# SmarterEPC

## D3.2 Adapting Smarter EPC tool to the requirements of the EPBD

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# Acronyms

| Acronyms | Description |
|---|---|
| **AFDD** | Automated Fault Detection and Diagnostics |
| **API** | Application Programming Interface |
| **BACS** | Building Automation and Control Systems |
| **DBL** | Digital Building Logbook |
| **EPB** | Energy Performance of Buildings |
| **EPBD** | Energy Performance of Buildings Directive |
| **EPC** | Energy Performance Certificate |
| **EU BSO** | European Union Building Stock Observatory |
| **HVAC** | Heating, Ventilation, and Air Conditioning |
| **IEQ** | Indoor Environmental Quality |
| **IoT** | Internet of Things |
| **MEPS** | Minimum Energy Performance Standards |
| **PEB** | Positive Energy Building |
| **ROI** | Return on Investment |
| **RP** | Renovation Passport (before EPBD IV, known as BRP Building Renovation Passport) |
| **SRI** | Smart Readiness Indicator |
| **TBS** | Technical Building Systems |
| **ZEB** | Zero-Emission Building |

# Executive summary

The SmarterEPC project, funded under the LIFE Clean Energy Transition sub-programme, is dedicated to modernising Energy Performance Certificates (EPCs) by integrating smart readiness aspects into building performance assessment, certification, and management. With the adoption of the 2024 recast Energy Performance of Buildings Directive (EPBD IV), SmarterEPC could play an instrumental role in ensuring that EPCs align with the EU's evolving energy efficiency and decarbonisation objectives.

EPBD IV introduces a series of transformative changes, including the establishment of Zero-Emission Buildings (ZEB) as the standard for all new constructions by 2030, the reinforcement of the Smart Readiness Indicator (SRI), and the integration of digital tools such as Renovation Passports (RPs) and Digital Building Logbooks (DBLs). These advancements emphasise the need for a more dynamic, data-driven approach to EPCs, ensuring that energy performance assessments are more reflective of real-world building conditions and renovations.

This report outlines the relevant provisions of EPBD IV and the corresponding strategic and technical adaptations recommended for SmarterEPC enhancing key areas of focus:

- SmarterEPC could ensure EPCs dynamically update to reflect staged renovations, linking recommended actions to financial incentives and regulatory compliance mechanisms
- Real-time performance data from heating, ventilation, air conditioning, and lighting systems could be integrated into EPCs, leveraging automated fault detection and diagnostics (AFDD) to improve efficiency and compliance tracking
- SmarterEPC will incorporate SRI scores into EPCs, and could furthermore utilise AI-powered analytics to provide predictive insights and optimisation strategies for building automation
- To comply with EPBD IV, SmarterEPC shall ensure that EPCs adhere to the newly standardised A-G rating scale and include expanded performance indicators such as indoor environmental quality (IEQ) metrics and renewable energy integration
- SmarterEPC will adopt open data standards (XML, JSON, RDF) to facilitate interoperability between EPC databases, national EPB platforms, and the EU Building Stock Observatory (EU BSO), ensuring automated compliance monitoring and data transparency
- The project could aim to replace manual inspections with automated monitoring via Building Automation and Control Systems (BACS), reducing administrative burdens and enhancing the accuracy of EPC ratings

By implementing these enhancements, SmarterEPC would be a key enabler of next generation building performance assessments, supporting policymakers, building owners, building professionals, and industry stakeholders in navigating the transition to a smarter, healthier, and more sustainable built environment.

# 1. Introduction

The SmarterEPC project, funded under the LIFE Clean Energy Transition (LIFE CET) subprogramme, is a forward-looking initiative that seeks to modernise and enhance the Energy Performance Certificate (EPC) framework by integrating, at least, smart readiness aspects into building performance assessment, certification and management processes. As part of the European Union's overarching objectives to improve energy efficiency, reduce carbon emissions, and accelerate the transition towards healthy, smart and decarbonised buildings, SmarterEPC plays a supportive role in bridging the gap between the Energy Performance of Buildings Directive (EPBD)'s provisions and their practical implementation at Member State level.

This report outlines how the SmarterEPC activities evolve in response to the latest revision of the EPBD[1]. The EPBD serves as the EU's primary legislative tool for, among other, guiding building energy certification schemes, setting minimum energy performance standards, and assessing the smart readiness of buildings. As this directive undergoes continual refinement to address emerging developments and challenges in the built environment, SmarterEPC team endeavours to adapt the activities accordingly to remain aligned with and supportive of the EU's policy priorities.

The basic scope of the activities carried out for preparing this report was to define the strategic and technical adjustments necessary for SmarterEPC to meet EPBD IV (2024) requirements effectively:

- Mapping the latest EPBD provisions to the existing EPC and SRI, and related policy instruments e.g. Renovation Passports (RP), inspection reports, frameworks to identify areas requiring adaptation.
- Adapting SmarterEPC's activities (e.g. digital infrastructure, including calculation methodologies, user interfaces, and interoperability features).
- Ensuring compatibility with the EU Building Stock Observatory[2], facilitating cross-border comparability and better data utilisation.
- Collaborating with DG Energy, national authorities, and industry experts to ensure that the adapted approach still supports real-world implementation.

The subsequent sections of this report delve deeper into the specific technical modifications, methodological advancements, and implementation strategies, and how SmarterEPC will translate the new provisions of the EPBD IV (2024) into actionable improvements, ensuring a seamless transition to the new regulatory landscape of the EPBD framework.

[1] https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en#revised-energy-performance-of-buildings-directive

[2] https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/eu-building-stock-observatory_en

# 2. The 2024 recast EPBD (EPBD IV)

## 2.1 The evolution of the EPBD since 2002

The Energy Performance of Buildings Directive (EPBD) has undergone significant evolution since its initial adoption in 2002, reflecting the European Union's increasing ambitions to improve energy efficiency, decarbonise the building sector, and enhance the quality of indoor environments. Each revision of the directive has progressively strengthened requirements for Energy Performance Certificates (EPCs), Smart Readiness Indicator (SRI), Renovation Passports (RP), building databases, inspections of heating, air conditioning and ventilation systems, Building Automation and Control Systems (BACS), and Indoor Environmental Quality (IEQ).

The **2002 EPBD** (**EPBD I**, Directive 2002/91/EC)[3] first introduced Energy Performance Certificates (EPCs) as a tool to inform property buyers, tenants, and owners about the energy performance of a building. It mandated the display of EPCs in large public buildings and those frequently visited by the public. This initial directive also required inspections of boilers and air-conditioning systems to ensure their efficiency. However, it provided only a basic framework for energy performance assessment without a detailed methodology for certification or enforcement.

With the **2010 recast EPBD** (**EPBD II**, Directive 2010/31/EU - Recast)[4], the role of EPCs was significantly strengthened, making them a mandatory requirement for all buildings at the point of construction, sale, or rental. This version of the directive required that EPC ratings be included in advertisements for property transactions and introduced independent control systems to ensure the credibility of the certificates. The establishment of national databases for EPCs became an essential recommendation, allowing Member States to collect and store building performance data systematically. Furthermore, the recast directive reinforced the need for regular inspections of heating and air conditioning systems and introduced requirements for nearly zero-energy buildings (NZEB) for new constructions, pushing the sector towards higher energy performance standards.

The **2018 amended EPBD** (**EPBD III**, Directive 2018/844/EU - Amended)[5] built upon the previous versions by further refining EPCs and making it mandatory for Member States to create centralised EPB databases. These databases were required to store information not only on EPCs but also on building inspections, thus supporting compliance monitoring and better policy design. The directive introduced the Smart Readiness Indicator (SRI) as a voluntary measure to assess how well a building integrates smart technologies to optimise energy use, improve occupant comfort, and interact with the energy grid. Another major addition was the Renovation Passport, a document outlining a step-by-step plan for

[3] https://eur-lex.europa.eu/eli/dir/2002/91/oj/eng
[4] https://eur-lex.europa.eu/eli/dir/2010/31/oj/eng
[5] https://eur-lex.europa.eu/eli/dir/2018/844/oj/eng

improving a building's energy performance over time, tailored to the specific needs of the building. The directive also introduced requirements for Building Automation and Control Systems (BACS), making BACS mandatory for non-residential buildings above a certain size to replace traditional inspections of heating, ventilation, and air-conditioning systems. It also emphasised indoor environmental quality (IEQ) by promoting healthy indoor climates, ensuring adequate ventilation, and considering the impact of building materials on occupant health.

The **2024 recast EPBD** (**EPBD IV**, Directive 2024/1275/EU - Recast) represents the most ambitious revision to date, aligning the building sector with the EU's 2050 climate neutrality targets. It introduces the concept of Digital Building Logbooks, which integrate EPCs, Renovation Passports, and inspection records into a single, comprehensive database. This new directive mandates that all new buildings be zero-emission buildings (ZEB) by 2030 and sets a pathway for transforming the existing building stock to zero-emission standards by 2050. It also requires minimum EPC performance levels for certain buildings, ensuring that the worst-performing buildings are gradually renovated or phased out. The SRI is further reinforced, with Member States encouraged to integrate it into EPC frameworks and national building databases.

The 2024 directive also places a strong focus on phasing out fossil fuel-based heating systems, requiring Member States to outline national policies for transitioning away from standalone boilers powered by fossil fuels. Financial incentives for such systems are set to be discontinued by 2025, with an emphasis on hybrid and renewable heating solutions, such as heat pumps and solar energy. The role of BACS is further expanded to smaller buildings, requiring their integration with renewable energy systems and smart grids. Additionally, the directive introduces a more structured approach to ventilation and IEQ, ensuring that IEQ is adequately maintained in both new and existing buildings.

Throughout its evolution, the EPBD has shifted from providing basic energy performance transparency to enforcing concrete, long-term measures for deep renovation, smart building integration, and decarbonisation. The latest revisions mark a decisive step towards zero-emission buildings, integrating whole-life carbon assessments, energy renovation standards, and solar-ready requirements. These developments collectively reinforce the EU's commitment to reducing energy consumption, ensuring climate resilience, and improving the quality of indoor environments for occupants while supporting the transition to a fully decarbonised building stock by mid-century.

## 2.2 Main novelties introduced by the EPBD IV

The EPBD IV is a fundamental pillar of the European Green Deal, closely aligned with both the Fit for 55 package[6] and the REPowerEU plan[7]. This directive strengthens the EU's commitment to reducing greenhouse gas emissions by at least 55% by 2030 and achieving climate neutrality by 2050, as mandated by the European Climate Law[8]. The EPBD IV integrates critical measures to accelerate the decarbonisation of the building sector, a key contributor to energy consumption and emissions, by establishing Zero-Emission Buildings (ZEB), phasing out fossil fuel heating systems, expanding Building Automation and Control Systems (BACS), enhancing Energy Performance Certificates (EPCs), and mandating the deployment of on-site renewable energy solutions.

### *2.2.1 Alignment with Fit for 55 and REPowerEU*

The Fit for 55 package, adopted in July 2021, introduced a series of legislative reforms aimed at ensuring the EU meets its climate targets for 2030. Buildings account for nearly 40% of total energy consumption and 36% of $CO_2$ emissions in the EU, making their transformation a key priority. EPBD IV builds on this by requiring all new buildings to be Zero-Emission Buildings (ZEB) by 2030 and setting a pathway for existing buildings to reach zero-emission standards by 2050. The directive also contributes to Fit for 55's Energy Efficiency Directive (EED) update[9], which strengthens energy-saving obligations, and the Renewable Energy Directive (RED)[10], which sets higher targets for renewable energy deployment in the building sector.

In parallel, the REPowerEU plan, launched in May 2022 in response to the Russian invasion of Ukraine, reinforces the urgency of reducing the EU's dependence on fossil fuels, particularly imported natural gas. The EPBD IV directly supports this goal by accelerating the electrification of heating systems, promoting district heating from renewable sources, and mandating the phasing out of standalone fossil fuel boilers by 2040. From 2025 onwards, Member States will no longer be able to provide financial incentives for new fossil fuel heating systems, except for hybrid systems that integrate a significant share of renewable energy, such as heat pumps or solar solutions.

[6] https://www.consilium.europa.eu/en/policies/fit-for-55/

[7] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en

[8] https://climate.ec.europa.eu/eu-action/european-climate-law_en

[9] https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficiency-targets-directive-and-rules/energy-efficiency-directive_en

[10] https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive_en

### 2.2.2 Zero-Emission Building (ZEB) and the transition to fossil-free heating

Under EPBD IV, Zero-Emission Buildings (ZEB) become the mandatory standard for all new buildings by 2030, ensuring that they have very low energy demand, no on-site carbon emissions from fossil fuels, and near-total reliance on renewables. Existing buildings shall be gradually renovated to meet ZEB standards by 2050, with clear intermediate targets. This requirement aligns with REPowerEU's objective of replacing fossil fuel heating with renewables and the Fit for 55 measures promoting deep renovations.

A major step toward fossil fuel phase-out is the directive's strict stance on heating systems. Today, 66% of heating and cooling in buildings still comes from fossil fuels, primarily gas boilers. EPBD IV introduces Minimum Energy Performance Standards (MEPS), which will require Member States to renovate the worst-performing buildings first and promote the deployment of heat pumps, district heating, and hybrid renewable systems. By 2040, fossil-fuel-based heating will be nearly eliminated, with a legal framework enabling Member States to ban new fossil-fuel-based heating installations.

### 2.2.3 Energy performance certificates, digital building logbooks, and databases

The directive strengthens the EPC system, ensuring greater transparency and reliability. EPCs will now include whole-life carbon assessments, detailing a building's carbon emissions from construction through operation. They will also cover indoor environmental quality indicators, the Smart Readiness Indicator (SRI), and renewable energy integration. To improve monitoring, EPCs will be linked to digital building logbooks, which will consolidate data on renovation progress, energy use, and inspection results.

Member States are required to establish national Energy Performance of Buildings (EPB) databases, centralising information on EPCs, renovation passports, and system inspections. These databases will support compliance enforcement and allow the EU to track progress toward its Fit for 55 and REPowerEU targets.

### 2.2.4 Smart Readiness Indicator and digitalisation

The Smart Readiness Indicator (SRI), introduced in EPBD III, becomes a key element of building performance assessments under EPBD IV. It evaluates a building's ability to optimise energy consumption dynamically, integrate renewable energy sources, and respond to grid demand through automation. The Fit for 55 package promotes smart energy management, and EPBD IV advances this goal by mandating automation and control systems (BACS) in non-residential buildings and larger residential buildings.

BACS requirements are extended to smaller buildings, ensuring real-time energy monitoring and optimisation. These systems will help reduce energy waste, improve grid flexibility, and

support the integration of electric vehicles (EVs) and decentralised renewable energy generation.

### 2.2.5 Indoor Environmental Quality (IEQ) and health considerations

For the first time, EPBD IV introduces binding requirements for Indoor Environmental Quality (IEQ). Renovations shall not only improve energy efficiency but also maintain or enhance air quality, thermal comfort, and natural lighting. EPCs will gradually include IEQ indicators, measuring aspects like ventilation rates, pollutant levels, and humidity control.

This aligns with the Fit for 55 objectives to ensure energy efficiency improvements do not come at the cost of health and well-being. It also supports the EU's broader Just Transition strategy[11], ensuring that vulnerable populations benefit from healthy and affordable living conditions.

### 2.2.6 Solar energy and on-site renewables

EPBD IV mandates that all new buildings be solar-ready, ensuring they are designed to optimise solar energy generation without costly retrofits. New public and non-residential buildings shall install solar panels, and existing buildings will be required to integrate solar installations in phased increments.

These provisions directly contribute to REPowerEU's goal of doubling solar energy capacity by 2025 and ensuring 600 GW of installed solar PV capacity by 2030. By leveraging rooftops and building-integrated solar solutions, EPBD IV plays a crucial role in meeting the EU's renewable energy expansion targets.

### 2.2.7 Financing mechanisms and just transition

To support compliance with the new regulations, Member States shall establish dedicated financial support mechanisms. EPBD IV requires governments to provide grants, low-interest loans, and tax incentives for building renovations, prioritising low-income households and social housing. This ensures that the green transition is equitable, preventing energy poverty and ensuring that all citizens benefit from energy-efficient, comfortable, and affordable buildings.

The EU's Social Climate Fund[12], part of the Fit for 55 package, will provide additional financial support for vulnerable groups facing energy poverty. In addition, REPowerEU mobilises additional funding to accelerate energy efficiency projects, including heat pump installations, district heating upgrades, and deep renovations.

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[11] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism_en

[12] https://commission.europa.eu/social-climate-fund_en

## 2.3 The gist of the EPBD IV

The EPBD IV (2024) is a landmark directive that aligns fully with the EU's Fit for 55 and REPowerEU strategies. By making Zero-Emission Building (ZEB) the new standard, phasing out fossil fuel heating, mandating on-site renewables, strengthening EPCs, introducing IEQ aspects, and expanding digital monitoring tools, the directive accelerates the transition to a fully decarbonised, energy-efficient, healthy and smart building sector.

Its alignment with Fit for 55 ensures a structured trajectory towards achieving the 55% emissions reduction target by 2030, while REPowerEU reinforces energy security by reducing dependence on fossil fuels and expanding renewable energy adoption. With ambitious renovation requirements, enhanced financial mechanisms, and smart technology integration, EPBD IV represents the most comprehensive and forward-looking building energy policy in EU history. By 2050, the European building sector will be fully climate-neutral, healthy, smart, and resilient, setting a global benchmark for sustainable development.

## 2.4 The EPBD IV articles and annexes

The EPBD IV is structured into 38 articles and 10 annexes, covering key regulatory, methodological, and implementation aspects. Below is the complete list:

**List of articles in EPBD IV**

Article 1 – Subject matter
Article 2 – Definitions
Article 3 – National building renovation plan
Article 4 – Adoption of a methodology for calculating the EPB
Article 5 – Setting of minimum energy performance requirements
Article 6 – Calculation of cost-optimal levels of minimum energy performance requirements
Article 7 – New buildings
Article 8 – Existing buildings
Article 9 – Minimum energy performance standards for non-residential buildings and trajectories for progressive renovation of the residential building stock
Article 10 – Solar energy in buildings
Article 11 – Zero-emission buildings
Article 12 – Renovation passports
Article 13 – Technical building systems (IEQ)
Article 14 – Infrastructure for sustainable mobility
Article 15 – Smart readiness of buildings
Article 16 – Data exchange
Article 17 – Financial incentives, skills, and market barriers
Article 18 – One-stop shops for the EPB
Article 19 – Energy performance certificates

Article 20 – Issue of EPCs
Article 21 – Display of EPCs
Article 22 – Databases for the EPB
Article 23 – Inspections
Article 24 – Reports on the inspection of heating systems, ventilation systems, and air-conditioning systems
Article 25 – Independent experts
Article 26 – Certification of building professionals
Article 27 – Independent control system
Article 28 – Review
Article 29 – Information
Article 30 – Consultation
Article 31 – Adaptation of Annex I to technical progress
Article 32 – Exercise of the delegation
Article 33 – Committee procedure
Article 34 – Penalties
Article 35 – Transposition
Article 36 – Repeal
Article 37 – Entry into force and application
Article 38 – Addressees

**List of annexes in EPBD IV**

1. Annex I – Common general framework for the calculation of the energy performance of buildings (Article 4)
2. Annex II – Template for the national building renovation plans (Article 3)
3. Annex III – Calculation of life-cycle global warming potential (GWP) of new buildings (Article 7(2))
4. Annex IV – Common general framework for rating the smart readiness of buildings (Article 15)
5. Annex V – Template for energy performance certificates (Article 19)
6. Annex VI – Independent control systems for EPCs (Article 27)
7. Annex VII – Comparative methodology framework to identify cost-optimal levels of energy performance requirements for buildings and building elements (Article 6)
8. Annex VIII – Requirements for renovation passports (Article 12)
9. Annex IX – Correlation table (Article 36)
10. Annex X – Transposition table

# 3. Adapting SmarterEPC to the EPBD IV

## 3.1 The EPBD IV articles & annexes relevant for SmarterEPC

The following articles and annexes introduce provisions that are relevant to the goals of SmarterEPC project.

### *3.1.1 Article 12 – Renovation passport (RP)*

Article 12 of EPBD IV (2024) introduces the Renovation Passport (RP) as a structured, step-by-step roadmap for improving a building's energy performance over time. The RP is a building-specific document that provides tailored renovation guidance to help owners transition toward Zero-Emission Building (ZEB) status. The Renovation Passport (RP) serves as:

- A long-term energy renovation plan that outlines cost-effective upgrades for energy efficiency improvements
- A tool for tracking staged renovations, ensuring each step contributes to progressive energy performance gains
    - Smart renovation tracking tools shall be implemented, allowing real-time progress updates based on actual renovation activities
- A document linked to EPCs, ensuring that recommended upgrades align with energy performance targets and Smart Readiness Indicator (SRI) assessments
- A means of supporting policy enforcement, particularly for meeting Minimum Energy Performance Standards (MEPS) and phasing out worst-performing buildings (EPC Class G)

Under article 12, Member States shall:

- Ensure that Renovation Passports are developed in a standardised format, as outlined in Annex VIII
- Integrate RP data into national EPB databases, ensuring accessibility for building owners, real estate professionals, and policymakers
    - Digital integration with EPC and Smart Readiness Indicator, ensuring that EPCs and SRI are automatically updated as renovations are implemented
    - Renovation Passports shall be stored in digital format, ensuring easy accessibility and interoperability, and synchronisation with Digital Building Logbooks
- Encourage the use of RPs in renovation subsidy schemes, allowing building owners to access financial incentives based on planned improvements
- Each RP shall be building-specific and contain:
    - Baseline assessment, meaning a current energy performance analysis, based on an EPC, including primary and final energy use, operational GHG

emissions, smart readiness evaluation (SRI score, if applicable), and IEQ metrics

- Step-by-step renovation plan, meaning a roadmap detailing energy efficiency improvements, categorised into short-term, medium-term, and long-term actions, expected energy savings and GHG emission reductions per renovation measure, technical feasibility of integrating renewable energy systems (solar PV, heat pumps, etc.), and recommendations for improving IEQ comfort and BACS capabilities
- Estimated cost and payback periods, meaning financial projections for total renovation costs, projected energy savings and return on investment (ROI), available financial incentives or subsidy schemes

**Topics of interest for SmarterEPC in relation to Article 12**

- Integration of RPs with EPCs, ensuring that stepwise renovations are reflected in EPC updates
- Development of AI-driven financial models to simulate renovation scenarios, helping owners identify the most cost-effective pathways
- Integration of automated monitoring of staged renovations into EPB databases, tracking the progress of energy efficiency upgrades over time
- Facilitation of automated RP tracking, ensuring that renovation milestones are met and reflected in updated EPC ratings
- Assessment of the impact of RP measures on overall energy performance in real time thanks to AI-driven tools
- Development of automated compliance tracking tools, flagging buildings that fail to meet required renovation milestones
- Identification of the most effective policy interventions to support energy-efficient renovations thanks to AI-powered RP recommendations

### *3.1.2 Article 13 – Technical building systems (TBS)*

Article 13 of EPBD IV (2024) establishes mandatory provisions for Technical Building Systems (TBS), which include all building components that impact energy performance. The key focus areas are:

- Heating, cooling, ventilation, domestic hot water, and lighting systems
- Building Automation and Control Systems (BACS)
- On-site renewable energy generation and storage technologies
- Smart grid integration and demand response capabilities
- Interoperability of technical systems with digital platforms, including EPB databases and Smart Readiness Indicator (SRI) frameworks

Article 13 mandates that Member States establish policies and regulatory measures to ensure that TBS are monitored, optimised, and integrated with smart control mechanisms. This is a significant shift from previous EPBD versions, where the focus was primarily on periodic inspections. Now, BACS shall replace manual inspections wherever feasible.

Article 13 establishes several mandatory requirements for the design, operation, and monitoring of TBS.

- Technical Building Systems are all energy-related building systems including:
    - Active energy systems: Heating, cooling, ventilation, domestic hot water, and lighting
    - Renewable energy integration: Solar PV, solar thermal, wind energy, biomass, geothermal, and battery storage
    - Smart energy management: BACS, energy metering, smart sensors, and real-time monitoring
- All TBS shall be designed and maintained to optimise energy efficiency and indoor environmental quality (IEQ)
- TBS shall be monitored continuously, ensuring real-time optimisation of heating, cooling, ventilation, and lighting
- Energy metering and smart controls shall be integrated into EPCs, allowing buildings to dynamically adjust energy consumption
- Low-temperature heating and cooling systems (e.g., heat pumps) shall be prioritised to reduce primary energy use
- Demand response capabilities shall be integrated, ensuring grid flexibility and peak load management
- BACS shall replace manual system inspections wherever possible, ensuring:
    - Automated fault detection and diagnostics (AFDD) for heating, ventilation, and air conditioning (HVAC) systems
    - Real-time adjustment of energy systems based on occupancy, external conditions, and energy prices
    - Smart scheduling and optimisation of energy use, enhancing comfort while reducing operational costs
- BACS requirements are expanded to smaller buildings, ensuring that automation-driven energy efficiency is accessible to all building types, not just large non-residential buildings
- A key change in EPBD IV is the direct linkage between TBS and EPCs:
    - All EPCs shall include TBS performance data to ensure real-world alignment of energy ratings
    - If a building undergoes a TBS upgrade, the EPC shall be updated accordingly, ensuring that efficiency improvements are reflected
    - Operational energy use data from smart meters and BACS can now be integrated into EPB databases, transitioning EPCs from static labels to dynamic performance assessments

- TBS performance data shall be stored in digital building logbooks (linked to EPB databases, Smart Readiness Indicators (SRI), and Renovation Passports (RPs))
- Energy consumption and efficiency data from BACS shall be made interoperable with national EPB databases, ensuring policy monitoring and compliance
- Standardised data-sharing protocols (aligned with Article 16 – Data Exchange) shall be developed to facilitate cross-border EPC harmonisation

**Topics of interest for SmarterEPC in relation to Article 13**

Article 13 directly impacts SmarterEPC by establishing new technical and regulatory requirements for EPC integration with TBS, BACS, and smart energy management systems.

- Integration of real-time TBS performance data into EPCs, allowing automated updates
- Possibility to predict and optimise building performance based on TBS operational data thanks to AI-driven analytics
- Building automation systems feeding directly into EPC calculations, enhancing data reliability
- Development of APIs for seamless EPC-TBS-BACS integration, ensuring cross-platform compatibility
- Development of automated TBS monitoring frameworks, ensuring continuous energy performance tracking
- Implementation of automated EPC verification mechanisms, detecting inefficiencies or anomalies in TBS operations
- Support to Member States to align EPC methodologies with TBS data collection mandates
- Assistance to national EPC authorities in setting up quality assurance systems, ensuring accurate EPC ratings that reflect real-world system performance

### *3.1.3 Article 15 – Smart readiness of buildings (SRI)*

Article 15 of EPBD IV (2024) establishes the Smart Readiness Indicator (SRI) as a key assessment metric for determining how well a building integrates smart technologies and automation systems to enhance energy efficiency, flexibility, and IEQ. The SRI measures a building's ability to:

- Automatically adjust energy consumption based on occupancy, external conditions, and energy price signals
- Improve interaction with the energy grid through demand-response capabilities
- Enhance occupant comfort, health, and well-being via smart indoor environmental quality (IEQ) monitoring
- Integrate on-site renewable energy production and storage for energy self-consumption
- Enable predictive maintenance and automated fault detection for heating, cooling, ventilation, and lighting systems

A delegated act will detail the methodology for calculating the SRI, based on criteria outlined in Annex IV. The SRI evaluation framework shall cover three main functional areas:

- Ability to adjust heating, cooling, ventilation, lighting, and domestic hot water use based on real-time conditions
    - Demand-side flexibility to optimise energy use when electricity prices are low
- Ability to respond to grid signals, such as incentives for peak load shifting
    - Integration of solar PV, battery storage, and smart charging for electric vehicles (EVs)
- Monitoring and automatic adjustment of indoor air quality (IAQ), temperature, humidity, and lighting.
    - Automated detection of faults in HVAC systems and ventilation controls

According to Article 15, by 30 June 2026, the Commission shall, after having consulted the relevant stakeholders, adopt an implementing act detailing the technical arrangements for the effective implementation of the SRI, including a timeline for a non-committal test phase at national level, and clarifying the complementary relation of the scheme to the EPCs.

In parallel, by 30 June 2026, the Commission shall submit a report to the European Parliament and the Council on the testing and implementation of the SRI on the basis of the available results of the national test phases and other relevant projects. Taking into account the outcome of that report, the Commission shall, by 30 June 2027, adopt a delegated act, supplementing this Directive by requiring the application of the SRI to non-residential buildings with an effective rated output for HVAC systems of over 290 kW, and an implementing act detailing the technical arrangements for such a mandatory application.

The four acts mentioned in Article 15 are visually represented by Figure 1.

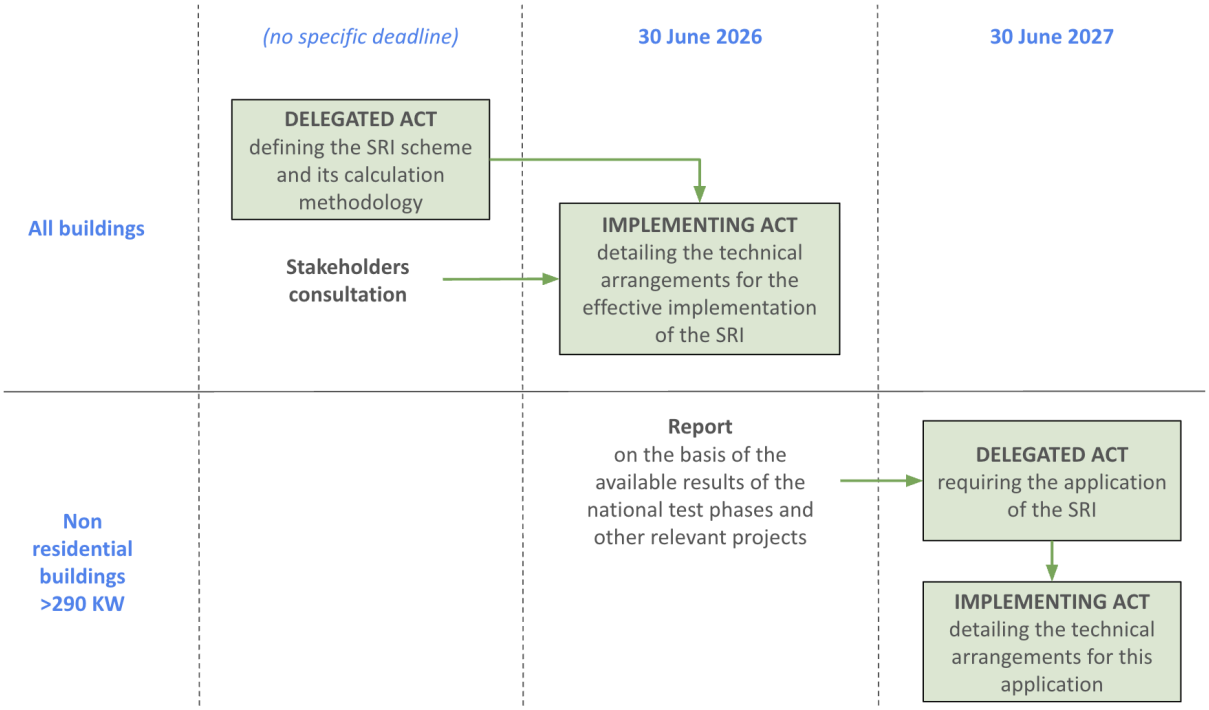


Figure 1. The delegated and implementing acts foreseen by Article 15

This article reinforces the role of digitalisation, automation, and AI-driven energy optimisation in buildings, making it a crucial link between EPCs and real-time performance monitoring:

- SRI ratings are recommended to be integrated into EPCs, making them part of building energy performance assessments
- National EPB databases are recommended to store SRI scores, allowing authorities to track smart building technology deployment
- Building owners and tenants shall have access to SRI assessments, helping them make informed investment decisions on smart upgrades
- Member States shall promote smart technology adoption in deep renovation programs
- Financial incentives (grants, tax deductions) should support the installation of smart systems (e.g., automated HVAC, demand-response, real-time monitoring)
- Buildings undergoing major renovations shall be evaluated for SRI potential, ensuring that automation and digital control systems are included in retrofit planning

**Topics of interest for SmarterEPC in relation to Article 15**

- The assurance that EPC methodologies include SRI scores, providing a more comprehensive energy performance assessment
- AI-driven predictive analytics used to determine which smart upgrades will improve SRI ratings

- Leveraging of real-time data from smart meters, IoT sensors, and BACS to automatically calculate and update SRI ratings
- Development of AI-driven monitoring tools to track how buildings use automation and adjust energy demand
- The usage of SRI data to support Member States in tracking smart building adoption and compliance with EPBD IV
- Integration of SRI and EPC data into the EU Building Stock Observatory (EU BSO), helping policymakers assess smart technology deployment rates
- Development of digital platforms and tools to help building owners understand their SRI rating and how to improve it
- Promotion of financial incentives for smart building technologies based on SRI-linked EPC recommendations

### *3.1.4 Article 16 – Data exchange*

Article 16 of the EPBD IV (2024) establishes a harmonised framework for data exchange, ensuring that information related to Energy Performance Certificates (EPCs), Smart Readiness Indicators (SRI), Renovation Passports (RPs), and Technical Building Systems (TBS) is:

- Interoperable across digital platforms, including national and EU-level databases
- Accessible in a machine-readable format, allowing for automated processing and compliance tracking
- Exchanged securely while complying with General Data Protection Regulation (GDPR)
- Integrated into policy monitoring mechanisms, enabling data-driven decision-making on building decarbonisation and energy efficiency improvements

Article 16 mandates Member States to establish national digital infrastructure for building performance data exchange, ensuring:

- All EPCs shall be stored in centralised national databases, ensuring harmonised data collection and reporting
- EPC data shall be machine-readable, allowing for automated EPC issuance, updates, and verification
- Open APIs and interoperable data formats shall be used to allow seamless cross-platform exchange between (national EPB databases, Smart Readiness Indicator (SRI) platforms, Renovation Passport (RP) registries, Technical Building System (TBS) performance records, EU-wide building performance observatories, such as the EU Building Stock Observatory (EU BSO))
- EPB databases shall connect with SRI and RP registries, ensuring that building performance data is holistic and comprehensive

- Building energy performance data shall be exchangeable between national authorities, energy agencies, and private-sector stakeholders (e.g., real estate companies, financial institutions, and renovation service providers)
- National EPC datasets shall contribute to the EU Building Stock Observatory (EU BSO), allowing EU-wide monitoring of building energy performance
- Real-time building energy data from smart meters, IoT sensors, and Building Automation and Control Systems (BACS) shall be integrated into EPB databases
- Instead of relying on outdated EPC assessments, building energy performance can be continuously updated based on actual energy consumption and smart system optimisations
- Strict data protection measures shall be implemented to ensure that personal data is anonymised and securely stored
- Data access shall be controlled, with clear protocols for sharing EPC and SRI data between different stakeholders (e.g., public authorities, energy companies, and research institutions)

**Topics of interest for SmarterEPC in relation to Article 16**

Key areas of adaptation to Article 16 for enabling seamless EPC data exchange with national and EU-wide databases include:

- Assurance that EPCs are stored in open, structured data formats (e.g., XML, JSON, RDF) to facilitate automated processing
- Integration of standardised EPC templates (Annex V) into tools, ensuring compatibility with national EPC/EPB platforms and the EU BSO
- Development of automated EPC update mechanisms, using real-time performance data from smart meters and IoT sensors
- The usage of AI-driven anomaly detection to flag discrepancies between expected and actual building energy performance
- Assurance that EPC data can be accessed and shared securely between different digital platforms
- EPC data exchange to enable policymakers to assess progress toward Minimum Energy Performance Standards (MEPS) and Zero-Emission Buildings (ZEB) targets
- Integration of AI-driven analytics to identify trends in renovation rates, SRI adoption, and smart building deployment.

### *3.1.5 Article 19 – Energy Performance Certificates (EPCs)*

Article 19 of EPBD IV (2024) establishes new and stricter rules for Energy Performance Certificates (EPCs), ensuring they are:

- More standardised across the EU through a harmonised A to G classification system
    - EPCs shall classify buildings into seven categories (A-G) based on their primary energy consumption (kWh/m².y)

    - A+ (optional) for Positive Energy Building (PEB) and A class reserved for Zero-Emission Building (ZEB)
    - G class shall correspond to the worst-performing 15% of buildings in each Member State, ensuring a relative benchmarking approach
- Machine-readable and interoperable, allowing integration with smart meters, IoT devices, and digital building logbooks
- Better linked to financial incentives and renovation strategies, making EPCs a real driver of deep energy renovations
    - EPCs shall be linked to financial incentives for renovations (subsidies, tax deductions)
- Mandatory for a broader set of buildings and transactions, increasing their visibility and market impact
    - Public EPC disclosure is required for large buildings, ensuring market transparency

Under article 19, Member States shall:

- Adopt a common template for EPCs (based on Annex V) and ensure EPCs include both mandatory and voluntary indicators
    - Mandatory indicators that shall be included in all EPCs
        - Annual primary and final energy consumption (kWh/m².y)
        - Operational greenhouse gas (GHG) emissions ($kgCO_2/m^2.y$)
        - Renewable energy share (%) used in the building
        - Smart Readiness Indicator (SRI) (where applicable)
        - Indoor Environmental Quality (IEQ) metrics, such as ventilation rates and air quality
    - Voluntary indicators that Member States may include:
        - Life-cycle carbon footprint (GWP)
        - Energy storage capabilities (batteries, thermal storage)
        - Connection to an efficient district heating or cooling network
        - Feasibility of adapting heating, cooling, and domestic hot water systems to lower temperature settings
        - Remaining lifespan of key building systems (heating, cooling, ventilation)
- Ensure EPB databases are fully digitalised, allowing for automated compliance checks and integration with Renovation Passports (RPs) and Smart Readiness Indicator (SRI)
    - All EPCs shall be digital, machine-readable, and stored in national databases
    - EPB databases shall support open data exchange formats (XML, JSON, RDF) for interoperability with smart meters, IoT devices, and policy monitoring platforms
    - EPCs shall be accessible to consumers, professionals, and authorities via digital portals

- Enhance the role of EPCs in policy enforcement, particularly for meeting Minimum Energy Performance Standards (MEPS) and Zero-Emission Building (ZEB) targets
    - EPCs shall be used for requiring the worst-performing buildings to upgrade

**Topics of interest for SmarterEPC in relation to Article 19**

- Tools ensuring compatibility with the new classification methodology, allowing seamless transition from national rating systems to the EU-wide standard
- Use of AI-driven EPC verification tools to detect misclassified buildings and ensure data integrity
- More detailed, data-rich performance assessments included in EPCs making automated EPC issuance and verification even more critical
- Development of real-time integration tools to ensure automated data input for EPC indicators from BACS, IoT sensors, and digital building logbooks
- Provision of automated EPC update functionalities, ensuring that real-world renovations are reflected dynamically in EPCs
- Development of AI-based EPC compliance tools to detect data anomalies or inconsistencies in performance ratings
- Development of automated MEPS compliance tracking, ensuring that buildings falling below the required energy performance levels are flagged for renovation
- Integration of AI-based financial modelling into EPC tools to recommend cost-optimal renovation paths based on EPC ratings and available funding schemes

### *3.1.6 Article 22 – Databases for the EPB*

Article 22 of EPBD IV (2024) mandates the creation and enhancement of national databases for the Energy Performance of Buildings (EPB), with the objective of improving data accessibility, standardisation, and compliance tracking. These databases serve as the centralised digital hubs for Energy Performance Certificates (EPCs), Smart Readiness Indicator (SRI), Renovation Passports (RPs), and Technical Building Systems (TBS) performance data. The EPB databases shall:

- Store all EPCs, SRI, and RPs in a structured, digital, machine-readable format
- Enable seamless data exchange between national and EU-wide platforms, particularly with the EU Building Stock Observatory (EU BSO)
- Facilitate automated real-time monitoring, compliance tracking, fraud detection, and performance verification
    - Automatic notifications shall be sent to building owners when their EPC is expiring, or their building is below MEPS requirements
- Support AI-driven analytics for policy monitoring and long-term energy efficiency assessments
    - National authorities shall be able to track progress toward Zero-Emission Building (ZEB) targets using EPB database analytics

Under article 22, Member States shall:

- Ensure that all new EPCs, SRI scores, and RPs are digitally stored and publicly accessible, where applicable
- Put in place secure data-sharing mechanisms to comply with General Data Protection Regulation (GDPR)
- Develop data analytics dashboards to visualise national energy performance trends
- Develop standardised digital formats (e.g., XML, JSON, RDF) to enable interoperability with other energy performance monitoring platforms
- Integrate the databases with real-time energy monitoring tools, smart meters, and digital building logbooks

**Topics of interest for SmarterEPC in relation to Article 22**

- Assurance of the full interoperability between EPC tools and national EPB databases, allowing real-time performance updates
- Implementation of AI-based fraud detection algorithms to identify inconsistencies or discrepancies in EPC and SRI ratings
- Integration of automated API-driven data flows to allow seamless information exchange with EU BSO and national policy platforms
- Design of user-friendly, web-based EPB databases, making building energy performance data accessible to the public
- Integration of AI-driven data visualisation tools to provide policymakers with insights on renovation trends, smart building adoption, and compliance gaps
- Development of AI-based compliance tracking tools, ensuring that buildings below MEPS thresholds are flagged for necessary renovations
- Application of machine learning models to predict renovation needs, based on historical EPC and RP data stored in the database

### *3.1.7 Articles 23 & 24 – Inspections & Reports on the inspection of heating systems, ventilation systems and air-conditioning systems*

Article 23 of EPBD IV (2024) introduces a more structured and technology-driven framework for the inspection of heating, ventilation and air-conditioning systems. The aim is to ensure that these systems operate efficiently, maintain IEQ, and align with decarbonisation objectives. The new inspection framework under Article 23 focuses on:

- Strengthening mandatory inspection requirements for heating, air conditioning, and ventilation systems
    - Buildings shall undergo regular inspections based on system size, age, and energy impact
- Encouraging digital and automated monitoring using Building Automation and Control Systems (BACS) and real-time energy performance tracking

    - BACS-enabled buildings shall demonstrate real-time efficiency adjustments in response to occupancy, climate conditions, and energy demand
- Linking inspections with EPCs, RPs, and SRI assessments and storing inspection reports in digital EPB databases
    - EPC recommendations shall include system upgrades if inspections reveal underperformance
- Aligning inspections with Minimum Energy Performance Standards (MEPS) to phase out low-efficiency fossil-fuel heating systems
    - Inspections shall assess the feasibility of phasing out fossil-fuel-based heating systems
    - Buildings below MEPS thresholds shall undergo mandatory efficiency upgrades following inspections
    - Public buildings shall meet higher efficiency standards, ensuring compliance with Zero-Emission Building (ZEB) targets

Under articles 23 & 24, Member States shall:

- Establish digitalised, automated, or remote monitoring solutions to replace manual inspections where possible
- Ensure that inspection results are integrated into EPB databases and trigger EPC updates where necessary (buildings reflecting actual operating efficiency rather than estimated performance)
- Use AI-driven diagnostics and predictive maintenance to improve system efficiency and reduce operational costs

**Topics of interest for SmarterEPC in relation to Articles 23 & 24**

- Integration of HVAC performance data into EPCs, ensuring that inspection results automatically update EPC ratings
- Incorporation of AI-driven fault detection into automated compliance tracking systems, ensuring that buildings flagged for inefficiencies receive follow-up audits
- Development of predictive analytics models to identify buildings at risk of falling below MEPS thresholds and recommend cost-optimal upgrade pathways
- Facilitation of BACS integration with EPC verification to replace manual inspections
- Implementation of data-driven inspection exemptions for buildings with high smart readiness scores
- Development of AI-driven EPC tools to auto-update certificates based on inspection results

### *3.1.8 Annexes I, IV, V & VIII*

**ANNEX I Common general framework for the calculation of the energy performance of buildings (Article 4)** establishes a standardised methodology for calculating energy performance, ensuring that EPB assessments across Member States are comparable,

transparent, and based on real-world energy performance data.

**ANNEX IV Common general framework for rating the smart readiness of buildings (Article 15)** provides a common methodology for evaluating a building's Smart Readiness Indicator (SRI), assessing automation, control, and energy flexibility capabilities

**ANNEX V Template for energy performance certificates (Article 19)** defines the mandatory EPC template, ensuring that all Member States adopt a uniform, structured, and machine-readable format.

**ANNEX VIII Requirements for renovation passports (Article 12)** defines the minimum content requirements for Renovation Passports (RPs), ensuring they act as long-term building upgrade roadmaps.

## 3.2 Recommendations for adjusting SmarterEPC's approach

Given the new provisions introduced by EPBD IV (2024) and the goals of the SmarterEPC project, the project should consider applying as technically and economically feasible the following adjustments and enhancements during its implementation and exploitation phases.

SmarterEPC project may refine its approach to **better integrate Energy Performance Certificates (EPCs) with Renovation Passports (RPs)**. A key adjustment would be ensuring that EPCs dynamically reflect staged renovations outlined in RPs, allowing for real-time updates that track incremental improvements toward Zero-Emission Building (ZEB). To achieve this, SmarterEPC should enhance the interoperability of its tools with national RP databases, ensuring that all data is stored in a standardised digital format. The introduction of AI-driven renovation roadmaps would provide building owners with a structured and financially viable pathway to renovation, linking recommended actions directly to available subsidy schemes. Furthermore, by automating the tracking of renovation stages, EPC ratings could be updated dynamically, ensuring compliance with Minimum Energy Performance Standards (MEPS). A compliance tracking module could also be developed to flag buildings that do not meet their staged renovation targets, ensuring better enforcement of policy measures.

SmarterEPC could also **improve its integration with Technical Building Systems (TBS)** by expanding EPCs to incorporate real-time data from heating, air conditioning, ventilation, and lighting systems. This would enable the use of automated fault detection and diagnostics, replacing outdated manual inspections with a smarter, data-driven approach. The project should facilitate the seamless flow of operational data from Building Automation and Control Systems (BACS) to national EPB databases, ensuring that EPC updates reflect real-world energy performance. Another important enhancement would be ensuring that EPC recommendations prioritise low-temperature heating and cooling systems, aligning with the broader goal of reducing primary energy use.

The project shall also strengthen its **focus on integrating the Smart Readiness Indicator (SRI) into EPC methodologies**. By ensuring that SRI scores are included in EPCs, SmarterEPC can provide a more holistic assessment of a building's energy performance, automation capabilities, and demand-response potential. AI-powered predictive analytics could be used to recommend smart technology upgrades that enhance a building's ability to adapt energy consumption based on real-time occupancy, external conditions, and energy price signals. The development of a dynamic scoring mechanism would ensure that a building's SRI rating evolves in response to technological upgrades and operational performance improvements.

To **comply with the revised EPC requirements**, SmarterEPC shall ensure that its tools align with the EU-wide standardised classification (A-G scale) and are capable of issuing EPCs that include mandatory performance indicators. AI-driven verification tools should be introduced to detect misclassifications and ensure data accuracy. Real-time integration with smart meters, IoT devices, and digital building logbooks should enable EPCs to reflect actual energy consumption patterns rather than relying on static, estimated values. Automated EPC issuance and verification mechanisms would enhance data reliability, ensuring that renovations and technical system upgrades are accurately documented. Additionally, integrating financial modelling tools could provide property owners with detailed cost-benefit analyses, helping them make informed decisions on energy efficiency investments.

Another critical area of improvement lies in **ensuring seamless data exchange between EPC platforms, national EPB databases, and the EU Building Stock Observatory**. SmarterEPC shall adopt open data standards such as XML, JSON, or RDF to facilitate interoperability across different platforms. The development of automated EPC update mechanisms, powered by AI-driven analysis of smart meter and IoT sensor data, would allow for continuous monitoring of building energy performance. To enhance transparency and accountability, anomaly detection algorithms should be implemented to flag discrepancies between expected and actual energy usage. Moreover, secure data-sharing protocols should be established to ensure compliance with GDPR while enabling stakeholders to access and analyze EPC data for policy assessment and market monitoring.

SmarterEPC may also **leverage automation and digital tools to modernise building inspections and reporting**. Replacing manual inspections with real-time monitoring through BACS would streamline compliance while reducing administrative burdens. Automated EPC compliance tools should be developed to integrate HVAC and TBS inspection results directly into EPC updates. Additionally, buildings with high Smart Readiness scores should be eligible for data-driven inspection exemptions, recognising the role of automation in ensuring continuous efficiency monitoring. AI-driven predictive analytics could further support this approach by identifying buildings at risk of falling below MEPS thresholds and generating cost-optimal renovation pathways. Finally, by establishing a digital reporting framework for storing inspection reports in national EPB databases, SmarterEPC would contribute to a more efficient and transparent compliance ecosystem.

By implementing these adjustments, SmarterEPC can ensure its approach aligns with the latest regulatory requirements while enhancing the practicality and market adoption of EPCs, SRI, RPs and inspection tools. The project's ability to integrate AI-driven automation, real-time performance tracking, and enhanced data interoperability will position it as a key enabler of smarter, data-driven building energy performance assessment and policy enforcement.

# 4. Conclusions

The SmarterEPC project is strategically positioned to support the modernisation of Energy Performance Certificates (EPCs) and align them with the latest provisions of the Energy Performance of Buildings Directive (EPBD IV, 2024). The evolution of the EPBD highlights a growing emphasis on digitalisation, automation, and data-driven compliance mechanisms, all of which are core elements of SmarterEPC's approach. This report has outlined the key developments in the EPBD IV and the possible adaptations for SmarterEPC to ensure seamless integration with the revised regulatory framework. Some of these suggestions may be adopted during the project implementation phase (until September 2026), while others may be considered in its exploitation phase (from October 2026 onwards). The implementation of these suggestions may also depend on the orientations adopted by the European Commission in its report on the implementation and testing of the SRI, and in its delegated and implementing acts (see Figure 1).

The introduction of Zero-Emission Building (ZEB) as the new standard for new constructions by 2030, the enhancement of EPCs with real-time data capabilities, and the integration of Renovation Passports (RPs), Smart Readiness Indicators (SRI), and Technical Building Systems (TBS) all reinforce the need for a more dynamic, data-centric building performance assessment methodology. SmarterEPC's role in bridging regulatory provisions with practical implementation is therefore crucial in facilitating compliance and supporting Member States in achieving the EU's 2050 climate neutrality targets.

A key takeaway from this report is the opportunity for SmarterEPC to refine its methodologies to better reflect the staged renovations outlined in RPs. By ensuring that EPCs dynamically update to track incremental building performance improvements, SmarterEPC can contribute to more transparent and effective renovation strategies. The integration of AI-driven financial models for renovation scenarios will further support building owners in making cost-effective investment decisions.

Another element is the improved interoperability of EPCs with real-time TBS performance data. The ability to monitor, assess, and verify building system efficiency using automated fault detection and diagnostics (AFDD) will enable SmarterEPC to replace outdated manual inspections with a smarter, data-driven approach. This will facilitate compliance tracking, ensuring that EPC ratings remain reflective of actual building performance rather than static estimations.

Moreover, the inclusion of the Smart Readiness Indicator (SRI) into EPC methodologies represents a significant advancement in building performance assessment. SmarterEPC's ability to integrate SRI scores within EPC frameworks will provide a more holistic perspective of building automation, energy flexibility, and digital readiness. AI-powered predictive analytics can further enhance this approach by identifying the most effective smart technology upgrades and their potential impacts on overall building performance.

To comply with the EPBD IV's enhanced EPC requirements, SmarterEPC shall ensure that its tools are fully aligned with the newly standardised A-G classification scale. The adoption of automated verification tools will help detect misclassified buildings and maintain data accuracy. Additionally, real-time data integration with smart meters, IoT devices, and digital building logbooks will enable EPCs to dynamically reflect actual energy consumption patterns, enhancing their reliability and market relevance.

Ensuring seamless data exchange between EPC platforms, national EPB databases, and the EU Building Stock Observatory is another critical priority. SmarterEPC should adopt open data standards such as XML, JSON, or RDF to enhance interoperability and enable automated EPC updates based on real-time performance data. Implementing AI-driven anomaly detection will further enhance transparency by flagging discrepancies between projected and actual building energy use, improving compliance monitoring.

The modernisation of building inspections is also essential. SmarterEPC should leverage automation and digital tools to replace manual inspections with real-time monitoring through Building Automation and Control Systems (BACS). By integrating HVAC and TBS inspection results directly into EPC updates, the project can streamline compliance processes while reducing administrative burdens. Additionally, buildings with high Smart Readiness scores could be granted data-driven inspection exemptions, recognising the role of automation in ensuring continuous efficiency monitoring.

By considering these strategic adaptations during its implementation and exploitation phases, SmarterEPC will ensure its continued alignment with evolving EU policies and facilitate the practical adoption of next-generation EPCs, SRI, RPs, and inspection frameworks. The project's focus on AI-driven automation, real-time performance tracking, and enhanced data interoperability will establish it as a leading enabler of smarter, data-driven building energy performance assessment and policy enforcement. These advancements will contribute significantly to achieving the EU's vision for a decarbonised, climate-neutral, energy-efficient, and resilient building sector by 2050.