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**Advanced Energy Performance Assessment towards Smart Living in Building and District Level**  
**SmartLivingEPC / Grant agreement ID: 101069639**

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**1. Establishing operational rating**

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It is a fact that at this stage, only 11 Member States have applied a scheme for the Operational Rating of buildings. This fact, though, is expected to change in the coming years, with the decision of the European Commission to deploy smart meters in all buildings of the Union. This decision, although it was initiated on a different basis, namely the need for liberalization of the electricity market in Europe, it constitutes a development that is expected to use the Operational Rating as a method of certification of buildings. The challenge that arises at this point for the Member States of the European Union is to adopt a joint scheme for the Operational Rating of buildings. At this stage, there are no standardized procedures for the Operational Rating of buildings at the European level. There are no standards or regulations governing this type of buildings classification. Also, there is a great diversification of approaches in the existing Operational Rating schemes, which leads to the inability to find a common approach for a pan-European scheme.

**2. Digitalizing the process: BIM-based, digital logbook-compatible certificates**

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A certificate should be targeted that will be issued with the use of digitized tools, compatible with digital building logbooks protocols, and retrieve the necessary assessment information for the building shell and building systems from BIM documents, including enriched energy and sustainability-related information for the as designed and the actual performance of the building. The digital twin approach should also be employed to integrate BIM and inverse modelling by employing operational data to ensure that building models are enhanced and evolved in accordance with their actual performance.

**3. Integration of building sustainability assessment aspects in the energy certification process**

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Sustainability key components should be included into the EPC calculation process, as well as environmental and human-centric variables that influence a building's energy efficiency. Among the new indicators that should be integrated into the EPC calculation procedure are the LCA, LCC, and human-centric indicators, which will take into consideration measurable data from real building performance, as well as the relevant indicators included in the Level(s) scheme towards the sustainability enhancement of buildings.

**4. Renovation wave of European Building Stock and the significance of certification**

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The appropriate framework should be delivered which will strengthen Pan-European initiatives in the field of promoting building renovation, by promoting the principles of long-term renovation strategies through the certification procedure. AI-added value tools should be developed, which will analyze real-time data to provide meaningful insights on comfort, occupancy, use of appliances, and building energy and along with the recommendations provided by the benchmarking and evaluation tool, will enhance activities towards developing building and user-specific renovation roadmaps and increasing the renovation rate of inefficient buildings across EU MSs.

**5. The unexploited information on HVAC inspections and certification processes**

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EPCs should integrate findings from technical audits of building systems, as imposed in accordance with the EN 15378, the EN 16798, the EN 16946, the EN 16947, and the EN 15251 standards series, and will integrate the information on the actual performance of technical systems to the information



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provided by the EPC, as well as in the calculation procedures. The audit results should be exploited in both the asset and the operational rating of buildings, delivering an updated and more accurate result concerning the actual energy performance of buildings. This initiative should also support the further development of the HVAC and BACS-related standards, towards delivering information that is tailored to the needs of the energy certification process.

#### 6. Smart buildings, smarter certificates

The findings of SRI assessment should be integrated in the certification procedure, turning the SRI assessment procedure into an integral component of the EPC calculation scheme. The development of a comprehensive methodology should be aimed, by which the intelligence readiness of buildings will be included in the energy class of the building. The methodology will be based on standardized procedures to deliver a certificate with an integrated SRI score into the EPC class.

#### 7. Energy Performance Assessment and Certification: The need for more reliable and cost-effective calculation methods

New rating schemes, which will be based not only on the asset energy assessment of the building but as well on other energy-related ratings of the building (SRI, Level(s)), as well as on actual data on the energy performance of buildings HVAC, delivered by technical audits should be delivered. This rating should be the result of a weighted rating of a set of building-related indicators, including in this manner in the assessment scheme aspects related to the sustainability and the smartness of the building, the well-being of its users, and the energy performance of the building shell.

#### 8. Shifting from Building Unit to Building Complex: Energy Certifications next big step

A parallel scheme at the level of assessing the energy performance at neighborhood level should be developed (Complex EPC), with the ultimate goal in the near future of certification of building within a neighborhood (district) based on the certification of individual units, as well as on additional aspects following an integrated participatory and neighborhood-based approach. Complex EPCs are anticipated to consist one of the major breakthroughs in buildings certification procedure, introducing additional aspects that need to be considered for achieving an energy-efficient built environment.