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D.2.2.2 MESTRI-CE Sustainable Building Methodology for (re)construction of buildings

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Contents

A. INTRODUCTION

This deliverable summarises the outcomes of the work carried out in Activity 2.2, which focused on developing a comprehensive methodological framework, referred to as the MESTRI-CE Sustainable Methodology (henceforth MESTRI-CE SBM), for evaluating both new and existing buildings. The framework is designed to assess building performance in terms of energy efficiency and sustainability, and to support the integration of the EU sustainable buildings framework into existing building standards within the pilot countries. Furthermore, the establishment of a shared methodological approach to building sustainability facilitates the comparison of the performance of buildings located in different EU countries.

The MESTRI-CE SBM is designed to be adaptable to national and regional contexts, facilitating its adoption at the local level and supporting the progressive enhancement of existing building standards across the MESTRI-CE partner countries. This flexibility ensures that the methodology remains relevant and applicable within diverse regulatory environments. The adapted version of the methodology integrates both region-specific metrics and targets and those defined within the MESTRI-CE SBM, allowing for a balanced approach that respects local practices while aligning with EU-wide sustainability goals.

Both the national/regional and transnational versions of the MESTRI-CE SBM utilise the Evaluation Toolbox (ET)—an open-source, Excel-based tool—as the core instrument for assessing the sustainability of buildings and projects. The ET supports a multi-dimensional evaluation approach, enabling the assessment of performance across various levels of compliance with the targets established for each metric. This structured and scalable framework ensures that stakeholders can effectively measure, compare, and improve building sustainability in alignment with current and future EU directives.

Building on the results of SBM testing on pilot buildings, as reported in Deliverable *"D2.6.1: Report on the Implementation of the Sustainable Building Methodology in Designated Building Stocks"*, this document further examines the effectiveness of the MESTRI-CE SBM in supporting key stakeholders—such as public and private building owners, project developers, designers, public authorities, and energy agencies—in aligning national certification instruments with EU objectives. It also highlights potential areas for enhancement and further uptake of the SBM.

To support the application and adaptation of the MESTRI-CE Sustainable Building Methodology (SBM) across different national contexts, two open-source Excel tools have been developed and attached to this deliverable:

- Annex A: The transnational version of the MESTRI-CE SBM, providing a standardized framework for consistent implementation across countries.
- Annex B: An example of national/regional adaptation of the MESTRI-CE SBM, using the Italian CasaClima certification scheme as a reference model.

These resources are designed to facilitate practical adoption, ensure flexibility for local requirements, and accelerate harmonisation with EU sustainability goals.

B. THE MESTRI-CE SUSTAINABLE BUILDING METHODOLOGY

1. Objective

The MESTRI-CE SBM aims to establish a harmonised approach for assessing building performance based on a comprehensive set of sustainability and climate neutrality criteria fully aligned with current EU directives and regulations including the latest Energy Performance of Buildings Directive (EPBD), the EU Taxonomy and the framework for sustainable building Level(s).

The MESTRI-CE SBM adopts a broad and integrated set of sustainability indicators, reflecting a truly holistic and forward-looking approach to sustainable construction. While traditional sustainability assessments have focused primarily on reducing energy consumption of buildings and improving the user comfort and health, the MESTRI-CE SBM methodology broadens this perspective by embedding key principles such as

- Sufficiency – using only the necessary amount of materials to minimize waste and resource depletion.
- Circularity – designing for reuse, recycling, and maintaining material value over time.
- Climate Resilience – ensuring buildings can withstand and adapt to the impacts of climate change.
- Biodiversity – fostering ecological balance and reducing disruption to natural habitats.
- Life Cycle Thinking- evaluating environmental and economic sustainability across the entire lifespan of the building.

By integrating these principles, the methodology addresses all dimensions of sustainability—environmental, economic, and social.

While the methodology provides a unified reference framework for sustainable building, it is designed to complement existing sustainable building standards and guidelines already developed or in use by project partners supporting a step-by-step alignment of national and regional practices with the EU Sustainable Buildings Framework. Recognizing the diversity of building regulations and standards across Central Europe, the MESTRI-CE SBM maintains flexibility to accommodate regional specificities. Each pilot country is expected to adapt the methodology to its own context, resulting in a national or regional version of the MESTRI-CE SBM. It is important to acknowledge that, although EU member states share common sustainability goals, they have legislated autonomously on building standards. These differences across Central European countries necessitate a gradual, step-by-step process to achieve full alignment with the EU framework.

The Sustainable Building Methodology has been designed to support stakeholders involved in the construction or renovation of buildings or large building stocks in leveraging the EU framework for sustainability. For each metric, indicator, and criterion, the MESTRI-CE SBM provides legal references and guidance, helping users understand its application and relevance. This makes the methodology a valuable resource for a large target group including public and private building owners, project developers and designers, sectoral agencies and policy makers. In essence, it can be proficiently used by all stakeholders involved in planning, designing, financing, and executing construction projects.

2. Metrics selection process

Thanks to the analysis carried out in D.2.2.1 Criteria for the creation of the MESTRI-CE Sustainable Building Methodology, the list of criteria, indicators and metrics previously identified have been evaluated in terms of the effort required to calculate, assess and evaluate them, as well as their potential impact in the development of an ambitious action plan aimed at achieving a carbon-neutral and sustainable building stock. The impact/effort analysis carried out, according to the responses of the experts from the partner countries, underlined that not all the thematic areas related to the holistic concept of sustainability can be expected to have equivalent impact. Some of them, namely 'Energy', 'Emissions', 'Materials', 'Adaptation and Resilience', 'Cost & Value' and 'Management' were identified as those with the potential for a higher impact.

Nevertheless, it was decided that a holistic approach to sustainability, and therefore the integration of all its dimensions into the building assessment, should remain the guiding principle for the design of the MESTRI-CE SBM. Therefore, in addition to the priority thematic areas and their key indicators, the MESTRI-CE SBM also includes the indicators identified in D.2.2.1 as less significant in terms of impact.

This approach empowers end users, i.e. public and private sector clients, project developers and designers, to determine the criteria, indicators or metrics to be incorporated into building standards already available and used in their country.

3. MESTRI-CE SBM description

The following table presents the thematic areas covered by the MESTRI-CE SBM and the number of metrics identified for each area. In some cases, the indicators for each thematic area have been further subdivided into subgroups.

A	ENERGY & ENVELOPE PERFORMANCE	18
B	EMISSIONS	4
C	MATERIALS	7
D	WATER	5
E	CLIMATE RISK & ADAPTATION	4
F	ADAPTABILITY	1
G	HEALTH & COMFORT	17
H	MOBILITY	3
I	SITE & BIODIVERSITY	5
L	COST & VALUE	1
M	MANAGEMENT	1

For each metric selected to be part of the MESTRI-CE SBM the following information have been provided:

- The type of building to which the metric can be applied (new or existing building)
- The name
- The unit of measurement (for quantitative metrics)
- The overall objective to be achieved through the specific indicator
- A short description of the metric itself
- The calculation or the assessment method used to evaluate the metric
- The reference.

The following paragraphs provide a brief description of the analysed thematic areas and sub-groups. More details are reported in *Annex A* and *Annex B* and in *D.2.5.1 Step-by-step guide on MESTRI-CE Sustainable Buildings Methodology*.

3.1. Use stage energy performance GROUP A

Assessing the energy performance of the building during its operational or 'in use' phase allows an evaluation of how efficiently the building uses energy resources for heating, cooling, lighting and other operational needs. Factors such as energy demand and consumption, the use of renewable energy sources and the overall efficiency of the technical building systems are considered. The aim is to promote and measure sustainable practices that minimise the environmental impact associated with the building's ongoing energy use, while maintaining appropriate indoor comfort conditions for occupants.

- Energy. The metrics considered estimate the energy used to operate the building in order to reduce its consumption. They can be expressed in terms of primary energy, including both non-renewable and renewable energy, or in terms of final energy, depending on the specific energy source used. At the same time, a useful way to reduce energy consumption of buildings is to minimise the need to use HVAC systems to create comfortable indoor environments. Indicators based on the performance of the building envelope are essential to this objective.
- Envelope performance. The ability to maintain adequate comfort conditions may also be related to the presence of thermal bridges through the building fabric and/or high levels of air infiltration. These aspects can also determine a premature ageing of the building itself, causing internal or surface condensation. Metrics that can assess the integrity of the building's elements can extend the useful life of the building. Climate change means that air temperatures are getting warmer. The ability of the building to slow its growth into confined spaces can help minimise energy consumption.
- Systems performance. Technical building systems, if not properly managed and controlled, cannot deliver the performance for which they were designed. They should also be able to adapt their functionality to the needs of the occupants, while taking into account inputs from the external environment.
- Renewable Energy Sources (RES). Improving energy independence from fossil fuels by promoting the use of energy from renewable sources allows several objectives to be achieved: limiting emissions of pollutants, making Europe independent from countries outside the EU and reducing energy poverty.

3.2. Greenhouse gas emissions - GROUP B

Reducing embodied greenhouse gas emissions throughout the life cycle of buildings, including those associated with product manufacture, maintenance, repair, adaptation, renovation and end-of-life, allows both direct and indirect emissions to be considered.

- Contribution to Global Warming Potential. Measuring the contribution to global warming of the building we are designing, constructing or refurbishing gives us a measure of the impact we will have on climate change. Although there are gases that have a greater impact on global warming than CO_2, this gas is now an easily understood benchmark.

3.3. Circularity & Building Materials environmental impact - GROUP C

This criterion aims at optimising material use, reduce waste and introduce circularity into design`s and materials choices to extend the buildings life cycle, the long-term material utilisation and reduce significant environmental impacts.

- Construction materials estimation. Every building can be considered as a significant material bank. For this reason, on the one hand, it is important to use only the strictly necessary amount of building materials and, on the other hand, it would be of primary importance to design and plan buildings in such a way that all their components can be reused, recycled and reassembled once the building is dismantled.
- Life Cycle Assessment. Buildings start emitting greenhouse gases before they are operational, and they continue to pollute the environment after they are built and when they are no longer in use. The real impact of a building on the environment can only be properly reduced by taking all these stages into account.
- Improving materials' use. Increasing the use of building products made with fewer primary raw materials can help reduce the carbon footprint of a building.

All metrics in this subgroup can be applied to both new and existing buildings, but they are characterized by different unit of measure. The general aim is the optimization of the use of materials that can be reached in different manners according to the specific metric considered. All these metrics are calculated and assessed during the detailed design phase. Significant changes that may occur during the construction phase, must be taken into account and the metrics recalculated according to the modified project.

Level(s) provides useful Excel-based tools for calculating almost all indicators, but commercial software capable of producing the same outputs can also be used.

3.4. Water use and disposal - GROUP D

Promoting the efficient use of water resources, introducing water efficiency measures and reusing grey water and rainwater can bring benefits to both the water environment and the running costs of the building.

- Use of water. Reducing pressure on freshwater resources can be achieved at a number of levels, from the plumbing fixtures installed in the building to the installation of rainwater harvesting and reuse systems.

3.5. Climate Risk&Adaptation - GROUP E

Buildings constructed or refurbished today should be able to provide future-proof performance to protect the health and comfort of occupants and minimise long-term risks to property value.

- Climate Risk. Assessing the exposure of the building to climate risk and its vulnerability can reduce the need to modify the building in the near future, i.e. to ensure appropriate comfort conditions in terms of thermal comfort.

Adaptation measures. Predicting extreme weather events is extremely difficult, and climate change is happening so fast on our planet that this prediction is becoming increasingly difficult. Therefore, implementing adaptation measures to increase the resilience of the building is of paramount importance to reduce potential damage to the building and its occupants.

3.6. Adaptability and flexibility - GROUP F

This criterion assesses the capacity of a building to continue fulfilling its function and to extend the useful service life into the future with the objective of reducing environmental impacts and increasing the building's value.

- Adaptability. Buildings generally have a long lifespan, during which the needs of the users and the demands and conditions of the market may change several times. To avoid the need for major interventions to maintain the suitability and profitability of the building, the design of adaptability should be a fixed point from the outset.

This subgroup includes only one metric that uses a semi-quantitative assessment method to define the adaptability and flexibility of office and residential buildings according to Level(s) indicator 2.3 Design for adaptability and renovation. The assessment of the extent to which the design of a building could facilitate future adaptation to changing user needs and market conditions, i.e. its adaptability, takes into account:

Offices:

- changes to the internal space distribution
- changes to the buildings servicing
- changes to the building's facade and structure

Residential buildings:

- changes to the internal space distribution
- changes to the buildings servicing
- changes to the use of units or floors
- changes in access requirements

For each adaptability aspect a score is assigned according to the level of incorporation into the building design.

3.7. Health & Comfort - GROUP G

The protection of human health and the provision of an adequate level of comfort for the building's occupants should be the main objective of any design process. However, despite the level of design detail that can be achieved today, occupant behaviour remains the variable that can derail even the best project.

- Indoor Air Quality. Approximately 90% of our lives are spent in enclosed spaces. Reducing the risks to human health associated with poor indoor air quality due to the presence of pollutants or other air conditions (CO2, humidity) is therefore crucial.
- Thermal comfort. Adequate thermal comfort is essential to ensure the wellbeing of occupants both in summer, when unwanted solar gains can require additional cooling energy, and in winter, when inadequate heating conditions can increase seasonal illnesses.
- Lighting and visual comfort. Improving and optimising lighting and visual comfort conditions can have a number of positive effects. Operating costs can be drastically reduced and occupant wellbeing improved in terms of general health, circadian rhythms and satisfaction with the environment in which we live.
- Acoustic comfort. An acoustically comfortable indoor environment should be able to avoid, or at least minimise, noise coming from outside and/or generated by people or systems inside the building. Particular attention should be paid to those spaces where communication between people is essential.

3.8. Green Mobility - GROUP H

All the criteria in this subgroup shall be verified both at the detailed design stage and in service. Therefore, compliance can be demonstrated through technical designs and/or reports and assessed through on-site inspections.

- Green Mobility. The first two metrics contribute to increasing the number of green vehicles, facilitating their recharging also in private places, decarbonising the electricity system and improving its efficiency, while metric H1.3 aims to reduce greenhouse gas emissions from transport, with significant benefits for individuals and communities.

3.9. Site and Biodiversity - GROUP I

Heat islands occur when a developed area has a higher temperature than surrounding areas, whether rural or not. The higher temperature leads to increased energy consumption for cooling, with a consequent increase in air pollutants and greenhouse gases. It can also affect human health and comfort and water quality.

About half of the greenhouse gases produced by human activities are absorbed by land and oceans. Conserving and restoring natural areas, both on land and in the water, is essential to limit carbon emissions and adapt to an already changing climate.

- Heat island effect. Heat island effect can be reduced through measures that positively influence the microclimate around the building.
- Biodiversity. Conserve and create new habitats for flora and fauna is crucial to promote biodiversity in the local context.

3.10. Cost & Value - GROUP L

These criteria aim at optimising the life cycle cost and value of buildings to reflect the potential for long-term performance improvement, inclusive of acquisition, operation, maintenance, refurbishment, disposal and end of life.

- Cost & Value. Investors, asset managers and occupiers can be encouraged to consider the relationship between up-front capital costs and usage phase costs to understand future performance, value and liabilities.

This subgroup has only one metric, Life Cycle Costing and Optimisation (LCC), which expresses the cost per square metre required to construct or refurbish the building and then to operate and maintain it. The evaluation of the metric should be done according to EN 15459, ISO 15686-5 and EN 16627 (for calculating the life cycle costs of each life cycle stage); ISO 15686-8 (for calculating and estimating the design life of elements and components). Costs for all life cycle stages should be reported. At least Energy and water costs for the use phase (life cycle stages B6 and B7); construction (life cycle stages A1-3) and long-term maintenance, repair and replacement costs (life cycle stages B2-4). The life cycle costing software tool shall be able to perform calculations according to a national cost-optimal methodology or be prescribed by EN 15459 or ISO 15686-5.

3.11. Management - GROUP M

Technical building systems that aren't properly managed and maintained, even if properly designed, will not be able to achieve estimated performance.

- Sustainable building management. Service and inspection by qualified personnel are crucial to help maintain the correct product specification and to ensure optimum performance from an environmental, safety and energy point of view.

Regulations in most EU countries require regular inspection of HVAC systems installed in both public and private buildings. Metric M1.1 requires this inspection to be carried out in accordance with the requirements of the specific country in which the building is located.

C. THE NATIONAL/ REGIONAL ADAPTATION PROCESS

To facilitate the adoption of the MESTRI-CE SBM methodology at national or regional level and to allow for a progressive upgrade of the building standards currently in use in the different MESTRI-CE pilot countries, the MESTRI-CE SBM can be adapted by project partners to the national or regional context in which it will be used. This "adapted" methodology may include both national or regional metrics and metrics as defined in the transnational MESTRI-CE SBM.

4. The elaboration of the national/regional adapted MESTRI-CE SBM

To develop a national/regional version of the MESTRI-CE SBM, it is necessary to assess whether the indicators/metrics already used in the country specific building standards and regulations can be considered “analogous” to those selected for the MESTRI-CE SBM.

It is proposed that a local metric can be regarded as “analogous” to the MESTRI-CE metric if it is demonstrated to have identical objectives. In this case, the local metric can be used instead of the MESTRI-CE metric, even if other aspects, such as for example the unit of measurement used, differ. If no analogue metric exists, the MESTRI-CE SBM metric will be used.

As a first step for the elaboration of a national/regional adapted MESTRI-CE SBM, the local metrics in line with the MESTRI-CE SBM shall be identified and described according to their unit of measurement, calculation method, assessment stage and the tools available for their assessment. In some cases, even the name of the metric could be different from the MESTRI-CE SBM.

In a second step, the local legal requirements or targets for each local metric have to be identified, according also to the type of intervention addressed (renovation or new buildings).

In a third step the levels of compliance for a specific metric with the target/requirements set at national/regional level and with the target/requirements set in the MESTRI-CE SBM shall be defined and entered in the Evaluation Toolbox. The levels of compliance are defined as follows:

- Not compliant: the national/regional target is not reached
- Compliant: the national/regional target is reached
- Beyond compliance (Step1-Step2-Step3): intermediate targets that exceed the actual national/regional target but do not reach the future proof target.
- EU-future proof: the target set in the MESTRI-CE SBM is reached or exceeded and the calculation method used, as well as the stage of the project at which the building is assessed, are identical to what is defined in the MESTRI-CE SBM.

The following figure shows the process described above for the Italian MESTRI-CE SBM, highlighting the fields of the Evaluation Toolbox to be addressed to a national/regional adaptation of the MESTRI-CE SBM.

MESTRI - CE
NATIONAL/REGIONAL EVALUATION TOOLBOX - ITALY
NEW BUILDING

THEMATIC AREA — A ENERGY & ENVELOPE PERFORMANCE

Use stage energy performance
Assessing the energy performance of the building during its operational or 'in use' phase allows an evaluation of how efficiently the building uses energy resources for heating, cooling, lighting and other operational needs. Factors such as energy demand and consumption, the use of renewable energy sources and the overall efficiency of the technical building systems are considered. The aim is to promote and measure sustainable practices that minimise the environmental impact associated with the building's ongoing energy use, while maintaining appropriate indoor comfort conditions for occupants.

A1 - ENERGY USE

	METRIC	UNIT MEASURE	ASSESSMENT STAGE		REQUIREMENT	NATIONAL/REGIONAL TARGET	PROJECT VALUE	PROJECT ASSESSMENT	TOOLS; DOCUMENTATION; MEASUREMENT OR ASSESSMENT MODE	COMMENTS
A1.1	Primary energy use	kWh/m² per year	Detailed design	X	30% lower than the national/regional target for total primary energy use (CasaClima class A)	150,00	120,00	BEYOND COMPLIANCE - STEP 3	Option B: Software based on the national or regional calculation method for energy performance laid down in the Member State where the building is located. proCasaClima (free software) https://www.agenziacasaclima.it/it/software-casaclima-2239.html	
			Construction	X						
			As Built	X						
			In use							
A1.2	Final energy use	kWh per year	Detailed design	1	30% lower than the national/regional target for total primary energy use	2	X 3	METRIC NOT APPLICABLE	1 Option B: Software based on the national or regional calculation method for energy performance laid down in the Member State where the building is located. proCasaClima (free software) https://www.agenziacasaclima.it/it/software-casaclima-2239.html	The final energy use is not used as a target value to evaluate the performance of the building. It is calculated and displayed as a result, but a target value does not exist.
			Construction							
			As Built	X						
			In use							
A1.3	Heating demand	kWh/m² per year	Detailed design	X	60% lower than the national/regional target for total primary energy use (CasaClima class A)	30,00	30,00	COMPLIANT	Option B: Software based on the national or regional calculation method for energy performance laid down in the Member State where the building is located. proCasaClima (free software) https://www.agenziacasaclima.it/it/software-casaclima-2239.html	
			Construction	X						
			As Built	X						
			In use							

If a MESTRI-CE SBM Reference indicator is used directly, the target or reference value will be equivalent to that of the aforementioned MESTRI-CE SBM. Consequently, the level of compliance will be designated as EU-future proof.

At the end, each MESTRI-CE pilot country will be provided of a national/regional adapted MESTRI-CE SBM which will contain both national/regional adapted metrics and MESTRI-CE SBM Reference metrics.

The elaboration of the national/regional adapted MESTRI-CE SBM will offer valuable insights into how ambitious the energy and sustainability standards in use in the different pilot countries are, or rather the gaps that exist in comparison to the transnational MESTRI-CE SBM, both in terms of the thematic areas of sustainability addressed by the indicators in use and the targets to be achieved.

D. RESULTS FROM THE TESTING

5. Implementation of the MESTRI-CE SBM in the pilot countries

The implementation and testing of the MESTRI-CE SBM across the pilot countries have yielded important insights into the feasibility, adaptability, and effectiveness of the proposed framework. While the methodology proved to be broadly applicable and aligned with EU policy goals, the pilot testing also revealed national-specific gaps, challenges, and opportunities for improvement, as reported in D.2.6.1 'Report on implementation of the Sustainable Building Methodology in designated building stocks'.

Building on the findings of the testing phase several matrices have been developed—each corresponding to a specific thematic area of sustainability- with the aim of highlighting which indicators and metrics from the MESTRI-CE SBM are already implemented in the pilot countries, either as a SBM “reference metric” or as an “adapted” SBM metric. If an index or metric is applied exactly as defined in the MESTRI-CE SBM, it is classified as a "reference" metric. When the same indicator or metric is used but adapted to align with national or regional regulatory framework or certification schemes, it is labelled as "adapted." Metrics that are deemed not relevant or applicable in a given context are marked as "not considered."

This analysis has enabled the definition of a preliminary list of applicable SBM indicators and metrics in the different pilot countries. However, it is important to stress that this list is not intended to be a final result. Project partners are expected to regularly update it in response to evolving European, national, and regional regulatory frameworks.

5.1. Use Stage Energy Performance - Analysis Matrices

5.1.1. A1 - Energy Use

Code	Metric	Austria	Croatia	Germany	Italy	Poland
A1.1	Primary energy use	Adapted	Adapted	Adapted	Adapted	Adapted
A1.2	Final energy use	Adapted	Adapted	Adapted	Not considered	Adapted
A1.3	Heating demand	Adapted	Adapted	Not considered	Adapted	Adapted
A1.4	Cooling demand	Adapted	Adapted	Not considered	Adapted	Adapted

All of these metrics can be easily obtained, as they are part of the indexes reported in the EPCs.

A1.1 is widely recognised as a pivotal parameter for achieving climate targets, particularly in scenarios where fossil energy sources are still employed in construction. It is utilised globally as a means of demonstrating adherence to national climate targets and building codes. Consequently, it can be considered as highly relevant for both regulatory compliance and sustainability assessment.

A1.2 is more closely linked to energy costs. Consequently, it is not frequently mentioned in climate targets, and its relevance is generally not considered to be very high by project partners. It is imperative to note that this calculation is mandatory in various countries. While its regulatory relevance may be lower compared to primary energy, it provides valuable insights into actual energy bills and operational costs for occupants.

A1.3 provides valuable insight into the thermal performance of the building envelope and the solar architecture, thereby contributing to reduced heating needs.

A1.4 is particularly pertinent in northern climates for non-residential buildings and for evaluating summer heat protection. In the southern climate zone, it is nevertheless important to evaluate the performance of the building envelope during the cooling season in order to reduce the demand for cooling. Furthermore, in countries where this metric is not yet a legal requirement, it is recognised that cooling demand is increasingly valued in building assessments due to climate change.

5.1.2. A2 - Envelope Performance

Code	Metric	Austria	Croatia	Germany	Italy	Poland
A2.1	Airtightness of the building envelope (testing) - $n_{50,lim}$	Reference	Adapted	Not considered	Adapted	Adapted
A2.2a	Thermal integrity of the building envelope /Thermal heat bridge correction	Not considered	Not considered	Not considered	Not considered	Not considered
A2.2b1		Not considered	Adapted	Adapted	Reference	Not considered
A2.2b2		Not considered	Not considered	Not considered	Reference	Not considered
A2.3a	Summer heat protection - Thermal lag	Not considered	Adapted	Not considered	Reference	Not considered
A2.3b	Summer heat protection - Decrement factor	Not considered	Adapted	Not considered	Reference	Not considered

A2.1 is mandatory in Croatia, Italy and Poland. It is considered essential to reduce or avoid energy consumption in order to operate buildings efficiently, to improve indoor comfort conditions and to prevent internal condensation. Determining the value of a non-residential building can be challenging, but it is crucial to demonstrate that the building's envelope has been constructed correctly.

Thermal heat bridge correction (A2.2b1) is a mandatory index in Croatia, Germany and Italy. Calculations must be performed according to local norms, which, in some cases, correspond to the reference introduced in the MESTRI-CE SBM. In Italy, a FEM calculation is not always necessary. A2.2b2 can be used when the construction joint does not deviate from the specifications outlined in the Construction Joints CasaClima Catalogue and/or in the CasaClima FEM Catalogue in case of existing buildings. This approach has the potential to accelerate the design process.

Indicators A2.3a and A2.3b assess the building's ability to control overheating, improving comfort levels while reducing energy consumption. As reported by the project partners, these measures are currently considered mandatory in Croatia and Italy. These countries are particularly vulnerable to the effects of climate change, which are manifesting in the form of increased temperatures during the summer months. In light of the near-term climate projections, the calculation of this metric is of paramount importance, at least until dynamic simulations become more prevalent.

5.1.3. A3 - Systems Performance

Code	Metric	Austria	Croatia	Germany	Italy	Poland
A3.1	Building automation and control systems	Adapted	Not considered	Not considered	Reference	Adapted
A3.2	SRI (Smart Readiness Indicator)	Not considered	Not considered	Not considered	Not considered	Not considered

A3.1 Building automation and control systems are vital components of building certification. They facilitate precise adjustments to energy consumption and indoor environmental conditions, ensuring optimal performance of heating, cooling, lighting, and ventilation systems based on occupancy and utilisation patterns. For existing buildings, this metric can only be applied if the refurbishment intervention aims to renovate the entire HVAC system, or part of it.

The Smart Readiness Indicator (SRI), despite being designated as a core metric by the new EPBD, cannot be implemented at this time as it is still in the design and preparation phase at the European level. Nevertheless, it should be maintained between the metrics of the MESTRI-CE SBM, since it will become mandatory as soon as its calculation method is defined.

5.1.4. A4 - Renewable Energy Sources (RES)

Code	Metric	Austria	Croatia	Germany	Italy	Poland
A4.1	Renewable energy produced on site	Adapted	Adapted	Not considered	Not considered	Adapted
A4.2	Share of renewable energy in delivered energy	Not considered	Not considered	Not considered	Adapted	Not considered
A4.3	Electrical storage capacity	Adapted	Not considered	Not considered	Not considered	Adapted
A4.4	Thermal storage capacity	Adapted	Not considered	Not considered	Not considered	Adapted

Both metrics A4.1 and A4.2 are recognised by the project partners as useful instruments to improve energy independence from fossil fuels. The two metrics are applied differently according to the country considered, which often specify specific percentages or amounts according to the intended use of the building in question.

Please note that metrics A4.3 and A4.4 have only been included in the Austrian examples. Nevertheless, these two metrics are considered of great importance for enhancing energy flexibility and reducing grid dependency. Recognising storage in certification supports sustainable energy use and future-ready building design.

5.2. Greenhouse gas emissions – Analysis Matrices

5.2.1. B1 - Global Warming Potential contribution

Code	Metric	Austria	Croatia	Germany	Italy	Poland
B1.1	Life-Cycle Global Warming Potential (GWP)	Not considered	Not considered	Reference	Not considered	Not considered
B1.2	Operational greenhouse gas emissions	Adapted	Adapted	Not considered	Adapted	Adapted
B1.3	Embodied greenhouse gas emissions	Adapted	Not considered	Adapted	Not considered	Not considered
B1.4	On-site carbon emissions from fossil fuels	Not considered	Not considered	Not considered	Adapted	Not considered

Among the partner countries, only Germany currently calculates a 'complete' GWP using EN 15978-based software. Some countries, such as Italy and Austria, use a simplified approach to obtain GWP (see indicator B1.3).

Metric B1.2 is generally included among the metrics listed in the EPCs, and is considered important for reaching climate targets. However, not all partner countries have set a target value for this metric yet, including Poland.

Although a common approach to calculating GWP does not yet exist across Europe, several countries have incorporated metrics into their certification processes that consider the impact of building materials on the construction process. Austria and Italy use alternative indicators instead of GWP: the Eco-index OI3 and the Nature Indicator – ICC, respectively.

Currently, only Italy has included the calculation of on-site carbon emissions from fossil fuels in the metrics used to determine a building's efficiency class. This is due to South Tyrol's special status as an autonomous territory that can legislate independently on certain topics.

5.3. Circularity&Materials environmental impact

5.3.1. C1 - Construction materials estimation

Code	Metric	Austria	Croatia	Germany	Italy	Poland
C1.1	Bill of quantities, materials and lifespans	Not considered	Not considered	Not considered	Not considered	Not considered
C1.2	Construction and demolition waste and materials	Adapted	Not considered	Not considered	Not considered	Not considered
C1.3	Design for deconstruction	Not considered	Not considered	Not considered	Not considered	Not considered

Although a bill of quantities and materials is undoubtedly one of the most important documents in any building project, the approach suggested by the MESTRI-CE SBM based on Level(s) indicator 2.1 is still a long way off. Of the metrics belonging to this sub-area, only Austria uses one that can be considered analogous to C1.2. The disposal indicator is a weighted volume of the disposal and recycling properties of all the building components and layers generated during the building's life cycle, calculated within the EPC.

5.3.2. C2 Life Cicle Assessment

Code	Metric	Austria	Croatia	Germany	Italy	Poland
C2.1	Building LCA (all phases or partial)	Adapted	Not considered	Reference	Adapted	Not considered

As already underlined for metric B1.1, Austria and Italy has settled a simplified LCA analysis through which the two partner countries calculate indicator Eco-index OI3 and the Nature Indicator – ICC. They are based on three environmental impact parameters: Contribution to global warming (GWP), Acidification potential of soil and water (AP), Demand for non-renewable primary energy, total (PENRT) and calculated for the sub-phases A1, A2, A3 and B4 of an entire LCA.

Conversely, Germany already uses an LCA calculation approach based on EN 15978.

5.3.3. C3 Improving materials' use

Code	Metric	Austria	Croatia	Germany	Italy	Poland
C3.1	Sustainable and efficient use of primary raw materials	Adapted	Not considered	Adapted	Not considered	Not considered

In countries that already use this metric certification documents are used as proof of compatibility.

5.4. Water use and disposal

5.4.1. D1 Use of water

Code	Metric	Austria	Croatia	Germany	Italy	Poland
D1.1a	Use stage water consumption	Adapted	Adapted	Not considered	Not considered	Adapted
D1.1b	Use stage water demand	Not considered	Not considered	Not considered	Adapted	Adapted
D1.2	Rainwater retention and harvesting	Not considered	Adapted	Adapted	Adapted	Adapted
D1.3	Requirements for water-saving sanitary fittings	Reference	Reference	Reference	Adapted	Adapted
D1.4	Greywater reuse	Not considered	Not considered	Adapted	Not considered	Adapted

Water scarcity is not yet widely recognised as a major problem in Austria, probably due to the cost of water itself. For this reason, the installations required by metrics D1.2 and D1.4 are not widely used. On the contrary, the installation of rainwater retention and harvesting systems is encouraged in southern countries, such as Croatia and Italy. The same can be said for Germany.

Installing water-saving appliances is seen as easy and practical, especially in new buildings. In some countries, as in Croatia, it Is mandatory.

5.5. Climate Risk&Adaptation

5.5.1. E1 - Climate Risk

Code	Metric	Austria	Croatia	Germany	Italy	Poland
E1.1	Climate risk & vulnerability assessment	Not considered	Adapted	Adapted	Not considered	Not considered
E1.2	Time outside of thermal comfort range (with future climate projections)	Adapted	Not considered	Not considered	Not considered	Adapted

Recent extreme weather events have made the German population more aware of climate-related risks, so these metrics are already well established in Germany.

5.5.2. E2 - Adaptation measures

Code	Metric	Austria	Croatia	Germany	Italy	Poland
E2.1	Adaptation measures for increased risk of extreme weather events	Not considered	Adapted	Adapted	Not considered	Not considered
E2.2	Sustainable drainage	Not considered	Not considered	Not considered	Not considered	Not considered

The metrics belonging to these two sub-areas are considered extremely challenging and difficult to obtain.

Austria has already introduced metric E1.2, even though it is associated with the thermal comfort area.

5.6. Adaptability and flexibility

5.6.1. F1 - Adaptability

Code	Metric	Austria	Croatia	Germany	Italy	Poland
F1.1	Design for adaptability and renovation	Adapted	Not considered	Adapted	Not considered	Adapted

Austria, through the Klimaaktiv certification process, measures adaptability based on how flexibly a building can be used or modified over time, taking into account design, construction methods, and infrastructure.

5.7. Health & Comfort

5.7.1. G1 - Indoor Air Quality

Code	Metric	Austria	Croatia	Germany	Italy	Poland
G1.1	In-situ measurement of IAQ conditions and target pollutants	Not considered	Adapted	Not considered	Adapted	Not considered

G1.2	Use of low-polluting materials	Adapted	Adapted	Adapted	Adapted	Adapted
G1.3	Installation of measuring and control devices for monitoring and regulation of IAQ	Not considered	Adapted	Adapted	Adapted	Not considered
G1.4	Radon risk exposure and constructive protection measures	Adapted	Adapted	Not considered	Adapted	Not considered
G1.5	Ventilation strategy and quality requirements for ventilation systems	Adapted	Adapted	Not considered	Adapted	Not considered

Differently form what the MESTRI-CE SBM suggests, Austria and Germany measure directly formaldehyde and VOCs, while the other countries rely on proof certificates. In Austria, radon problems are detected using radon maps, while in Croatia, they are measured during the building's service life.

5.7.2. G2 - Thermal comfort

Code	Metric	Austria	Croatia	Germany	Italy	Poland
G2.1a	Time outside of thermal comfort range	Adapted	Not considered	Adapted	Not considered	Not considered
G2.1b	PPD (Predicted Percentage of Dissatisfied)	Not considered	Not considered	Not considered	Not considered	Not considered
G2.1c	Acceptable summer indoor temperature range	Not considered	Not considered	Not considered	Not considered	Not considered

Thermal comfort in Austria is defined using the G2.1a metric only and it can be calculated using three different but well developed and standardized methods. In Germany simulation are done according to DIN 4108 -2 and EN 16798-1.

5.7.3. G3 - Lighting and visual comfort

Code	Metric	Austria	Croatia	Germany	Italy	Poland
G3.1a	Daylight Factor target (DT) minimum Daylight Factor target (DTM)	Adapted	Not considered	Adapted	Adapted	Not considered
G3.1b	spatial Daylight Autonomy (sDA)	Not considered	Not considered	Not considered	Not considered	Not considered
G3.2	Daylight Glare Probability (DGP_e)	Not considered	Not considered	Not considered	Not considered	Not considered
G3.3	Views to the outside	Not considered	Not considered	Not considered	Not considered	Not considered
G3.4	Luminaire efficacy	Not considered	Not considered	Not considered	Adapted	Not considered
G3.5	Correlated Colour Temperature (CCT)	Not considered	Not considered	Not considered	Adapted	Not considered

G3.6	Colour Rendering Index	Not considered	Not considered	Not considered	Adapted	Not considered
G3.7	Lighting control	Not considered	Not considered	Not considered	Adapted	Not considered

Among the metrics related to lighting and visual comfort, Austria and Germany calculate only the daylight factor, used in building certifications like klimaaktiv to assess the quality of natural lighting in indoor spaces. Most metrics related to the efficiency or performance of artificial lighting sources can be applied only to non-residential buildings in Italy.

5.7.4. G4 - Acoustic comfort

Code	Metric	Austria	Croatia	Germany	Italy	Poland
G4.1	Airbone and impact sound insulation (testing)	Not considered	Not considered	Reference	Adapted	Not considered
G4.2	Reverberation time, speech intelligibility (testing)	Not considered	Not considered	Not considered	Adapted	Not considered

5.8. Mobility

5.8.1. H1 - Green Mobility

Code	Metric	Austria	Croatia	Germany	Italy	Poland
H1.1	Recharging points for e-vehicles/ e-bikes	Adapted	Adapted	Adapted	Adapted	
H1.2	Pre-cabling of parking spaces	Adapted	Adapted	Not considered	Adapted	
H1.3	Parking spaces for bicycles	Adapted	Adapted	Adapted	Adapted	

All the three metrics are used are present in Austrian and Croatian certification system.

5.9. Site & Biodiversity

5.9.1. I1 - Heat island effect

Code	Metric	Austria	Croatia	Germany	Italy	Poland
I1.1	Green and open space factor (GFF)	Reference	Not considered	Not considered	Adapted	Not considered
I1.2	Microclimate analysis	Not considered	Not considered	Not considered	Not considered	Not considered
I1.3	Solar Reflectance Index (SRI)	Not considered	Reference	Not considered	Adapted	Not considered

The GFF metric forms part of the set of indexes proposed by the klimaaktiv certification procedure. In Italy an analogous metric is applied aiming at maintaining the natural water cycle.

5.9.2. I2 - Biodiversity

Code	Metric	Austria	Croatia	Germany	Italy	Poland
I2.1	Biodiversity -promoting vegetation	Not considered	Adapted	Adapted	Not considered	Adapted
I2.2	Outdoor light pollution	Not considered	Adapted	Not considered	Adapted	Not considered

In Germany biodiversity is already part of the DGNB certification system.

5.10. Cost & Value

5.10.1. L1 - Cost & Value

Code	Metric	Austria	Croatia	Germany	Italy	Poland
L1.1	Life cycle cost calculation and optimisation (LCC)	Not considered	Not considered	Adapted	Not considered	

Although LCC is still considered a complex metric that is difficult to standardise, a specific calculation approach has been defined in Germany according to EN 15686.

5.11. Management

5.11.1. M1 - Sustainable building management

Code	Metric	Austria	Croatia	Germany	Italy	Poland
M1.1	Inspection and maintenance of heating and air conditioning systems	Adapted	Adapted	Adapted	Not considered	Adapted

Metric M1.1 is already set out in local regulations.

E. CONCLUSIONS

The testing phase, carried out by the project partners (Austria, Croatia, Germany, Italy and Poland) on pilot projects, demonstrated a strong alignment between the MESTRI-CE SBM indicators and the existing building certification schemes (e.g. DGNB in Germany, klimaaktiv in Austria and CasaClima in Italy). Building certification schemes already prioritise sustainability as a core criterion in building assessments, reinforcing the relevance and applicability of the MESTRI-CE SBM. The logical and adaptable structure of the MESTRI-CE SBM enables its application even in contexts where sustainable building certification schemes are absent. Many of its indicators are already familiar or partially integrated into existing building regulation, which facilitates adoption and scalability across diverse national or regional frameworks.

The upcoming spring 2026 deadline for the transposition of the revised Energy Performance of Buildings Directive (EPBD) across all EU Member States is expected to accelerate the integration of more advanced metrics—such as the Global Warming Potential (GWP)—that are currently missing in some countries. Nonetheless, certain advanced indicators, including climate risk assessments and life cycle costing, remain underdeveloped or rarely applied, posing challenges for widespread implementation.

Across all five participating countries, the comprehensive scope of the MESTRI-CE SBM was evaluated particularly positive, as it facilitates the identification of priority areas for intervention, it allows benchmarking of existing performance, and fosters the integration of environmental, economic and social design goals. However, this broadness, while a key strength, also presents challenges. Some indicators cannot be easily or rapidly introduced into national frameworks due to legislative, technical, or institutional constraints. Despite these hurdles, project partners remain confident that evolving legislation, growing competencies, and improved tools will support the gradual integration of these aspects in the building practice.

Continued collaboration among EU-level initiatives, national and regional policy makers, and local practitioners will be essential to scale the MESTRI-CE SBM and unlock its full potential in driving the decarbonization and sustainability transformation of the building sector in Central Europe and beyond.

This collaboration will be particularly useful in incorporating those indicators that have been found to be the furthest removed from current approaches to assessing the sustainability of buildings into the certification tools currently in force or used in partner countries.

This is one of the MESTRI-CE project's main objectives, as well as the objective of the methodology described in this document: to encourage construction industry stakeholders to broaden their perspective on sustainability.

F. ANNEXES

Two open-source Excel files are integral part of this deliverable:

- Annex A: The transnational version of the MESTRI-CE SBM, which provides a standardised framework for consistent implementation across countries.
- Annex B: An example of the national/regional adaptation of the MESTRI-CE SBM using the Italian CasaClima certification scheme as a reference model.

In both Annex A and Annex B a specific Excel spreadsheet is dedicated to each thematic area, according to the table included at page 5 of this deliverable. In Annex B, any metrics, indicators or criteria that were selected for inclusion in the transnational MESTRI-CE SBM but were replaced in the adapted national/regional version by an analogous metric, indicator or criterion, are indicated in italics. A brief recap of the content of each Annex is provided in the first Excel spreadsheet, titled 'General'.