SmarterEPC

D2.2 EPC and SRI current coverage and uptake policies

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Acronyms

Acronyms	Description
BACS	Building Automation and Control Systems
BaU	Business as Usual
EU BSO	European Union Building Stock Observatory
CEN	European Committee for Standardisation
CET	Clean Energy Transition
CINEA	European Climate, Infrastructure and Environment Executive Agency
DHW	Domestic Hot Water
DIF	Digital and Integrated Future
DG ENER	Directorate-General for Energy
EPB	Energy Performance of Buildings
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Certificate
GWP	Global Warming Potential
HVAC	Heating, Ventilation, and Air Conditioning
IEQ	Indoor Environmental Quality
JSON	JavaScript Object Notation
MEPS	Minimum Energy Performance Standards
PA	Policy Acceleration
QA	Quality Assurance
RP	Renovation Passport
SRI	Smart Readiness Indicator
WLC	Whole Life-Cycle Carbon
XML	Extensible Markup Language

Executive summary

This report offers a comprehensive analysis of the current implementation and coverage of Energy Performance Certificates (EPC) and the Smart Readiness Indicator (SRI) across EU Member States, highlighting significant variations in EPC uptake and outlining critical barriers such as enforcement mechanisms, data infrastructure maturity, and public awareness. It emphasises the importance of EPCs and SRI as key tools in achieving the EU's ambitious energy efficiency and decarbonisation goals under the revised Energy Performance of Buildings Directive (EPBD IV).

The study identifies that while EPC frameworks have been universally adopted, their effective implementation varies considerably, leading to inconsistent data quality, limited public accessibility, and significant gaps in coverage, particularly among existing building stock. Additionally, SRI, though promising, remains in early stages of experimentation in many Member States, demonstrating varying levels of administrative readiness and integration with existing EPC systems.

Predictive scenario analyses presented in the report clearly illustrate that maintaining the status quo (Business as Usual scenario) will not achieve the desired EU-wide coverage and effectiveness of EPC and SRI schemes. Instead, proactive policy acceleration and comprehensive digital integration are identified as crucial pathways for enhancing EPC and SRI uptake, data quality, and alignment with EPBD IV objectives.

The report begins with an **'Introduction'**, which sets the stage by providing essential background information, clearly defining the objectives, and underscoring the significance of EPCs and SRIs in the context of EU energy policy. It emphasises the role of these indicators in achieving energy efficiency, decarbonisation, and sustainable development goals.

Following the introduction, the **'Methodology'** chapter outlines the approach taken for data collection, analysis, and scenario modelling. It describes how information was gathered from multiple sources, including national databases, expert consultations, and EU-level data repositories, ensuring robust, comprehensive, and reliable results.

The **'EU-wide overview'** chapter presents a detailed assessment of the current status of EPC and SRI implementation across all Member States. It provides a comparative analysis, highlighting variations in data quality, availability, accessibility, and the maturity of the respective systems. This chapter identifies key factors influencing the effectiveness and coverage of EPC and SRI schemes at the EU level.

In the **'Current national situation'** chapter, the report offers detailed country-specific reports for Cyprus, Finland, France, Greece, Italy, the Netherlands, and Romania. Each report examines national implementation frameworks that offer valuable insights and lessons for other Member States.

The report then explores **'Future scenarios for EPC and SRI uptake'**, presenting three distinct scenarios: Business as Usual, Policy Acceleration, and Digital and Integrated Future. Each scenario projects potential trajectories for EPC and SRI implementation from 2025 to 2040, highlighting the policy actions and innovations required to enhance coverage, compliance, and impact.

Finally, the **'Conclusions and recommendations'** chapter summarises key findings and provides strategic, actionable recommendations to enhance EPC and SRI implementation. It emphasises the necessity for standardised data reporting, improved database transparency, greater interoperability, comprehensive building coverage, robust enforcement mechanisms, and continued research and innovation.

Key recommendations include:

- Improving standardisation of EPC data collection and reporting through EU-wide harmonised formats and guidelines
- Enhancing accessibility and transparency of national EPC databases, promoting anonymised data for research and policy development
- Facilitating interoperability and data sharing between national and EU-level databases to improve data quality and availability
- Achieving comprehensive EPC coverage across all building segments, including residential, commercial, and public sectors
- Strengthening enforcement and compliance mechanisms, especially concerning mandatory EPC provision at the point of sale or rental
- Supporting ongoing research and innovation, focusing on refining EPC schemes, methodologies, and data-driven policy development

Overall, the findings and recommendations provided in this report aim to support the harmonised and effective implementation of EPC and SRI schemes, ensuring their critical role in achieving a smarter, sustainable, energy-efficient and healthy European building stock.

Disclaimer and call for contributions

The data and insights presented in this report reflect the state of implementation and available information as of early 2025. Due to the dynamic nature of national and EU-level regulatory developments, it is possible that some information may be outdated or subject to change. Readers are encouraged to contact the SmarterEPC project team[1] should they notice any inaccuracies, updates, or omissions. We furthermore welcome input from stakeholders in countries not yet covered in the country-specific sections of this report. Your contributions will help ensure that future updates, such as the version foreseen for mid-2026, are as comprehensive, accurate, and actionable as possible.

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1. Introduction

This report provides a comprehensive snapshot of the current status of implementation of Energy Performance Certificates (EPCs) and the Smart Readiness Indicator (SRI) across EU Member States, as of the time of publication. It offers an overview of how both schemes are embedded in national regulatory frameworks, supported by institutional and technical infrastructures, and how much aligned with the provisions and implementation framework of the recast Energy Performance of Buildings Directive 2024 (EPBD IV)[2].

The introduction of the SRI as a complementary indicator to EPCs represents a step toward achieving smarter, more responsive, and ultimately more sustainable buildings in Europe. While EPCs have long been established and implemented across the EU, the SRI is still in its early phase, with its national testing and rollout varying significantly between Member States. EPBD IV reinforces the need for convergence by mandating stronger integration of smart readiness elements into building performance assessments, increasing the relevance of aligning EPC and SRI schemes in policy and its practical implementation and enforcement.

This report serves a dual purpose. Firstly, it captures the status quo, documenting the coverage, legal status, data infrastructure, and tools associated with EPCs and SRI in each Member State. Secondly, it takes a forward-looking perspective, employing predictive modelling to explore various scenarios for the potential future uptake of these schemes, reflecting different policy and market trajectories.

In addition to informing EU and national stakeholders, the findings of this report support the ongoing development of the SmarterEPC hub (a centralised, digital environment that will enable the streamlined issuance of EPCs and SRI assessments through shared procedures and data frameworks). The results will also contribute to the harmonisation of methodologies, training and certification pathways, and to evidence-based recommendations for EPBD IV implementation.

To enhance accessibility and usability, the content of this report will be visually displayed via the EPC Atlas[3], a user-friendly online tool, developed by the SmarterEPC team, that allows dynamic exploration of national data and implementation progress. The EPC Atlas will be periodically updated as Member States advance in their transposition and rollout of EPBD IV provisions.

An updated and expanded version of this report will be produced by June 2026, reflecting new developments in the practical implementation of national policy, lessons learned from the activities of SmarterEPC and sister projects', additional country reports, and the broader evolution of EPC and SRI practices in the EU context.

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

[3] https://www.epc-atlas.eu/

2. Methodology

The methodology underpinning this report reflects a multi-layered, evidence-based approach combining partner-provided national inputs, targeted desk research, and strategic alignment with EU policy requirements. It was designed to map the current state of Energy Performance Certificate (EPC) and Smart Readiness Indicator (SRI) implementation across EU Member States, while offering a potential outlook for future uptake and policy relevance in light of the EPBD IV.

The core of the data collection process was a structured spreadsheet developed by the EPB Center and distributed to SmarterEPC partners. This template was an outcome of the previous lessons learned in iEPB project[4], which had already gathered similar information for Austria, the Netherlands, and Spain. This inter-project cooperation ensured consistency across EU-funded efforts and helped avoid duplication while promoting convergence in the assessment of EPC and SRI implementation.

The template focused on four thematic blocks, directly aligned with EPBD IV provisions and the emerging SmarterEPC digital architecture:

- National Annexes & Datasheets (Annex I)
- National EPC reports & labels (Annex V)
- EPC databases & data models (Articles 16 & 22)
- Accredited tools & market penetration

Each block contained a mix of qualitative and quantitative fields, such as database accessibility, data formats (e.g. XML, JSON), tool accreditation procedures, and whether specific EPBD IV performance indicators were already included in national EPCs.

This structured input was complemented by in-depth desk research led by the EPB Center, which integrated key findings and figures from: EU Building Stock Observatory (BSO)[5], national EPC registries and legal databases, reports by the European Commission's DG ENER, Concerted Action EPBD[6], sectoral studies by the Buildings Performance Institute Europe (BPIE) and outputs of EU-funded sister projects of the Next Gen EPC cluster (such as QualDeEPC[7], U-CERT[8], X-tendo[9], D2EPC[10], E-DYCE[11], ePANACEA[12], EPC RECAST[13], crossCERT[14],

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[4] https://iepb-project.eu/

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

[6] https://www.ca-epbd.eu/

[7] https://qualdeepc.eu/

[8] https://u-certproject.eu/

[9] https://x-tendo.eu/

[10] https://www.d2epc.eu/en

[11] https://edyce.eu/

[12] https://epanacea.eu/

[13] https://epc-recast.eu/

[14] https://www.crosscert.eu/

EUB SuperHub[15], iBRoad2EPC[16], TIMEPAC[17], CHRONICLE[18], SmartLivingEPC[19], iEPB[20], tunES[21] and EPBD.wise[22]).

This approach aimed to validate national partner inputs and fill potential data gaps while building a pan-European picture grounded in the best available evidence.

The evaluation of the national data followed a harmonised assessment framework, developed to compare and visualise differences across Member States. This framework included dimensions such as:

- EPC coverage levels (as % of building stock)
- Public accessibility of databases and annexes
- Alignment with EPBD IV provisions
- Digital infrastructure maturity
- Quality control and enforcement mechanisms
- Integration of EPC and SRI tools or procedures
- Cross-national scope of EPC tools

Country results are compiled into comparative formats, which shall feed into the SmarterEPC EPC Atlas, a digital visualisation platform for user-friendly access to the data.

Building on both partner inputs and research insights, three predictive scenarios were constructed to estimate future EPC and SRI coverage trajectories:

- **Scenario 1 Business as Usual (BaU):** Minimal policy change; EPC/SRI uptake driven by current triggers (sale, rent, new build)
- **Scenario 2 Policy Acceleration (PA):** Full transposition and active enforcement of EPBD IV, including Minimum Energy Performance Standards (MEPS) and mandatory SRI thresholds (e.g., >290kW)
- **Scenario 3 Digital and Integrated Future (DIF):** Advanced interoperability of databases, Digital Building Logbooks, and next-gen digital EPCs/SRIs supported by user-centric platforms

Each scenario is populated with semi-quantitative variables such as renovation rates, trigger frequency, and enforcement reach. Scenarios serve to guide policy implementation recommendations and inform SmarterEPC's technical developments (e.g. integrated issuance workflows in the SmarterEPC hub).

[15] https://eubsuperhub.eu/
[16] https://ibroad2epc.eu/
[17] https://timepac.eu/
[18] https://www.chronicle-project.eu/
[19] https://www.smartlivingepc.eu/en
[20] https://iepb-project.eu/
[21] https://empirica.com/tunes/
[22] https://www.bpie.eu/epbdwise/

The methodology acknowledges several limitations:

- Data fragmentation and variability across Member States in reporting definitions, coverage metrics, and calculation methodologies
- Inconsistent public access to EPC databases or national reports
- Varying scope of transposition and enforcement of EPBD provisions (e.g. MEPS, renovation passports, digitalisation requirements)
- Absence of a centralised, up-to-date EU-wide EPC coverage dataset, despite recent improvements in the EU BSO framework

To address these, this report presents a snapshot of implementation as of early 2025, with a commitment to periodic updates, including a June 2026 version which will incorporate further SmarterEPC findings, additional Member State inputs, and improved data standardisation as the EPBD IV becomes operational at national level.

3. EU-wide overview

The EPBD stands as the central legal framework within the European Union aimed at fostering improvements in the energy efficiency of buildings. The ultimate objective of the EPBD is to achieve a completely decarbonised building stock throughout the EU by the middle of the 21st century. Recognising that buildings account for the largest share of energy consumption in Europe, addressing their energy performance is indispensable for the EU to meet its ambitious energy and climate targets. To further this aim, the EU has recently updated its legislative framework through the EPBD IV. The updated provisions of EPBD IV are designed to significantly boost the energy performance of buildings across the Union[23]. Member States are mandated to incorporate the provisions of this updated EPBD into their national laws by May 2026. Without these robustness increasing mechanisms to track and improve building energy performance, the EU's ability to meet its climate commitments would be severely hampered.

EPCs serve as a policy instrument for evaluating and communicating the energy performance of a building. By providing a clear and comparable assessment, EPCs aim to enhance transparency for building owners, potential buyers, and tenants regarding a property's energy performance. Typically, an EPC includes vital information such as the building's energy performance class, its primary and/or final energy consumption, and recommendations for cost-effective measures to improve its energy performance. Beyond simply providing information, EPCs are intended to act as a trigger for building performance improvements, particularly targeting those buildings identified as having the poorest energy performance, a key objective of the EPBD IV. The widespread availability and utilisation of EPCs are therefore crucial for driving energy efficiency improvements across the EU building stock and for monitoring progress towards decarbonisation goals. If a significant portion of buildings lack EPCs, the ability to effectively inform and motivate energy performance upgrades is diminished.

Effective implementation of the EPBD, particularly the widespread coverage of buildings with EPCs, is essential for several reasons:

- It empowers consumers to make informed decisions about the energy performance of properties they intend to occupy or purchase
- Aggregated EPC data provides valuable insights into the overall energy performance of the national building stock, allowing member states to monitor progress towards their energy efficiency targets and to evaluate the impact of relevant policies
- Comprehensive EPC coverage can support the enforcement of minimum energy performance standards and inform the development of targeted renovation strategies

[23] SmarterEPC D3.2 Adapting Smarter EPC tool to the requirements of the EPBD

Despite the significance of EPCs, the level of their implementation and coverage has varied considerably across EU Member States since their introduction. Factors such as differing national regulations, varying levels of enforcement, and the maturity of national EPC schemes have contributed to this heterogeneity.

3.1 EPC coverage

By 2020, all EU Member States had established EPC frameworks and were issuing EPCs for both residential and non-residential buildings. However, the share of building stock covered by EPCs varied widely. In countries with early and stringent EPC mandates (e.g. mandatory certification at sale or rental since the late 2000s), EPC coverage has reached a substantial portion of buildings, with some estimates suggesting over half of all dwellings had EPCs by the early 2020s. In contrast, Member States that were slower to implement or enforce EPC requirements showed very low coverage rates, in some cases only a single-digit percentage of buildings had an EPC even by the late 2010s.

On average, coverage for new buildings is high (nearly all new constructions obtain an EPC as part of compliance), but coverage for the existing building stock remains incomplete. Many countries have only 10–20% of existing buildings certified, reflecting the challenge of retroactively certifying millions of older buildings and building units. The gap between EPC coverage in residential vs. non-residential sectors also persists, a few Member States report higher certification rates in non-residential buildings (often due to public-sector lead-by-example programs), while others focus more on housing.

Overall, despite universal adoption of EPC schemes, the EU-wide snapshot[24] as of 2020 reveals uneven progress: some national markets have made EPCs nearly ubiquitous in real estate transactions, whereas others have significant ground to cover in certifying their building stock.

3.2 EPC compliance and enforcement practices

All Member States legally require EPCs to be provided when buildings are sold or rented, and the EPBD mandates that real estate advertisements include the energy performance indicator (the EPC rating). In practice, compliance rates differ markedly[25]. Reported compliance with the requirement to produce an EPC at the point of sale is relatively high, averaging about 88% for property sales across the EU. For new rentals, however, compliance is lower (around 73% on average), as enforcement in the rental sector is often weaker.

The obligation to display the EPC rating in advertisements showed the greatest variation: compliance rates ranged from as low as ~13% in some cases to nearly 100% in others. Only about one-third of Member States could even report robust data on advertisement compliance, indicating monitoring gaps.

24 https://confluence.external-share.com/content/18675/ca_epbd_v_database_2020_(public)
25 https://confluence.external-share.com/content/18675/ca_epbd_v_database_2020_(public)

Likewise, the requirement to display EPCs in public buildings (e.g. offices, schools) saw mixed enforcement. Spot checks found that in several countries only 25%–50% of inspected public buildings had the EPC visibly posted, whereas a few others achieved near-full compliance.

Most Member States have provisions for penalties (fines) if a building is sold or rented without a valid EPC, but enforcement of these penalties is inconsistent. Only a small number of countries operate a truly robust enforcement system for EPCs at point of sale. In those cases, the process often involves legal professionals (notaries or solicitors) who must verify the presence of a valid EPC before allowing the transaction to proceed. However, in many other countries, authorities rarely issue fines or systematically check EPC compliance, especially for private rentals which often occur without involvement of a notary or similar official.

In summary, by 2020 the legislative framework for EPC compliance was in place everywhere, but effective enforcement lagged in many regions, particularly for rental properties and advertisement rules. This gap suggests that while awareness of EPC obligations had risen, more work was needed on consistent enforcement and compliance monitoring across the EU.

3.3 EPC databases and public access

Central EPC databases (registries) have become gradually a cornerstone of EPC implementation in all Member States. By 2020, almost every country maintained a national or regional database for EPCs, where assessors must upload each certificate's data for it to be officially registered[26]. These databases typically store key information from the EPC (building address, energy performance metrics, recommended improvements, assessor details, etc.) and often assign a unique ID to each certificate. In many countries, uploading the EPC to the central database is mandatory for the EPC to be valid, ensuring authorities have a record of issued certificates. The data content is substantial, for example, one national EPC register contains on the order of 400 data fields per building in an open XML format, enabling interoperability with different software tools. This richness of data allows for advanced analysis but also raises privacy considerations.

When it comes to public accessibility of EPC data, approaches vary. As of the mid-2010s, only about 12 out of 28 EU countries provided some level of public access to EPC information[27]. Public access can mean different things: in some cases, open web portals allow anyone to look up an EPC by building address or download anonymised datasets; in others, only aggregated statistics (e.g. average EPC ratings by region or the distribution of ratings) are published, or access is restricted to certain users (researchers, public bodies) on

[26] https://confluence.external-share.com/content/18675/ca_epbd_v_database_2020_(public)

[27] https://www.sciencedirect.com/science/article/pii/S0378778822005722#:~:text=Building%20stock%20characteristics%20of%20residential,information%20regarding%20the%20current

request. By 2020, the trend was toward greater transparency, an increasing number of Member States were developing online platforms or open data initiatives for EPCs, often publishing anonymised, aggregated data about the building stock's energy performance in line with EU data privacy rules. For instance, some countries launched map-based portals where users can see average EPC ratings in their neighbourhood, and a few made individual certificate records (minus personal data) openly downloadable for analysis. Nonetheless, many EPC databases remained closed to the general public in 2020, citing privacy and security concerns.

In summary, data infrastructure for EPCs is in place EU-wide, but the degree of openness and user-friendliness of these databases is uneven. Progress is being made toward more accessible, machine-readable EPC data to unlock its value for market and policy uses.

3.4 EPC quality assurance and assessor qualifications

Ensuring the quality and credibility of EPCs is a priority across Member States. All countries require that certifiers (EPC assessors) are qualified independent experts. Typically, assessors must possess relevant technical education (e.g. architecture or engineering background) and/or professional credentials, and many states mandate completion of an approved training course or passing an exam to become accredited. Some countries require continuous professional development or periodic recertification for EPC assessors to maintain their license, which helps keep skills up to date.

By 2020, most Member States had an official register of qualified experts and a defined process to sanction or remove experts who do not follow the methodology or who produce poor-quality certificates. In terms of quality assurance (QA), the EPBD requires Member States to implement independent control systems that check a sample of issued EPCs for accuracy and compliance.

By the late 2010s, all Member States had some QA mechanism in operation[28]. Common practice is to conduct random audits on a percentage of EPCs, for example, a certain fraction of all certificates issued each year is selected for detailed review. Some authorities sample a fixed percentage of every assessor's work, while others randomly sample certificates across the whole pool. These audits may involve desk checks of the input data and results, or even on-site verification of the building to ensure the EPC reflects reality.

An emerging best practice is the use of digital QA tools: a few countries have introduced automated software checks that flag potential errors or inconsistencies in EPC inputs (for instance, outlier values or logical inconsistencies in the data) for further investigation.

Enforcement of quality is backed by penalty systems for assessors in case of negligence or malpractice. All Member States by 2020 had defined penalties for issuing incorrect or misleading EPCs. Minor infractions typically result in warnings or requirements to correct

[28] https://confluence.external-share.com/content/18675/ca_epbd_v_database_2020_(public)

and re-issue the certificate, often coupled with extra training for the assessor. More serious or repeated violations can lead to fines, and in several countries, suspension or revocation of the assessor's license in severe cases. This tiered penalty approach aims to uphold the credibility of EPCs.

In practice, the rigor of QA enforcement still varies, some Member States report very high rates of non-compliance being caught and corrected, while others have only minimal resources devoted to EPC auditing. Nonetheless, the overall trend is toward strengthening quality assurance and harmonising assessor qualifications EU-wide, to build trust in EPC labels. By maintaining robust qualification schemes and independent control systems, countries lay the groundwork for high-quality, reliable EPCs as envisioned in the EPBD.

3.5 Use of EPC data for policy, planning, and financing

Initially conceived as an information tool for building owners and buyers, EPCs have increasingly become a strategic data resource for policymaking and investment decisions. By 2020, around half of EU countries were actively leveraging EPC data to inform renovation programs and track energy savings.

One common practice is to require an EPC both before and after energy renovation works: this allows governments to measure the improvement in the EPC rating (or energy performance indicators) as a result of renovation, effectively quantifying energy savings achieved.

In many cases, access to public incentive programs for building renovation is tied to EPC results, for example, homeowners may need to submit a valid EPC to qualify for a retrofit grant or low-interest loan, and then demonstrate an improved rating (say, from E to C) with a post-renovation EPC to receive the full subsidy. This linkage has made EPCs a de facto monitoring tool for national renovation strategies, feeding into Long-Term Renovation Strategies (National Building Renovation Plans in EPBD IV) under the EU framework. It also incentivises owners to invest in efficiency: improving an EPC rating can unlock financial benefits.

Beyond renovation incentives, policy planners use EPC databases to map the building stock and identify priorities. Since EPC registers contain rich data on construction periods, building types, and energy systems, several countries aggregate this information to guide urban planning and climate strategies. For instance, analysis of EPC data enables mapping of low-performing building clusters (neighbourhoods with predominantly F or G-rated buildings) so that authorities can target those areas for energy efficiency programs or awareness campaigns.

Some pilot projects at the regional level have merged EPC data with other datasets (such as census data, fuel poverty indicators, or renewable energy potential) to create GIS-based tools. These tools provide a geographical visualisation of energy performance and help local governments and utilities plan more effectively.

The financial sector is also increasingly interested in EPC data. Banks and green finance initiatives have started to incorporate EPC ratings into mortgage risk assessments and "green mortgage" products, on the premise that better-rated (energy-efficient) buildings or building units have lower running costs and potentially higher value.

At the policy level, discussions were underway by 2020 for minimum energy performance standards (MEPS) that would require worst-performing buildings (often defined as EPC class G) to be renovated by certain deadlines, a concept introduced in the EPBD IV. Even prior to formal MEPS, the European Investment Bank (EIB) and Cohesion Funds showed interest in using EPCs as a proof point, for example, an EIB-backed retrofit program might require buildings to achieve a certain EPC rating post-renovation to qualify for financing.

In sum, the use of EPC data in 2020 went well beyond certification at transactions: EPCs had become a multifaceted tool supporting policy monitoring, strategic planning, and investment decisions at the EU and national levels.

3.6 EPC digitalisation and interoperability

Digitalisation of EPC systems has advanced considerably, contributing to better interoperability and user access. By 2020 most Member States had fully digital workflows for EPC issuance, assessors use certified software to calculate ratings and then upload data electronically to the central registry, with certificates often generated as PDF documents containing standardised data formats.

The EPBD III (2018) amendments spurred further digital improvements by requiring that EPCs be made available in a machine-readable form. This led several countries to upgrade their systems so that each new EPC is not only a static document but also a data file (XML or similar) that can be parsed and reused by other applications. For example, at least one country's EPC database stores certificates in an open XML schema with hundreds of data fields, enabling any compliant software to read or write EPC data and thus fostering a market of interoperable EPC tools. Such standardisation supports the creation of cross-platform tools, e.g. third-party apps for energy audit or real estate listing can pull data from EPC files rather than requiring manual re-entry. Interoperability maturity, however, varies across the EU. A number of Member States still operate older database systems or regional databases that are not interconnected, meaning data sharing between regions or with the EU level (for initiatives like the EU BSO) can be cumbersome.

By 2020, a few front-runners had also begun linking EPC databases with other building data systems, for instance, connecting building permit systems and EPC registries so that when a new building is completed it automatically receives an EPC record, or integrating EPC data with national cadastres and property databases to streamline data flows. These efforts are aligned with creating a broader digital building logbook, where an EPC is one component of a building's digital record.

Innovative uses of digital EPC data were also emerging. As highlighted by the Concerted Action EPBD, some regions have created online portals for homeowners that combine EPC information with personalised advice. One pilot "portal" provides homeowners with their EPC details, offers comparisons to average homes in the area, and even connects them with qualified experts and suppliers to implement recommended improvements. Another example integrated EPC data with interactive maps, allowing users to click on a map to see local buildings' energy performance ratings and potential savings, thereby raising public awareness and fostering competition to improve ratings.

These digital innovations demonstrate the growing interoperability and data exchange capabilities surrounding EPCs. Still, as of 2020, not all Member States had reached the same level of digital maturity, some were just beginning to offer online EPC verification tools or open APIs, whereas others already had sophisticated data analytics platforms built on EPC data.

The overall trajectory is clear: greater digitisation and interoperability to make EPC data more accessible and useful for all stakeholders, in line with EU directives pushing for open data and smart, data-driven buildings policy.

3.7 SRI across the EU Member States

Levels of readiness and implementation

By March 2025, more than half of EU's Member States are exploring the SRI, though at varying stages. About 16 countries have launched official SRI pilot/test phases at national level[29]. This group of front-runners includes a mix of large and small states (e.g. Austria, France, Italy, Poland, Portugal, among others), each trialling the common EU SRI framework in their context. Several of these pilots are supported by EU LIFE CET projects and coordinated with the European Commission's SRI Support Team. New test phases are continually being initiated, for example, Portugal kicked off its trial in late 2024, and Italy launched a 12-month test in March 2025.

At least a few countries have completed initial SRI pilot phases and are now evaluating results. For instance, Denmark and France have finalised their first official test phases (Denmark assessed ~25 buildings across various types, and France piloted SRI on 30 buildings in 2023). France's test phase was conducted by trained Energy Performance Certificate (EPC) assessors and even issued formal SRI certificates to building owners. Similarly, the Czech Republic and Finland wrapped up pilot programs and are feeding insights

[29] https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/smart-readiness-indicator_en/sri-eu-countries_en

into next steps[30]. These completed pilots serve as proof-of-concept, and follow-up projects are scaling up the number of SRI assessments to hundreds of buildings to gather more data.

A growing number of other Member States are in planning or preparatory stages for SRI implementation. Some have not yet notified an "official" test phase to the Commission but are actively involved in exploratory projects. For example, the Netherlands has not formally begun a government-run SRI pilot, but national stakeholders are participating in EU projects like easySRI, iEPB, and SmarterEPC to build capacity. Likewise, countries such as Hungary, Romania, and Luxembourg have not launched dedicated SRI schemes as of 2025, but they are keeping engaged through studies or Horizon Europe/LIFE CET project activities. In summary, roughly half of the EU-27 are actively testing SRI, while others are observing and laying groundwork, and only a few have yet to initiate any SRI-related actions.

Importantly, no Member State has made SRI fully mandatory so far, the approach is universally one of voluntary adoption and gradual rollout in line with the EPBD's optional provision. A notable emerging leader is Belgium's Flanders region, which after a preparation phase is expecting to roll out an SRI scheme from 2025 onward as a voluntary complement to its EPC system.

In general, countries are being cautious and iterative: starting with small-scale pilots, evaluating cost/benefit, and then deciding on broader national SRI schemes or integration into existing building policies.

Administrative setup for SRI schemes

Across the Member States, the administrative arrangements for SRI implementation are taking shape, usually piggybacking on existing building energy performance structures:

- **In nearly all cases, national energy agencies and/or energy and environment ministries have been designated to oversee SRI.** For example, Austria's pilot is led jointly by the Federal OIB (Institute of Construction Engineering) and the Climate Ministry, and in Belgium (Flanders) the Energy and Climate Agency (VEKA) is in charge. Similar approaches are seen elsewhere: Cyprus's test is under its Ministry of Energy. Italy's under the Ministry of Environment with technical support from ENEA. And Spain's under its Ministry for the Ecological Transition with a national research center (CENER) providing support. This indicates a clear trend of entrusting SRI administration to the same bodies responsible for EPCs or building energy policy, ensuring alignment with existing frameworks.
- **Many countries have appointed or partnered with technical organisations (research institutes, universities, or consultancies) to carry out SRI assessments and analysis during the pilot phase.** For instance, Croatia's SRI test involves the Energy Institute Hrvoje Požar as a technical partner to the Ministry. In Austria, AEE Intec and BOKU

[30] https://sriobservatory.eu/

University are conducting on-site assessments for the government. These entities often help adapt the SRI methodology to local conditions and gather feedback. Additionally, the European Commission's SRI Support Team and various EU-funded consortia are providing centralised guidance and tools, effectively acting as an extension of the administrative setup in each country.

- **Since SRI is a new domain, training programs for SRI assessors are a key part of the administrative setup.** Most pilot schemes leverage the existing network of certified EPC assessors, expanding their qualifications to include SRI. For example, France trained a group of its accredited EPC experts to perform SRI evaluations, with the support of CEREMA, and issued them formal recognition to conduct SRI audits. In Belgium (Flanders), a major focus of the test phase is defining training requirements for SRI assessors and ensuring quality control, given the intent to link SRI with the established EPC scheme. Spain is similarly using its EPC assessors: during its pilot, training sessions are turning EPC assessors into SRI experts so that SRI can be evaluated alongside energy performance. Several countries plan to develop accreditation or certification procedures if and when SRI moves beyond the pilot stage. Poland's ongoing pilot, for instance, includes developing training material and then certifying a larger pool of assessors after an initial trial on 50+ buildings. While formal SRI licenses are not yet widespread (since SRI isn't mandatory), the groundwork for an assessor accreditation framework is being laid through these training programs. In practice, this means future SRI assessors will likely be drawn from professionals already accredited for EPC or building inspections, after completing dedicated SRI courses or exams.
- **Member States are also considering how to integrate SRI processes into their digital building data systems.** A common administrative goal is to utilise or expand existing IT platforms (such as EPC databases, digital building logbooks, or e-permitting systems) to handle SRI data. Germany's pilot explicitly includes developing a digital infrastructure for SRI calculations, aiming for a simple online tool to compute SRI scores. This kind of tool can streamline assessments and potentially plug into Germany's EPC database or other registries. In Portugal, the SRI test is coordinated with the national EPBD transposition working group, and they are evaluating how SRI can align with the electronic systems used for EPCs and the new Building Automation and Control Systems (BACS) requirements. The Portuguese pilot makes use of a LIFE CET project's digital evaluation tool (adapted into Portuguese) for data collection, illustrating how IT tools developed at EU level are being deployed nationally. Several LIFE CET projects have created online calculators and e-learning platforms that countries are adopting to ensure consistency. While full integration of SRI into public databases is still in progress, these early steps show that linking SRI administration with digital infrastructure is a priority. In the future, one can expect SRI certificates and scores to be stored in national EPC databases or emerging digital building logbooks, enabling easy data exchange and monitoring.

Overall, the administrative setups for SRI remain lean and project-based during this pilot phase, relying on existing institutions, interim training/accreditation measures, and prototype digital tools. As countries move toward full implementation, these setups are expected to formalise into permanent arrangements (e.g. officially designated SRI competent authorities, accredited SRI assessor schemes, and integrated data management systems).

Integration with EPCs and other building policy instruments

Because the Smart Readiness Indicator is closely related to a building's energy and automation features, most Member States are actively exploring how to integrate SRI with existing building performance tools like EPCs, renovation passports, and digital logbooks:

- **Integration with EPCs is widely seen as a logical step to avoid duplicate inspections and leverage synergies.** Many national pilots are testing combined or parallel assessment processes. In practice, this often means when an assessor visits a building for an EPC, they could also collect data for the SRI. Countries are examining overlaps between EPC input data and SRI service criteria. For example, Italy's test phase specifically aims to explore integration of the SRI into EPCs and analyse correlations between SRI scores and EPC ratings. This will show whether smarter buildings tend to have better energy classes or if there are discrepancies, informing policy on joint certification. Greece's pilot is likewise looking at ways to introduce an SRI assessment linked to the current EPC scheme, with training materials suggesting that an SRI certificate could be issued alongside the EPC in the future. In Spain, as noted, the strategy is to train existing EPC assessors on SRI, effectively preparing the ground for a dual EPC+SRI evaluation process. Flanders (BE) has explicitly stated the goal of aligning SRI with its regional EPC system from the outset. The advantage of such integration is clear: building owners could receive an SRI rating at the same time as an EPC, providing a more comprehensive view of both energy performance and smartness. It also means data interoperability, many countries plan to store SRI results in the same databases as EPCs, making it easier to track and update SRI when an EPC is updated (for instance, after a renovation that adds smart controls). While full integration is still being piloted, the trajectory is toward treating SRI as a complementary module of the EPC framework.
- **Member States are also considering how SRI might feed into longer-term renovation planning tools.** Building Renovation Passports (RPs) and Digital Building Logbooks are emerging instruments that compile a building's performance data and recommendations over time. SRI can add value here by highlighting smart upgrade opportunities. Although this integration is mostly conceptual now in 2025 (since few countries have deployed RPs or logbooks yet), the idea is gaining traction as a best practice for the future. For instance, experts have noted that SRI results could be stored in a Digital Building Logbook to enrich the building's data repository and

inform future improvements. This means that as smart devices generate data (on energy usage, indoor climate, etc.), an SRI framework linked to a logbook could continuously update a building's smart readiness profile. Some pilot projects are starting to explore connecting SRI evaluation with digital logbook prototypes and one-stop renovation platforms. The long-term vision is that when a building owner uses a renovation passport or logbook, they would see not just energy efficiency measures but also smart readiness enhancements as recommended actions. This could be very powerful to drive holistic renovations.

As SRI integration with other tools progresses, data management practices are being designed to ensure SRI information is handled transparently. In pilots, SRI data is typically recorded in a digital format (often using Excel-based calculators or online tools provided by the SRI Support Team and the LIFE CET projects). The next step will be uploading these into central databases. Some countries (like France in its pilot) have issued SRI certificates to building owners; these certificates can eventually be made accessible similarly to EPC certificates. Public access to SRI data is not yet common, since schemes are voluntary, results are usually shared with the participant building owners and the authorities for analysis. However, looking ahead, if SRI becomes an official part of building certification, Member States may choose to publish SRI ratings (for instance, on real estate listings or open data portals, as is done for EPC ratings in some jurisdictions). Data exchange standards are also on the radar: the SRI framework defines a consistent methodology, so an SRI score from one country is comparable to another. This opens possibilities for cross-border data tools. The SRI Observatory, for example, is aggregating data on national implementations, and SmartReadiness-Training.eu provides a platform for sharing SRI assessment data and lessons learned.

Overall, integration with EPCs and digital logbooks means SRI is not being implemented in isolation; it's being woven into the broader digital ecosystem of building performance data. This integrated approach should make it easier for building owners and policymakers to use SRI information alongside energy, carbon, and renovation data to make better decisions.

EU level alignment and support

From an EU policy perspective, the rollout of SRI across Member States is happening in a coordinated and aligned manner, thanks to the framework set by the EPBD and supporting measures. The European Commission's SRI Support Team (comprising experts from the initial SRI study consortium and new projects) provides direct guidance. It has organised multiple plenary meetings and webinars where Member State representatives share pilot results and discuss challenges. The Support Team also offers technical assistance upon request, helping countries tailor the SRI calculation to national needs (within the allowed parameters).

Many countries have leveraged LIFE Clean Energy Transition projects as extensions of this support. Projects such as easySRI[31], SmartSquare[32], SRI-ENACT[33], SRI2MARKET[34], iEPB[35], SmarterEPC and tunES[36] form the SRI cluster, and they actively coordinate with national governments. These projects develop training curricula, user-friendly calculators, and stakeholder engagement strategies, which are then freely available to Member States. Through such EU-level resources, even countries in early stages (or those yet to start) have a wealth of knowledge to draw on, ensuring that when they do implement SRI, they will do so in line with the common methodology and informed by others' experiences. This pan-European alignment is further reinforced by emerging standards, notably, CEN (European Committee for Standardisation) has begun work on standard documents for SRI (as of 2025, a first CEN workshop agreement on SRI is reported), which will give countries additional confidence in the scheme's robustness.

In summary, the EU-level framework and support for SRI mean that national implementations are converging toward a harmonised approach, even as each Member State adapts timing and focus to its context. The alignment with EPBD provisions ensures no country is left behind or going off on a tangent, all are either implementing the SRI according to the EU rules or watching closely from the sidelines with the option to join later. The collective knowledge-sharing is accelerating learning curves and promoting consistency across the Union.

[31] https://www.easysri.eu/en
[32] https://www.smartsquare-project.eu/
[33] https://srienact.eu/
[34] https://sri2market.eu/
[35] https://iepb-project.eu/
[36] https://empirica.com/tunes/guidance/

4. Current situation in SmarterEPC countries

This section presents a series of structured country reports providing a detailed snapshot of the current status of EPCs implementation across the Member States covered by the SmarterEPC project. The content is based on inputs gathered from national project partners, supplemented by desk research and public documentation.

Each country report follows a consistent structure aligned with key provisions of the EPBD IV, specifically focusing on the following aspects. The aim is to offer a comprehensive yet comparable overview across Member States by examining these four core implementation areas.

National Annexes and Datasheets (EPBD IV Annex I)

This section evaluates whether a Member State has developed its national annex and associated datasheets as required under EPBD Annex I, used to adapt the common methodology to national contexts. It also clarifies the availability status (public vs. restricted), accessibility channels (e.g., online, upon request), and contact points at the relevant national authority. Additionally, it explores whether there is interest or opportunity for SmarterEPC to offer support, building on the EPB Center's prior work, to facilitate alignment with Annex I provisions.

EPC reports and labels (EPBD IV Annex V)

This section analyses the national EPC format and visual presentation for both residential and non-residential buildings, with attention to possible differences between new and existing buildings. It includes a breakdown of:

- The energy performance classification scale and thresholds applied
- The input and output data used in national EPCs
- The degree of coverage of mandatory and voluntary indicators as set out in Annex V
- Links to public sources where EPC formats and related documentation are available

Visual examples of EPC reports and energy labels for the 27 EU Member States are presented in SmarterEPC D3.4 Integration of SRI into the EPC.

National EPC databases (EPBD IV Articles 16 & 22)

This section provides an assessment of each country's EPC database infrastructure, considering, whether a central or regional database exists, the degree of interoperability with other digital building systems (e.g., cadastral registers, renovation passports), the level of public access to the database and any licensing requirements, the technical data model and file formats used (e.g., XML, JSON), and whether these are published, and the the extent of compliance with EPBD IV requirements for data availability, accessibility, and stakeholder usage.

National EPC accredited tools (SmarterEPC EPC Atlas[37])

This final section identifies the software tools commonly used in each country for EPC assessments and whether any formal accreditation mechanisms are in place. It outlines the most used calculation tools and their method types (e.g., monthly, dynamic), the existence (or absence) of a national accreditation process, the presence of any quality control mechanisms to ensure consistency in outputs, insights on market shares of tools depending on building typology and calculation method, whether any tools have a multinational scope, being accredited or used in other EU Member States.

The structure of these reports aims to support both policy benchmarking and technical harmonisation by highlighting good practices, common gaps, and areas for cross-country collaboration. These country profiles also serve as a foundation for identifying needs and opportunities to further develop the SmarterEPC platform and its supporting services.

4.1 Cyprus

National Annexes & Datasheets (EPBD IV Annex I)

As of the time of reporting, Cyprus has not formally issued national annexes and datasheets as defined under Annex I of EPBD III or the recast EPBD IV. These documents are crucial for supporting the transparent and harmonised implementation of the national calculation methodology in line with EU-wide standards. Currently, no publicly accessible documents or official templates are available that would fulfil this function in Cyprus.

Despite the absence of formal national annexes and datasheets, Cyprus has established a national calculation methodology forming the basis of its Energy Performance Certification (EPC) framework. This methodology is embedded within the officially adopted software tool iSBEMcy—a nationally customised version of the SBEM (Simplified Building Energy Model) developed to reflect the specific characteristics of the Cypriot building stock and climate conditions.

iSBEMcy serves as the operationalisation of the national methodology. It applies a monthly quasi-steady-state approach consistent with CEN EPB standards, allowing for the uniform assessment of buildings' energy performance. It is the sole validated and supported tool authorised by the Cyprus Energy Service (Ministry of Energy, Commerce and Industry)[38] for the calculation and issuance of EPCs.

The iSBEMcy implementation of the national methodology includes the following components:

- Detailed thermal envelope evaluation (U-values, surfaces, orientations)
- Incorporation of internal gains and usage schedules adapted to national building typologies

[37] SmarterEPC D2.1 Assessment of tools for the calculation of the EPC and the SRI
[38] https://www.energy.gov.cy/en/

- Modelling of technical systems (heating, cooling, ventilation, hot water, and lighting)
- Consideration of energy carrier types, including renewable energy technologies
- Use of national primary energy factors and CO_2 emission coefficients

iSBEMcy also integrates regulatory thresholds for minimum energy performance requirements, which vary by building type and year of construction. The output of the methodology includes:

- Primary energy demand (kWh/m²/year)
- CO_2 emissions ($kgCO_2/m^2$/year)
- Energy performance class (A–G)
- A set of recommendations for performance improvement

The tool thus not only facilitates EPC issuance but also acts as a regulatory compliance checker. The methodology is accessible to all certified assessors, and the software is made available free of charge by the Ministry via the official energy performance portal[39].

While the calculation method is well established, the absence of official national datasheets and annexes limits the ability to align transparently with Annex I of the EPBD.

National EPC reports and labels (EPBD IV Annex V)

Cyprus has a standardised EPC format applicable across residential and non-residential buildings. The EPC reports are generated exclusively through the iSBEMcy software tool, following the national calculation methodology. The output is a structured, multi-page certificate that includes energy performance results, emissions indicators, and recommendations for improving the building's performance. The format and structure of the EPC are aligned with the requirements of both the national legislation and the overarching framework of the EPBD.

The energy performance class in Cyprus ranges from A to G, and is based on the Primary Energy Use Index (kWh/m²/year) calculated using iSBEMcy. The following ranges (reference building[40]) apply:

- A ≤ 0.50
- B+ 0.51 – 0.75
- B 0.76 – 1.00
- C 1.01 – 1.50
- D 1.51 – 2.00
- E 2.01 – 2.50

[39] https://energy.gov.cy/λογισμικό-isbemcy.html
[40] The reference building represents a theoretical building of the same geometry, use, and location as the assessed one, but designed to meet the minimum energy performance requirements (i.e. the regulatory requirements in force). The calculated primary energy use of the actual building is then compared to this reference building, resulting in a ratio that places it in one of the performance classes. For example, a building that consumes half as much primary energy as the reference building will be rated as Class A (≤ 0.50), whereas one consuming more than triple the reference will fall into Class G (> 3.00).

- F 2.51 – 3.00
- G > 3.00

In addition, the EPC includes a separate carbon emissions indicator, which is expressed in $kgCO_2/m^2/year$ and displayed on a colour-coded scale, from 0 $kgCO_2/m^2/year$ (very environmentally friendly) up to >120 $kgCO_2/m^2/year$ (not environmentally friendly). The specific numerical CO_2 value is always included on the EPC to reflect the environmental impact of the building's operational energy use.

The iSBEMcy-generated EPCs are based on detailed data inputs, including:

- Building geometry (dimensions, surfaces, orientation)
- Thermal characteristics of building envelope (U-values)
- Technical systems (heating, cooling, ventilation, DHW, lighting)
- Energy carriers and renewables (PV, solar thermal, biomass, etc.)
- Occupancy and operational schedules (per building type)

The main outputs presented in the EPC are:

- Primary energy consumption ($kWh/m^2/year$)
- CO_2 emissions ($kgCO_2/m^2/year$)
- Energy performance class (A–G)
- Recommended measures for energy performance improvement
- Building identification data and validity of the certificate

According to the official Energy Service[41], EPCs in Cyprus can only be issued by qualified professionals officially registered as Energy Performance Experts. These experts must hold a recognised diploma or university degree in engineering or architecture and must complete specialised training provided by accredited educational institutions.

The qualification process includes both theoretical and practical training in building energy performance assessment and the use of the iSBEMcy software. Upon successful completion of training, candidates are required to pass an examination administered by the Energy Service to receive certification.

Only certified experts listed in the national register[42] [43] are authorised to issue EPCs. The Energy Service regularly audits the performance of certified assessors and reserves the right to suspend or revoke licenses in case of non-compliance. This system ensures the technical rigour and quality of the EPC process.

The recast EPBD IV introduces a comprehensive list of mandatory and voluntary indicators that must or may be included in EPCs. Cyprus's current EPC system addresses most of the mandatory indicators but has yet to adopt the full set of voluntary indicators.

[41] https://www.energy.gov.cy/en/sections/70
[42] https://energy.gov.cy/en/secondary-menu/2143/useful-information-for-eu-citizens/overview-epc.html
[43] https://epc.meci.gov.cy/

Mandatory indicators covered

The following mandatory indicators, as stipulated by EPBD IV Annex V, are currently included in EPCs issued via the iSBEMcy tool:

- Energy performance class
- Calculated annual primary energy use in kWh/(m^2·y)
- Calculated annual final energy use in kWh/(m^2·y)
- Renewable energy produced on-site in % of energy use
- Operational GHG emissions (kgCO_2/(m^2·y))
- Calculated annual primary and final energy consumption (kWh or MWh)
- Renewable energy production (kWh or MWh), including energy carrier and type
- Calculated energy needs (heating, cooling, DHW) in kWh/(m^2·y)
- Yes/no indicator: building can react to external signals (partially indicated)
- Yes/no: ability to operate at efficient temperature levels (partially indicated)

Mandatory indicators not covered

These elements are required under EPBD IV but are currently not yet included in the Cypriot EPC system:

- Contact information for a one-stop shop for renovation advice
- Life-cycle Global Warming Potential (GWP)

Voluntary indicators not yet covered

These optional indicators can enhance the value and usability of EPCs but are not yet present in Cyprus's implementation:

- Greenhouse gas emission class
- Renovation passport status
- Average U-values of opaque and transparent elements (as discrete values)
- Results of overheating risk analysis
- Presence of indoor environmental quality (IEQ) sensors and responsive controls
- Availability and characteristics of EV charging infrastructure
- Type and capacity of energy storage systems
- Estimated remaining lifespan of major building systems
- Demand-side flexibility of HVAC and DHW systems
- Metered energy consumption data
- Connection to district heating/cooling networks and associated carbon factors
- Operational PM2.5 emissions
- Presence of a Smart Readiness Indicator or Digital Building Logbook link

Overall, while Cyprus covers the core mandatory components of Annex V, the voluntary indicators and advanced digital integrations (e.g., smart readiness, DBL) remain areas for future development, particularly as part of the EPBD IV transposition process.

National EPC database (EPBD IV Articles 16 & 22)

Cyprus has a centralised digital system for the management of Energy Performance Certificates (EPCs), maintained by the Energy Service of the Ministry of Energy, Commerce and Industry[44]. This system is accessible via the dedicated national platform[45], which serves multiple functions including the issuance, validation, storage, and oversight of EPCs, as well as the registration of certified assessors.

The EPC database operates at the national level, ensuring a unified and consistent structure across the country. It collects all EPC-related data issued through the iSBEMcy software and stores it in a structured, digital format. This centralised model allows the Energy Service to perform monitoring, statistical reporting, and compliance checks effectively. The system is also designed to enable partial interoperability with other public databases such as the building cadastre, although full technical integration is still in development.

Access to the database is regulated:

- Certified energy assessors use the system to submit, review, and finalise EPCs
- Public authorities may access statistical and anonymised datasets for energy planning and policy monitoring
- The general public can verify the authenticity of EPCs and find certified professionals through the same portal

Although publicly available documentation on the underlying data model remains limited, the platform supports structured data input, likely in XML or database-compatible formats as used within the iSBEMcy tool. The digital system is consistent with the secure data handling practices mandated under GDPR and EU cybersecurity standards.

Cyprus demonstrates partial to good alignment with the requirements of Articles 16 and 22 of the EPBD IV.

Article 16

- The EPC database provides access to building energy performance data, including to building owners, tenants, and managers without extra charges
- Public authorities and research institutions may access aggregated data for policy analysis
- The system is structured to support future interoperability with digital logbooks and building renovation tools

Article 22

- The EPC database serves as the national platform for EPC registration
- It enables the reporting of aggregated EPC statistics

[44] https://www.energy.gov.cy/en/sections/70
[45] https://epc.meci.gov.cy/

- It ensures the availability of anonymised data for energy planning by public authorities

However, it does not yet include renovation passports, Smart Readiness Indicators, or life-cycle Global Warming Potential (GWP) data, which will be required under future EPBD implementation stages.

In conclusion, Cyprus has implemented a centralised, functional EPC database that fulfils key provisions of EPBD IV Articles 16 and 22, with room for further enhancement in areas related to interoperability, data openness, and coverage of emerging indicators.

National EPC accredited tools (SmarterEPC EPC Atlas)

In Cyprus, the national EPC framework is built around a single officially accredited software tool: iSBEMcy[46], which is a national adaptation of the UK's Simplified Building Energy Model (SBEM). This tool is provided and maintained by the Energy Service of the Ministry of Energy, Commerce and Industry, and is made available free of charge through the Ministry's official website. It is the only validated and authorised tool for the calculation and issuance of Energy Performance Certificates (EPCs) in the country.

The iSBEMcy tool incorporates the national calculation methodology aligned with the CEN EPB standards. It supports energy modelling for both residential and non-residential buildings and is used for verifying compliance with minimum energy performance requirements as well as for assigning the correct EPC rating. The tool is subject to periodic updates to ensure alignment with evolving national regulations and EPBD provisions.

The accreditation process for energy performance software tools in Cyprus is overseen by the Energy Service. While only iSBEMcy is currently accredited, the Ministry allows for the possibility of evaluating and approving alternative tools upon request, provided they demonstrate full compatibility with the national methodology and regulatory framework.

To maintain quality assurance, the Energy Service periodically reviews software outputs and may conduct audits of EPCs issued. Additionally, all assessors must use the tool in accordance with the official guidelines, and their activities are monitored as part of the national certification and inspection process.

As iSBEMcy is the only tool officially approved for EPC issuance, it holds a 100% market share in Cyprus. No other tools, whether national or international, are currently authorised for this purpose. Consequently, there is no known use of EPC tools in Cyprus that are accredited in more than one EU Member State.

In summary, the national approach to EPC software tools in Cyprus is centralised and standardised around iSBEMcy, ensuring consistency and regulatory compliance while limiting diversity in the tool ecosystem. The option for future accreditation of additional tools remains open but has not yet been exercised.

[46] https://energy.gov.cy/λογισμικό-isbemcy.html

4.2 Finland

National Annexes & Datasheets (EPBD IV Annex I)

Finland has comprehensive information and detailed guidelines governing the calculation and issuance of Energy Performance Certificates (EPCs). The primary authority responsible for EPC implementation and oversight is the Ministry of the Environment[47], supported extensively by Motiva Oy[48], a national sustainable development company specialising in energy efficiency.

The cornerstone of Finland's EPC system is the national Energy Performance Certificates Act (50/2013, with subsequent amendments), which explicitly transposes the requirements of the EPBD into national legislation. The full legislative text is publicly available via the official Finnish legal portal[49].

The Act details the following essential elements:

- Scope and applicability: Defines clearly which buildings are required to have EPCs (e.g., residential, commercial, public), including clear exemptions and transition rules
- Certification process: Specifies procedures for EPC issuance, validity periods (10 years), and cases when new EPCs are required
- Responsibilities: Outlines the obligations of building owners, property managers, and EPC certifiers regarding EPC issuance and compliance

Finland provides extensive practical support through detailed EPC calculation guidelines, aligning with European and national calculation standards (CEN/ISO standards). Motiva maintains a dedicated webpage offering authoritative documentation for certifiers[50].

These guidelines comprehensively cover:

- Methodologies: Two main calculation methods are recognised—monthly calculation (simplified method) and dynamic simulation (detailed hourly calculation). The choice between these methods depends on building complexity and certifier preferences
- Building types covered: Separate instructions are provided for residential buildings (single-family houses, apartment blocks), commercial buildings, public buildings, and specialised facilities
- Primary energy conversion factors: The document specifies standard national primary energy factors for various energy carriers (electricity, district heating, fossil fuels, and renewables), ensuring consistency across EPCs
- U-values and thermal performance parameters: Detailed reference values and calculation methods for walls, roofs, floors, windows, and other building elements

[47] https://ym.fi/en/front-page
[48] https://www.motiva.fi/en
[49] https://www.finlex.fi/fi/lainsaadanto/2013/50
[50] https://www.motiva.fi/ratkaisut/energiatodistusneuvonta/energiatodistusten_laatijat/energiatodistusten_laskentaohjeet_2018

- Technical building systems: Guidance on evaluating and inputting data for HVAC, lighting, domestic hot water, renewable energy systems, and associated controls into EPC calculations
- Renewable energy integration: Clear instructions on how renewables (solar PV, solar thermal, heat pumps, biomass heating) are accounted for within EPC calculations
- Renovation measures and improvement recommendations: Certifiers are given explicit advice on formulating and presenting actionable recommendations for building owners within EPC reports

Motiva further ensures transparency and accessibility by providing easily understandable materials targeted towards building owners, tenants, real estate professionals, and the general public. These resources explain the EPC concept, its importance, and how to interpret EPC labels:

- How to read and understand an EPC: A step-by-step guide explaining EPC content, ratings (A-G), the meaning of various indicators, and practical implications for owners and tenants[51]
- Frequently Asked Questions (FAQs) on EPCs: Provides clear answers addressing common public inquiries, such as EPC validity, situations where EPCs are required, cost implications, and certifier contact points[52]

All mentioned resources, including the legislative framework, calculation guidelines, user guides, and FAQs, are fully publicly accessible online without restriction. They are actively promoted by the Finnish energy authorities and Motiva through regular information campaigns, training seminars, and outreach activities.

The comprehensive availability of these resources supports Finland's effective implementation of EPBD Annex I requirements, ensuring that both EPC certifiers and building stakeholders can consistently apply standardised methodologies and have clear, actionable information readily available. Despite having extensive supporting documentation and guidelines, Finland has not explicitly developed or officially submitted formal National Annexes or Datasheets as specifically stipulated in Annex I of EPBD III and the subsequent EPBD IV. This indicates a gap in fully formalising national EPC specifications in alignment with the exact format and template requirements defined by the EPBD directives, presenting a potential area for further alignment and improvement.

National EPC reports and labels (EPBD IV Annex V)

In Finland, Energy Performance Certificates (EPCs) follow a detailed, standardised multi-page format. Each EPC provides:

- Building identification details (address, building type, construction year, floor area, use category)

51 https://www.motiva.fi/ratkaisut/energiatodistusneuvonta/mika_on_energiatodistus/nain_luet_energiatodistusta

52 https://www.motiva.fi/ratkaisut/energiatodistusneuvonta/usein_kysyttya_energiatodistuksista

- An energy efficiency class clearly indicated (A–G scale)
- Primary energy consumption data (calculated)
- Detailed technical information about building envelope, systems, renewable energy installations
- Tailored recommendations for potential energy efficiency improvements
- EPC assessor's contact information for further advice

Finnish EPCs classify energy performance clearly from Class A (most efficient) to Class G (least efficient), based on calculated primary energy use (kWhE/m²/year). Specific thresholds vary according to building types:

Small residential buildings (detached and semi-detached houses, heated net area Anet): single-family house, two-family house, building that is part of a terraced house and other detached small house.

- 50–150 m²
  - A ≤110 - 0.2 × Anet
  - B 110 - 0.2 × Anet – 215 - 0.6 × Anet
  - C 215 - 0.6 × Anet – 252 - 0.6 × Anet
  - D 252 - 0.6 × Anet – 332 - 0.6 × Anet
  - E 332 - 0.6 × Anet – 462 - 0.6 × Anet
  - F 462 - 0.6 × Anet – 532 - 0.6 × Anet
  - G >532 - 0.6 × Anet
- 150–600 m²
  - A ≤83 - 0.02 × Anet
  - B 83 - 0.02 × Anet – 131 - 0.04 × Anet
  - C 131 - 0.04 × Anet – 173 - 0.07 × Anet
  - D 173 - 0.07 × Anet – 253 - 0.07 × Anet
  - E 253 - 0.07 × Anet – 383 - 0.07 × Anet
  - F 383 - 0.07 × Anet – 453 - 0.07 × Anet
  - G >453 - 0.07 × Anet
- >600 m²
  - A ≤ 71
  - B 71 – 106
  - C 107 – 130
  - D 131 – 210
  - E 211 – 340
  - F 341 – 410
  - G > 411

Terraced houses and 2-story apartment buildings

- A ≤ 80
- B 81 – 110
- C 111 – 150
- D 151 – 210
- E 211 – 340
- F 341 – 410
- G > 410

Apartment buildings (≥3 floors)

- A ≤ 75
- B 76 – 100
- C 101 – 130
- D 131 – 160
- E 161 – 190
- F 191 – 240
- G > 240

Office buildings: offices & health centre.

- A ≤ 80
- B 81 – 120
- C 121 – 170
- D 171 – 200
- E 201 – 240
- F 241 – 300
- G > 300

Commercial buildings: department store, shopping center, retail building (excluding grocery stores under 2000 m²), retail hall, theater, opera, concert, and conference hall, cinema, library, archive, museum, art gallery, exhibition hall.

- A ≤ 90
- B 91 – 170
- C 171 – 240
- D 241 – 280
- E 281 – 340
- F 341 – 390
- G > 390

Accommodation buildings: hotel, dormitory, service house, elderly home, care facility.

- A ≤ 90
- B 91 – 170
- C 171 – 240

- D 241 – 280
- E 281 – 340
- F 341 – 450
- G > 450

Educational buildings and daycare centres

- A ≤ 90
- B 91 – 130
- C 131 – 170
- D 171 – 230
- E 231 – 300
- F 301 – 360
- G > 360

Sports halls (excluding swimming pools and ice rinks)

- A ≤ 90
- B 91 – 130
- C 131 – 170
- D 171 – 190
- E 191 – 240
- F 241 – 280
- G > 280

Hospitals

- A ≤ 150
- B 151 – 350
- C 351 – 450
- D 451 – 550
- E 551 – 650
- F 651 – 800
- G > 800

Other buildings: warehouses, transport buildings, swimming pools, ice rinks, small grocery stores.

- A ≤ 90
- B 91 – 130
- C 131 – 170
- D 171 – 190
- E 191 – 240
- F 241 – 280
- G > 280

The calculation of EPC ratings in Finland involves a comprehensive set of input data reflecting building-specific characteristics and energy system features. The output data presented in each EPC offers detailed insights into the building's current energy performance and potential improvement measures. These inputs and outputs provide critical information to stakeholders, enabling informed decisions regarding energy efficiency upgrades.

EPC inputs

- Building envelope details: insulation type, thickness, thermal bridging, airtightness, U-values for walls, roofs, floors, windows, and doors
- HVAC systems: type, efficiency, control mechanisms, seasonal performance factors for heating, cooling, ventilation, and domestic hot water systems
- Renewable energy systems: specifications for solar photovoltaic (PV), solar thermal, heat pumps, biomass boilers, etc.
- Lighting systems: installed lighting power density, controls, and automation features
- Occupancy and internal load profiles: occupancy schedules, appliance loads, and internal heat gains (for non-residential buildings)

EPC outputs

- Annual primary energy consumption (kWhE/m²/year)
- Annual final energy use (kWh/m²/year) by energy source and end-use
- Specific energy efficiency class (A–G)
- Estimated renewable energy contribution to overall energy consumption
- Potential energy savings and energy class improvements achievable via recommended measures

In Finland, EPC assessors must undergo formal certification as per the national regulations outlined in the Energy Performance Certificates Act (50/2013). To obtain the qualification for issuing EPCs, the assessors are required to:

- Have a suitable degree or equivalent work experience and successfully pass a certification examination administered by authorised organisations
- While participation in an approved training course is not mandatory, it can significantly help candidates prepare for the certification examination by covering EPC methodologies, calculation standards, and relevant regulations
- Successfully pass a certification examination administered by authorised organisations
- Register officially with the Ministry of the Environment or designated competent authority
- Participate in regular professional development or refresher courses to maintain certification status

There are two qualification levels: basic and higher. The higher-level qualification is required when the EPC is prepared for a building or part of a building that includes cooling systems or when a dynamic calculation method is used. The qualification is valid for a maximum of seven years, after which renewal or re-certification is required. This ensures a high professional standard and consistency in the issuance of EPCs across Finland.

The revised EPBD IV's Annex V introduces a comprehensive and harmonised set of mandatory and voluntary indicators to be reflected in national EPC schemes. These indicators are designed to improve the reliability, comparability, and usefulness of EPCs across the EU, encompassing not only energy consumption data but also broader aspects such as renewable energy use, indoor environmental quality, and smart readiness. The Finnish EPC system has been assessed against this Annex to identify which indicators are already implemented, which are partially addressed, and which are currently missing. The summary below provides a structured overview distinguishing between mandatory and voluntary indicators.

Mandatory indicators fully covered

- Energy performance class
- Calculated annual primary energy use (kWh/m²/year)
- Calculated annual primary and final energy consumption
- Renewable energy production (kWh or MWh)
- Main energy carrier
- Type of renewable energy source
- Calculated energy need (kWh/m²/year)
- Contact information for renovation advice

Mandatory indicators missing or insufficiently covered

- Calculated annual final energy use (kWh/m²/year) explicitly indicated on the EPC
- Renewable energy produced on-site as percentage of total energy use
- Annual operational greenhouse gas emissions (kgCO2/(m².year))
- Whole life-cycle carbon emissions (Global Warming Potential, GWP)
- Capacity to react to external signals and adjust energy consumption
- Capability of heat distribution system to operate at low/efficient temperatures

Voluntary indicators covered

- Energy use for building technical systems
- Main energy carriers for heating, cooling, domestic hot water, ventilation
- Average U-values for opaque and transparent elements
- Metered energy consumption
- Connection to district heating and cooling networks

Voluntary indicators missing or insufficiently covered

- Peak load
- Size of generator or system
- In-built lighting
- Overheating risk analysis results
- Fixed sensors for indoor environmental quality
- Controls responding to indoor environmental quality

- Electric vehicle charging points
- Energy storage systems
- Smart readiness assessment
- Digital building logbook availability

Motiva ensures transparency and accessibility by providing easily understandable materials targeted towards building owners, tenants, real estate professionals, and the general public. These resources explain the EPC concept, its importance, and how to interpret EPC labels:

- How to read and understand an EPC: A step-by-step guide explaining EPC content, ratings (A-G), the meaning of various indicators, and practical implications for owners and tenants[53]
- Frequently Asked Questions (FAQs) on EPCs: Provides clear answers addressing common public inquiries, such as EPC validity, situations where EPCs are required, cost implications, and certifier contact points[54]

National EPC database (EPBD IV Articles 16 & 22)

Finland's national EPC database, the Energiatodistusrekisteri (Energy Certificate Register), has been operational since 1 May 2015 and is managed by the Finnish Ministry of the Environment. It serves as the central platform for the issuance, validation, and oversight of all Energy Performance Certificates (EPCs) in Finland. As of January 2025, the database contains 291,748 EPCs. The registry is accessible to the public[55], allowing basic searches of EPCs using either the certificate ID or the property address.

Summary data is provided free of charge and includes energy class, certificate date and expiry, certifier name and qualification level, basic building and location details. Users can also search for qualified EPC issuers/certifiers by name or location and filter results by qualification level. For each certifier, contact information such as address, email, phone number, and website are available.

Additionally, the platform offers comparative statistics based on certificate versions (2013 and 2018), energy class distributions, and building types. Notably, the database excludes EPCs for 1–2 apartment properties (detached and semi-detached houses) from public access due to data protection rules.

The data model used for EPC uploads and storage is XML-based and structured to reflect Finnish national EPC calculation and documentation rules. The model is available publicly[56]. The use of the .xml file format ensures data is machine-readable and allows for batch uploads and validation of EPCs within a standardised digital environment. The data model includes:

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53 https://www.motiva.fi/ratkaisut/energiatodistusneuvonta/mika_on_energiatodistus/nain_luet_energiatodistusta

54 https://www.motiva.fi/ratkaisut/energiatodistusneuvonta/usein_kysyttya_energiatodistuksista

55 www.energiatodistusrekisteri.fi

56 https://www.energiatodistusrekisteri.fi/energiatodistusrekisterin-aineistopalvelu

- Building typology and geometry
- Energy performance indicators (calculated primary and final energy use)
- Details of heating, cooling, ventilation, DHW, and lighting systems
- Issuer metadata and performance recommendations

Organisations can access the EPC database in one of three ways, all subject to data licenses issued by ARA (The Housing Finance and Development Centre of Finland).

Energy Certificate Register Data Service

- Offers broad access to EPC data through a secure interface
- Requires a formal license and processing agreement
- Intended for institutions authorised to handle personal data
- Charged according to ARA's pricing policy

Energy Certificate Register Interface Service (Suomi.fi gateway)

- Allows retrieval of individual EPCs through a secure digital identity portal
- Requires a license, a separate contract, and a designated access server
- Also limited to organisations authorised to process personal data

Case-by-case data requests

- ARA can respond to direct data inquiries and charges by hourly rates

Currently, only EPC summaries are freely available online. Full EPC content access is not provided unless through the licensed interfaces, which diverges from EPBD IV Article 22's principle of making full EPCs available at no cost to defined stakeholders.

The Energiatodistusrekisteri aligns with the operational aspects of EPBD IV Article 16. It ensures EPCs are collected, validated, and stored in a central register, which supports certificate verification and oversight. However, the affordability and proportionality of access costs for certain users (e.g., research institutions or energy agencies) remain a point of consideration. The current setup however, does not fully comply with EPBD IV Article 22. Only EPC summaries are freely available. Full EPCs require subscriptions or formal agreements, which contradicts the article's provision for stakeholder access without cost. There is no known linkage or interoperability between the EPC database and other relevant national databases (e.g., cadastre, permitting, renovation passports). No free access to full data for stakeholders such as financial institutions, public authorities, or grid operators, as envisioned in Article 22.

National EPC accredited tools (SmarterEPC EPC Atlas)

Finland does not operate a formal national accreditation scheme for EPC software tools. As such, there are no officially accredited EPC tools listed or endorsed by the Finnish Ministry of the Environment or Motiva, the national energy agency responsible for guidance and capacity-building. Instead, EPC assessors are expected to adhere strictly to the official EPC calculation guidelines, the most recent of which are the 2018 EPC calculation instructions, made publicly available by Motiva. These guidelines include all calculation procedures and assumptions for both residential and non-residential buildings and allow assessors to select any calculation tool that complies with the national methodology. The absence of an accreditation list means that a variety of commercial, proprietary, and in-house tools are used across the market, each applied according to the building typology and complexity of the project.

The following overview reflects the most widely used tools, their scope, and the level of market penetration, as reported by Finnish partners and confirmed through desk research and Motiva documentation.

- **IDA ICE** (by EQUA Simulation)[57]: dynamic simulation tool; commonly used for complex and non-residential buildings, especially those requiring detailed modelling (e.g., office buildings, schools, hospitals); allows hourly-based simulations that capture building physics, internal loads, and HVAC system behaviour in depth.
- **Riuska** (developed by Granlund Oy, based on AutoCAD platform)[58]: dynamic simulation, integrated with CAD-based design tools; used primarily by engineering and architecture firms for building performance simulations in new and existing buildings.
- **Lamitor**[59]: monthly method and dynamic calculation; offers a user-friendly platform for a wide range of building types; commonly used by EPC assessors in residential sectors.
- **Laskentapalvelut**[60]: monthly calculation approach; a specialised online platform tailored for EPC assessments; primarily used for small residential buildings.
- **Excel-based tools**: manual input based on national methodologies; frequently developed and used in-house by smaller engineering firms for specific use cases, particularly when working on familiar building typologies or replicable designs; most suitable for monthly method calculations of detached houses and small-scale residential buildings.

There is currently no formal accreditation process for EPC software tools in Finland. The responsibility for ensuring compliance with the official methodology rests entirely with the certified EPC assessor. Motiva and the Ministry of the Environment do not evaluate or approve software. The EPC calculation methodology must be followed as published, and any tool that delivers outputs consistent with this methodology may be used.

There is no tool-specific quality control process in place in Finland. However, quality assurance and compliance is enforced through:

- Mandated adherence to official EPC calculation guidelines (2013 and 2018 versions)
- Optional training and mandatory certification for EPC assessors
- Responsibility of certified EPC assessors to ensure methodological correctness

[57] https://www.equa.se/en/ida-ice
[58] https://www.magicad.com/fi/sovellukset/magicad-comfort-energy/
[59] https://www.lamitor.fi/
[60] https://www.laskentapalvelut.fi/index_for_JRF.php

- Oversight through the Energiatodistusrekisteri and occasional audits (spot checks and audits of EPCs entered into the national EPC register)
- Systematic validation checks built into the database platform (e.g., error messages if entries fall outside plausible ranges)

This decentralised approach allows flexibility and encourages innovation, but it can also introduce inconsistencies in outputs if tools are not properly maintained or if assessors do not regularly update their methods.

Dynamic simulation tools (IDA ICE, Riuska) dominate the non-residential and complex building segment. Monthly and Excel-based tools are prevalent in single-family houses and smaller residential projects, where calculation simplicity and speed are critical. Lamitor and Laskentapalvelut serve a broad range of users thanks to their web-based interfaces and modularity. Exact market shares are not publicly available, but partner insights suggest:

- Excel-based tools dominate monthly method calculations (~60–70% of residential cases)
- IDA ICE and Riuska are most common in the dynamic calculation segment

None of the tools currently used in Finland are formally recognised as “accredited” in multiple EU Member States. However, IDA ICE is widely used in other Nordic and Central European countries for dynamic simulations and energy compliance, while Riuska and Lamitor have limited market presence beyond Finland.

Finland’s flexible approach to EPC software tool usage offers accessibility and adaptability, especially for smaller firms and varied building types. However, the lack of a formal accreditation and quality assurance process for tools introduces a risk of methodological divergence.

4.3 France

National Annexes & Datasheets (EPBD IV Annex I)

France has developed a comprehensive set of technical documents and regulatory frameworks that support the implementation of its national EPC scheme *(DPE – Diagnostic de Performance Énergétique)*. These include detailed methodological texts aligned with the objectives of Annex I of the EPBD.

However, while France has published a fully consolidated technical methodology describing the national calculation procedures for energy performance, it has not yet formally submitted a National Annex or Datasheets in the structured format outlined in EPBD Annex I. This means that although the content is functionally equivalent and publicly available, it does not yet constitute an “officially formatted” national annex submission under the EPBD framework.

The methodological and regulatory documents that underpin the DPE in France are fully public and accessible via government-hosted websites. This ensures transparency and facilitates widespread use and reference by energy experts, software developers, and other stakeholders.

- DPE notice, a public guide[61]: offers an overview of the DPE methodology and objectives
- Standardised DPE models[62]: templates and forms for various types of buildings (residential/non-residential, existing/new)
- Consolidated Annex 1 to the *Arrêté* of 31 March 2021[63]: provides the full national methodology and procedural requirements for energy performance assessment

This last document, Annex 1 to the *Arrêté* of 31 March 2021, constitutes the authoritative reference for the national calculation methodology (*méthode 3CL-DPE 2021*). It includes all procedural aspects related to the definition of indicators, the use of calculation coefficients, climatic zoning, system typologies, and energy carriers. Nevertheless, despite the completeness and availability of this document, it does not formally constitute a submission of the National Annex and Datasheets as defined by the structure in EPBD Annex I. The information is equivalent in scope but not organised or published in the harmonised annex/datasheet format foreseen for EU comparability.

The competent authority for the development, implementation, and oversight of the DPE methodology in France is the *Ministère de la Transition Écologique et de la Cohésion des Territoires, Direction de l'Habitat, de l'Urbanisme et des Paysages (DHUP)*[64].

Technical oversight and methodology development is delegated to the *Centre Scientifique et Technique du Bâtiment (CSTB)*[65]. Inquiries can also be directed through the ADEME-supported *Observatoire DPE & Audit*[66].

National EPC reports and labels (EPBD IV Annex V)

France's Energy Performance Certificate has undergone several evolutions, with the most recent format updated in July 2021. The goal of the redesign was to enhance clarity, usability, and legal reliability. The DPE is mandatory for both residential and non-residential buildings and must be presented at points of sale, rental, or new construction. Each DPE includes:

- A summary page with dual indicators: primary energy consumption and greenhouse gas (GHG) emissions.
- A color-coded classification scale (A to G), highlighting the worst-performing of the two indicators as the overall class.
- Building characteristics, technical systems, and energy use estimates.

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[61] https://www.ecologie.gouv.fr/sites/default/files/documents/notice_DPE.pdf
[62] https://rt-re-batiment.developpement-durable.gouv.fr/modeles-des-dpe-a788.html
[63] https://rt-re-batiment.developpement-durable.gouv.fr/IMG/pdf/consolide_annexe_1_arrete_du_31_03_2021_relatif_aux_methodes_et_procedures_applicables.pdf
[64] https://www.ecologie.gouv.fr/
[65] https://www.cstb.fr/
[66] https://observatoire-dpe-audit.ademe.fr/accueil

- Tailored renovation recommendations and cost projections.
- Identification of the certifier and reference to national resources.

EPC templates, interpretation guides, and methodological documentation are publicly available from the following official sources: official DPE templates and forms[67], public guide to interpreting a DPE[68] and ADEME DPE Observatory[69]. These platforms enable users, professionals, and wider stakeholders to access structured documentation and public datasets, supporting widespread adoption and quality assurance of EPC practices in France.

France employs a double-criteria classification system for EPCs: primary energy consumption (kWh/m²/year) and CO_2 emissions (kg CO_2eq/m²/year). The overall DPE rating is determined by the worst-performing of the two. This ensures that buildings with high fossil fuel usage are penalised even if their energy use is moderate. Thresholds differ by building use category, and separate reference values are provided for different non-residential types. Below is a detailed breakdown of energy and emission thresholds for residential and selected non-residential buildings.

Residential buildings (individual houses and apartments)

Class	Energy (kWh/m²/year)	Emissions (kg CO_2/m²/year)
A	≤ 50	≤ 5
B	51 – 90	6 – 10
C	91 – 150	11 – 20
D	151 – 230	21 – 35
E	231 – 330	36 – 55
F	331 – 450	56 – 80
G	> 450	> 80

Offices

Class	Energy (kWh/m²/year)	Emissions (kg CO_2/m²/year)
A	≤ 75	≤ 5
B	76 – 125	6 – 10
C	126 – 200	11 – 20
D	201 – 300	21 – 35
E	301 – 375	36 – 55
F	376 – 400	56 – 80
G	> 400	> 80

[67] https://rt-re-batiment.developpement-durable.gouv.fr/modeles-des-dpe-a788.html
[68] https://www.ecologie.gouv.fr/sites/default/files/documents/comprendre_mon_dpe.pdf
[69] https://observatoire-dpe-audit.ademe.fr/ressources

Schools

Class	Energy (kWh/m²/year)	Emissions (kg CO_2/m²/year)
A	≤ 90	≤ 5
B	91 – 140	6 – 10
C	141 – 210	11 – 20
D	211 – 310	21 – 35
E	311 – 390	36 – 55
F	391 – 420	56 – 80
G	> 420	> 80

Retail

Class	Energy (kWh/m²/year)	Emissions (kg CO_2/m²/year)
A	≤ 95	≤ 5
B	96 – 145	6 – 10
C	146 – 220	11 – 20
D	221 – 320	21 – 35
E	321 – 400	36 – 55
F	401 – 450	56 – 80
G	> 450	> 80

These reference values are extracted from the official annexes of the DPE regulatory methodology. Each category is assigned its own set of classification ranges to reflect sector-specific energy usage profiles. For full details, refer to consolidated Annex 1 of the DPE Arrêté (PDF)[70].

The dual classification also plays a significant role in France's national renovation strategy. For example, F and G rated dwellings *("passoires thermiques")* are subject to rental restrictions and prioritised under renovation subsidy schemes.

The DPE methodology (3CL-DPE 2021) requires a broad set of input data including:

- Building geometry and surface area
- Orientation and exposure
- Thermal envelope (U-values of walls, roof, floors, windows)
- Technical systems (heating, cooling, ventilation, DHW)

70 https://rt-re-batiment.developpement-durable.gouv.fr/IMG/pdf/consolide_annexe_1_arrete_du_31_03_2021_relatif_aux_methodes_et_procedures_applicables.pdf

- Energy vectors and equipment age/efficiency
- Regional climate data

The output includes:

- Primary energy use (kWh/m²/year)
- GHG emissions (kg CO_2/m²/year)
- Final EPC class
- Energy cost estimation
- Breakdown of energy use by system (heating, DHW, etc.)
- Recommendations for improvement

All fields are documented in the national data dictionary for new residential buildings[71], existing residential buildings[72] and non-residential buildings[73].

In France, DPE assessments must be conducted by certified energy performance diagnosticians. These professionals must:

- Hold a valid certification from an approved certification body (accredited by COFRAC[74])
- Complete mandatory training specific to energy diagnostics
- Use only software tools that have been officially validated by the Ministry of Ecological Transition (CSTB coordination)[75]
- Participate in regular audits and quality control checks

Certification is issued for a period of seven years, after which re-certification is required. The list of certified assessors is publicly available[76], and assessments must be submitted digitally to the national EPC register. Only qualified professionals are authorised to generate legally binding DPEs.

France's EPC (DPE) covers all core mandatory indicators of EPBD IV Annex V, and a subset of voluntary indicators, though certain advanced smart and lifecycle-related fields are not yet integrated. The assessment below is based on the review of EPC templates, national resources, and the DPE data dictionary.

Mandatory indicators covered

- Energy performance class (A–G)
- Calculated annual primary and final energy use (kWh/m²/year)
- Operational greenhouse gas emissions (kg CO_2/m²/year)
- Energy carrier type and source

[71] https://data.ademe.fr/datasets/dpe02neuf
[72] https://data.ademe.fr/datasets/dpe03existant
[73] https://data.ademe.fr/datasets/dpe01tertiaire
[74] https://www.cofrac.fr/
[75] https://rt-re-batiment.developpement-durable.gouv.fr/IMG/pdf/reglement_evaluation_logiciel_dpe_2021_-_audit_energetique-13122022_v2.pdf
[76] https://www.rt-re-batiment.developpement-durable.gouv.fr/diagnostiqueurs-certifies-r132.html

- Renovation recommendations with cost estimations
- Surface area, building use, and year of construction
- Certifier contact and regulatory references
- Contact for one-stop shop for renovation

Mandatory indicators not yet or partially covered

- Renewable energy production in kWh or MWh (*partially covered, indicated as RES type, with estimated share shown online, but not in the EPC document*)
- Calculated energy needs in kWh/(m².year)
- Building capacity to respond to external signals (smart readiness)
- Heating system capability to operate at low temperature

Voluntary indicators covered

- Greenhouse gas emission class
- Average U-values for transparent and opaque elements
- Connection to district heating and cooling networks
- Overheating risk
- Main energy carriers and types of system elements for heating, cooling, DHW

Voluntary indicators not yet covered

- Smart readiness assessment or score
- Digital Building Logbook availability
- PM2.5 emissions or indoor air quality sensors
- Recharging points for electric vehicles
- Energy storage systems
- Remaining lifespan of systems
- Feasibility of adapting technical systems to operate at more efficient temperatures
- Metered energy consumption
- Life-cycle GWP
- Renovation passport availability

France's EPC system has a strong alignment with most of the EPBD IV Annex V mandatory elements and some key voluntary indicators, but lacks deeper integration of smart, digital, and operational monitoring features. Future iterations of the DPE may incorporate these elements as part of convergence with the Smart Readiness Indicator and Digital Building Logbook initiatives.

National EPC database (EPBD IV Articles 16 & 22)

France has established a comprehensive national EPC database managed by ADEME[77] *(Agence de la transition écologique)* under the oversight of the Ministry for the Ecological Transition. The central repository serves as the official platform for collecting, validating,

[77] https://www.ademe.fr/en/frontpage/

storing, and publishing data from all DPEs[78] issued in the country. It is a national-level system, ensuring consistency and integration across all regions and territories.

France ensures a high level of public transparency through open access to EPC data via the following platforms: ADEME DPE Observatoire[79] (offers public access to statistical insights, data visualisations, and methodological resources), France's official open data portal[80] (hosts multiple datasets published by ADEME, including public EPC records), open access EPC dataset page[81] (provides detailed DPE data for public use).

These portals provide: downloadable datasets (updated regularly), aggregated statistics and visual dashboards, direct links to documentation (methodology, codebooks, and APIs). While raw data is anonymised, stakeholders (e.g., public authorities, researchers, developers) can freely access extensive EPC information at building level, except for sensitive personal or location-identifiable content.

The DPE database supports various structured digital formats and interfaces:

- CSV and XLSX standard downloadable formats available through the open data portal
- XML format used for data submission by software tools and assessors
- API access structured interfaces are available for automated querying of public datasets and integration with external platforms

The database architecture is aligned with modern principles of open data, machine readability, and interoperability. It facilitates national and local analyses, digital service development, and third-party tool integration.

While the EPC database is well-developed in terms of accessibility and functionality, interoperability with other national registries (such as cadastral, renovation passports, or building permits) is still evolving. As of 2024, there is no fully automated link to the French cadastral system, no established integration with renovation passport schemes (although staged recommendations are included in the EPC), and no known integrations with Building Logbooks or BIM repositories.

France's EPC database shows a high degree of compliance with EPBD IV Articles 16 and 22, particularly with regards to Article 16:

- All DPEs are registered digitally and centrally
- Quality assurance is supported by automated validation and post-submission audits
- All EPCs are submitted electronically by certified assessors via approved tools

With what concerns Article 22 provisions the following are already in place in France:

- Summary-level EPC data is freely accessible to the public

[78] https://www.ecologie.gouv.fr/politiques-publiques/diagnostic-performance-energetique-dpe
[79] https://observatoire-dpe-audit.ademe.fr/
[80] https://www.data.gouv.fr/fr/organizations/ademe/
[81] https://www.data.gouv.fr/fr/posts/la-base-des-diagnostics-de-performance-energetique-dpe/

- EPCs include all relevant building-level information in a structured, downloadable format
- Access to full datasets is available without cost, fulfilling the article's transparency and accessibility goals
- Stakeholders (e.g. local authorities, financial institutions) can request deeper access if needed

At the same time there are areas for improvement remaining, such as no public access to full certificate PDFs (only structured data), lack of integration with other digital building infrastructure, smart readiness and operational energy metrics are not yet integrated in the database architecture.

National EPC accredited tools (SmarterEPC EPC Atlas)

France maintains a formal accreditation system for EPC (DPE) software tools. Only tools that have been officially validated and listed by the Ministry for the Ecological Transition, through the CSTB, are authorised for use by certified energy assessors. The list of validated tools is publicly available on the ministry's portal[82].

As of April 2024, the list of validated tools authorised for use with the 3CL-DPE 2021 methodology includes the following, along with their respective developer websites:

- AnalysImmo developed by Altibitum[83]
- ARGOS developed by ITHAQUE[84]
- CLIMAWIN 2020 developed by BBS SLAMA[85]
- DPEWIN developed by Logiciels Perrenoud[86]
- DiagINBOX developed by ITGA[87]
- EXPERTEC Pro developed by Office Expert[88]
- LICIEL Diagnostics developed by LICIEL Environnement[89]
- WINDPE developed by OBBC Développement[90]
- Pleiades developed by Izuba énergies[91]
- DjeserDiag developed by Tekimmo (specific to tertiary buildings)[92]

Each of these tools incorporates the official calculation engine and generates EPCs in compliance with the national 3CL-DPE format as mandated by French regulation.

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[82] https://rt-re-batiment.developpement-durable.gouv.fr/evaluation-des-logiciels-a647.html
[83] https://www.altibitum.fr
[84] https://www.ithaque-diagnostics.fr
[85] https://www.bbs-slama.com
[86] https://www.bertrandperrenoud.com
[87] https://www.itga.fr
[88] https://www.officeexpert.fr
[89] https://www.liciel.fr
[90] https://www.obbc.fr
[91] https://www.izuba.fr
[92] https://www.tekimmo.fr

The accreditation of software tools is managed by CSTB on behalf of the Ministry for the Ecological Transition. The process is detailed in the official regulatory document[93]. This process entails the submission of candidate tools, documentation review, benchmarking against official DPE reference cases, and detailed validation tests to verify computational accuracy, compliance with formatting standards, and consistency of results. Only tools that pass this rigorous process are certified and included in the national validated list.

France enforces multiple layers of quality assurance for DPE issuance. First, all validated tools are built around the official DPE calculation engine, ensuring standardisation of outputs. Second, the national EPC registry managed by ADEME performs automated consistency checks during EPC submission. Third, certified assessors are subject to random audits and periodic performance evaluations. Additionally, CSTB performs cross-validation of tool performance using benchmark buildings to maintain calculation integrity across the ecosystem.

Although precise market share data is not publicly disclosed, anecdotal insights from the sector suggest that tools such as DPEWIN (Logiciels Perrenoud), LICIEL Diagnostics (LICIEL Environnement), and Pleiades (Izuba énergies) are widely used by energy assessors, particularly in the residential segment. CLIMAWIN 2020 by BBS SLAMA and AnalysImmo by Altibitum also have a solid user base, particularly among engineering offices and independent certifiers. Tools like DiagINBOX, EXPERTEC Pro, WINDPE, and ARGOS offer specialised functionalities or regional market penetration depending on the profile of the assessor or building type. For tertiary buildings, DjeserDiag by Tekimmo is specifically adapted. Overall, the availability of multiple validated tools allows assessors to select platforms that best suit their project typologies and workflow preferences, contributing to a balanced and competitive ecosystem.

Currently, none of the software tools validated for DPE issuance in France are recognised or accredited in other EU Member States, because they are tailored to the French 3CL-DPE methodology, which incorporates national climatic zones, building types, and regulatory benchmarks. France's structured approach to tool validation could serve as a reference for other countries looking to implement robust quality assurance and transparency mechanisms in their own EPC systems.

4.4 Greece

National Annexes & Datasheets (EPBD IV Annex I)

Greece does not maintain a separate set of National Annexes and Datasheets in the format typically associated with Annex I of the EPBD. Instead, the country follows an integrated regulatory approach whereby the KENAK framework (Κανονισμός Ενεργειακής Απόδοσης

93 https://rt-re-batiment.developpement-durable.gouv.fr/IMG/pdf/reglement_evaluation_logiciel_dpe_2021_-_audit_energetique-13122022_v2.pdf

Κτιρίων), established through Ministerial Decision D6/B/5825/2010 and updated periodically, serves as the core technical and legal structure for building energy performance assessment.

This framework is supported by a suite of implementation documents known as T.O.T.E.E. (Τεχνικές Οδηγίες ΤΕΕ), published by the Technical Chamber of Greece (TEE). These guidelines provide detailed technical specifications and assumptions that govern calculation procedures, input data ranges, occupancy schedules, and climatic considerations. As such, the combination of KENAK and T.O.T.E.E. effectively fulfills the function of a National Annex under EPBD III and IV.

Greece is divided into four climate zones (A to D), and the entire calculation methodology, including reference buildings and minimum energy performance standards, is tailored accordingly. These region-specific adaptations ensure that building energy assessments reflect the local climate and usage patterns.

Key regulatory references include:

- Law 3661/2008 original transposition of Directive 2002/91/EC into Greek law (FEK A' 89/19.05.2008)
- Law 4122/2013 transposes Directive 2010/31/EU and introduces EPCs as a legal obligation (FEK A' 42/19.02.2013)
- Ministerial Decision D6/B/5825/2010 establishes KENAK (FEK B' 407/09.04.2010)
- T.O.T.E.E. 20701-1/2017: Methodology for thermal assessments
- T.O.T.E.E. 20701-2/2017: Technical systems (HVAC, RES, lighting, etc.)

These documents are publicly available through official government platforms:

- Government Gazette Portal[94]
- Ministry of Environment and Energy[95]
- Technical Chamber of Greece (TEE)[96]

Despite the absence of a formally labeled "National Annex," the Greek regulatory ecosystem fully meets the intent and substance of Annex I of the EPBD. That said, these materials are not yet presented in a harmonised EU-wide datasheet format, which may pose challenges for structured interoperability at the European level.

National EPC reports and labels (EPBD IV Annex V)

In Greece, Energy Performance Certificates (EPCs), known as Πιστοποιητικά Ενεργειακής Απόδοσης (ΠΕΑ), are issued in accordance with the methodology defined in KENAK and the associated T.O.T.E.E. guidelines. The EPCs are mandatory for a range of trigger events

[94] https://www.et.gr
[95] https://ypen.gr
[96] https://www.tee.gr

and must be submitted through the national platform[97] where they are generated in a standardised digital format using officially accredited software.

As set out in Law 4122/2013, EPCs are required under the following circumstances:

- New buildings and major renovations, EPCs must be submitted as part of the building permit and usage certification process
- Sale or rental, the EPC must be presented at the start of any transaction to ensure transparency for buyers or tenants
- Public buildings over 250 m², these must obtain and visibly display EPCs to promote energy awareness and policy compliance

In addition, EPC ratings must be displayed in real estate advertisements, as mandated by national ministerial decisions.

The Greek EPC provides a comprehensive set of data points, including:

- Building identification details: address, ownership, surface area, climate zone
- Building use type: residential, non-residential, mixed-use
- Energy performance results
  - Primary and final energy use per end-use (heating, cooling, DHW, lighting)
  - Reference building comparison (RR) values
  - Estimated CO_2 emissions
- EPC rating from A+ to H (see below)
- Energy-saving recommendations: suggestions include thermal insulation, HVAC upgrades, renewable integration, etc.
- Auditor information: name, registration number, and software used
- Validity: 10 years, unless substantial changes to the building occur

Greece employs a comparative classification system, where each building's calculated primary energy consumption (EP) is compared to a corresponding reference building (RR) designed to comply with current minimum regulatory standards.

The energy classes are defined as follows:

- A+ ≤ 0.33
- A 0.33 < … ≤ 0.50
- B+ 0.50 < … ≤ 0.75
- B 0.75 < … ≤ 1.00
- C 1.00 < … ≤ 1.25
- D 1.25 < … ≤ 1.50
- E 1.50 < … ≤ 2.00
- F 2.00 < … ≤ 2.73
- G > 2.73

[97] https://www.buildingcert.gr/

This ratio-based system ensures alignment with national targets while allowing for continuous performance improvements through periodic updates to the reference building definitions under KENAK.

Energy audits and EPC issuance in Greece are reserved for certified Energy Inspectors listed in the national registry. The qualification process is governed by Law 4409/2016, which stipulates the following:

- Inspectors must hold relevant degrees in engineering, architecture, or technical disciplines.
- They are required to complete training programs and pass an exam, which is administered by either the Technical Chamber of Greece (TEE) or the Ministry of Environment and Energy
- Once certified, inspectors are granted access to the national platform, where they upload audit data and generate valid EPCs
- Regular updates and CPD (Continuing Professional Development) may be required when new versions of KENAK or T.O.T.E.E. are released

The registry of certified inspectors[98] is managed by TEE and the Ministry, ensuring quality control and traceability. Inspectors are subject to random audits under Article 13 of Law 4122/2013, and non-compliance may result in penalties or loss of certification.

The Greek EPC template covers most of the mandatory indicators set out in EPBD IV Annex V and provides a solid basis for future enhancements.

Mandatory indicators covered

- Energy performance class (A+ to H)
- Calculated annual primary energy use ($kWh/m^2\cdot year$)
- Calculated annual final energy use ($kWh/m^2\cdot year$)
- Renewable energy produced on-site (% of use and in kWh)
- Operational GHG emissions ($kg\ CO_2/m^2\cdot year$)
- Calculated annual primary/final energy consumption (in both $kWh/m^2\cdot year$ and total kWh)
- Energy needs for heating, cooling, and DHW
- Yes/no indication of connection to central heating/cooling network (if applicable)

Mandatory indicators not yet covered

- Life-cycle Global Warming Potential (GWP)
- Capacity for demand-response / smart operation
- Heat distribution adaptability at low temperatures
- Contact details of a one-stop-shop for renovation (currently not integrated)

[98] https://www.buildingcert.gr/inspectors/startValues.view

None of the voluntary indicators are covered presently

- Energy use, peak load, and system size by end-use (heating, cooling, DHW, ventilation, lighting)
- Greenhouse gas emission class (separate from CO_2 performance indicator)
- Information on carbon removals (e.g., biogenic or temporary carbon storage)
- Yes/No indication of the presence of a renovation passport
- Average U-values for opaque and transparent envelope elements
- Type of most common transparent elements (e.g., double-glazing)
- Overheating risk assessment
- Presence of fixed sensors monitoring indoor environmental quality
- Presence of control systems that respond to indoor quality levels
- Number and type of recharging points for electric vehicles
- Presence, type, and size of energy storage systems
- Expected remaining lifespan of HVAC and DHW systems
- Feasibility of adapting heating, DHW, and AC systems to operate at lower temperatures
- Metered energy consumption
- Connection to a district heating/cooling network and potential for efficient system integration
- Local primary energy and emission factors for connected networks
- Operational fine particulate matter (PM2.5) emissions
- Smart readiness assessment (Yes/No and score if applicable)
- Link to a Digital Building Logbook (Yes/No)

While the current implementation satisfies the core regulatory requirements, the inclusion of smart building indicators, renovation guidance, and dynamic consumption metrics is expected as part of the future update to KENAK, likely in alignment with the national transposition of EPBD IV.

National EPC database (EPBD IV Articles 16 & 22)

Greece operates a centralised digital registry for Energy Performance Certificates (EPCs) through the official platform Buildingcert[99]. This web-based system, administered by the Ministry of Environment and Energy in collaboration with the Technical Chamber of Greece (TEE), ensures the secure submission, verification, issuance, and storage of EPCs.

The system functions under national jurisdiction and is the sole platform authorised to issue EPCs across the Greek territory. All certified energy auditors must use Buildingcert to upload building data and generate EPCs. While the platform is national in scope, it accommodates region-specific input fields to reflect Greece's four climatic zones (A to D).

[99] https://www.buildingcert.gr/

Buildingcert acts as a comprehensive digital repository, housing both EPC metadata and detailed technical inputs. It provides oversight capabilities for the competent ministry and enables quality assurance processes such as inspector audits and random EPC validity checks.

EPC submissions in Buildingcert must include a wide array of structured information, in line with national and EU requirements. The database structure supports the following categories:

- Building characteristics: building type and use (residential/non-residential), total heated surface area, volume, and number of floors, construction year and renovation history, climatic zone
- Thermal envelope: U-values of walls, roofs, floors, and windows, orientation, shading devices, and infiltration levels, solar gain coefficients and thermal bridges
- Technical systems: heating and cooling equipment types, efficiencies, fuel types, domestic hot water (DHW) production systems, mechanical ventilation and air conditioning units, integration of renewable systems (e.g., PVs, solar thermal)
- Lighting (non-residential): installed capacity, control strategies, efficiency ratings
- Calculation results: final and primary energy demand (per end-use and in total), CO_2 emissions, energy class (A+ to H)
- Recommended measures for energy efficiency improvements
- Auditor and software information: assessor ID and contact details
- Accredited software tool used (e.g. TEE-KENAK, KENAK++, 4M-KENAK)

The database accepts data primarily in structured form via official software exports. The system architecture is designed to support XML data structures, although the exact public documentation of the technical schema is not available.

The platform ensures compliance with GDPR and national data protection laws. Accessibility is role-based:

- General public may verify the existence and validity of an EPC using the certificate ID or property address
- Certified auditors have full access to their own submitted data and EPC files
- The Ministry and TEE have administrative access for auditing, compliance tracking, and statistical reporting

The system does not allow full public access to detailed technical files, thereby protecting sensitive personal and commercial information.

Greece shows good compliance with the key requirements of Articles 16 and 22 of EPBD IV. With regards to Article 16, the Buildingcert database provides authorised access to EPC data for building owners, tenants, public authorities, and researchers, in line with GDPR provisions. Data is stored securely and is made available at no additional cost to relevant stakeholders. In terms of Article 22, Buildingcert functions as the national EPC database, ensuring the collection, centralisation, and aggregation of EPC data. It supports policy development through anonymised datasets and enables monitoring of the building stock's energy performance. However, features such as renovation passports, Smart Readiness Indicator (SRI) fields, and whole life-cycle carbon disclosures are not yet included.

As of early 2025, Buildingcert does not offer interoperability with other national registries such as the building cadastre or renovation incentive platforms. However, future updates, particularly those aligning with EPBD IV transposition, are expected to address these gaps by introducing modules for new indicators and enhancing cross-platform integration.

National EPC accredited tools (SmarterEPC EPC Atlas)

In Greece, the issuance of Energy Performance Certificates (EPCs) is governed by the KENAK framework (Κανονισμός Ενεργειακής Απόδοσης Κτιρίων). To ensure compliance and standardization, the Ministry of Environment and Energy accredits specific software tools that implement the methodologies outlined in KENAK and its accompanying T.O.T.E.E. guidelines. These tools are essential for certified energy auditors to perform accurate assessments and issue valid EPCs.

The officially accredited EPC software tools are as follows:

- **TEE-KENAK**[100] Developed by the Technical Chamber of Greece (TEE), TEE-KENAK is the primary software for EPC issuance. It employs a monthly energy balance method aligned with EN ISO 13790 standards and is tailored to Greece's four climatic zones. TEE-KENAK is widely used due to its official status and comprehensive features.
- **KENAK++**[101] is a commercially available software that has been accredited for EPC calculations in Greece. It offers an enhanced user interface and additional functionalities that streamline the energy auditing process, making it a preferred choice for professionals seeking advanced features.
- **4M-KENAK**[102], developed by 4M S.A., is another accredited tool designed for EPC issuance. It integrates seamlessly with Building Information Modeling (BIM) workflows, providing a robust solution for engineers and architects involved in energy performance assessments.
- **IsZEB Certify**[103] is a comprehensive software package that facilitates the holistic evaluation and certification of buildings based on the IsZEB Standard. It encompasses three sub-tools: Energy Performance Assessment (calculates the energy classification of a building for EPC issuance, adhering to KENAK regulations and integrating with the TEE-KENAK core engine), Smart Readiness Indicator (SRI) Assessment (evaluates the smart readiness of buildings using the European SRI methodology, providing insights into the building's technological capabilities), Holistic Building Evaluation (assesses various aspects such as energy efficiency, smartness, thermal comfort, indoor air quality, and more, culminating in certification according to the IsZEB

[100] https://www.tee.gr
[101] https://www.kenakplus.gr
[102] https://www.4msa.com
[103] https://iszeb.gr/iszeb-certify

standard). IsZEB Certify is recognized for its user-friendly environment, integration with BIM, and extensive databases of materials and mechanical, electrical, and plumbing (MEP) systems.

All EPC software tools undergo a stringent accreditation process managed by the Ministry of Environment and Energy in collaboration with TEE. This process ensures that each tool:

- Adheres to the KENAK methodology
- Produces results consistent with national standards
- Maintains data integrity and calculation transparency.

Certified energy auditors are required to use these accredited tools to ensure uniformity and reliability in EPC issuance. The Buildingcert platform monitors the software used for each EPC, facilitating quality control and compliance. Certified assessors may face penalties, including fines and license suspensions, if they deviate from standard protocols or submit incorrect assessments. In severe cases, they may lose certification permanently.

4.5 Italy

National Annexes & Datasheets (EPBD IV Annex I)

Italy has transposed EPBD III and is currently aligning with EPBD IV through a combination of national legislative acts and implementing decrees. The main legal instrument transposing EPBD III is Legislative Decree No. 48 of 10 June 2020 (Decreto Legislativo 10 Giugno 2020, n. 48), available publicly via the official legal gazette[104]

Further implementing acts were developed by the Ministry of Enterprises and Made in Italy (MIMIT)[105] (former Ministry of Economic Development MISE). These include:

- Presidential Decree on professional requirements for certifiers
- Ministerial Decree on inspection/control of heating systems
- Ministerial Decree establishing the national EPC portal (SIAPE)

Although EPBD III requirements were transposed at national level, Italy has a decentralised energy governance model involving 22 regional and autonomous provincial authorities. Historically, this created regional differences in implementation. However, from EPBD III onward, efforts have significantly improved national harmonisation across regions.

The national-level legislative framework is supported by technical guidelines issued by CTI (Comitato Termotecnico Italiano)[106], which provide the necessary specifications and protocols for energy performance calculations. More information is publicly available[107].

[104] https://www.gazzettaufficiale.it/eli/id/2020/06/10/20G00066/sg
[105] https://www.mimit.gov.it/it/
[106] https://www.cti2000.it/
[107] https://11300.cti2000.it/

While the structure of national requirements aligns with the EPBD Annex I format in terms of technical content (including indicators and calculation principles), Italy has not officially submitted or published a dedicated National Annex or Datasheets structured as required under EPBD Annex I. Thus, while content-wise the system is robust, formal compliance with the EPBD IV Annex I template is not yet in place.

Several public portals host regulatory and technical content: Ministry of Environment and Energy Security (MASE)[108], Ministry of Enterprises and Made in Italy (MIMIT)[109], ENEA's Energy Efficiency Department (DUEE)[110].

National EPC reports and labels (EPBD IV Annex V)

Italy's Energy Performance Certificate (Attestato di Prestazione Energetica – APE) is structured according to the Interministerial Decree of 26 June 2015, which includes a detailed Annex B defining the official certificate format. The APE is required for all new constructions, as well as for the sale or lease of existing buildings or building units. It must be produced by a qualified expert using approved methodologies and submitted to the relevant regional or national database.

The APE template includes:

- Basic information (address, certifier, client)
- Energy class scale from A4 (best) to G (worst)
- CO_2 emissions bar ($kgCO_2/m^2$ per year)
- Breakdown of energy uses (heating, cooling, DHW, lighting)
- Annual estimated costs and savings
- Recommendations for energy improvement

The visual structure and full format can be accessed via Annex B[111] of the guidelines[112]:

Italy uses a 10-class energy rating scale based on the building's global non-renewable energy performance index (EPgl,nren), expressed in kWh/m^2·year. The classification compares a building's performance with the national reference value (EPgl,limit) for buildings of the same type and climatic zone, as defined in national calculation standards.

The classification system is consistent across both residential and non-residential buildings, but the reference EPgl,limit values used to define each class differ depending on the building typology (e.g., single-family house, apartment block, office building, school, etc.) and the climatic zone. These threshold values are specified in the national annexes and accompanying technical norms developed under the UNI/TS 11300 series, which are implemented and periodically updated by CTI (Comitato Termotecnico Italiano). A detailed

108 https://www.mase.gov.it/energia/efficienza-energetica/edifici
109 https://www.mimit.gov.it/it/component/tags/tag/efficienza-energetica
110 https://www.efficienzaenergetica.enea.it/
111 https://www.mimit.gov.it/images/stories/normativa/DM_Linee_guida_APE_appendiceB.pdf
112 https://www.mimit.gov.it/images/stories/normativa/DM_Linee_guida_APE.pdf

breakdown of energy classification thresholds for each building typology can be accessed through CTI's official website[113].

- A4 ≤ 0.40 × EPgl,limit (best performing)
- A3 0.40 – 0.60 × EPgl,limit (very high efficiency)
- A2 0.60 – 0.80 × EPgl,limit (high efficiency)
- A1 0.80 – 1.00 × EPgl,limit (good efficiency)
- B 1.00 – 1.20 × EPgl,limit (slightly above standard)
- C 1.20 – 1.50 × EPgl,limit (reference average)
- D 1.50 – 2.00 × EPgl,limit (moderate performance)
- E 2.00 – 2.60 × EPgl,limit (poor performance)
- F 2.60 – 3.50 × EPgl,limit (very poor performance)
- G > 3.50 × EPgl,limit (worst performing)

This system allows for location-adjusted and use-specific evaluations, ensuring comparability across Italy's diverse climatic conditions and building stock. EPgl,limit reference values are determined in compliance with the Ministerial Decree of 26 June 2015, and associated guidelines.

The APE is built upon a detailed calculation model following the Italian adaptation of EPB standards, particularly the UNI/TS 11300 series. Input and output fields include:

- **Input data**
    - Building geometry (volume, surface, height)
    - Construction materials and envelope transmittance
    - Type and efficiency of HVAC and DHW systems
    - Type and use of renewable sources
    - Climatic zone and occupancy profile
- **Output data**
    - EPgl,nren (non-renewable primary energy)
    - EPgl,ren (renewable primary energy)
    - Total energy need by service (heating, DHW, cooling, ventilation, lighting)
    - Global CO_2 emissions ($kg/m^2 \cdot year$)
    - Assigned energy class (A4–G)
    - Suggested retrofit actions

In Italy, the training and accreditation of Energy Performance Certificate (EPC) assessors, referred to as *certificatori energetici*, are governed by national legislation, primarily the Presidential Decree of 16 April 2013, n. 75[114], which sets forth the professional qualifications, training standards, and certification process. This legislative act forms part of Italy's broader transposition of the EPBD framework.

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[113] https://11300.cti2000.it/
[114] https://www.gazzettaufficiale.it/eli/id/2013/06/21/13G00107/sg

To become a certified EPC assessor in Italy, professionals must meet the following requirements:

- Possess a relevant academic degree (e.g. in engineering, architecture, or technical sciences)
- Complete a specialised training course (typically 80 to 120 hours) from a recognised and accredited provider, covering topics such as building physics, energy systems, national methodology, and use of software tools
- Pass a final exam, consisting of theoretical and practical components, validated by the training provider
- Register in the regional or national register of EPC assessors to obtain legal authorisation.

Due to Italy's regional governance model in energy matters, the registration and ongoing oversight of EPC assessors are managed by regional authorities, although harmonised minimum standards apply nationwide. Training providers and exam administrators are authorised by these regional entities, in coordination with national bodies such as ENEA and the CTI. Public registers of assessors are available via regional websites, and EPCs issued are centrally collected through SIAPE[115], Italy's national EPC database.

The quality assurance framework includes regular audits and inspections coordinated by regional agencies. Sanctions are foreseen in the case of non-compliance, including fines and potential suspension or revocation of accreditation.

This well-structured and multi-level approach ensures that EPCs in Italy are issued by qualified experts, in compliance with both regional procedures and EU-level obligations under the EPBD.

Italy's current EPC system (APE) aligns well with most mandatory indicators required by the EPBD IV, particularly those related to calculated energy performance and system description. However, several emerging requirements are not yet integrated. The voluntary indicators introduced in Annex V are also not currently addressed.

Mandatory indicators covered

- Energy performance class
- Calculated annual final energy use in kWh/(m²·year)
- Renewable energy produced on-site (% of energy use)
- Operational greenhouse gas emissions in kg CO_2/(m²·year)
- Calculated annual primary energy use in kWh/(m²·year) *(unclear if explicitly stated; possibly embedded or derivable)*
- Renewable energy production in kWh or MWh, with specification of main energy carrier and renewable source
- Calculated energy needs in kWh/(m²·year)
- Contact information for a one-stop shop or renovation advice

[115] https://siape.enea.it/

Mandatory indicators not covered

- Calculated annual primary and final energy consumption in kWh or MWh (absolute values)
- Yes/No indication: ability to react to external signals (smart readiness)
- Yes/No indication: whether heat distribution system can operate at lower, more efficient temperatures

According to the Italian national analysis, none of the voluntary indicators are currently covered:

- Energy use, peak load, and system size by end-use (heating, cooling, DHW, ventilation, lighting)
- Greenhouse gas emission class (separate from CO_2 performance indicator)
- Information on carbon removals (e.g., biogenic or temporary carbon storage)
- Yes/No indication of the presence of a renovation passport
- Average U-values for opaque and transparent envelope elements
- Type of most common transparent elements (e.g., double-glazing)
- Overheating risk assessment
- Presence of fixed sensors monitoring indoor environmental quality
- Presence of control systems that respond to indoor quality levels
- Number and type of recharging points for electric vehicles
- Presence, type, and size of energy storage systems
- Expected remaining lifespan of HVAC and DHW systems
- Feasibility of adapting heating, DHW, and AC systems to operate at lower temperatures
- Metered energy consumption
- Connection to a district heating/cooling network and potential for efficient system integration
- Local primary energy and emission factors for connected networks
- Operational fine particulate matter (PM2.5) emissions
- Smart readiness assessment (Yes/No and score if applicable)
- Link to a Digital Building Logbook (Yes/No)

Italy's current APE format is substantially compliant with the EPBD's core mandatory indicators. However, integration of newer aspects such as smart readiness, operational metering, lifecycle carbon metrics, and interoperability with digital tools (e.g., renovation passports, logbooks) remains pending. There is no current implementation of the voluntary indicators, which will be crucial to fulfilling the recast EPBD 2024's ambition for an enhanced, interoperable, and user-centric building performance certification ecosystem.

National EPC database (EPBD IV Articles 16 & 22)

Italy operates a centralised national EPC database known as SIAPE (Sistema Informativo per l'Attestazione della Prestazione Energetica)[116], which consolidates EPC data from all 22

[116] https://siape.enea.it

regions and autonomous provinces. It was established by Interministerial Decree of 26/06/2015 and is managed by ENEA (National Agency for New Technologies, Energy and Sustainable Economic Development)[117].

The primary aim of SIAPE is to provide a detailed and consistent overview of the status of energy renovation across the national building stock. It serves as a unified platform for energy performance information, facilitating policy design, monitoring, and enforcement by public authorities.

Energy certification and building data governance in Italy is divided between the national level (ENEA and ministries) and the regional level (22 regional and autonomous provincial authorities). SIAPE enables data exchange between regional EPC systems and the centralised national infrastructure, thereby ensuring both horizontal (across regions) and vertical (regional to national) interoperability.

Moreover, SIAPE is designed to interface with other administrative and spatial databases, such as the national building cadastre and the property registry, although the actual degree of linkage varies by region and is still evolving. The system is structured to allow future integration with digital building tools, such as renovation passports, Smart Readiness Indicator (SRI), and Digital Building Logbook as mandated by EPBD IV.

SIAPE is primarily designed as a professional and institutional tool. The general public does not have direct access to individual EPCs, but aggregated reports and analytics are published periodically via the SIAPE portal and ENEA's energy efficiency websites[118].

Regional and local authorities can access SIAPE for their jurisdiction through secure credentials. To obtain access, they must request it by writing to ENEA's certified email address: enea@cert.enea.it.

Data from regional EPC systems is transmitted to SIAPE using a standardised XML format. As of early 2020, 20 out of 22 regions and autonomous provinces are actively transmitting EPC data to SIAPE using this harmonised structure. The XML schema aligns with the national calculation standards (UNI/TS 11300 series).

Although the structure of the data model is documented internally, the complete XML schema is not publicly available online. There are currently no public APIs or download options for third-party access.

Italy's SIAPE system exhibits a high degree of compliance with the requirements set forth in Articles 16 and 22 of the EPBD IV.

Under Article 16, SIAPE ensures that EPC data is accessible to relevant public authorities and third parties upon request. It promotes data exchange and interoperability between regional and national registers and complies with the General Data Protection Regulation (Regulation

[117] https://www.enea.it/en/

[118] https://siape.enea.it/#/monitoraggio

(EU) 2016/679) to safeguard personal data. Building owners and tenants can access their own EPCs without incurring additional costs. Furthermore, aggregated and anonymised data is made available to policy makers for planning and monitoring purposes, and the system's structured format supports integration with other national administrative databases.

Under Article 22, SIAPE serves as the national EPC and inspection database. It provides anonymised and aggregated building data to national and local authorities, as well as researchers, and supports energy planning by enabling access at local and municipal levels. Regular publications of national EPC statistics and summaries are available. Although there is currently limited information on user-friendly services or tools built on SIAPE data, an implementation plan is in place and evolving. SIAPE's architecture is designed to be interoperable with administrative systems such as the national cadastre, supporting the broader digitalisation goals of the EPBD IV.

National EPC accredited tools (SmarterEPC EPC Atlas)

Italy does not maintain a single centralised list of EPC tools officially accredited at national level. However, certain regions, like Lombardy, have implemented regional accreditation schemes. The CENED system[119] in Lombardy publishes and maintains a list of accredited commercial EPC tools that meet regional energy calculation methodologies and technical standards.

As of the latest available update, the following tools are officially accredited in Italy:

- Blumatica Energy by Blumatica Srl[120]
- EC780 by Edilclima Srl[121]
- Energetika 2000 by Energetika 2000 Srl[122]
- Euclide Certificazione Energetica by Geo Network Srl[123]
- Mc4 Suite 2023 by Mc4 Software[124]
- Namirial Termo by Namirial SpA[125]
- TermiPlan by TermiPlan Srl[126]
- Termiko One by Termiko Srl[127]
- Termolog 14 by Logical Soft Srl[128]
- TerMus by ACCA Software Srl[129]

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119 https://www.cened.it/elenco-client-autorizzati/-/asset_publisher/ng13HTowzQzX/content/elenco-dei-software-commerciali-accreditati/

120 https://www.blumatica.it/software/blumatica-energy/

121 https://www.edilclima.it/

122 https://www.energetika2000.it/

123 https://www.geonetwork.it/euclide-certificazione-energetica/

124 https://www.mc4software.com/

125 https://www.termopro.it/

126 https://www.termiplan.it/

127 https://www.termiko.it/

128 https://www.logical.it/termolog/

129 https://www.acca.it/software-certificazione-energetica

These tools incorporate national regulatory requirements and adhere to the calculation methodologies outlined in the UNI/TS 11300 standards.

Accreditation processes in Italy operate under a decentralised model. At national level, software tools are expected to comply with calculation methodologies established by the Comitato Termotecnico Italiano (CTI) and the technical specifications defined by the Ministry of Enterprises and Made in Italy (MIMIT). In regions such as Lombardy, a structured accreditation process is implemented by the CENED authority. This process includes:

- Submission of technical documentation by the software developer
- Testing of the calculation engine against standardised benchmarks
- Issuance of formal accreditation if compliance is demonstrated

While national authorities do not currently maintain a central registry of approved EPC tools, the tools listed above are recognised within the profession and supported by training institutions.

There is no national level quality assurance regime specifically for EPC software. However, quality assurance is supported through:

- Regional verification of EPCs issued using accredited tools
- National and regional updates to calculation methodologies
- Training and qualification requirements for EPC assessors, who are expected to use tools compliant with technical norms

This results in a decentralised supervision model grounded in professional and regional oversight.

Precise data on market share is not publicly available. However, based on industry knowledge and training curriculum references, tools such as Termolog, Blumatica Energy, and MC4 Suite are commonly used across Italy. Preferences may vary based on region, assessor type (freelancer vs company), and project scale.

There is no indication that the above tools are formally accredited in other EU Member States. Some tools may be used informally for building energy analysis in neighbouring countries, but they are not recognised as multinational EPC software solutions at this time.

4.6 Netherlands

National Annexes & Datasheets (EPBD IV Annex I)

The Netherlands has completed its National Annexes and Datasheets in accordance with the requirements of EPBD III and IV. These documents were prepared internally by the Ministry of the Interior and Kingdom Relations (BZK), particularly under the Directorate-General for Housing and Building. However, they have not been made publicly available.

Rather than public publishing as outlined in Annex I of the EPBD, the Netherlands operationalises its national implementation via the well-established NTA 8800 methodology.

This national standard sets out the technical procedures for calculating the energy performance of both residential and non-residential buildings. It forms the basis of national energy performance regulation and has been widely adopted by professionals across the building sector.

The most recent legal basis for the transposition of the EPBD in the Netherlands is the Besluit bouwwerken leefomgeving (Buildings in the Living Environment Decree)[130], which integrates provisions for energy performance requirements under the Omgevingswet (Environment and Planning Act). This legislation replaces previous instruments such as the Bouwbesluit 2012 and consolidates regulatory requirements for energy efficiency and building performance.

Although the Annexes and Datasheets themselves are not accessible to the public, several core implementation resources are available online. These include the national EPC registry (EP-online)[131], technical documentation for professionals[132], and access to the NTA 8800 standard itself[133].

National EPC reports and labels (EPBD IV Annex V)

The Netherlands applies a robust, standardised system for Energy Performance Certificates (EPCs), grounded in the national methodology NTA 8800. EPCs are mandatory for most buildings when they are constructed, sold, or rented. They are issued exclusively by certified energy advisors using accredited tools and digital platforms, following national guidelines outlined by the Ministry of the Interior and Kingdom Relations.

EPCs in the Netherlands cover both residential and non-residential buildings and follow a uniform layout with digital traceability. EPC reports include a summary page with key indicators and a full technical annex that describes the calculation methodology, assumptions, and building systems. Visual examples of EPC labels can be accessed via the official EP-online portal, which also houses a public registry of all EPCs issued since the introduction of the system.

The energy performance classification system ranges from class A++++ (very energy-efficient) to class G (poorly performing). Classification is based on the building's calculated primary energy demand per square metre per year, expressed in kWh/m²/year, following NTA 8800.

The following class thresholds apply for the different building types and are publicly available[134,135]:

Residential buildings

[130] https://iplo.nl/regelgeving/omgevingswet/inhoud/besluit-bouwwerken-leefomgeving/
[131] https://www.ep-online.nl/
[132] https://www.gebouwenergieprestatie.nl/
[133] https://www.nen.nl/nta-8800-2024-nl-320123
[134] https://woninglabel.nl/labelnieuws/wat-betekenen-de-energielabels-a-tot-en-met-g
[135] https://www.gebouwenergieprestatie.nl/

- A++++ ≤ 0 kWh/m²/year
- A+++ ≤ 50 kWh/m²/year
- A++ 50 – 75 kWh/m²/year
- A+ 75 – 105 kWh/m²/year
- A 105 – 160 kWh/m²/year
- B 160 – 190 kWh/m²/year
- C 190 – 250 kWh/m²/year
- D 250 – 290 kWh/m²/year
- E 290 – 335 kWh/m²/year
- F 335 – 380 kWh/m²/year
- G > 380 kWh/m²/year

Office buildings

- A+++++ ≤ 0 kWh/m²/year
- A++++ ≤ 40 kWh/m²/year
- A+++ 40 – 80 kWh/m²/year
- A++ 80 – 120 kWh/m²/year
- A+ 120 – 160 kWh/m²/year
- A 160 – 180 kWh/m²/year
- B 180 – 200 kWh/m²/year
- C 200 – 225 kWh/m²/year
- D 225 – 250 kWh/m²/year
- E 250 – 275 kWh/m²/year
- F 275 – 300 kWh/m²/year
- G > 300 kWh/m²/year

Gathering buildings

- A+++++ ≤ 0 kWh/m²/year
- A++++ 0 – 50 kWh/m²/year
- A+++ 50 – 100 kWh/m²/year
- A++ 100 – kWh/m²/year
- A+ 150 – 200 kWh/m²/year
- A 200 – 230 kWh/m²/year
- B 230 – 255 kWh/m²/year
- C 255 – 285 kWh/m²/year
- D 285 – 320 kWh/m²/year
- E 320 – 355 kWh/m²/year
- F 355 – 385 kWh/m²/year
- G >385 kWh/m²/year

Daycare buildings

- A+++++ ≤ 0 kWh/m²/year
- A++++ 0 – 55 kWh/m²/year

- A+++ 55 – 110 kWh/m²/year
- A++ 110 – 165 kWh/m²/year
- A+ 165 – 220 kWh/m²/year
- A 220 – 265 kWh/m²/year
- B 265 – 290 kWh/m²/year
- C 290 – 330 kWh/m²/year
- D 330 – 365 kWh/m²/year
- E 365 – 405 kWh/m²/year
- F 405 – 445 kWh/m²/year
- G > 445 kWh/m²/year

Education buildings

- A+++++ ≤ 0 kWh/m²/year
- A++++ ≤ 50 kWh/m²/year
- A+++ 50 – 100 kWh/m²/year
- A++ 100 – 150 kWh/m²/year
- A+ 150 – 200 kWh/m²/year
- A 200 – 235 kWh/m²/year
- B 235 – 260 kWh/m²/year
- C 260 – 295 kWh/m²/year
- D 295 – 330 kWh/m²/year
- E 330 – 360 kWh/m²/year
- F 360 – 395 kWh/m²/year
- G > 395 kWh/m²/year

Healthcare buildings without beds

- A+++++ ≤ 0 kWh/m²/year
- A++++ 0 – 45 kWh/m²/year
- A+++ 45 – 90 kWh/m²/year
- A++ 90 – 135 kWh/m²/year
- A+ 135 – 180 kWh/m²/year
- A 180 – 210 kWh/m²/year
- B 210 – 230 kWh/m²/year
- C 230 – 260 kWh/m²/year
- D 260 – 295 kWh/m²/year
- E 295 – 325 kWh/m²/year
- F 325 – 355 kWh/m²/year
- G > 355 kWh/m²/year

Healthcare buildings with bed

- A+++++ ≤ 0 kWh/m²/year
- A++++ 0 – 90 kWh/m²/year

- A+++ 90 – 180 kWh/m²/year
- A++ 180 – 270 kWh/m²/year
- A+ 270 – 360 kWh/m²/year
- A 360 – 430 kWh/m²/year
- B 430 – 470 kWh/m²/year
- C 470 – 530 kWh/m²/year
- D 530 – 595 kWh/m²/year
- E 595 – 655 kWh/m²/year
- F 655 – 715 kWh/m²/year
- G > 715 kWh/m²/year

Retail buildings

- A+++++ ≤ 0 kWh/m²/year
- A++++ ≤ 60 kWh/m²/year
- A+++ 60 – 120 kWh/m²/year
- A++ 120 – 180 kWh/m²/year
- A+ 180 – 240 kWh/m²/year
- A 240 – 285 kWh/m²/year
- B 285 – 315 kWh/m²/year
- C 315 – 355 kWh/m²/year
- D 355 – 395 kWh/m²/year
- E 395 – 435 kWh/m²/year
- F 435 – 475 kWh/m²/year
- G > 475 kWh/m²/year

Sports buildings

- A+++++ ≤ 0 kWh/m²/year
- A++++ 0 – 35 kWh/m²/year
- A+++ 35 – 70 kWh/m²/year
- A++ 70 – 105 kWh/m²/year
- A+ 105 – 140 kWh/m²/year
- A 140 – 155 kWh/m²/year
- B 155 – 170 kWh/m²/year
- C 170 – 195 kWh/m²/year
- D 195 – 215 kWh/m²/year
- E 215 – 240 kWh/m²/year
- F 240 – 260 kWh/m²/year
- G >260 kWh/m²/year

Accommodation buildings

- A+++++ ≤ 0 kWh/m²/year
- A++++ 0 – 50 kWh/m²/year

- A+++ 50 – 100 kWh/m²/year
- A++ 100 – 150 kWh/m²/year
- A+ 150 – 200 kWh/m²/year
- A 200 – 230 kWh/m²/year
- B 230 – 255 kWh/m²/year
- C 255 – 285 kWh/m²/year
- D 285 – 320 kWh/m²/year
- E 320 – 355 kWh/m²/year
- F 355 – 385 kWh/m²/year
- G >385 kWh/m²/year

Prison buildings

- A+++++ ≤ 0 kWh/m²/year
- A++++ 0 – 60 kWh/m²/year
- A+++ 60 – 120 kWh/m²/year
- A++ 120 – 180 kWh/m²/year
- A+ 180 – 240 kWh/m²/year
- A 240 – 300 kWh/m²/year
- B 300 – 330 kWh/m²/year
- C 330 – 370 kWh/m²/year
- D 370 – 415 kWh/m²/year
- E 415 – 455 kWh/m²/year
- F 455 – 500 kWh/m²/year
- G > 500 kWh/m²/year

EPCs in the Netherlands are generated using advanced calculation tools that collect a wide range of data inputs, including:

- Geometric data: floor area, volume, window-to-wall ratio, building orientation
- Thermal envelope: U-values of walls, roofs, floors, and glazing; thermal bridges
- Technical systems: system type, efficiency of heating, cooling, DHW, ventilation, lighting
- Renewable systems: PV panels, solar thermal, biomass, connection to district heating
- Airtightness values and infiltration rates
- Operational parameters: building usage patterns, internal heat gains, set point temperatures

The generated EPC then includes output data that addresses the following:

- Final and primary energy use (kWh/year and kWh/m²/year)
- Energy needs (for heating, cooling, DHW, ventilation)
- Share of renewable energy (%)
- Operational CO_2 emissions ($kgCO_2/m^2/year$)
- Energy performance class (A to G)
- Expiry date and certificate registration number

To ensure the consistency and quality of EPCs, assessors in the Netherlands must undergo specialised training and pass a national examination. Energy advisors must be certified by an accredited body and listed in the national registry. This qualification authorises them to perform on-site inspections and issue EPCs using validated calculation software. The certification framework is supervised by the Ministry and coordinated with quality assurance mechanisms, including random audits and compliance monitoring.

The training, examination and registration of energy advisors is supported via the KEGO platform[136], which offers guidance documents, certification information, and system support for assessors. Additionally, the platform gebouwenergieprestatie[137] provides a detailed FAQ section for prospective EP advisors, outlining the qualifications needed, how to register for training and exams, and the pathway to become authorised. The requirements vary depending on whether one aims to certify residential or non-residential buildings, and there are multiple certification levels (e.g. EP-W/B, EP-W/D, EP-U/B, EP-U/D) based on the building type and method of assessment (basic or detailed).

Citizens and property owners seeking to request an EPC must contact a certified energy advisor or agency. According to government.nl, only recognised and listed assessors may perform EPC assessments. The actual EPC must always be registered in the national EP-Online database. The registry of authorised professionals and companies is available at the Centraal Register Techniek[138], where users can search for qualified experts by location and certification type. Ongoing professional development is encouraged through periodic refresher training and updated guidance in response to evolving standards, such as updates to the NTA 8800 methodology or regulatory shifts under the Omgevingswet. The certification framework is supervised by the Ministry and coordinated with quality assurance mechanisms, including random audits and compliance monitoring.

A cross-comparison with Annex V of the EPBD IV shows that the Dutch EPC system covers a substantial share of the mandatory indicators on both the front page and within the full certificate. However, several important elements remain to be included, particularly with respect to smart readiness and system-level flexibility.

Mandatory indicators covered

- Energy performance class
- Calculated annual final energy use in kWh/(m²·y)
- Renewable energy produced on-site in % of energy use
- Operational GHG emissions (kgCO_2/(m²·y))
- Calculated energy needs in kWh/(m²·y)
- Renewable energy production (partial), type of renewable energy source and main energy carrier

[136] https://portaal.stichtingkego.nl/support/home
[137] https://www.gebouwenergieprestatie.nl/faqs-voor-aankomende-ep-adviseurs/
[138] https://platform.centraalregistertechniek.nl/Vakbedrijven/Particulieren?BusinessArea=Energieprestatieadvies&QualificationType=Energielabel%20voor%20een%20woning

- Contact information of relevant one-stop shop for renovation advice
- Average U-value for opaque elements (R-values shown instead)
- Average U-value for transparent elements
- Overheating risk presented as qualitative assessment (e.g. high/low risk)

Mandatory indicators not covered

- Calculated annual primary energy use in kWh/(m²·y)
- Calculated annual primary and final energy consumption in kWh or MWh
- Building's capacity to react to external signals
- Ability of heating system to work at low temperatures

Voluntary indicators not covered

- Energy use, peak load, system size by end-use
- Greenhouse gas emission class
- Carbon removals in building materials
- Renovation passport (only improvement advice provided)
- Type of most common transparent elements (e.g., glazing type)
- Indoor environmental quality sensors and controls
- EV charging infrastructure
- Energy storage systems
- Expected remaining lifespan of technical systems
- Adaptability of systems to lower operating temperatures
- Metered energy consumption
- Connection to district heating/cooling network
- Local primary energy/carbon emission factors of district heating/cooling
- Operational PM2.5 emissions
- Smart readiness assessment or score
- Digital Building Logbook availability (only link to energy label database provided)

Overall, while the Dutch EPC framework performs strongly in core compliance areas, its current implementation does not yet fully reflect the expanded ambition of EPBD IV in terms of digitalisation, smart readiness, and operational building data. The current structure of EP-online and the NTA 8800 methodology offers a sound and modular technical foundation upon which these additional indicators may be progressively implemented in future updates.

National EPC database (EPBD IV Articles 16 & 22)

The Netherlands operates a highly developed and centralised energy performance certificate (EPC) database through the national platform EP-online[139]. This database is the official register where all EPCs issued for residential and non-residential buildings must be uploaded. Managed by RVO (Netherlands Enterprise Agency)[140], it serves both regulatory and transparency purposes.

[139] https://www.ep-online.nl/
[140] https://www.rvo.nl/

EP-online is not only a central registry but also a public-facing platform. It allows citizens, building owners, tenants, and professionals to:

- Access the EPC of a property using its address
- Verify the energy performance class and key energy indicators
- View the validity and registration details of a certificate

The EPC system is managed at the national level under the authority of the Ministry of the Interior and Kingdom Relations. However, it interacts with a wider ecosystem of tools and registries. EPC data is interoperable with other systems via structured data exchange formats, particularly XML. For example, connections exist with the building cadastre and potentially with future digital building logbooks. The standardised data structure supports administrative procedures and emerging smart digital services.

The EP-online platform provides open access to EPC information for individual buildings. In addition, datasets of anonymised EPCs are available for download and analysis, enabling researchers and policymakers to assess building stock characteristics and trends. The full technical user manual is accessible[141].

The EPC database uses a standardised XML format for uploading and structuring EPC data. The XML schema is aligned with the NTA 8800 methodology and ensures consistency across different software tools used by assessors. The structure allows integration of key indicators such as primary and final energy use, renewable energy share, system types, and other technical parameters. The full XML schema published online[142], and the guidelines referenced above provide a technical overview.

The Dutch EPC database system demonstrates strong alignment with the provisions of Articles 16 and 22 of the EPBD IV.

Article 16

- EPC data is accessible to building owners and tenants at no cost
- Certified energy assessors upload EPCs directly into EP-online via structured interfaces
- Public authorities, research organisations and accredited users have access to anonymised and aggregated data
- Privacy and data protection measures are implemented in line with the General Data Protection Regulation (GDPR)

Article 22

- EP-online acts as the national repository of EPCs and is equipped for integration with future instruments like Smart Readiness Indicators (SRI) and Digital Building Logbooks
- Annual reporting on the coverage of EPCs across the building stock is performed

141 https://www.rvo.nl/sites/default/files/2025-02/handleiding-ep-online-voor-energieadviseurs-2024-versie-9.pdf
142 https://www.rvo.nl/sites/default/files/2025-02/handleiding-ep-online-opvragen-van-bestanden.pdf

- There is ongoing work to align EP-online with future EU-level interoperability and reporting standards

Overall, the Netherlands' EPC database structure and governance model offer a high degree of transparency, functionality, and preparedness for the digital and policy developments anticipated under the recast EPBD framework.

National EPC accredited tools (SmarterEPC EPC Atlas)

In the Netherlands, Energy Performance Certificates (EPCs) must be issued using officially accredited software tools that are compliant with the national calculation methodology NTA 8800. These tools undergo a validation process and are used exclusively by certified energy advisors registered in the national database. The validation and oversight of the software tools fall under the responsibility of the Dutch Ministry of the Interior and Kingdom Relations, supported by technical stakeholders.

The following software tools are actively used and validated for EPC assessments in the Netherlands:

- UNIEC 3[143] is a widely adopted tool for both residential and non-residential buildings, offering modules for basic and detailed calculations
- Vabi EPA[144] offers comprehensive modules for energy performance analysis, including renovation scenarios and reporting features
- BINK Energieprestatie[145] is developed for detailed energy modelling under NTA 8800, BINK's tool is known for its integration with BIM environments
- Energieprestatie Gebouwen (EPG)[146], part of the BouwConnect suite, is a software that supports both residential and non-residential EPCs and is integrated with BouwConnect's data libraries

All these tools are listed in the official register of validated software tools[147], which provides updates on validation status, technical specifications, and software updates.

The accreditation process requires tool developers to demonstrate full alignment with the NTA 8800 methodology. Validation tests are performed to ensure consistency and reliability of calculated results. Once a tool is deemed compliant, it is formally validated and listed as suitable for EPC issuance. The Kwaliteit voor Installaties Nederland (KvINL)[148] and RVO play key roles in administering the accreditation and overseeing compliance.

While specific market share data is not publicly available, anecdotal evidence and industry sources suggest that UNIEC 3 and Vabi EPA are among the most commonly used tools in the Dutch market. Each software provider includes mechanisms for internal checks, and quality

143 https://uniec3.nl
144 https://www.vabi.nl/nta8800/
145 https://www.binksoftware.nl/epc-software-nta-8800/
146 https://www.bouwconnect.nl/bouwkundigen/software/bc-nta-8800/
147 https://www.gebouwenergieprestatie.nl/stelsel-energieprestatie-van-gebouwen/
148 https://kvinl.nl/

assurance is further reinforced through national oversight, cross-checking of results, and training requirements for users.

As of now, the software tools validated for use in the Netherlands are tailored specifically to the Dutch methodology (NTA 8800) and legal framework. They are not officially validated for EPC use in other EU Member States. However, some providers such as Vabi and BouwConnect have international activities and software development experience, potentially enabling future cross-border adaptation.

In summary, the Netherlands maintains a reliable and transparent framework for EPC software accreditation, with validated tools forming a crucial component in ensuring consistent and high-quality energy certification across its building stock.

4.6 Romania

National Annexes & Datasheets (EPBD IV Annex I)

Romania's building energy performance framework is based on the MC 001-2022 national methodology, which was introduced to update and refine the previous MC 001-2006 standard. The new methodology ensures improved alignment with the recast EPBD IV (Directive 2024/1275) and relevant European standards (EN ISO/CEN). It reflects an effort to modernise assessment criteria, improve consistency across building typologies, and support national and EU-level decarbonisation targets.

The MC 001-2022 methodology was developed through collaboration between national technical institutions including INCERC (National Institute for Research in Construction), AIIR (Romanian Association for Building Services Engineers), and UTCB (Technical University of Civil Engineering Bucharest), and was formally approved by the Ministry of Development, Public Works and Administration.

The updated methodology is structured into the following key parts:

- MC 001/1 Energy performance of the building envelope (detailed methods for calculating transmission losses, solar gains, and overall thermal efficiency, adapted to Romania's climate zones)
- MC 001/2 Energy performance of building systems (covers the energy performance of technical systems such as heating, ventilation, air-conditioning (HVAC), domestic hot water (DHW), and renewable energy systems)
- MC 001/3 Energy audit and classification methodology (defines performance thresholds and procedures for classifying buildings into energy classes (A to G), based on calculated primary energy demand and CO_2 emissions)

In parallel, Romania maintains a complementary set of technical standards under C107/1 – C107/5, which specify minimum requirements and calculation procedures. These are applied nationally and serve as baseline references for envelope performance:

- External walls max. U-value 0.40 W/m²·K
- Windows max. U-value 1.10 W/m²·K
- Roofs max. U-value 0.14 W/m²·K
- Floors (on ground/unheated spaces): max. U-value 0.22 W/m²·K

The C107 standards also establish procedures for calculating:

- Annual heating demand (Qh)
- Transmission heat losses
- Solar gain contributions
- Thermal comfort indices
- The global thermal quality coefficient (G)

Despite the comprehensive technical framework, Romania has not yet published National Annexes and Datasheets as defined in Annex I of the EPBD IV. This means that the specific national parameters, assumptions, and input values required for full transparency and harmonisation at EU level are not formally structured or accessible in a public, machine-readable format (e.g., XML or JSON). As such, there is currently no online registry or downloadable repository that allows public or institutional users to access or validate these national datasets. Additionally, while MC 001-2022 introduces broader provisions for system-level efficiency, the integration of Building Automation and Control Systems (BACS) remains limited.

Although Romania has significantly advanced its regulatory and technical standards through MC 001-2022, further steps are needed to fully comply with EPBD IV Annex I. These include publishing formalised national annexes and datasheets, enabling structured data formats, and expanding the methodology to incorporate additional indicators.

National EPC reports and labels (EPBD IV Annex V)

Energy Performance Certificates (EPCs) were introduced in Romania in 2007 (for new buildings) and extended to sale/rental transactions in 2011. EPCs are issued by certified energy auditors using licensed tools based on Mc001. These include a general summary page with the EPC label (A+ to G), followed by detailed technical documentation.[149]

Each EPC includes:

- Building location and typology
- Total heated area (m²), volume, and surface-to-volume ratio
- Final and primary energy consumption (kWh/m²/year)
- Annual CO_2 emissions ($kgCO_2/m^2/year$)
- Energy source (electricity, gas, biomass, DH)
- Improvement recommendations (envelope upgrades, system retrofits)

[149] https://our-cee.eu/wp-content/uploads/2024/07/Baseline-assessment-Romania.pdf

Romania's EPC structure meets core EPBD IV requirements, but several indicators remain missing or partial:

- No reporting of lifecycle GWP or embodied carbon
- No data on smart readiness or system flexibility
- Indoor air quality and overheating risk are not addressed
- No evaluation of operational energy use vs calculated values
- Missing indicators for PM2.5 emissions, EV charging readiness, system adaptability, or digital logbook references

Visual samples of EPCs are not published, and there is no public-facing platform for checking issued EPCs or exploring typology-specific benchmarks. While EPCs provide general renovation advice, they do not include staged deep renovation paths or cost-optimal scenario modelling.

Single family houses

- A+ ≤ 91kWh/m²/year
- A 91 – 129 kWh/m²/year
- B 129 – 257 kWh/m²/year
- C 257 – 390 kWh/m²/year
- D 390 – 522 kWh/m²/year
- E 522 – 652 kWh/m²/year
- F 652 – 783 kWh/m²/year
- G > 783kWh/m²/year

Office buildings

- A+ ≤ 68 kWh/m²/year
- A 68 – 97 kWh/m²/year
- B 97 – 193 kWh/m²/year
- C 193 – 302 kWh/m²/year
- D 302 – 410 kWh/m²/year
- E 410 – 511 kWh/m²/year
- F 511 – 614 kWh/m²/year
- G > 614 kWh/m²/year

Primary schools

- A+ ≤ 48 kWh/m²/year
- A 48 – 68 kWh/m²/year
- B 68 – 135 kWh/m²/year
- C 135 – 246 kWh/m²/year
- D 246 – 358 kWh/m²/year
- E 358 – 447 kWh/m²/year
- F 447 – 536 kWh/m²/year
- G > 536 kWh/m²/year

Other typologies such as hospitals, supermarkets, and hotels follow function-specific thresholds and are publicly available[150].

EPCs are issued by certified energy auditors. These professionals must complete accredited training programmes, pass a national examination, and maintain registration with URBAN-INCERC. Certification allows auditors to carry out site visits, collect technical data, and use approved calculation tools. Auditors are periodically reviewed through randomised checks to ensure procedural compliance. However, deeper technical quality control (e.g., recalculation or on-site revalidation) is not currently standard practice.

As of 2025, Romania has established an online registry of certified assessors (as lists published via the Ministry of Energy[151]), however citizens commonly contact auditors through independent directories or municipal offices.

A review of EPBD IV Annex V compliance shows that Romanian EPCs cover basic indicators but miss several advanced features:

Mandatory indicators covered

- Final and primary energy consumption
- CO_2 emissions ($kgCO_2/m^2/year$)
- Energy performance class (A to G)
- General technical recommendations

Mandatory indicators not covered

- Smart readiness score
- Overheating risk
- System flexibility and operational metrics
- Renewable energy share (only partial)
- Metered or real-use energy data

According to the Romanian national analysis, none of the voluntary indicators are currently covered:

- Energy use, peak load, and system size by end-use (heating, cooling, DHW, ventilation, lighting)
- Greenhouse gas emission class (separate from CO_2 performance indicator)
- Information on carbon removals (e.g., biogenic or temporary carbon storage)
- Yes/No indication of the presence of a renovation passport
- Average U-values for opaque and transparent envelope elements
- Type of most common transparent elements (e.g., double-glazing)
- Overheating risk assessment
- Presence of fixed sensors monitoring indoor environmental quality
- Presence of control systems that respond to indoor quality levels

[150] https://our-cee.eu/wp-content/uploads/2024/07/Baseline-assessment-Romania.pdf
[151] https://energie.gov.ro/eficienta-energetica/

- Number and type of recharging points for electric vehicles
- Presence, type, and size of energy storage systems
- Expected remaining lifespan of HVAC and DHW systems
- Feasibility of adapting heating, DHW, and AC systems to operate at lower temperatures
- Metered energy consumption
- Connection to a district heating/cooling network and potential for efficient system integration
- Local primary energy and emission factors for connected networks
- Operational fine particulate matter (PM2.5) emissions
- Smart readiness assessment (Yes/No and score if applicable)
- Link to a Digital Building Logbook (Yes/No)

National EPC database (EPBD IV Articles 16 & 22)

Romania operates a national energy performance certificate (EPC) database managed by the National Institute for Research and Development in Construction, Urban Planning and Sustainable Spatial Development (URBAN-INCERC). The database was established in 2008 and serves as the official repository for all EPCs issued in the country. It is used exclusively by certified energy auditors, who are required to upload EPCs upon issuance for both residential and non-residential buildings.[152]

The Romanian EPC database is not publicly accessible. Building owners, tenants, or professionals cannot retrieve or consult EPCs by address. The system is designed for regulatory compliance and data storage but lacks the features necessary for public transparency, user interaction, or digital renovation planning.

The EPCs are submitted in PDF format along with metadata including:

- Building address and typology
- Auditor registration number
- Energy class and performance indicators (final and primary energy use, CO_2 emissions)
- Date of issuance and certificate validity

There is no public portal where users can view or download anonymised EPC data. Furthermore, researchers, public authorities, and policymakers do not have access to aggregated datasets, nor is there an official dashboard showing national coverage statistics.

Interoperability with other national databases is currently absent. The EPC system is not connected with the building cadastre, planning permits, or renovation grant programmes. The EPC data is not exchanged in structured formats such as XML or JSON, and there are no APIs or digital workflows to support data-driven policy development.[153]

[152] European Commission (2023). EU Building Stock Observatory: Romania
[153] https://energyindustryreview.com/events/epbd-recast-policy-challenges-and-implementation/

Article 16 compliance status

- EPCs are uploaded by certified energy auditors, who are individually registered
- Data is stored centrally but not accessible to building owners or tenants
- No mechanisms for data-sharing with public authorities or researchers
- No integration with renovation one-stop-shops or funding platforms

Article 22 compliance status

- No structured data exchange (e.g. XML schema) is implemented
- No integration with Smart Readiness Indicators (SRI) or Digital Building Logbooks
- No public reporting on EPC coverage or compliance rates
- No provisions in place for future EU-level interoperability

In its current form, the Romanian EPC database fulfils basic legal requirements but does not meet the transparency, digitalisation, or interoperability goals outlined in the 2024 recast EPBD framework.

National EPC accredited tools (SmarterEPC EPC Atlas)

In Romania, the issuance of Energy Performance Certificates (EPCs) is governed by the updated national calculation methodology MC 001-2022, which replaced the earlier 2006 version. This updated methodology aligns with European standards and introduces more detailed parameters for assessing energy performance, including refined calculation steps for renewable energy, heating/cooling systems, and building envelope performance.

Certified energy auditors are required to use software tools that apply this methodology to generate legally valid EPCs. However, there is no formal national registry of accredited EPC software, nor does the Ministry of Development, Public Works and Administration operate a centralised validation or certification framework for these tools.

The software tools most commonly used in Romania for EPC assessments include[154]:

- **AllEnergy**[155] is a versatile tool for energy performance calculations for different building types
- **ALLPLAN AX300**[156] is an architectural design tool with modules for thermal and energy calculations
- **Doset-PEC**[157] is a legacy software used for performance assessment and certification, applied mainly by independent auditors
- **Energ-Plus**[158] is a modern platform offering EPC calculation, document management, and integration with auditor workflows. Increasingly popular among newer auditors for its clean interface and digital submission features

[154] https://bpie.eu/wp-content/uploads/2018/01/iBROAD_CountryFactsheet_ROMANIA-2018.pdf
[155] https://www.algorithm.ro/
[156] https://model.allbim.net/produse/ax3000/
[157] https://www.dosetimpex.ro/doset-pec/doset-pec.php
[158] https://energ-plus.ro

Despite the MC 001-2022 update, there is no uniform data model or export structure used across these tools. Most operate as standalone desktop applications and do not offer XML-based data exchange or APIs for integration with national registries or cadastre systems. This limits the interoperability and digital processing potential of EPCs in Romania, which could hamper future implementation of the EPBD IV requirements for structured, digital, and interoperable data flows.

Furthermore, only EPC software used in the specific case of apartment assessments in multifamily residential buildings is subject to limited oversight, typically through informal quality checks at the local level. For other building types (e.g., non-residential, new constructions), there are currently no calibration procedures, validation benchmarks, or enforced technical compliance checks.

To align with the evolving requirements under the EPBD IV, Romania would benefit from establishing the following:

- A public registry of validated software tools, maintained by the Ministry or an authorised technical body
- A national software testing framework to ensure consistency of outputs across tools
- Mandatory compliance and periodic auditing of EPC software, linked to the accreditation of energy auditors
- Development of a national data model and interoperability protocols, enabling machine-readable data exchange (e.g. XML format) and integration with future digital building logbooks or renovation passports

Until such systems are introduced, the reliability and comparability of EPCs in Romania will continue to depend heavily on the individual auditor's training and the choice of software tool used.

5. Future scenarios for EPC and SRI coverage

5.1 Factors influencing the variation in EPC coverage

The EPBD provides a framework, but the responsibility for its implementation rests with the individual Member States. This has resulted in diverse national implementation timelines and approaches, significantly influencing the current levels of EPC coverage[159]. Some countries adopted mandatory EPC schemes for new constructions relatively early, while others prioritised their implementation for existing buildings at the point of sale or rental. The specific triggers for requiring an EPC, such as new construction, major renovation, sale, or rental, vary across Member States, impacting the rate at which EPCs are issued. Furthermore, the initial scope of EPC schemes differed, with some countries initially excluding certain types of buildings, such as industrial buildings. These variations in implementation strategies and the scope of application have directly contributed to the observed differences in EPC coverage across the EU. Member States that adopted more comprehensive and earlier mandates for EPCs are generally expected to exhibit higher levels of coverage compared to those with more gradual or limited implementation.

The presence and sophistication of national EPC registers and the underlying data infrastructure play a crucial role in facilitating data collection and monitoring the extent of EPC coverage[160]. In several Member States, the official approval of an issued EPC requires its mandatory upload to a central database. These registers serve as primary sources of information regarding certified buildings, allowing for a more accurate assessment of coverage. However, the accessibility and scope of these registers differ across the EU. Some registers offer public access to EPC data, while others have limited or no public access. The types of data fields included in these registers also vary. Countries with well-established and comprehensive EPC registers are better positioned to track the issuance of certificates and, consequently, to have more accurate data on overall coverage. The maturity of the digital infrastructure supporting these registers also influences the efficiency of data management and the reliability of coverage statistics.

The effectiveness of EPC schemes is intrinsically linked to the robustness of enforcement mechanisms and the resulting levels of compliance with the requirement to produce and present EPCs. While the majority of Member States have provisions for issuing fines for failing to present a valid EPC at the point of sale or rental, the practical enforcement of these requirements and the actual issuance of fines vary considerably across the EU. Analysis by the European Commission has indicated that only a limited number of Member States have established robust systems for ensuring the presentation of EPCs during property transactions, with some requiring legal professionals to verify the presence of an EPC as part

[159] https://www.climatexchange.org.uk/publications/operational-delivery-of-energy-performance-certificates-in-europe/

[160] https://energy.ec.europa.eu/system/files/2016-11/enerperfcertificates_0.pdf

of the sale process. Furthermore, compliance rates tend to be higher for newly constructed buildings and properties being sold compared to those being rented out. Weak enforcement can lead to lower compliance, resulting in a discrepancy between the legal mandate for EPCs and the actual number of buildings with certificates. This lack of consistent and rigorous enforcement across the EU contributes to the observed variations in EPC coverage.

EPCs are typically mandated at specific trigger points related to a building's lifecycle, such as upon new construction, during major renovations, or when a building is offered for sale or rent. The frequency of these triggers naturally varies across the building stock. For instance, some buildings may remain under the same ownership for extended periods and may not undergo major renovations frequently. Consequently, relying solely on these transaction-based triggers for EPC issuance can result in a significant portion of the existing building stock not having an EPC available. Unless specific policies are implemented to target buildings outside of these typical trigger events, achieving comprehensive EPC coverage across the entire building stock can be a slow process. The effectiveness of EPC coverage is therefore influenced by the breadth and frequency of the conditions that necessitate the issuance of a certificate.

The level of public awareness regarding the benefits and requirements of EPCs can significantly influence the demand for and compliance with EPC regulations. If building owners and occupants are well-informed about the value of EPCs in understanding and improving their building's energy performance, they may be more proactive in obtaining and utilising these certificates. Factors such as the user-friendliness of the EPC and the perceived relevance of the recommendations provided can also impact public acceptance. Low public awareness or a lack of perceived value in the information contained within EPCs can lead to less engagement with the scheme and potentially lower rates of compliance. Conversely, effective communication campaigns and clear demonstrations of the benefits of energy efficiency improvements identified through EPCs can foster greater public acceptance and drive higher coverage rates.

5.2 Challenges and opportunities in enhancing EPC coverage and data quality

Attaining comprehensive EPC coverage across the EU presents several significant challenges. The sheer volume and diversity of the European Union's building stock, encompassing a wide range of building types and ages, make it a complex undertaking to ensure every building has an EPC[161]. Reaching building owners who are not actively involved in property transactions or major renovations poses a particular hurdle. Many buildings, especially residential properties, may remain under the same ownership for decades without triggering the requirement for an EPC under existing regulations. Additionally, the

161 https://www.housingeurope.eu/wp-content/uploads/2024/10/Impact-of-MEPS-in-revision-EPBD_Copenhagen-Economics_20211004_final-report.pdf

perceived costs and administrative burden associated with obtaining an EPC can act as a deterrent for some building owners, particularly those in the private residential sector. Overcoming these challenges requires proactive strategies that go beyond relying solely on transactional triggers and may necessitate targeted campaigns, incentives, or even mandates for obtaining EPCs for existing buildings that have not yet been certified.

The reliability and comparability of EPC data across the EU are affected by variations in calculation methodologies, the software tools used for assessment, and the qualifications of EPC assessors in different Member States. Concerns have been raised regarding the quality and robustness of some EPC assessments. The existence of different energy performance rating scales and calculation methods across countries makes it difficult to directly compare the energy efficiency of buildings in different parts of the EU, a phenomenon sometimes referred to as the "Babel Tower of EPC ratings" . Recognising these issues, there are ongoing efforts at the EU level to harmonise EPC methodologies and standards. Enhancing the quality and comparability of EPC data is crucial for ensuring that these certificates provide meaningful and reliable information to building owners, potential buyers, and policymakers, and for facilitating effective EU-wide analysis of building energy performance.

The increasing focus on digitalisation and the drive towards greater standardisation offer significant opportunities to enhance both the coverage and the quality of EPCs across the EU. The development and implementation of digital EPCs, coupled with centralised national databases, can greatly improve data management, accessibility, and overall data quality. The revised EPBD emphasises the importance of increased digitalisation of EPCs, which should facilitate better data collection and sharing. Furthermore, the adoption of standardised templates and calculation methodologies across Member States is essential for improving the comparability and reliability of EPCs. By leveraging digital technologies and promoting standardisation, the EU can move towards a more unified and effective system for assessing and communicating building energy performance, ultimately supporting the achievement of its energy efficiency and decarbonisation goals.

5.3 Smart readiness emerging trends, challenges and good practices

As the SRI initiative matures across Europe, several key trends and common challenges have emerged.

One clear trend is that voluntary uptake is accelerating. While no country has mandated SRI yet, the number of participants has grown steadily (from a handful in 2020 to 16 by 2025). There’s a sense of momentum, with more pilots launching each year and early adopters considering expansion of their schemes. Importantly, many countries are embedding SRI into broader digitalisation and renovation strategies (as seen with integration into EPCs and planning for logbooks). This indicates that SRI is being viewed not as a standalone novelty, but as part of the future toolkit for smart, efficient buildings. A trend of note is some regions aiming to make SRI a selling point for buildings, for example, if Flanders' roll-out in 2025 is successful, having an SRI score might become a value indicator in the property market alongside the EPC. The overall tone is cautious optimism: policymakers see the potential benefits of smarter buildings (energy savings, flexibility, user comfort), so they are steadily building the infrastructure to rate and eventually encourage smart readiness.

Despite progress, Member States face several challenges in implementing the SRI. A frequently voiced concern is to avoid the SRI becoming just another "piece of paper" with little impact. Both officials and stakeholders worry that if the SRI certificate is purely voluntary and not tied to incentives or requirements, building owners might not act on it. The challenge is to make the SRI meaningful, for instance, by coupling it with recommendations for smart upgrades or linking high SRI scores to positive outcomes (like easier access to certain grants or Demand Response programs).

Countries are finding that training assessors in this new field is non-trivial. SRI assessment spans IT, HVAC, and electrical systems knowledge, which not all energy auditors possess. A challenge is to build a cadre of competent SRI assessors who can not only calculate scores but also suggest practical smart retrofit interventions. Maintaining quality and consistency in assessments across different assessors and regions is an ongoing concern.

Conducting an SRI assessment takes time and resources, which translates to additional cost for building evaluations. Several pilots are examining the cost-benefit aspect. For example, Denmark and others looked at how long an SRI audit takes for various building types. A challenge is to keep the process efficient so that costs remain reasonable. Until SRI is more established, demand from building owners is relatively low (since it's voluntary), so creating market demand is a bit of a "chicken and egg" situation. Incentivising early adopters (through awareness campaigns or integration with existing required EPC visits) is one way to address this.

Europe's building stock is very heterogeneous (from modern smart homes to century-old apartments). Some technical challenges lie in making the SRI methodology flexible enough to be relevant for all these cases. For instance, a high SRI score might be easy to achieve in a new office with cutting-edge BMS, but an old historic building might inherently score low, which could unfairly stigmatise older buildings or be seen as penalising them. Pilot feedback from countries like Finland suggests that the highest levels of smartness don't always correlate with lower carbon emissions in every context, meaning the impact weighting might need calibration for different climates or grid conditions. Member States must grapple with how to interpret SRI results in context, so that building owners are not discouraged. Many are considering building-type-specific approaches (e.g., different relevant domains for residential vs. tertiary buildings) to tackle this challenge.

As SRI moves into digital logbooks and real-time data, issues of data privacy and cybersecurity arise. Ensuring that any smart device data used for SRI (like smart meter data) is handled securely and complies with privacy laws is a technical and legal challenge that will need addressing as schemes scale up.

Alongside trends and challenges, a number of good practices are emerging from the national experiences.

A widely adopted good practice is to integrate SRI delivery with the EPC infrastructure, as discussed. This piggyback approach (joint assessments, shared databases, common assessor pools) greatly reduces administrative overhead and market fragmentation. It also helps in raising awareness, building owners are introduced to SRI through a process (EPC) that they already know from, say, selling or renting property.

Countries are collaborating on training curricula, often using standard e-learning modules from EU projects. The SRI2MARKET and easySRI platforms, for example, offer multilingual online courses for SRI assessors which multiple countries have adopted, ensuring a common knowledge base. Similarly, the use of a standardised calculation tool (based on the EU methodology) is a good practice – it ensures consistency and makes it easier to update everyone's tools when the method is refined.

Providing actionable outputs: The most forward-looking implementations pair the SRI score with recommendations or improvements analysis. For instance, some pilots have begun to calculate the potential improvement in SRI if certain smart technologies are added, along with rough payback analysis. This turns the SRI assessment into a more useful advisory tool, akin to how EPCs provide recommendations for insulation or heating upgrades. It's becoming a best practice to ensure the SRI report answers the question, "How can I make my building smarter and more efficient?" rather than just giving a score. Some EU projects, such as EVELIXIA[162], are working on developing decision-support tools to help assessors in identifying the most cost-efficient smartness upgrades.

Another good practice is proactive engagement with building owners, facility managers, technology providers, and financiers to build an ecosystem around SRI. Some countries have hosted workshops and webinars (often with EU support) to educate stakeholders on the benefits of smart-ready buildings. The more the market (installers of smart systems, ESCOs, etc.) is aware of SRI, the more they can use it in their services e.g., an energy service company might start offering "SRI improvement packages" knowing that this could be officially recognised via an updated SRI score. We see early signs of this in how smart charging for EVs or smart lighting systems are marketed as improving a building's smart readiness.

A good practice is not reinventing the wheel, e.g. when one country finds a solution to integrate SRI with a building logbook, others take note and may follow that template. The SRI cluster actively fosters this by clustering national workshops and even performing cross-country assessments (benchmarking one methodology against another). This collaborative spirit is accelerating improvements and helping everyone converge on what works best.

[162] https://www.evelixia-project.eu/

Overall, the outlook for SRI implementation across the EU in 2025 is positive, with an expanding knowledge base. While challenges exist (as with any new scheme), they are being actively addressed through pilot feedback and EU-wide cooperation. Common hurdles like assessor training and demonstrating value can be overcome by continuing the good practices of integration, providing clear benefits to end-users, and maintaining strong alignment with EU standards. In conclusion, Europe is steadily moving toward a future where the Smart Readiness Indicator becomes a familiar and useful component of building information, much like the EPC, enabling smarter, more responsive buildings in support of energy performance and the digital transition.

5.4 The foreseeable future of EPCs and SRI

Enhanced requirements and harmonisation

The EPBD IV introduces enhanced requirements and a stronger emphasis on the harmonisation of EPCs across the European Union. Member States are now required to ensure that their national EPCs comply with a new standardised template outlined in the directive by May 2026. This template includes mandatory indicators on calculated primary and final energy use and consumption, aiming to provide more consistent and comprehensive information. Furthermore, the recast EPBD 2024 mandates the adoption of a common energy performance classification scale, ranging from A to G, where A signifies a zero-emission building and G represents the least energy-efficient buildings. This move towards a unified template and rating scale is a significant step towards improving the consistency and comparability of EPCs throughout the EU, making it easier to understand and compare building energy performance across different Member States.

Integration with Minimum Energy Performance Standards (MEPS)

Under the revised EPBD 2024, EPCs will play a crucial role in verifying compliance with the newly introduced Minimum Energy Performance Standards (MEPS). These standards require Member States to renovate the 16% worst-performing non-residential buildings by 2030 and the 26% worst-performing buildings by 2033. EPCs will serve as a key tool for identifying these underperforming buildings and for monitoring the progress of renovations. Additionally, the directive sets targets for reducing the average primary energy use of the national residential building stock by at least 16% by 2030 and by 20-22% by 2035. EPC data will likely be instrumental in tracking the overall improvement in the energy performance of the residential building stock and in assessing whether these targets are being met. The direct link between EPCs and MEPS underscores the increasing importance of EPCs as a policy instrument for driving energy performance improvements and achieving the EU's ambitious energy performance targets for buildings.

The role of building Renovation Passports (RP)

The EPBD IV also introduces the concept of 'Renovation Passports' as a complementary tool to EPCs. These passports are intended to help building owners plan and execute staged, deep energy renovations by providing a long-term renovation roadmap tailored to their specific building. The information contained within an EPC, such as the current energy performance and recommendations for improvement, will serve as a valuable starting point for developing a comprehensive renovation passport. For renovation passports to be effective in driving deep renovations across the EU building stock, a high level of EPC coverage will be essential. The widespread availability of EPCs will ensure that building owners have the necessary baseline information to understand their building's energy performance and to utilise the renovation passport scheme effectively.

Inclusion of Whole Life-Cycle Carbon (WLC)

Looking towards the future, the recast EPBD 2024 expands the scope of EPCs to include information on the whole life-cycle carbon (WLC) emissions of buildings. Starting from 2028, all new buildings with a usable floor area greater than 1,000 m² will be required to disclose their WLC in the EPC. This requirement will extend to all new buildings, regardless of size, from 2030 onwards. Furthermore, Member States will be obligated to set maximum GWP (Global Warming Potential) limits for new buildings by 2030. The inclusion of WLC in EPCs represents a significant advancement, broadening the assessment beyond operational energy use to encompass the environmental impact associated with the materials, construction, and eventual disposal of buildings. This more holistic approach will provide a more complete picture of a building's environmental footprint and will further enhance the value of EPCs as a tool for promoting sustainable building practices.

Supporting digitalisation and smarter building operation

The recast EPBD 2024 reinforces the SRI as a voluntary but harmonised Union scheme, aiming to assess and promote the technological capacity of buildings to monitor, control, and optimise energy use. While implementation remains optional for Member States, EPBD IV introduces a clear pathway for strengthening SRI uptake. Specifically, it requires Member States to promote the adoption of the common EU SRI scheme for non-residential buildings with a heating or combined heating and cooling system output above 290 kW, creating a clear entry point for large and technically complex buildings[163]. In parallel, mandatory minimum requirements for Building Automation and Control Systems (BACS) are already in force across the EU under EPBD III (2018), and these obligations have been retained and clarified in the 2024 recast. As of 2025, all non-residential buildings with technical building systems of an effective rated output above 290 kW must be equipped with BACS to continuously monitor, log, analyse, and adjust energy usage, and enable fault detection and

[163] Taking into account the outcome of a report submitted by the Commission 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.

performance improvement. The 290 kW threshold is consistent across both the BACS and SRI provisions, ensuring aligned implementation logic. The presence of BACS also facilitates SRI assessment and provides the technical backbone needed to activate smart services such as demand-response, predictive control, and system interoperability, reinforcing the role of SRI as a strategic tool for building digitalisation. This dual focus, on minimum BACS and voluntary SRI, fosters a coherent digitalisation agenda that encourages building owners to assess and improve their smart readiness in parallel with energy performance improvements. By harmonising the methodology and encouraging digital tools such as logbooks, renovation passports, and EPC databases to integrate SRI outputs, the directive ensures that smart readiness is no longer treated as a separate or optional feature but as an integral aspect of modern, decarbonised, and user-responsive buildings across Europe.

5.5 Predictive future EPC and SRI coverage trajectories (2025–2040)

To explore how EPC and SRI uptake might evolve, three scenarios were envisaged reflecting different levels of policy ambition, enforcement, and digital integration. Each scenario below outlines semi-quantitative coverage estimates for EU residential and non-residential buildings by 2030 and 2040, alongside the key drivers and assumptions (e.g. renovation rates, administrative capacity, enforcement intensity, policy maturity, integration with financing, and digital readiness) that shape those outcomes.

Scenario 1 Business as Usual (BaU)

In the Business-as-Usual scenario, only minimal new measures are introduced beyond current practices. EPC issuance continues to be driven primarily by natural trigger points, properties being sold or rented and new constructions requiring certification. Enforcement remains patchy and low intensity, meaning many buildings that technically should have an EPC may not actually obtain or update one. As a result, EPC coverage of the building stock increases only gradually. By 2030, roughly 50% of residential buildings and 60–70% of non-residential buildings are expected to have a valid EPC in this scenario (up from today's still modest coverage levels). By 2040, as more of the existing stock turns over, EPC coverage might reach on the order of 70–80% of homes and around 85% of non-residential buildings under BaU. These gains are driven largely by market activity (transactions and new builds) rather than proactive policy: buildings not changing hands or undergoing major renovation often remain without certificates for decades.

The SRI remains a niche voluntary scheme. As of the mid-2020s the SRI is still in a testing phase in a subset of Member States, and under BaU its rollout sees little further support. Only a small fraction of large buildings participate in voluntary SRI assessments. By 2030, perhaps 5% or less of large non-residential buildings (and effectively 0% of homes) might have an SRI score. Even by 2040, SRI uptake stays limited, maybe on the order of 10–15% of large commercial/public buildings (those owned by forward-looking organisations or in pilot programs), translating to only a few percent of the total EU building stock. Most homeowners and smaller businesses do not pursue SRI certification in this scenario, due to low awareness and lack of incentives.

Key drivers and assumptions:

- **Renovation rates remain low,** roughly in line with current ~1% per year levels, meaning only slow improvement of the building stock's efficiency. Without new regulations to spur action, the Minimum Energy Performance Standards (MEPS) proposed in the recast EPBD 2024 are not effectively implemented, many countries delay or water down these requirements.
- **Administrative capacity and political will for EPC enforcement are limited**: authorities focus on issuing EPCs at point of sale or rent as required by law, but do little proactive compliance checking. Penalties for not having an EPC are seldom applied, and quality control checks on issued certificates remain sporadic. The EPC thus continues to be seen more as a formality than a driver of renovation in BaU.
- **Integration with financial schemes is minimal**; for example, mortgage lenders and subsidy programs infrequently use EPC ratings to condition benefits, due to ongoing concerns about EPC data reliability.
- **Digital readiness of EPC/SRI infrastructure is also low**. While all Member States have set up EPC databases, these databases often remain siloed and not fully interoperable across regions. There is little coupling of EPC data with emerging digital tools like building logbooks or renovation passports. This means building owners have no single "digital record" of their property's performance, the EPC is isolated and updated only at infrequent trigger events.

> Overall, **the BaU scenario** portrays a continuation of the status quo: slow incremental progress in EPC coverage and almost negligible adoption of SRI, constrained by weak enforcement and lack of strong new incentives or digital integration.

Scenario 2 Policy Acceleration (PA)

The Policy Acceleration scenario assumes the full and effective transposition of the recast EPBD 2024 (EPBD IV) by all Member States, coupled with robust enforcement. This yields a significant uptick in both EPC and SRI coverage by 2030. All major provisions of EPBD IV come into play: Minimum Energy Performance Standards (MEPS) are implemented on schedule, mandatory Building Automation and Control Systems (BACS) are required in large buildings (HVAC > 290 kW) by the stipulated deadlines, and the SRI scheme is actively promoted, and possibly integrated within the existing EPC framework. In fact, following a successful testing phase, the SRI becomes mandatory for large non-residential buildings above 290 kW HVAC capacity by the late 2020s (as envisaged in the EPBD timeline). Under this scenario, EPCs become nearly ubiquitous. Governments not only make EPCs obligatory at sale or rent (which is already law) but also undertake campaigns and regulations to ensure all buildings obtain an EPC by a certain date. This could mean, for example, that by 2030 every building must have at least one up-to-date EPC on record , a recommendation supported by experts to enable MEPS enforcement. By 2030, one can expect over 80–90% of residential buildings and virtually all public and large commercial buildings to hold a valid EPC in this scenario. Even many single-family homes and smaller buildings (which under BaU might escape the system if never sold or rented) are swept into coverage through MEPS-related outreach or one-stop-shop programs. By 2040, EPC coverage approaches saturation, on the order of 95%+ of the building stock, since successive MEPS milestones (e.g. requiring buildings to reach at least energy class E by 2030, D by 2033/2035, etc.) compel any remaining uncertified buildings to get assessed and improved. The high rate of EPC issuance is accompanied by improved quality and consistency, as the new EPC template and calibration across the A–G scale are uniformly applied in all countries.

On the SRI side, the Policy Acceleration scenario leads to significantly expanded uptake in large non-residential buildings. By 2030, all large buildings (offices, shopping centers, campuses, etc.) above the 290 kW threshold have undergone an SRI assessment at least once, due to the delegated act making it compulsory. This means a sizable share of non-residential floor area, potentially 30–50% of the non-residential stock, is covered by SRI ratings by 2030 (though the number of buildings is smaller, focused on big complexes). Several Member States also encourage voluntary SRI for medium-sized buildings and public facilities below the threshold, by linking SRI results to recognition schemes or incentives. As a result, the overall penetration of SRI in the building stock rises to perhaps 10–15% of buildings by 2030 (from near-zero today). By 2040, SRI coverage further expands: with positive market feedback, the scheme could be extended to a broader set of buildings. In this scenario we assume most large and medium non-residential buildings will have an SRI by 2040, and even some residential multi-family buildings will adopt it (e.g. as part of smart building certifications or to comply with utility demand-response programs). Roughly 70–80% of non-residential floor area (including virtually all buildings in commercial use) might be SRI-rated by 2040, which equates to on the order of 30–40% of the total building stock when residential units are included. SRI remains voluntary for individual houses, but by 2040, many new homes come with smart-ready features by default, and a subset of tech-savvy homeowners opt for SRI assessments as smart home devices proliferate.

Key drivers and assumptions:

- **This accelerated scenario is characterised by high policy ambition and enforcement intensity**. Annual renovation rates climb toward ~2% or more, spurred by the MEPS deadlines (owners of the worst-performing buildings undertake upgrades to avoid non-compliance).

- **Member States invest in administrative capacity to implement the new rules**: for example, training and deploying more certified energy experts, increasing funding for EPC compliance checks, and setting up robust monitoring systems.
- **Quality control mechanisms are tightened**, more frequent audits of EPC reports and penalties for non-compliant or poor-quality certificates, to ensure the EPC database is reliable for tracking MEPS progress. By addressing the earlier shortcomings in EPC reliability, this scenario builds trust such that EPCs become a central tool in building policy.
- **Crucially, enforcement is greatly strengthened**: authorities verify at the point of notary or rental contract that an EPC is present (issuing fines or blocking transactions if not), and they require proof of EPC and renovation status for buildings hitting MEPS trigger years (e.g. class G buildings by 2030). Many countries might adopt the principle that no building can remain without a certificate beyond a certain date, operationalising the recommendation to "ensure that all buildings have an EPC by 2030".
- **There is also strong integration with financial and support schemes**. For instance, governments link renovation subsidies and financing programs to EPC outcomes, e.g. offering grants or tax rebates for buildings that improve their rating by a certain number of classes. Banks and green mortgage providers intensify use of EPC labels in their lending criteria, given the now-standardised A–G scale and improved data access.
- **Under EPBD IV, national EPC databases are opened up for data sharing** by 2026, enabling public authorities and even private actors (with proper safeguards) to use the data for innovative services (benchmarking, building stock analyses, etc.).
- **However, in this Policy Acceleration scenario, digital integration is improved but not yet transformative**. The focus through the 2020s is on meeting targets and compliance; thus, while EPC and SRI databases are well-established and some begin to interface with other tools (for example, linking EPC recommendations with newly introduced Building Renovation Passports), the user-facing digital experience could still be better. By 2040, some integration has occurred (e.g. one-stop-shop platforms where an owner can see their EPC, SRI, and RP together), but these are uneven across the EU.

In summary, the **Policy Acceleration scenario** achieves high coverage through classic regulatory push, every building is reached by the EPC mandate and large buildings by the SRI mandate, underpinned by strong enforcement and improved linkage to renovation incentives. It stops short of full digital transformation, but it lays the groundwork (via open data and standardised schemes) for a more integrated future.

Scenario 3 Digital and Integrated Future (DIF)

The Digital and Integrated Future scenario represents a high-ambition world where policy, market, and technology trends converge to produce widespread uptake of EPCs and SRIs, facilitated by advanced digital infrastructure. In addition to fully implementing EPBD IV measures (as in Scenario 2), this scenario assumes strong investment in digital tools, data platforms, and integration of building information. By 2030, all Member States have introduced Digital Building Logbooks (DBLs) for storing building data (energy, renovation history, smart readiness, etc.), and EPC and SRI systems are seamlessly integrated into these DBLs and into RPs. This means when an owner or inspector updates a building's logbook (for example, after a renovation or an inspection), the EPC rating and SRI score are automatically updated as well, creating a living document of the building's performance. Conversely, any change to the EPC rating or SRI score would also automatically reflect in the building's logbook. Thanks to user-friendly online platforms and apps, building owners find it much easier to obtain and update certificates, much of the data entry and analysis is automated via smart meters, IoT sensors, and AI-driven tools. For instance, an owner might grant a digital platform access to their smart thermostat and energy consumption data, which an AI tool uses to partially pre-fill an EPC assessment or to calculate certain SRI functionalities.

Market uptake of EPCs and SRI becomes virtually universal by 2040 in this scenario. By 2030, a very high proportion of buildings (on the order of 90%) have an EPC on record, as digital workflows enable even previously hard-to-reach segments (e.g. owner-occupied single-family homes with no transactions) to be brought into the system. Many owners voluntarily get an updated EPC via the digital platform to understand their building's status or to access recommendations, even if not strictly required by law. By the late 2030s, obtaining an EPC is often an automated byproduct of other actions, for example, applying for a renovation permit or installing a new HVAC system might trigger an automatic update to the building's performance record. Essentially every building has a digital profile by 2040, and the EPC element of that profile is routinely kept up to date (the concept of a certificate expiring after 10 years might be replaced by continuous monitoring).

Similarly, the SRI becomes widely adopted across building types. Through the 2030s, the SRI (or an analogous smart readiness evaluation) would have been integrated into smart building management systems. Large buildings not only comply with the mandatory SRI scheme for >290 kW HVAC but also use real-time data to improve their SRI scores (for example, by adding smart controls or demand-response capabilities). Medium and smaller buildings also join in, by 2030, SRI coverage could reach ~25% of the total building stock, expanding beyond Scenario 2 through voluntary uptake in the residential sector and smaller tertiary buildings. Notably, multi-family apartment blocks and even some single-family homes participate, aided by off-the-shelf digital solutions (e.g. a "smart home readiness" app that guides homeowners through assessing their devices and yields an SRI score). By 2040, smart readiness assessment is a mainstream practice, effectively covering most buildings that have any notable level of automation. We estimate over 80% of non-residential buildings and over half of residential buildings could have some form of SRI rating or smart functionality certificate by 2040 in this scenario.

In fact, the distinction between EPC and SRI might blur by 2040, the building's digital logbook provides a comprehensive dashboard of energy performance, smart features, and even environmental indicators, updated continuously. This is enabled by high digital penetration, by the 2030s, most new building equipment is "smart" by default (capable of connectivity), so assessing smart readiness becomes an automated process in many cases.

Key drivers and assumptions:

- **The DIF scenario is underpinned by both strong policy and technological innovation**. Renovation rates are high, approaching 3% per year by the 2030s, boosted by the synergy of digital tools and financing schemes that make renovations easier to plan and execute. Each building's RP is linked with its EPC, providing owners with clear, step-by-step guidance on how to move up the energy classes over time.
- **Administrative capacity is enhanced not just by hiring more staff, but by leveraging automation and data analytics**. For example, regulators use analytics to identify buildings that likely lack an EPC or are due for an update, and then automatically notify those owners. Enforcement in this scenario is tech-enabled: non-compliance (e.g. a building missing an EPC or failing to meet a MEPS milestone) is quickly flagged by cross-referencing permitting databases, utility data, and the digital logbooks. This allows for near-real-time enforcement with far less manual effort.
- **Policy maturity is high**, not only are EPBD IV measures fully in force, but policymakers continuously refine the schemes using the rich data now available. By the late 2020s, for instance, many Member States mandate digital logbooks at key trigger points (such as at property sale or for any building receiving public renovation funding), ensuring that new owners automatically inherit a digital record that includes the EPC and SRI.
- **The integration with financial schemes reaches full potential**: banks, insurance companies, and subsidy programs plug into the interoperable databases. A bank can instantly retrieve a building's verified EPC and SRI ratings (with the owner's consent) from the national database via an API, making "green mortgage" processing seamless. Likewise, when an owner improves their building (as recorded in the logbook and evidenced by a new EPC/SRI), that information can automatically adjust their insurance premiums or make them eligible for an interest rate reduction, creating a strong market pull for keeping certifications up to date.
- **Digital readiness across Europe is assumed to be advanced**: high-speed connectivity even in rural areas allows smart devices in homes to be effective; common data standards and platforms (potentially built on EU-wide initiatives) enable different systems to "talk" to each other. By 2030, all national EPC databases are open and

interoperable, and an EU-level convergence of data models allows cross-country comparison and integration.

- **User-centric design is a priority**, the tools for obtaining an EPC or SRI are as simple as using a smartphone app to scan QR codes on appliances or using AI chatbots to guide data collection. This ease of use dramatically lowers the barrier to entry for building owners. Importantly, the scenario assumes continued public and private investment in these digital solutions throughout the 2020s. The payoff by 2040 is a self-reinforcing system: building performance data flows freely (with proper privacy protections) between stakeholders, and the EPC/SRI become dynamic elements of a building's identity, automatically driving improvements.

In sum, the **Digital and Integrated Future scenario** achieves near-universal coverage of EPCs and a high uptake of SRI by leveraging policy enforcement and digital innovation in tandem. It paints a picture of an EU building stock where energy performance and smart capability information is readily available for virtually every building, thereby supporting not only regulatory compliance but also smarter decision-making in real estate and renovation markets.

These narrative scenarios are designed to be internally consistent and to reflect the range of plausible futures, from minimal intervention to full digital integration, for Europe's building performance assessment, certification and management landscape. Each scenario's assumptions and outcomes will be further used to inform recommendations and the development of the SmarterEPC hub (e.g. features to support the high-uptake DIF scenario).

6. Conclusions

The current coverage of EPCs across EU Member States exhibits significant disparities, with many countries still having a relatively low percentage of their building stock covered. This analysis indicates that factors such as the timing and comprehensiveness of national implementation strategies, the maturity of EPC data infrastructure, the effectiveness of enforcement mechanisms, the triggers for requiring EPCs, and the level of public awareness all play a crucial role in determining the extent of EPC coverage. Challenges related to data availability, quality, and comparability persist, limiting a complete and accurate assessment of the situation across the entire EU.

However, the EPBD IV and the outcomes and ongoing work of numerous EU-funded projects including QualDeEPC[164], U-CERT[165], X-tendo[166], D2EPC[167], E-DYCE[168], ePANACEA[169], EPC RECAST[170], crossCERT[171], EUB SuperHub[172], iBRoad2EPC[173], TIMEPAC[174], CHRONICLE[175], SmartLivingEPC[176], iEPB[177], tunES[178], EPBD.wise[179], EVELIXIA[180], openBEP4EU[181] and OBSERVE[182] promise to bring about significant improvements. The mandatory harmonisation of EPC templates and rating scales, the integration of EPCs with Minimum Energy Performance Standards, the introduction of Renovation Passports, and the inclusion of whole life-cycle carbon considerations support a future where EPCs will play an even more critical role in driving the EU's building decarbonisation agenda.

Achieving comprehensive and reliable EPC data across all Member States is critical for effectively monitoring progress towards the EU's ambitious energy and climate goals for the building sector. While historical coverage has been limited in many countries, the robust framework introduced by the revised EPBD 2024 and the dedicated efforts of these EU funded projects provide a pathway for substantial improvements in the coming years,

[164] https://qualdeepc.eu/
[165] https://u-certproject.eu/
[166] https://x-tendo.eu/
[167] https://www.d2epc.eu/en
[168] https://edyce.eu/
[169] https://epanacea.eu/
[170] https://epc-recast.eu/
[171] https://www.crosscert.eu/
[172] https://eubsuperhub.eu/
[173] https://ibroad2epc.eu/
[174] https://timepac.eu/
[175] https://www.chronicle-project.eu/
[176] https://www.smartlivingepc.eu/en
[177] https://iepb-project.eu/
[178] https://empirica.com/tunes/
[179] https://www.bpie.eu/epbdwise/
[180] https://www.evelixia-project.eu/
[181] https://www.openbep4.eu/
[182] https://lifeprojects.r2msolution.com/observe/

ultimately contributing to a smarter, more sustainable, energy-efficient and healthy building stock across the European Union.

To enhance the understanding and effectiveness of EPC and SRI implementation across the European Union, the following recommendations are proposed.

Improve standardisation of EPC data collection and reporting: The European Commission should actively establish specific guidelines and potentially mandate a standardised format for Member States to report EPC coverage data to the EU Building Stock Observatory. This standardisation should include clear and consistent definitions for building stock categories, reporting periods, and key metrics related to EPC coverage.

Enhance accessibility of national EPC databases: Member States should increase the transparency and accessibility of anonymised and aggregated data derived from their national EPC registers for research and analytical purposes. This should be done in a manner that fully respects data privacy regulations but allows for a more comprehensive understanding of EPC issuance and the characteristics of the certified building stock.

Promote data sharing and interoperability: Greater efforts should be made to facilitate seamless data sharing and enhance interoperability between the EU Building Stock Observatory, various national databases, and relevant research organisations. This improved data ecosystem would enhance the quality, availability and comparability of EPC-related information for analysis and policy development.

Focus on comprehensive coverage across all building types: Member States should prioritise strategies and initiatives aimed at achieving more comprehensive EPC coverage across all segments of their building stock. This includes not only residential buildings but also commercial and public sector buildings, ensuring a complete picture of energy performance can be effectively captured.

Strengthen enforcement and compliance mechanisms: Effective enforcement of the EPBD requirements related to EPCs and SRI is crucial for achieving higher issuance rates. The European Commission should actively monitor and encourage the implementation of robust enforcement mechanisms across all Member States, particularly concerning the mandatory provision of EPCs at the point of sale or rent and the mandatory application of SRI for the “biggest” non-residential buildings.

Support ongoing research and data analysis: Continued investment in research projects aimed at refining EPC and SRI schemes, improving data quality, and enhancing the utilisation of EPC/SRI data for informing policy decisions and driving market transformation is essential. These projects will provide critical insights to address existing limitations related to data and methodologies