in isolation, detached from broader planning, investment, and asset management processes. This limits their impact and reduces their ability to guide long-term transformation.

To address this challenge, sustainable building standards should be systematically embedded into **integrated planning frameworks** that connect policy objectives, technical requirements, and implementation instruments across the building lifecycle.

National and regional authorities should promote closer alignment between sustainable building standards and:

- climate and energy strategies,
- renovation roadmaps,
- spatial and urban development plans,
- and sectoral policies related to housing, health, and education.

The MESTRI-CE Sustainable Building Methodology provides a structured reference framework that enables such alignment by translating high-level objectives into measurable performance criteria applicable at project and building-stock level.

4.1.1 Linking standards with lifecycle oriented perspective to renovation and investment planning

Pilot actions revealed that standards are most effective when they support **strategic decision-making**, rather than acting solely as compliance tools. Integrating SBM-based criteria into renovation planning enables authorities to:

- prioritise investments based on performance gaps,
- compare alternative renovation scenarios,
- and assess long-term impacts across energy, emissions, costs, and usability.

The Evaluation Toolbox and Smart Data Hub further support this integration by enabling portfolio-level assessments and early-stage evaluations, even when detailed building data are not yet available.

Integrated planning should extend beyond operational performance to include:

- lifecycle greenhouse gas emissions,
- adaptability and long-term functionality,
- climate risk and resilience,
- and life-cycle cost optimisation.

The pilots demonstrated that while such aspects are not yet systematically embedded in national standards, their inclusion through the SBM is feasible and valuable. Gradual integration of these criteria into planning processes helps ensure that buildings designed or renovated today remain **fit for future regulatory, climatic, and societal conditions**.

Public authorities play a central role in setting market signals. Integrating sustainable building standards into:

- public procurement criteria, terms of reference,
- design briefs, minimum output project specifications
- and funding conditions

creates a consistent framework that reinforces planning objectives and accelerates market uptake. Using SBM-aligned indicators and compliance levels enables transparent communication of expectations and performance outcomes across stakeholders.

4.1.2 Policy pathway for integrated planning

To enhance sustainable building standards through integrated planning, the strategy recommends:

- embedding standards into national and regional renovation and climate strategies,
- using SBM and ET outputs to inform investment prioritisation,
- promoting cross-departmental coordination within public administrations,
- and leveraging digital tools to support data-driven planning.

Through these measures, integrated planning becomes a **structural enabler** for the progressive enhancement of sustainable building standards.

4.2 Community engagement and co-creation

The enhancement of sustainable building standards is not only a technical or regulatory process, but also a **social and institutional one**. Pilot actions within the MESTRI-CE project demonstrate that the effectiveness of standards depends significantly on their **acceptance, usability, and perceived relevance** among end users, practitioners, and local communities.

Community engagement and co-creation therefore, play a crucial role in ensuring that enhanced standards are not only ambitious, but also **applicable and widely adopted**.

Sustainable building standards affect a broad range of actors (that for named Community), including:

- public authorities and standard-setting bodies,
- building owners and facility managers,
- designers, engineers, project managers, other experts and contractors,
- certification bodies and auditors,
- and building users and local communities.

Pilot experiences showed that early and structured involvement of these groups improves understanding of sustainability objectives and helps identify **practical barriers** that may not be visible at the policy level. Co-creation processes allow standards to reflect real operational needs while maintaining alignment with long-term policy goals.

4.2.1 Improving usability and acceptance of standards within local context

One recurring challenge identified during pilot implementations is that sustainability standards are often perceived as complex, difficult to interpret, or disconnected from everyday planning and operation practices. By involving stakeholders in the development and testing of indicators, metrics, and evaluation procedures, co-creation helps to: simplify application pathways, clarify documentation requirements, and improve transparency of compliance logic.

The positive reception of the MESTRI-CE Evaluation Toolbox illustrates the value of **user-centred design**, particularly the use of clear compliance levels and alternative assessment methods.

Local conditions strongly influence building performance, including:

- climatic and geographic characteristics,
- construction traditions and material availability,
- user behaviour and occupancy patterns,
- and institutional capacities.

Community engagement enables the integration of this **context-specific knowledge** into sustainable building standards, supporting more realistic targets and adaptable solutions. The adaptability of the SBM to national and regional metrics provides a strong foundation for incorporating such local insights without fragmenting the overall framework. Co-creation processes contribute to a stronger sense of **ownership** among stakeholders, which is essential for long-term commitment to enhanced standards. When actors understand how standards are developed, tested, and revised, they are more likely to apply them consistently, invest in capacity building, and support future upgrades.

In the context of public building portfolios, engagement with building users and facility managers also improves feedback on actual performance, supporting continuous improvement.

4.2.2 Policy pathway for community engagement and co-creation

To strengthen sustainable building standards through community engagement, the strategy recommends:

- establishing participatory processes for the development and revision of standards,
- involving practitioners and end users in pilot testing and evaluation,
- using tools such as the Evaluation Toolbox as communication instruments, not only assessment tools,
- and supporting local networks and advisory hubs that facilitate dialogue and knowledge exchange.

Through these measures, community engagement and co-creation become **structural components** of standards enhancement, increasing their effectiveness, legitimacy, and durability.

4.3 Capacity building and knowledge exchange

The progressive enhancement of sustainable building standards requires not only appropriate methodologies and policy frameworks, but also **sufficient institutional and professional capacity** to apply them effectively. Pilot actions within the MESTRI-CE project clearly demonstrated that capacity constraints remain one of the main barriers to the broader uptake of advanced sustainability criteria.

Capacity building and knowledge exchange are therefore essential components of a strategy aimed at strengthening national and regional sustainable building standards.

The implementation of the Sustainable Building Methodology (SBM) and the Evaluation Toolbox (ET) revealed uneven levels of knowledge and experience across key stakeholder groups, including:

- public authorities responsible for planning, procurement, and regulation,
- designers, engineers, and construction professionals,
- building owners and facility managers,
- and certification bodies and auditors.

While energy-related requirements are generally well understood, more advanced sustainability aspects—such as lifecycle assessment, climate adaptation, circularity, and long-term cost optimisation—require **new competencies, tools, and workflows**.

4.3.1 Strengthening institutional capacity within public administrations and supporting professional skills and practices

Public authorities play a central role in applying and enforcing sustainable building standards, particularly in relation to public building portfolios and funding programmes. Capacity building efforts should therefore focus on:

- integrating sustainability criteria into planning and procurement procedures,
- interpreting and applying multi-dimensional performance indicators,
- and using evaluation results to support strategic decision-making.

The use of structured tools such as the Evaluation Toolbox and Smart Data Hub can significantly support public administrations by reducing complexity and enabling **data-driven assessments** at both project and portfolio level.

For designers, engineers, and other building professionals, enhanced standards require:

- familiarity with new indicators and calculation methods,

- the ability to work across disciplines and lifecycle stages,
- and experience with digital assessment and simulation tools.

Pilot actions showed that hands-on training, peer learning, and access to practical guidance are particularly effective in building confidence and competence. Embedding SBM-related methods into existing professional training programmes and certification schemes can further support mainstream adoption.

Advisory hubs and competence centres established or strengthened within MESTRI-CE play a crucial role in facilitating **knowledge exchange and continuous learning**. They act as interfaces between policy, practice, and research by providing technical assistance and guidance and supporting pilot and demonstration projects. Transnational exchange within the project demonstrated that many challenges related to sustainable building standards are shared across Central Europe. Peer learning, therefore, represents a highly efficient mechanism for accelerating capacity development and avoiding duplication of effort.

To ensure long-term impact, capacity building should be embedded into the process of standards enhancement rather than treated as a parallel activity. This includes:

- linking training and guidance to the introduction of new or revised indicators,
- using pilot projects as learning laboratories,
- and ensuring that evaluation feedback informs both policy development and professional practice.

By systematically strengthening capacities alongside technical and regulatory improvements, sustainable building standards can evolve in a way that is **ambitious, usable, and resilient**.

4.3.2 Policy pathway for capacity building and knowledge exchange

The strategy recommends:

- using developed training programmes for public authorities and practitioners and upgrading them,
- integrating SBM and ET concepts into professional education and certification,
- supporting advisory hubs and competence centres at the regional level,
- and maintaining transnational knowledge exchange platforms beyond the project lifetime.

Through these measures, capacity building and knowledge exchange become **enablers of effective standards enhancement**, ensuring that improved requirements translate into real-world performance improvements.

4.4 Innovative financing and funding mechanisms

The enhancement of sustainable building standards is closely linked to the availability and effectiveness of **financing and funding mechanisms**. Pilot actions within the MESTRI-CE project confirm that even technically sound and ambitious standards will have limited impact if they are not aligned with investment frameworks and financial decision-making processes.

Innovative financing mechanisms therefore play a crucial role in translating enhanced standards into **bankable projects and scalable investment programmes**. Sustainable building standards increasingly serve as **signals of investment quality and risk mitigation**. When clearly defined, measurable, and aligned with EU frameworks, standards help investors, lenders, and public funding bodies to:

- assess performance and compliance transparently,
- reduce information asymmetry,
- and differentiate between baseline and high-performing projects.

The MESTRI-CE Sustainable Building Methodology (SBM), supported by the Evaluation Toolbox (ET), provides a structured framework for translating sustainability performance into **credible and comparable investment criteria**, particularly through its progressive compliance levels and “EU future-proof” benchmarks.

4.4.1 Aligning standards with funding

Public funding programmes and subsidies are powerful levers for enhancing sustainable building standards. Pilot experiences indicate that linking eligibility and funding intensity to performance levels defined by SBM-aligned indicators can:

- encourage higher ambition without imposing rigid regulatory requirements,
- reward projects that go beyond minimum compliance,
- and improve the cost-effectiveness of public investment.

Using graduated performance thresholds enables authorities to design **performance-based incentives**, supporting gradual improvement while maintaining accessibility for a wide range of projects.

Enhanced building standards also facilitate access to private capital by improving the **credibility and predictability of sustainability outcomes**. Alignment with EU-level frameworks, such as Level(s) and the EU taxonomy, strengthens the relevance of standards for:

- green loans and mortgages,
- sustainable bonds,
- and blended public–private financing models.

The Evaluation Toolbox supports this alignment by documenting calculation methods, data sources, and compliance levels, thereby increasing transparency and reducing transaction costs for financiers. Data-driven approach enhances trust in sustainability claims and supports the development of **outcome-based financing mechanisms**, including performance-linked funding and pay-for-performance schemes.

Despite these opportunities, several barriers remain:

- limited familiarity of financial institutions with advanced sustainability indicators,
- fragmentation between technical assessments and financial criteria,
- and insufficient integration of lifecycle and resilience aspects into investment appraisals.

Addressing these barriers requires closer cooperation between policy makers, standard-setting bodies, and financial stakeholders, as well as targeted capacity building and pilot financing schemes.

4.4.2 Policy pathway for innovative financing and funding mechanisms

To strengthen the role of sustainable building standards in financing decisions, the strategy recommends:

- aligning national and regional funding schemes with SBM-based performance criteria,
- promoting the use of progressive compliance levels in incentive design,
- fostering dialogue between public authorities, financial institutions, and building owners,
- and supporting digital tools that improve data transparency and comparability.

Through these measures, enhanced sustainable building standards become **enablers of investment**, accelerating the transition toward climate-neutral and resilient building stocks.

4.5 Monitoring, evaluation and adaptive management

The enhancement of sustainable building standards is not a one-off regulatory exercise, but a **continuous process of learning, adjustment, and improvement**. Pilot actions within the MESTRI-CE project clearly demonstrate that effective standards require robust monitoring and evaluation mechanisms, enabling them to respond to changing policy objectives, technological developments, and real-world performance outcomes.

Monitoring, evaluation, and adaptive management are therefore essential to ensure that enhanced standards remain **relevant, credible, and effective over time**. Traditional building standards often focus on design-stage compliance, with limited insight into actual performance during operation. The MESTRI-CE approach supports a shift toward **performance-based monitoring**, combining design, construction, and use-phase data.

Through the Sustainable Building Methodology and Evaluation Toolbox, standards can:

- incorporate indicators assessed at different lifecycle stages,
- distinguish between design intent and measured outcomes,
- and enable systematic performance tracking over time.

This approach improves accountability and supports evidence-based policy decisions.

The Evaluation Toolbox provides a structured framework for documenting indicator values, calculation methods, and compliance levels, enabling **consistent and comparable assessments** across projects and regions. Its flexibility allows national and regional authorities to integrate existing methods while maintaining alignment with EU objectives.

Digital tools, particularly the Smart Data Hub, enhance monitoring capacity by:

- aggregating data from different sources,
- providing estimates where direct measurements are not yet available,
- and supporting building portfolio analysis.

Together, these tools form the basis for a **data-driven monitoring system** supporting standards enhancement.

4.5.1 Feedback loops for standards evolution with institutional arrangements

Pilot experiences highlight the importance of **systematic feedback loops** between implementation and policy development. Evaluation results from pilot projects and building portfolios can inform:

- revision of indicator definitions and thresholds,
- identification of metrics requiring further standardisation,
- prioritisation of capacity-building efforts,
- and refinement of funding and incentive schemes.

This adaptive management approach allows standards to evolve incrementally, reflecting both **policy ambition and practical feasibility**. Monitoring and evaluation are also critical for financing mechanisms. By linking monitored performance to compliance levels and incentives, authorities can reinforce the role of standards as **drivers of measurable impact**, rather than administrative requirements.

Effective monitoring and adaptive management require clear institutional responsibilities. Pilot actions indicate the value of:

- assigning coordination roles at national or regional level,
- ensuring cooperation between planning, energy, and finance departments,
- and involving advisory hubs in data interpretation and feedback processes.

Such arrangements support continuity beyond individual projects and ensure that monitoring outcomes are systematically used to improve standards.

4.5.2 Policy pathway for monitoring, evaluation and adaptive management

To strengthen sustainable building standards through adaptive management, the strategy recommends:

- integrating monitoring requirements into standards and funding schemes,
- using SBM and ET outputs as inputs for periodic standards review,
- supporting digital infrastructures for data collection and analysis,
- and institutionalising feedback mechanisms linking implementation to policy revision.

Through these measures, monitoring and evaluation become **core functions of standards governance**, enabling continuous improvement and long-term effectiveness.

4.6 Scaling up beyond pilot cities

The pilot actions implemented within the MESTRI-CE project demonstrate that the enhancement of sustainable building standards is both **feasible and beneficial** across diverse national and regional contexts. To maximise impact, however, the approaches tested in pilot cities and regions must be **scaled up and mainstreamed** beyond the project's immediate scope.

Scaling up is therefore a central objective of this strategy, ensuring that lessons learned, tools developed, and capacities built contribute to a broader transformation of the building sector in Central Europe.

4.6.1 Transferability and adaptability of the MESTRI-CE approach

A key strength of the MESTRI-CE Sustainable Building Methodology and Evaluation Toolbox lies in their **adaptability**. By allowing national and regional metrics to be integrated where appropriate, while maintaining alignment with EU-level objectives, the approach supports transferability without imposing uniform solutions.

This balance enables regions and cities with different regulatory maturity, market conditions, and institutional capacities to adopt the methodology incrementally, and progressively enhance their existing standards.

Scaling up requires embedding the MESTRI-CE approach into **mainstream policy and implementation frameworks**, including:

- national and regional renovation strategies,
- public building investment programmes,
- funding and subsidy schemes,

- and voluntary certification or labelling systems.

By using SBM-aligned indicators and compliance levels as reference points, authorities can promote convergence of practices while preserving flexibility in implementation pathways.

Transnational cooperation and peer learning have been critical to the success of the pilot phase. Maintaining and expanding these networks beyond the project lifetime is essential for scaling up. Regional and national networks of public authorities, certification bodies, advisory hubs, and professional organisations can support replication of successful approaches, and coordinate updates of standards and tools.Such cooperation strengthens institutional learning and accelerates the diffusion of innovation across Central Europe.

Scaling up also depends on ensuring the **long-term usability and relevance** of enhanced standards. This includes:

- continuous capacity building and training,
- regular updates of methodologies and tools,
- and integration of new policy requirements, technologies, and market practices.

The adaptive management approach outlined in Section 4.5 provides a governance framework for sustaining and expanding the impact of the strategy over time.

Through its integrated methodology, tested tools, and evidence-based policy pathways, MESTRI-CE provides a **replicable model** for enhancing sustainable building standards in Central Europe. By supporting gradual convergence rather than rigid harmonisation, the project contributes to:

- improved comparability of building performance,
- increased investment readiness,
- and accelerated progress toward climate-neutral building stocks.

Scaling up beyond pilot cities transforms the project's results into a **lasting strategic legacy**, reinforcing the role of sustainable building standards as key enablers of the European green transition.

5 Conclusions and Way Forward

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