JOINED RESOURCE FOR

EPC & SRI PRACTICE COLLECTION

tunES: Tuning EPC and SRI instruments to deliver full potential

Objective

The objective of the collection is to identify, describe and iterate already successfully or currently tested practices on EPC and SRI design, deployment and implementation.

tunES will use the results to drive the national implementation plan of revised EBPD and make all technological advance available to all national energy agencies and responsible ministries.

Structure

tunES describes the entire scope of EPC and SRI projects in five major building blocks. Each practice is linked to at least one of the following building blocks:

Understanding EPC collects practices on how the EPC itself or linked results can be better understood by all involved stakeholders.
Recommendations for harmonisation process

This project has received funding from the European Union's funding instrument for the environment and climate action (LIFE programme) under grant agreement No 101120926.

Country(s)	France, Germany, Spain, Italy, Slovakia, Luxembourg
Source (project info links)	https://epc-recast.eu/
Contact details	Rofaïda Lahrech rofaida.lahrech@cstb.fr
LATER: EPBD Recast	
Problem/Motivation	The motivation behind this practice is to harmonize the 28+ different approaches to EPC across the EU and improve their comparability. This is driven by the need for standardization in assessing building energy performance.
Short description of practice as implemented	The "Recommendation for Harmonisation Process" practice involves advocating for the standardization and harmonization of EPC methodologies across the European Union. This includes incorporating international standards, smart building technologies, and data sets into a cohesive approach to ensure EPC comparability over the EU.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Indicator Development for EPC Contextual Analysis

Country(s)	France, Germany, Spain, Italy, Slovakia, Luxembourg
Source (project info links)	https://epc-recast.eu/
Contact details	Rofaïda Lahrech rofaida.lahrech@cstb.fr
LATER: EPBD Recast	
Problem/Motivation	The practice is motivated by the need to improve the assessment of building energy performance within different national contexts in the EU. It aims to address the variability and challenges encountered in implementing EPC across diverse regulatory and building environments.
Short description of practice as implemented	The practice involves creating indicators that can effectively assess the implementation and performance of EPCs within various national contexts in the EU. These indicators are designed to capture both the challenges and successes encountered during EPC implementation.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Identification of Gaps in Current Sustainability Frameworks

Country(s)	EU countries, South Africa, China, Hong Kong (China), India, Mexico, Germany, USA
Source (project info links)	https://www.smartlivingepc.eu/en/ D2.1 Asset methodology assessment in building level D2.2 Asset assessment methodology in complex level
Contact details	Dr. Dimosthenis Ioannidis - djoannid@iti.gr
LATER: EPBD Recast	
Problem/Motivation	The lack of specific metrics and indicators directly linked to energy consumption in sustainability frameworks.
Short description of practice as implemented	The practice involves examining existing urban sustainability frameworks and identifying the absence of specific energy consumption metrics.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	Integrate robust energy efficiency indicators in urban sustainability frameworks and NSA tools.
Policy measures required for large-scale deployment	Development and integration of standardized energy efficiency metrics..
Evaluation	

Development and Implementation of an Energy-Efficient Building Renovation Planner

Country(s)	Denmark, Ireland, Spain, Greece, Switzerland
Source (project info links)	https://www.chronicle-project.eu/
Contact details	Leon Nielsen – Project Manager lnielsen@fcire.es
LATER: EPBD Recast	
Problem/Motivation	Challenges such as suboptimal energy efficiency in buildings, the complexity of renovation planning, financial considerations, tenant comfort, and sustainability concerns.
Short description of practice as implemented	The Renovation Planner is a tool designed for building professionals and homeowners to plan energy-efficient building renovations. It assesses various renovation scenarios, offering complete financial evaluations and considering factors like tenant comfort and carbon emissions. Users can prioritize preferences, and the tool provides a list of recommended scenarios. Each scenario includes a detailed renovation roadmap. After selecting a preferred scenario, the Renovation Planner issues a building renovation passport (BRP) containing proactive information about future inspections, maintenance, and renovations based on expected component and material service life.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Development of an Investment Appraiser for Building Performance and Energy Saving Investments

Country(s)	Denmark, Ireland, Spain, Greece, Switzerland
Source (project info links)	https://www.chronicle-project.eu/
Contact details	Leon Nielsen – Project Manager lnielsen@fcire.es
LATER: EPBD Recast	
Problem/Motivation	Building professionals and stakeholders often lack a comprehensive tool for assessing the true value and long-term costs of building performance, including both financial and environmental aspects. There is a growing need for informed decision-making when it comes to energy-saving investments and building valuations. Without a robust tool, stakeholders may struggle to evaluate the full financial and environmental implications of their choices.
Short description of practice as implemented	The Investment Appraiser is a tool developed to address challenges in the building industry by providing a comprehensive solution for assessing building value, life cycle costs, and carbon impact. Its primary functions include performing Life Cycle Cost (LCC) analyses, encompassing dynamic and static costs, and calculating the Carbon Bill for both baseline and renovation scenarios. This tool empowers stakeholders with the information needed to make informed decisions regarding building performance, energy-saving investments, and environmental impact, contributing to more sustainable and financially sound choices in the AEC industry.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Development of apps for both residents (ChroViewOcc) and professionals (ChroViewPlus) to understand and improve energy consumption

Country(s)	Denmark, Ireland, Spain, Greece, Switzerland
Source (project info links)	https://www.chronicle-project.eu/
Contact details	Leon Nielsen – Project Manager lnielsen@fcire.es
LATER: EPBD Recast	
Problem/Motivation	The motivation for this practice is to enable residents and professionals to better understand and manage energy consumption in buildings, contributing to increased energy efficiency and reduced carbon footprint.
Short description of practice as implemented	ChroViewOcc is an app designed for building residents to monitor and improve their energy consumption, providing insights into current energy performance and actionable suggestions for energy efficiency improvements. ChroViewPlus is targeted at professionals like Energy Service Companies (ESCOs) and Facility Managers (FM), offering expert recommendations and in-depth insights to effectively reduce energy consumption and costs.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Development of EMPOWER (Energy Monitoring POrtal for aWare usERs) to monitor energy consumption and improve the awareness of users

Country(s)	Italy
Source	https://www2.enea.it/it/ricerca-di-sistema-elettrico/accordo-di-programma-MiSE-ENEA-2019-2021/tecnologie/efficienza-energetica-e-risparmio-di-energia-negli-usi-finali-elettrici-degli-edifici
Contact details	biagio.dipietra@enea.it
Problem/Motivation	i) Energy consumption of Italian residential building stock accounts for around 43% of the national energy requirements, most of which concerns space heating (i.e., approximatively 70%) based on fossil fuels. ii)Improving awareness of final users on their energy consumptions, enabling them to better manage energy use, save energy and lower their bill. iii)EU Directive 2018/2002, transposed into Legislative Decree 73/2020, mandates more frequent information provision to end-users about their consumption.
Short description of practice	EMPOWER is a web portal devoted to visualize energy consumption data collected from smart meters installed in buildings with centralized heating systems. EMPOWER displays simplified energy indices of apartments by comparing the actual energy consumption with: i) the expected heating demand of the apartment (preliminary calculated); ii) the average of the condominium apartments.
Evidence on impact	Users that frequently access to EMPOWER are encouraged to modify their behaviours.
Lessons learnt / recommendations for large-scale roll-out:	Adaptation of companies and installers to new obligations and, consequently, market uptake of smart metering and communication technology.
Policy measures required for large-scale deployment	According to Legislative Decree 73/2020, starting from January 1, 2027, remote reading of individual heat meters and allocators will be mandatory.
Evaluation of policy measure	n.a.

Upgrading EPC collects practices on improving and optimising EPC methodology, generation process or indicators.

Databases and Tools collects practices on (existing or new) data infrastructure and tools requiring central or federated data management.

SRI Development and Deployment collects practices implementing SRI calculation methodology and necessary processes as well as linked use cases.

Integration of Instruments collects practices that integrate EPC and SRI and/or achieve harmonisation, efficiency and interoperability across EPC, SRI and other tools.

How to find your practices?

See section 1.2.2 in table of content or navigation (via CTRL+F) where practices are cross-linked by project.

How to contribute?

Projects listed are invited to edit, update and improve the description of the practices identified. Projects missing can add new entries with the template in section 1.1.

Please use track changed and comments function. The practice titles are work in progress, please use comments to suggest a change as the file uses cross-referencing.

The results can be freely used provides tunES and authors are referenced. tunES will clear the file and generate a PDF-compendium in regular intervals.

How will the collection evolve?

Over time, tunES will incorporate references to EPBD revision and categorise practices accordingly.

How will / can the results be used? Attribution?

Within tunES, the results built the basis for seven energy agencies (and any which follows) to prepare the policy implementation of EPC & SRI. We will document progress with edited iterations of a deliverable.

Beyond tunES, the results are freely available and you can be utilised provided they are attributed to tunES and authors at empirica. To the extent we are able, we will record and make visible all contributors in the living document and in our deliverables.

Contact and support

You can use cluster channel conversations or tag to Georg Vogt, Petr Popov, Tatiana Novikova or write to tunES@empirica.com.

Authors: Georg Vogt, Petr Popov, Tatiana Novikova (all empirica)

Contributors: to be recorded to the extent it can be identified (best write name in comment)

Contents

1 Overview

1.1 Fields for each practice / template

Descriptive title for practice

Country(s)	Countries where a practice is/was implemented.
Source	Project information links such as websites and reports.
Contact details	Contact information of individuals responsible for implementing practices in a project.
LATER: EPBD Recast	List to which EPBD requirements the practice contributes
Problem/Motivation	Underlying reason or cause that prompted the development or implementation of the practice.
Short description of practice	Short description of practice as implemented with given context to status quo where relevant - in case of multiple locations the description is split with paragraphs.
Evidence on impact	How was the impact of a practice measured, including the type, size, and impact that was measured.
Lessons learnt / recommendations for large-scale roll-out:	What recommendations are proposed for large-scale implementation after impact assessment?
Policy measures required for large-scale deployment	What are the recommended policy measures for the large-scale implementation of a practice?
Evaluation of policy measure	How could the success of the practice be evaluated (3-5 years) after policy was implemented?

Note: to add new practice copy the abovementioned template

1.2 Lists of practices

1.2.1 Listed by section

Understanding EPC

Improving renovation recommendations on EPCtowards deep energy renovation
Online tool for comparing EPC recommendations to deep energy renovation recommendation
Stakeholder Analysis and Interviews
Status Overview Collection EPCs across MS
Analysis of the current EPC Methodologies in 10 countries

Analysis of existing EPC attitudes and needs Inventory of similar EU projects

Integration of a new set of indicators (SRI Method B, among others) into NG EPCs using the D^2EPC web platformRecommendations for harmonisation process
Indicator Development for EPC Contextual Analysis
Identification of Gaps in Current Sustainability Frameworks

Development of apps for both residents (ChroViewOcc) and professionals (ChroViewPlus) to understand and improve energy consumption
Development and Implementation of an Energy-Efficient Building Renovation Planner
Development of an Investment Appraiser for Building Performance and Energy Saving Investments

Development of EMPOWER (Energy Monitoring POrtal for aWare usERs) to monitor energy consumption and improve the awareness of usersUpgrading EPC

Enhancing EPCs by incorporating Building Renovation Passport (BRP)
Standardised Procedure for EPC Enhancement with Specialist Input
iBRoad2EPC Assistant Tool for Enhanced EPCs
iBroad2EPC Basic and Additional Modules

Country(s)	Bulgaria, Greece, Romania, Poland, Portugal, Spain
Source (project info links)	https://ibroad2epc.eu/# iBRoad2EPC in depth
Contact details	contact@ibroad2epc.eu
LATER: EPBD Recast	
Problem/Motivation	The need for a comprehensive tool that meets the needs of the market, the possibility of introducing BRP elements in the EPC, and opportunities for further development.
Short description of practice as implemented	The iBRoad2EPC Basic Module comprises all core features of iBRoad2EPC. In addition to the Basic Module it is possible to add special features to the iBRoad2EPC individually. This will allow an upgrade to the iBRoad2EPC that is tailored to the specific country's needs. When implementing iBRoad2EPC, countries can decide whether and which additional features they want to integrate, so that iBRoad2EPC fits well into the existing consulting landscape or with other existing policy instruments in the buildings sector. Additional modules possible: • Cost Module • Energy Demand Module • Indoor Environmental Quality (IEQ) Module • Smart Readiness Indicator (SRI) Module • Other
Evidence on impact	The project aims to test and evaluate the applicability of the iBRoad2EPC concept in six countries.
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

iBRoad2EPC Additional Modules for Enhanced EPCs

Using Building Information Modelling (BIM) for the EPC generation process
Integrated District Energy Assessment for EPCs
Comprehensive Indoor Comfort Assessment in EPCs
Integrated Environmental and Health Impact Assessment in EPCs
Behavioural Impact Analysis and Performance Gap Closure via EUB SuperHub Platform
Performance assessment using well-defined Key Performance Indicators (KPIs)
Process Upscaling for EPC Methodology Improvement
Recommendation for Cloud System Roll-Out
Incorporation of non-energy aspects to building assessment
Introduction of new rating scheme at the building complex level
Innovative Neighbourhood Scale Analysis
Recommendations on integration of Next-generation dynamic EPC in national certification scheme
E-learning program on SRI assessments.

Development of digital building logbooks - new generation of EPCs

Development of digital One-stop-shop platform built upon Digital Building Logbook

Databases and Tools

Characteristics of a successful EPC scheme
Knowledge Exchange Centre for EPCs
Interoperability of EPC Databases

Interoperability of EPC Databases

Country(s)	Spain, Croatia, Malta, UK, Slovenia, Greece, Poland, Bulgaria, Denmark, Austria
Source (project info links)	Expected: D4.2 Analysis of the current integration of EPC data
Contact details	Eva Suba: e.suba@klimabuendnis.org
Problem/Motivation	Identification of the current status of the existing databases and the barriers and challenges still to overcome to achieve fully interoperable and useful EPC databases.
Short description of practice as implemented	D4.2 has been planned to focus and expand the information on the potential uses for EPC databases
Evidence on impact	The concepts of EPC storage, processing, interaction, and interoperability are readily understood. In addition, dividing concepts and tools allows the generation of tailor-made guidelines for each stage of the EPC life cycle.
Lessons learnt / recommendations for large-scale roll-out:	To be developed
Policy measures required for large-scale deployment	Different guidelines have been proposed as a common road map to achieve harmonisation and potential value for the existing databases
Evaluation	

Integrating Implemented Building Performance Tools into a Digital Building Logbook
Implementation of a Semantically Enriched Building Information Modelling Based Common Data Environment (CDE)
3D Visualisation & Monitoring Platform (ChroViewFM) for monitoring real-time data from smart equipment
Building Repository-Enhanced EPC Management
Characteristics of a successful EPC databaseDevelopment of digital One-stop-shop platform built upon Digital Building Logbook

SRI Development and Deployment

Development of Web-based SRI Assessment Toolkit
SRI Decision Support ToolSRI Decision Support Tool
Training and Capacity Building for SRI Auditors in SRI-ENACT
Stakeholder Engagement in Co-creation of SRI-ENACT Tools and Services
Making Energy Efficiency visible
Recommendations on introducing SRI into national regulation
Public Funding Schemes for SRI Upgrades
SRI2MARKET Tool SuiteSRI2MARKET Tool Suite
Automated SRI Calculation and Machine Learning Services
Advanced SRI Assessment and Ethical Conduct in TIMEPAC Project

Smart readiness and Life Cycle Analysis IntegrationIntegration of SRI Indicators into next generation EPCs
Preliminary evaluation of the Smart Readiness Indicator of existing buildings in the Italian building stock
Analysis, application and validation of the Smart Readiness Indicator calculation methodology in the Italian building context
Conceptualization of the benefits of building smartness from the perspectives of carbon-neutral energy system in the Smart-Ready Buildings projectDevelopment of a holistic and modular EPC methodology
Policy implications and national priorities
Training packages and guidance for certification

Integration of Instruments

Use of Smart Readiness Indicator methodology for Integration in EPC schemes
Cross-assessment of EPC

Development and Implementation of a Digital Twin Framework for Building Performance Monitoring and Simulation

Use of Smart Readiness Indicator methodology into EUB digital passport

1.2.2 Listed by project

CHRONICLE

3D Visualisation & Monitoring Platform (ChroViewFM) for monitoring real-time data from smart equipment
Development and Implementation of a Digital Twin Framework for Building Performance Monitoring and Simulation**Error! Reference source not found.**
Development and Implementation of an Energy-Efficient Building Renovation Planner
Development of an Investment Appraiser for Building Performance and Energy Saving Investments
Development of apps for both residents (ChroViewOcc) and professionals (ChroViewPlus) to understand and improve energy consumption
Implementation of a Semantically Enriched Building Information Modelling Based Common Data Environment (CDE)

Interoperability of EPC Databases

Country(s)	Spain, Croatia, Malta, UK, Slovenia, Greece, Poland, Bulgaria, Denmark, Austria
Source (project info links)	Expected: D4.2 Analysis of the current integration of EPC data
Contact details	Eva Suba: e.suba@klimabuendnis.org
Problem/Motivation	Identification of the current status of the existing databases and the barriers and challenges still to overcome to achieve fully interoperable and useful EPC databases.
Short description of practice as implemented	D4.2 has been planned to focus and expand the information on the potential uses for EPC databases
Evidence on impact	The concepts of EPC storage, processing, interaction, and interoperability are readily understood. In addition, dividing concepts and tools allows the generation of tailor-made guidelines for each stage of the EPC life cycle.
Lessons learnt / recommendations for large-scale roll-out:	To be developed
Policy measures required for large-scale deployment	Different guidelines have been proposed as a common road map to achieve harmonisation and potential value for the existing databases
Evaluation	

Integrating Implemented Building Performance Tools into a Digital Building Logbook
Performance assessment using well-defined Key Performance Indicators (KPIs)

CrossCERT

Analysis of existing EPC attitudes and needs
Analysis of the current EPC Methodologies in 10 countries
Building Repository-Enhanced EPC Management
Cross-assessment of EPC
Knowledge Exchange Centre for EPCs
Inventory of similar EU projects
Interoperability of EPC Databases
Harmonisation of EPCs
Analysis of new scales and KPIs

D^2EPC

Recommendations on integration of Next-generation dynamic EPC in national certification scheme

Integration of a new set of indicators (SRI Method B, among others) into NG EPCs using the D^2EPC web platform

Integration of SRI Indicators into next generation EPCs

easySRI

Automated SRI Calculation and Machine Learning Services
Policy implications and national priorities
Training packages and guidance for certification

ePANACEA

Stakeholder Analysis and Interviews
Development of a holistic and modular EPC methodology

EPC RECAST

Recommendations for harmonisation process
Indicator Development for EPC Contextual Analysis
Process Upscaling for EPC Methodology Improvement
Recommendation for Cloud System Roll-Out

EUB SuperHub

Behavioural Impact Analysis and Performance Gap Closure via EUB SuperHub Platform
Development of digital building logbooks - new generation of EPCs
Development of digital One-stop-shop platform built upon Digital Building Logbook
Use of Smart Readiness Indicator methodology into EUB digital passport

iBRoad2EPC

Enhancing EPCs by incorporating Building Renovation Passport (BRP)
Standardised Procedure for EPC Enhancement with Specialist Input
iBRoad2EPC Assistant Tool for Enhanced EPCs
iBRoad2EPC Basic and Additional Modules

QualDeEPC

Improving renovation recommendations on EPC
Online tool for comparing EPC recommendations to deep energy renovation recommendation
Building automation
Characteristics of a successful EPC scheme

Smart Living EPC

Identification of Gaps in Current Sustainability Frameworks
Incorporation of non-energy aspects to building assessment
Introduction of new rating scheme at the building complex level
Smart readiness and Life Cycle Analysis Integration
Innovative Neighbourhood Scale Analysis
Smart readiness and Life Cycle Analysis Integration

Smarter EPC

SRI2MARKET

Recommendations on introducing SRI into national regulation
Public Funding Schemes for SRI Upgrades
SRI2MARKET Tool Suite
E-learning program on SRI assessments.

SRI-ENACT

Development of Web-based SRI Assessment Toolkit
SRI Decision Support Tool
Training and Capacity Building for SRI Auditors in SRI-ENACT
Stakeholder Engagement in Co-creation of SRI-ENACT Tools and Services

TIMEPAC

Country(s)	Bulgaria, Greece, Romania, Poland, Portugal, Spain
Source (project info links)	https://ibroad2epc.eu/# iBRoad2EPC in depth
Contact details	contact@ibroad2epc.eu
LATER: EPBD Recast	
Problem/Motivation	The need for a comprehensive tool that meets the needs of the market, the possibility of introducing BRP elements in the EPC, and opportunities for further development.
Short description of practice as implemented	The iBRoad2EPC Basic Module comprises all core features of iBRoad2EPC. In addition to the Basic Module it is possible to add special features to the iBRoad2EPC individually. This will allow an upgrade to the iBRoad2EPC that is tailored to the specific country's needs. When implementing iBRoad2EPC, countries can decide whether and which additional features they want to integrate, so that iBRoad2EPC fits well into the existing consulting landscape or with other existing policy instruments in the buildings sector. Additional modules possible: • Cost Module • Energy Demand Module • Indoor Environmental Quality (IEQ) Module • Smart Readiness Indicator (SRI) Module • Other
Evidence on impact	The project aims to test and evaluate the applicability of the iBRoad2EPC concept in six countries.
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

iBRoad2EPC Additional Modules for Enhanced EPCs

Using Building Information Modelling (BIM) for the EPC generation process
Advanced SRI Assessment and Ethical Conduct in TIMEPAC Project

U-CERT

Status Overview Collection EPCs across MS

X-tendo

Integrated District Energy Assessment for EPCs
Comprehensive Indoor Comfort Assessment in EPCs
Integrated Environmental and Health Impact Assessment in EPCs
Use of Smart Readiness Indicator methodology for Integration in EPC schemes

2 Understanding EPC

2.1 Summary – to follow

2.2 Practices

Improving renovation recommendations on EPC

Country(s)	Bulgaria, Germany, Greece, Hungary, Latvia, Spain, Sweden
Source (project info links)	https://qualdeepc.eu/ QualDeEPC – Deliverable D3.2 White Paper on good practice in EPC assessment, certification, and use, p. 18-23 QualDeEPC- Deliverable D4.5 Summary evaluation report p 18-38
Contact details	mail@qualdeepc.eu
LATER: EPBD Recast	
Problem/Motivation	Currently, renovation recommendations in EPCs in most European countries are limited to low–cost measures or to reach minimum legal requirements. Such recommendations may not be the most cost-effective actions taken. Often no recommendations are given on deep energy renovation leaving owners unaware of the potential.
Short description of practice as implemented	The developed guidance describes high-quality renovation recommendations and how these should be selected and presented on EPCs. Moreover, the energy rating was proposed with 'traffic light system' for individual recommendations for building envelope and technical systems in order to support staged deep renovation.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	The specific renovation recommendations selected by EPC assessors/issuers differ by country because of specific climate zones, national requirements and building standards, and the uncertainty about the interpretation of "cost-effectiveness". Often "typical" values are hard to specify because no official documentation about renovation recommendations exist.
Policy measures required for large-scale deployment	Create guidance on recommendations toward 'deep energy renovation' sorted by themes: o External wall insulation o Roof insulation o Insulation of ceiling of an unheated basement/ ground floor o Window replacement o Door replacement o Replacement/ Installation of shading o Replacement/ installation of the mechanical ventilation system o Replacement/ modernisation of the heating system o Replacement/ modernisation of the cooling system o Replacement/ modernisation of the DHW system o Integration of renewable energy sources o Lighting o Reduction of thermal bridging o Increased air tightness o Building automation

Evaluation	The renovation recommendations were included and tested as part of the testing phase of the project via the enhanced EPC form proposed by the QualDeEPC. The testing phase included 98 pilot cases/buildings in the 7 participating countries both residential (61) and non-residential (37). The evaluation results were mainly derived from 1) a comparison of the standard and enhanced EPCs (general and for pilot buildings), 2) questionnaires answered by pilot building representatives, and 3) stakeholder roundtable meetings at national level. A key result from the transnational comparison of the of the standard and enhanced EPCs showed on average that the Enhanced EPCs presented an average energy savings potential of 49.4%. The building representatives found a proposed feature called 'traffic light system' that classified the efficiency of building envelope and technical systems, and the information on energy and cost savings to be informative.

Online tool for comparing EPC recommendations to deep energy renovation recommendation

Country(s)	Bulgaria, Germany, Greece, Hungary, Latvia, Spain, Sweden
Source (project info links)	https://qualdeepc.eu/ QualDeEPC – Deliverable D3.2 White Paper on good practice in EPC assessment, certification, and use, p. 24-33 QualDeEPC- Deliverable D4.5 Summary evaluation report p 30-32 & 77-78
Contact details	mail@qualdeepc.eu
LATER: EPBD Recast	
Problem/Motivation	Regular homeowners have no means of assessing which renovation measures can be taken and which impact they have.
Short description of practice as implemented	By entering the information provided by the EPC (location, envelope, technical systems), the QualDeEPC tool calculates and informs regular homeowners about simulated renovations and the resulting energy performance of the dwellings/multifamily building. The tool informs users about which measures would be required to achieve higher levels of energy performance, corresponding to deep renovation. The QualDeEPC tool (Master version) was based on the existing Greek Home Energy Check tool (HEC) enriched with the new features in terms of elements (e.g., further building types), systems and recommendations, The proposed recommendations are presented in a prioritized manner and included in the relevant lists for improving energy efficiency, so as the user to get familiar with the typical order of implementing such measures avoiding any damages of the systems in the future or lock-in effects. The output includes the calculated energy class before and after renovation of the building, indicative costs and savings, the CO2 emissions reduction (in %) which can be used to seek professional advice about the viability of performing the renovation.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	Overall, the online tool received wide acceptance from the stakeholders. On national level, these platforms should be operated by the energy agencies, which will give the possibility to consult them not only online, but also physically and receive the required support from them. The cost related information is perceived too unreliable due to the dynamically fluctuating market environment. However, this could be overcome by annually updating the cost database.
Policy measures required for large-scale deployment	Provide citizens with a simplified simulation tool for deep energy renovations.
Evaluation	The evaluation for the online tool was mainly based on the interviews with pilot building representatives and stakeholder roundtable meetings at national level. Most stakeholders have expressed

	interest in the information provided in such an online tool and in many of its features, suggesting that stakeholders in most countries have similar needs. The implementation of such tools in more countries could support the increase convergence of EPC schemes in MS.

Stakeholder Analysis and Interviews

Country(s)	Austria, Belgium, Finland, Germany, Greece, Spain
Source (project info links)	https://epanacea.eu/, ePANACEA – Stakeholder Analysis
Contact details	contact@epanacea.eu
LATER: EPBD Recast	
Problem/Motivation	Need to comprehensively grasp the diverse perspectives, needs, and challenges surrounding EPCs. Lack of accuracy, a gap between theoretical and real consumption patterns, absence of proper protocols for inclusion of smart and novel technologies, little convergence across Europe, lack of trust in the market and very little user awareness related to energy efficiency
Short description of practice as implemented	The practice entailed a detailed examination of EPC end users and other influential stakeholders. The approach involved a thorough literature review, collaboration with partners across multiple countries, and the development of general and country-specific stakeholder maps. This foundational work was designed to guide subsequent interviews and workshops, aimed at understanding stakeholder interactions with EPCs and shaping future iterations to better meet user needs.
Evidence on impact	The project conducted 63 interviews across six countries, with 38 involving end users and 25 with other stakeholders. These interviews informed the design of user-needs workshops, where participants' feedback was crucial for developing the next generation of EPCs. The workshops, lasting about two hours, were designed to understand varying critiques and needs among different stakeholders.
Lessons learnt / recommendations for large-scale roll-out:	EPCs for building energy efficiency comparison, mandatory for property transactions. Centralise EPC registration, ensure site visits, certify auditors, and offer certifier training. Streamline calculation parameters, include ecological and energy factors. Create user-specific EPCs with cost insights and energy-saving advice. Introduce dynamic EPCs with visual tools and renovation guides.
Policy measures required for large-scale deployment	Improve EPC communication by intermediaries. Create user-friendly and technical EPC versions. Link EPCs to fuel cost databases for dynamism. Add digital features for real-time EPC updates. Establish criteria for adequate EPCs and integrate relevant databases.
Evaluation	

Commented [Ga2]: Lack of accuracy, a gap between theoretical and real consumption patterns, absence of proper protocols for inclusion of smart and novel technologies, little convergence across Europe, lack of trust in the market and very little user awareness related to energy efficiency (AEA)

Status Overview Collection EPCs across MS

Country(s)	Bulgaria, Denmark, Estonia, France, Hungary, Italy, Netherlands, Romania, Slovenia, Spain, Sweden
Source (project info links)	https://u-certproject.eu/ D2.1 Report on implementation of EPC schemes in U-CERT partner countries
Contact details	info@u-certproject.eu
LATER: EPBD Recast	
Problem/Motivation	EPC programs may exhibit variations in scope, quality, and effectiveness across different countries. By collecting and analysing data on EPC implementation, it becomes possible to assess these variations, benchmark best practices, identify common challenges, and inform policy decisions.
Short description of practice as implemented	The "Status Overview Collection EPCs across MS" involves a systematic collection and analysis of the status of EPCs across various Member States. This practice is intended to gather comprehensive data on the implementation, challenges, and effectiveness of EPC schemes within these countries. By comparing the EPC frameworks and outcomes across different national contexts, U-CERT aims to identify areas for improvement, and opportunities for harmonisation in the realm of building energy performance assessment.
Evidence on impact	The collection of the EPC reports in the U-CERT countries was coordinated by REHVA (The Federation of European Heating, Ventilation and Air Conditioning) with the support of all the relevant project partners responsible for the UCERT case studies for which the EPCs and accompanying annexes were collected and translated to English.
Lessons learnt / recommendations for large-scale roll-out:	Most analysed EPC case studies did not include explicit cost-effective recommendations for improvement. When included, the information often lacked completeness and understandability for the building owner or prospective owner. The French EPC case, depicted in the report, utilised user-friendly icons to better illustrate potential improvements. This approach can enhance the understandability of EPCs. Danish EPCs include contextual information on energy savings proposals, which may facilitate building owners' understanding of the recommendations.
Policy measures required for large-scale deployment	Standardise EP rating methods across countries.
Evaluation	

Commented [Ga3]: The page is blocked (AEA)

Commented [GV4R3]: Available for me

Commented [Ga5]: Also, a holistic and user-centred EPC, new set of energy-performance standards easily accessible to a wide range of users by leveraging the diverse services offered by the EPB centre (AEA)

Analysis of the current EPC Methodologies in 10 countries

Commented [Ga6]: Inserted because it may got lost (?)(AEA)

Country(s)	Spain, Croatia, Malta, UK, Slovenia, Greece, Poland, Bulgaria, Denmark, Austria
Source	https://www.crosscert.eu/ CrossCERT - D3.1 Review of approaches to EPC assessment across chosen member states, p.32-33
Contact details	Eva Suba: e.suba@klimabuendnis.org
LATER: EPBD Recast	
Problem/Motivation	Creation of a benchmark repository, providing technical guidelines for the next generation of EPCs, Development of guidelines and tools for the exploitation of EPCs' data, Elaboration of a tool for the design of people-centred EPCs, Providing recommendations for the harmonisation of next generation EPCs, Creation of an EPCs knowledge exchange centre, Creation of an EPC community forum
Short description of practice	Review of general aspects and some technical details of EPC assessment methodologies. Different approaches may influence the results of cross-testing as the input parameters and assessment differs.
Evidence on impact	Comparison and analysis of EPC methodologies in 10 countries.
Lessons learnt / recommendations for large-scale roll-out:	There are several approaches observed in the EPC methodologies: Most partner countries' approaches are closer to the standardized with single values or ranges of values provided for each parameter. Bulgaria uses a tailored approach: default values for the inputs are not provided by the methodology, and the assessor uses their experience or actual data collected on site to fill in such inputs. The performance gap (between actual building and calculation results) might be lower, such an approach makes EPC rating comparison between buildings a fundamentally different exercise, where assessors could provide different inputs to the calculation software resulting in different ratings for a given building. Poland and Slovenia use approaches with some inputs tailored to each building and provide the assessor with a higher degree of freedom in terms of the inputs of EPC calculation. Education requirements for EPC assessors: UK and Denmark have less strict conditions compared to other countries; Bulgaria and Croatia have the highest level of education and experience requirements, which is to be expected since the Bulgarian method relies more on the assessor's knowledge and their data collection skills.
Policy measures required for large-scale deployment	

Evaluation of policy measure	

Analysis of existing EPC attitudes and needs

Country(s)	Spain, Croatia, Malta, UK, Slovenia, Greece, Poland, Bulgaria, Denmark, Austria
Source (project info links)	https://www.crosscert.eu/ CrossCERT – Deliverable D5.1 Report on existing EPC attitudes, expectations and needs, p.26-47
Contact details	Eva Suba: e.suba@klimabuendnis.org
LATER: EPBD Recast	
Problem/Motivation	There is a discrepancy between the declared theoretical value of EPCs and the actual experienced and perceived value, which in practice is often reflected in dull descriptions of EPCs, such as them being an administrative necessity or a tax. Lack of homogeneity in EPCs schemes across MSs (AEA)
Short description of practice as implemented	CrossCERT contrasts theory and practice as two largely separate perspectives on understanding existing EPBD policies and EPC schemes.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	Theoretical assumptions and expectations regarding the impact (or performance) of EPC schemes and EPCs do not match its actual effect on the markets, the people, or society, at least with regard to reflections in lived experiences shared by many relevant stakeholders. Some ambitions projected onto EPCs cannot be realised only by the EPCs as such because of the challenge of diversity in national-level EPBD implementation. Buildings should not be considered only as structured physical materials but also as complex (assemblages) of social objects and meanings.
Policy measures required for large-scale deployment	
Evaluation	

Commented [Ga7]: Lack of homogeneity in EPCs schemes across MSs (AEA)

Inventory of similar EU projects

Country(s)	Spain, Croatia, Malta, UK, Slovenia, Greece, Poland, Bulgaria, Denmark, Austria
Source (project info links)	https://www.crosscert.eu/fileadmin/user_upload/crossCert_D2.3_Recent_EPC_initiatives_across_Europe_3rd_version__delivered_.pdf
Contact details	Eva Suba: e.suba@klimabuendnis.org
Problem/Motivation	Determine the starting point of the project related to the similar work already done by all other projects referred to either as progress or as barriers towards the harmonization of EPCs across EU countries.
Short description of practice as implemented	crossCert partners assess previous projects in respect of lessons learned, EPC developments and new EPC approaches. In that way, the previous work that was funded by the European Union will be capitalised and each crossCert partner will have yeast to start processing the EPCs convergence issues. In particular, the document retrieves the information from projects that have tested the current EPCs or have proposed new approaches, from projects that have worked with new Key Performance Indicators, SRI or have tested new software for the energy assessment of buildings. Finally, the document includes sections that refer to the human factor (training, marketing and the improved relation between EPCs and the building owners. It contains also a brief description of each project as well as contact details.
Evidence on impact	Review of 30 EU related projects and mapping them according to project's priorities.
Lessons learnt / recommendations for large-scale roll-out:	To be developed
Policy measures required for large-scale deployment	Some of the projects include Policy recommendations
Evaluation	

Analysis of available KPIs and scales from Horizon2020 projects and partner countries

Country(s)	Spain, Croatia, Malta, UK, Slovenia, Greece, Poland, Bulgaria, Denmark, Austria
Source (project info links)	Expected: D3.3 Analysis of new scales and KPIs
Contact details	Eva Suba: e.suba@klimabuendnis.org
Problem/Motivation	Need to describe and categorize indicators found in projects as well as partner countries to compare and draw conclusions
Short description of practice as implemented	D3.3 takes existing EPC approaches of member states, alongside Horizon2020 projects, and propose a series of appropriate output metrics and KPIs that are deemed achievable from those methods (where some of these metrics may already be used by those methodologies). This mapping of appropriate output metrics with assessment type will then be used to highlight which type of approach is suitable for meeting “new” requirements of EPCs, and the degree to which such assessment approaches may be harmonized across member states.
Evidence on impact	Review of EU related projects and partner’s EPCs mapping them according to five categories.
Lessons learnt / recommendations for large-scale roll-out:	The predominant focus of these projects lies in the refinement and adaptation of existing Key Performance Indicators (KPIs) through conducted research and surveys. Primarily, considerable attention is directed towards KPIs related to the smartness and energy efficiency of buildings. In countries, the most popular indicators are the KPIs from the "life cycle" category, the second most popular category is the indicators from the "climate change" category. - each of them related to CO2 emissions. The third most popular were financial KPIs. "Smartness" and "human-centric" indicators were missing from the front page
Policy measures required for large-scale deployment	Some of the projects include Policy recommendations
Evaluation	

Commented [PP8]: Understanding or integration?

Integration of a new set of indicators (SRI Method B, among others) into NG EPCs using the D^2EPC web platform

Country(s)	Austria, Cyprus, Greece, Germany, Lithuania, Netherlands, Spain
Source (project info links)	D^2EPC
Contact details	Panagiota Chatzipanagiotidou: phatzip@iti.gr
LATER: EPBD Recast	
Problem/Motivation	Traditional EPCs focus primarily on energy efficiency but do not fully account for a building's overall environmental impact throughout its lifecycle. This gap can lead to underestimation of a building's carbon footprint and overlooks the broader sustainability aspects.
Short description of practice as implemented	The D^2EPC methodology includes a novel set of indicators into EPC assessment, namely the Smart Readiness Indicator (SRI), human comfort and wellbeing indicators, energy and environmental indicators and financial indicators. It aims to raise awareness of the benefits of smart technologies and ICT in buildings, to consider the whole life cycle of the building as a structure, to focus also on the “human-centric” nature of the next generation EPC and to increase the user-friendliness of the EPC by using terms that are widely understood and accepted by the public, such as the monetary indicators related to the main energy consumptions of the building(heating, cooling, lighting, appliances). The D^2EPC web platform and additional services comprise an intuitive user interface, where developed functionalities are accessible by end users. It serves as a common user-friendly interactive environment for accessing all the D^2EPC tools. It hosts the presentation of all the results from the different components and sub-components, such as the EPCs, the KPIs, and the additional services. Through the web platform, end users (engineers, building owners, registries, etc.) can not only customise and configure certain components by all the necessary data through the user interface after uploading the building’s IFC file (BIM), but also request directly the execution of certain processes. An asset or operational rating based EPC can be issued; a road-mapping-tool, an AI performance forecasts module along with performance alerts and notifications is available; and a Building Energy Performance Benchmarking tool provides a ranking, based on the user role, of buildings that have been assessed using the web platform. In order to ensure adequate data quality, a data verification process is applied to all data collected by the Energy Performance Verification and Credibility Tool from metering/sensing infrastructure. The D^2EPC prototype also provides a WebGIS tool.
Evidence on impact	Testing and validation of the D^2EPC prototype on 6 pilot sites

Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Recommendations for harmonisation process

Country(s)	France, Germany, Spain, Italy, Slovakia, Luxembourg
Source (project info links)	https://epc-recast.eu/
Contact details	Rofaïda Lahrech rofaida.lahrech@cstb.fr
LATER: EPBD Recast	
Problem/Motivation	The motivation behind this practice is to harmonize the 28+ different approaches to EPC across the EU and improve their comparability. This is driven by the need for standardization in assessing building energy performance.
Short description of practice as implemented	The "Recommendation for Harmonisation Process" practice involves advocating for the standardization and harmonization of EPC methodologies across the European Union. This includes incorporating international standards, smart building technologies, and data sets into a cohesive approach to ensure EPC comparability over the EU.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Indicator Development for EPC Contextual Analysis

Country(s)	France, Germany, Spain, Italy, Slovakia, Luxembourg
Source (project info links)	https://epc-recast.eu/
Contact details	Rofaïda Lahrech rofaida.lahrech@cstb.fr
LATER: EPBD Recast	
Problem/Motivation	The practice is motivated by the need to improve the assessment of building energy performance within different national contexts in the EU. It aims to address the variability and challenges encountered in implementing EPC across diverse regulatory and building environments.
Short description of practice as implemented	The practice involves creating indicators that can effectively assess the implementation and performance of EPCs within various national contexts in the EU. These indicators are designed to capture both the challenges and successes encountered during EPC implementation.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Identification of Gaps in Current Sustainability Frameworks

Country(s)	EU countries, South Africa, China, Hong Kong (China), India, Mexico, Germany, USA
Source (project info links)	https://www.smartlivingepc.eu/en/ D2.1 Asset methodology assessment in building level D2.2 Asset assessment methodology in complex level
Contact details	Dr. Dimosthenis Ioannidis - djoannid@iti.gr
LATER: EPBD Recast	
Problem/Motivation	The lack of specific metrics and indicators directly linked to energy consumption in sustainability frameworks.
Short description of practice as implemented	The practice involves examining existing urban sustainability frameworks and identifying the absence of specific energy consumption metrics.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	Integrate robust energy efficiency indicators in urban sustainability frameworks and NSA tools.
Policy measures required for large-scale deployment	Development and integration of standardized energy efficiency metrics..
Evaluation	

Development and Implementation of an Energy-Efficient Building Renovation Planner

Country(s)	Denmark, Ireland, Spain, Greece, Switzerland
Source (project info links)	https://www.chronicle-project.eu/
Contact details	Leon Nielsen – Project Manager lnielsen@fcire.es
LATER: EPBD Recast	
Problem/Motivation	Challenges such as suboptimal energy efficiency in buildings, the complexity of renovation planning, financial considerations, tenant comfort, and sustainability concerns.
Short description of practice as implemented	The Renovation Planner is a tool designed for building professionals and homeowners to plan energy-efficient building renovations. It assesses various renovation scenarios, offering complete financial evaluations and considering factors like tenant comfort and carbon emissions. Users can prioritize preferences, and the tool provides a list of recommended scenarios. Each scenario includes a detailed renovation roadmap. After selecting a preferred scenario, the Renovation Planner issues a building renovation passport (BRP) containing proactive information about future inspections, maintenance, and renovations based on expected component and material service life.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Development of an Investment Appraiser for Building Performance and Energy Saving Investments

Country(s)	Denmark, Ireland, Spain, Greece, Switzerland
Source (project info links)	https://www.chronicle-project.eu/
Contact details	Leon Nielsen – Project Manager lnielsen@fcire.es
LATER: EPBD Recast	
Problem/Motivation	Building professionals and stakeholders often lack a comprehensive tool for assessing the true value and long-term costs of building performance, including both financial and environmental aspects. There is a growing need for informed decision-making when it comes to energy-saving investments and building valuations. Without a robust tool, stakeholders may struggle to evaluate the full financial and environmental implications of their choices.
Short description of practice as implemented	The Investment Appraiser is a tool developed to address challenges in the building industry by providing a comprehensive solution for assessing building value, life cycle costs, and carbon impact. Its primary functions include performing Life Cycle Cost (LCC) analyses, encompassing dynamic and static costs, and calculating the Carbon Bill for both baseline and renovation scenarios. This tool empowers stakeholders with the information needed to make informed decisions regarding building performance, energy-saving investments, and environmental impact, contributing to more sustainable and financially sound choices in the AEC industry.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Development of apps for both residents (ChroViewOcc) and professionals (ChroViewPlus) to understand and improve energy consumption

Country(s)	Denmark, Ireland, Spain, Greece, Switzerland
Source (project info links)	https://www.chronicle-project.eu/
Contact details	Leon Nielsen – Project Manager lnielsen@fcire.es
LATER: EPBD Recast	
Problem/Motivation	The motivation for this practice is to enable residents and professionals to better understand and manage energy consumption in buildings, contributing to increased energy efficiency and reduced carbon footprint.
Short description of practice as implemented	ChroViewOcc is an app designed for building residents to monitor and improve their energy consumption, providing insights into current energy performance and actionable suggestions for energy efficiency improvements. ChroViewPlus is targeted at professionals like Energy Service Companies (ESCOs) and Facility Managers (FM), offering expert recommendations and in-depth insights to effectively reduce energy consumption and costs.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Development of EMPOWER (Energy Monitoring POrtal for aWare usERs) to monitor energy consumption and improve the awareness of users

Country(s)	Italy
Source	https://www2.enea.it/it/ricerca-di-sistema-elettrico/accordo-di-programma-MiSE-ENEA-2019-2021/tecnologie/efficienza-energetica-e-risparmio-di-energia-negli-usi-finali-elettrici-degli-edifici
Contact details	biagio.dipietra@enea.it
Problem/Motivation	i) Energy consumption of Italian residential building stock accounts for around 43% of the national energy requirements, most of which concerns space heating (i.e., approximatively 70%) based on fossil fuels. ii)Improving awareness of final users on their energy consumptions, enabling them to better manage energy use, save energy and lower their bill. iii)EU Directive 2018/2002, transposed into Legislative Decree 73/2020, mandates more frequent information provision to end-users about their consumption.
Short description of practice	EMPOWER is a web portal devoted to visualize energy consumption data collected from smart meters installed in buildings with centralized heating systems. EMPOWER displays simplified energy indices of apartments by comparing the actual energy consumption with: i) the expected heating demand of the apartment (preliminary calculated); ii) the average of the condominium apartments.
Evidence on impact	Users that frequently access to EMPOWER are encouraged to modify their behaviours.
Lessons learnt / recommendations for large-scale roll-out:	Adaptation of companies and installers to new obligations and, consequently, market uptake of smart metering and communication technology.
Policy measures required for large-scale deployment	According to Legislative Decree 73/2020, starting from January 1, 2027, remote reading of individual heat meters and allocators will be mandatory.
Evaluation of policy measure	n.a.

3 Upgrading EPC

3.1 Summary – to follow

3.2 Practices

Enhancing EPCs by incorporating Building Renovation Passport (BRP)

Country(s)	Bulgaria, Greece, Poland, Portugal, Romania and Spain
Source (project info links)	https://ibroad2epc.eu/# iBRoad2EPC in depth
Contact details	contact@ibroad2epc.eu
LATER: EPBD Recast	
Problem/Motivation	The gap in current EPCs which often lack comprehensive, long-term renovation strategies aligned with national climate targets. Often, EPCs do not include concrete technical renovation recommendations, are selected automatically, describe only few measures with insufficient information, and have no strict relation to the national strategies for the building stock.
Short description of practice as implemented	This approach enhances EPCs by integrating long-term, step-by-step renovation strategies tailored to individual buildings. These strategies are aligned with national climate and energy targets, providing a detailed, forward-looking plan that surpasses the traditional EPC format, which typically offers only a static snapshot of a building's energy performance.
Evidence on impact	The project aims to test and evaluate the applicability of the iBRoad2EPC concept in six countries.
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Standardised Procedure for EPC Enhancement with Specialist Input

Country(s)	Bulgaria, Greece, Portugal, Spain, Romania
Source (project info links)	https://ibroad2epc.eu/# Conceptualising iBRoad2EPC
Contact details	contact@ibroad2epc.eu
LATER: EPBD Recast	
Problem/Motivation	The practice was developed to address the limitations of existing EPCs in accurately reflecting the unique energy performance characteristics of individual buildings. It seeks to improve the precision and relevance of EPCs by incorporating the expertise of specialists.
Short description of practice as implemented	This practice involves a standardised procedure where specialists conduct on-site visits to evaluate buildings. They then determine the most appropriate renovation measures, their sequence, and their alignment with national GHG targets. The practice emphasises individualised strategies for each building, considering its specific characteristics and future legal obligations.
Evidence on impact	The project aims to test and evaluate the applicability of the iBRoad2EPC concept in six countries.
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

iBRoad2EPC Assistant Tool for Enhanced EPCs

Country(s)	Bulgaria, Greece, Romania, Poland, Portugal, Spain
Source (project info links)	https://ibroad2epc.eu/# Conceptualising iBRoad2EPC
Contact details	contact@ibroad2epc.eu
LATER: EPBD Recast	
Problem/Motivation	Need to streamline the process of integrating Building Renovation Passport elements into existing EPCs, ensuring uniformity in design, ease of use for issuers, and adaptability to various platforms.
Short description of practice as implemented	The iBRoad2EPC Assistant Tool is an online backend tool designed to create iBRoad2EPCs in a uniform format. It allows for the output of iBRoad2EPC in both online and printable versions, provides user-friendly guidance for issuers, facilitates the assignment of renovation measures at specific times, and allows for easy modification of default content. The tool is designed for compatibility with various platforms, including existing EPC software and energy performance registers in Member States.
Evidence on impact	The project aims to test and evaluate the applicability of the iBRoad2EPC concept in six countries.
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

iBRoad2EPC Additional Modules for Enhanced EPCs

Country(s)	Bulgaria, Greece, Romania, Poland, Portugal, Spain
Source (project info links)	https://ibroad2epc.eu/# iBRoad2EPC in depth
Contact details	contact@ibroad2epc.eu
LATER: EPBD Recast	
Problem/Motivation	The need for a comprehensive tool that meets the needs of the market, the possibility of introducing BRP elements in the EPC, and opportunities for further development.
Short description of practice as implemented	The iBRoad2EPC Basic Module comprises all core features of iBRoad2EPC. In addition to the Basic Module it is possible to add special features to the iBRoad2EPC individually. This will allow an upgrade to the iBRoad2EPC that is tailored to the specific country's needs. When implementing iBRoad2EPC, countries can decide whether and which additional features they want to integrate, so that iBRoad2EPC fits well into the existing consulting landscape or with other existing policy instruments in the buildings sector. Additional modules possible: • Cost Module • Energy Demand Module • Indoor Environmental Quality (IEQ) Module • Smart Readiness Indicator (SRI) Module • Other
Evidence on impact	The project aims to test and evaluate the applicability of the iBRoad2EPC concept in six countries.
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Using Building Information Modelling (BIM) for the EPC generation process

Country(s)	Austria, Croatia, Cyprus, Italy, Slovenia, and Spain
Source (project info links)	https://timepac.eu/ D2.1 Generating enhanced EPCs with BIM data Transversal Deployment Scenario 1
Contact details	Leandro Madrazo Agudin – Project Coordinator leandro.madrazo@salle.url.edu
LATER: EPBD Recast	
Problem/Motivation	EPCs may not reflect a building's actual energy performance due to outdated or incomplete data and lack of standardisation. Varying methods, tools, and experts used for assessment can lead to inaccurate input data.
Short description of practice as implemented	BIM is a digital representation of a building's physical and functional characteristics. It supports design, construction, operation, and maintenance. BIM models provide accurate data on geometry, materials, systems, and performance, used to calculate EPCs. Using BIM reduces human errors, improving the reliability and efficiency of energy needs assessment.
Evidence on impact	Case studies in six countries: a total of 30 buildings, with five buildings from each country, were modelled following the guidelines. These buildings varied significantly in terms of their design, type, and purpose providing a diverse set of models for examination.
Lessons learnt / recommendations for large-scale roll-out:	Creating a BIM just for an EPC may not be worth it due to the time required. BIM in a BRP is justified. Use open standards and protocols that enable different software applications and systems to exchange data seamlessly. For a model to be optimally developed, exported, verified, and imported, it should avoid any lack of information, particularly when different individuals are responsible for each of the processes. To assess the reliability of a BIM model, a comprehensive comparison should be conducted between the model and actual building data. Improve data interoperability between BIM and EPC software, ensuring smoother and more accurate energy performance assessments.
Policy measures required for large-scale deployment	Government and regulatory bodies can influence standards adoption through project requirements and codes.
Evaluation	

Integrated District Energy Assessment for EPCs

Country(s)	Denmark, Italy, Poland, Romania
Source (project info links)	https://x-tendo.eu/ X-tendo feature 5: district energy p. 9-17
Contact details	Lukas Kranzl – Project Coordinator Lukas.Kranzl@tuwien.ac.at
LATER: EPBD Recast	
Problem/Motivation	
Short description of practice as implemented	The "Integrated District Energy Assessment for EPCs" practice evaluates the energy efficiency and environmental impact of a district heating (DH) or cooling network near a building. It assesses the DH network's efficiency, carbon content, and renewable energy share, as well as the building's suitability for low-temperature heat supply. The assessment aids residents in understanding the network's performance and potential connection to a low-temperature DH system, promoting energy efficiency and decarbonisation in heating.
Evidence on impact	In-building tests in three countries: Romania, Italy, Poland using the calculation tool. To use the calculation tool, additional data, with respect to those currently collected for the usual EPC issuing process in the different countries was collected during the on-site visit, and additional calculations (i.e., the heat load of the representative room) were performed.
Lessons learnt / recommendations for large-scale roll-out:	Essential to offer estimation tables for various radiator and heat transfer system types with thermal output at different temperatures, aiding EPC assessors.
Policy measures required for large-scale deployment	For the implementation of this feature there must be provisions in place to set up two databases with DH parameters and parameters of the radiators at national level. It is important to show the economic feasibility of district heating, to involve the public in urban planning, engage people in finding solutions and planning district heating.
Evaluation	

Comprehensive Indoor Comfort Assessment in EPCs

Country(s)	Austria, Greece, Portugal, Romania
Source (project info links)	https://x-tendo.eu/ X-tendo feature 2: comfort indicator p. 9-17
Contact details	Lukas Kranzl – Project Coordinator - Lukas.Kranzl@tuwien.ac.at
LATER: EPBD Recast	
Problem/motivation	Currently no assessment of the comfort levels of a building is being conducted and therefore recommended renovation measures might ignore the potential of improving or adverse effects on comfort.
Short description of practice as implemented	The "Comprehensive Indoor Comfort Assessment in EPCs" enriches EPCs by evaluating indoor air quality, thermal comfort, and acoustic comfort. It informs building owners and occupants about the quality of their indoor environment, offering guidance on optimising heating, cooling, ventilation, and noise levels for a more comfortable and energy-efficient living or working space.
Evidence on impact	Tested in four countries (Romania, Portugal, Greece, Austria) through in-building testing on various building types, including single-family houses, multi-family houses, offices, and schools. The testing aimed to assess user comfort by quantifying thermal, indoor air, visual, and acoustic comfort on a scale of 1-10, with an overall comfort rating.
Lessons learnt / recommendations for large-scale roll-out:	The comfort feature methodology is adaptable for different building typologies. CORP tool is more rigorous, while CARP is faster and effective for onsite assessment. Overheating is an important issue in MS for which both the methodologies CORP and CARP have been designed to evaluate. The comfort feature is designed to fill the awareness gap about healthy and comfortable homes. There is a very high interest from homeowners and renters in comfort related information on EPCs. Asset rating must be followed by operational rating for more accurate assessment when the building is occupied. Further studies are required at a national level to determine which comfort indicators are relevant for national EPCs.
Policy measures required for large-scale deployment	Define comfort indicators and methodology to measure them. Inform public and professionals about the indicators and their relevance.
Evaluation	

Integrated Environmental and Health Impact Assessment in EPCs

Country(s)	Austria, Belgium, Denmark, Estonia, Greece, Italy, Poland, Portugal, Romania, Scotland
Source (project info links)	https://x-tendo.eu/ X-tendo Feature 3: outdoor air pollution indicator p. 9-16
Contact details	Lukas Kranzl – Project Coordinator Lukas.Kranzl@tuwien.ac.at
LATER: EPBD Recast	
Problem/Motivation	
Short description of practice as implemented	The "Integrated Environmental and Health Impact Assessment in EPCs" in the X-tendo project employs two key indicators: the Local Air Pollution Contributor Index and the Indoor Air Purity Index. These indicators evaluate a building's local smog impact and air filtration efficacy, applicable to various building types, including new, existing, and under-renovation structures. This approach enriches Energy Performance Certificates by incorporating environmental and health aspects, enhancing their relevance and utility.
Evidence on impact	Two types of testing: user testing with 31 participants (e.g., energy auditors, authorities, researchers) using a calculation tool and questionnaire, and in-building testing across 10 buildings in different locations. The tests, conducted from April to November 2021, evaluated the Local Air Pollution Contributor Index and Indoor Air Purity Index, focusing on their applicability, user-friendliness, and the practical challenges in data collection and interpretation.
Lessons learnt / recommendations for large-scale roll-out:	Prioritise comprehensive pollutant integration for reliable AQI data. Install monitoring stations in areas lacking air quality data. Consider indoor/outdoor air quality, energy sources, and filtration. Address calculation method limitations, like reference data and maintenance. Simplify the methodology for wider usage. Engage stakeholders in high-pollution regions for adoption. Adapt to local contexts and building types. Ensure compatibility with EPC schemes for integration.
Policy measures required for large-scale deployment	Set up additional installations for measuring outdoor pollution. Set up national databases for outdoor pollution. Besides the existing CO2 indicator and the proposed PM2.5 by the 2021 EPBD, additional pollutants such as PM10, NOx, SOx and CO should be displayed in the EPC.
Evaluation	

Behavioural Impact Analysis and Performance Gap Closure via EUB SuperHub Platform

Country(s)	Austria, Croatia, Germany, France, Hungary, Italy, Ireland
Source (project info links)	https://eubsuperhub.eu/
Contact details	Peter Gyuris - Project Coordinator coordinator@eubsuperhub.eu
LATER: EPBD Recast	
Problem/Motivation	
Short description of practice as implemented	The EUB SuperHub Platform boosts EPCs with a multi-module system including a digital E-passport cockpit, a performance evaluation tool, and a virtual marketplace linking service providers and users. It enhances building energy transparency and efficiency and offers an E-training module for platform use and sustainability skills.
Evidence on impact	The focus groups, involving a diverse range of stakeholders, assess trust in EPCs and their role in decisions, highlighting a need for more holistic, transparent sustainability certifications. The "Fast-Effective Survey" prioritises thematic areas for future EPCs, allowing stakeholders to rate their importance, thereby shaping the development of more comprehensive and credible certifications.
Lessons learnt / recommendations for large-scale roll-out:	Trust and Transparency: Stakeholders viewed current Energy Performance Certificates (EPCs) as lacking transparency, leading to reduced trust and a gap in their effectiveness on decision-making in building sustainability and energy efficiency. Holistic Approach: There's a need to broaden EPCs to include overall sustainability, environmental impacts, and user considerations, making them more relevant for sustainability goals. Stakeholder-Driven Improvements: A "Fast-Effective Survey" helped prioritise improvements for next-gen EPCs, ensuring they meet stakeholder needs and expectations, crucial for positive behavioural changes and sustainability performance.
Policy measures required for large-scale deployment	Mandate EPCs in real estate ads, integrate EPC data with databases, and monitor implementation. Improve EPC auditor training and standardise certification software. Review energy infrastructure incentives and establish advisory systems with mandatory energy officers. Integrate EPCs into building design and require ongoing expert training. Update and digitise EPCs, adding smartness and comfort indicators, and develop a national system. Make EPCs digital, user-friendly, and include actual consumption data. Encourage collaboration and offer financial incentives for energy efficiency.

Evaluation	
Performance assessment using well-defined Key Performance Indicators (KPIs)	
Country(s)	Denmark, Ireland, Spain, Greece, Switzerland
Source (project info links)	https://www.chronicle-project.eu/
Contact details	Leon Nielsen – Project Manager lnielsen@fcire.es
LATER: EPBD Recast	
Problem/Motivation	The practice is motivated by the need to improve building performance in terms of energy efficiency, comfort, and well-being. Utilising KPIs allows for a more measurable and objective assessment of these factors.
Short description of practice as implemented	The practice involves assessing building performance through well-defined Key Performance Indicators. These KPIs are based on static building design information as well as dynamic sensor measurements, tailored to the building's use, age, and lifecycle stage. This method enables a comprehensive evaluation of various aspects of building performance.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Process Upscaling for EPC Methodology Improvement

Country(s)	France, Germany, Spain, Italy, Slovakia, Luxembourg
Source (project info links)	https://epc-recast.eu/
Contact details	Rofaïda Lahrech rofaida.lahrech@cstb.fr
LATER: EPBD Recast	
Problem/Motivation	The motivation behind this practice is to improve and optimize the methodology of EPCs.
Short description of practice as implemented	The "Process Upscaling for EPC Methodology Improvement" practice in the EPC RECAST project involves the enhancement and upscaling of the EPC methodology. This includes expanding the scope of EPC assessments to encompass not only energy efficiency but also factors like CO2 emissions, occupant comfort, indoor air quality, and health-related indicators.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Recommendation for Cloud System Roll-Out

Country(s)	France, Germany, Spain, Italy, Slovakia, Luxembourg
Source (project info links)	https://epc-recast.eu/
Contact details	Rofaïda Lahrech rofaida.lahrech@cstb.fr
LATER: EPBD Recast	
Problem/Motivation	The motivation behind this practice is to support the implementation of the new generation EPC methodology by integrating a full cloud system prototype. This addresses the need for a more efficient, technologically advanced approach to building performance assessment.
Short description of practice as implemented	The practice involves proposing the integration and deployment of a cloud-based system prototype as part of the EPC RECAST methodology. This system includes various technology components like a BIM modelling service, consistency checkers, and energy-related data analysis tools. The aim is to enhance the efficiency and accuracy of building energy performance assessments.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Incorporation of non-energy aspects to building assessment

Country(s)	
Source (project info links)	https://www.smartlivingepc.eu/en/ D2.1 Asset methodology assessment in building level
Contact details	Dr. Dimosthenis Ioannidis - djoannid@iti.gr
LATER: EPBD Recast	
Problem/Motivation	The narrow focus of conventional energy rating systems fails to capture the broader spectrum of factors influencing a building's environmental impact and overall performance. Buildings are spaces for human occupancy, occupant's well-being and satisfaction should be put at the forefront, aiming to enhance the overall quality of life for building users.
Short description of practice as implemented	Non-energy assessment evaluates aspects that impact the comfort and quality of life in a building, such as indoor air quality, acoustics, thermal comfort, lighting, accessibility, and functionality. Important non-energy factors that contribute to IEQ (indoor environmental quality) include things like air quality, temperature, illumination, and noise. Important non-energy issues include safety, radon danger, earthquake potential, accessibility, flexibility, and ecological sustainability.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Introduction of new rating scheme at the building complex level

Country(s)	
Source (project info links)	https://www.smartlivingepc.eu/en/ D2.1 Asset methodology assessment in building level D2.2 Asset assessment methodology in complex level
Contact details	Dr. Dimosthenis Ioannidis - djoannid@iti.gr
LATER: EPBD Recast	
Problem/Motivation	
Short description of practice as implemented	By recognizing the interconnectedness of buildings within a complex, this innovative approach ensures a more accurate and relevant evaluation of collective energy performance and sustainability attributes.
Evidence on impact	The project aspires to develop a new rating scheme for neighbourhood scale, based on the assessment of individual building units and additional building complex parameters with the aim of energy performance certification of building complexes. The energy infrastructure and services on a building block scale, as well as the interaction of the block buildings, were studied.
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Innovative Neighbourhood Scale Analysis

Country(s)	EU countries, South Africa, China, Hong Kong (China), India, Mexico, Germany, USA
Source (project info links)	https://www.smartlivingepc.eu/en/ D2.2 Asset assessment methodology in complex level
Contact details	
LATER: EPBD Recast	
Problem/Motivation	EPCs have been limited to representing a rating scheme that summarizes the energy performance of buildings. However, there is a need to assess and improve the sustainability performance of urban areas.
Short description of practice as implemented	
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Recommendations on integration of Next-generation dynamic EPC in national certification scheme

Country(s)	Austria, Greece, Germany, Lithuania, Netherlands, Cyprus, Spain
Source (project info links)	D^2EPC – Deliverable 6.6 Recommendation report on integration of NG EPC in national/regional certification schemes v2, p.51-53
Contact details	Panagiota Chatzipanagiotidou: phatzip@iti.gr
LATER: EPBD Recast	
Problem/Motivation	Limited information on the actual energy performance of buildings, insufficient information to building users and limited user-friendliness, need for harmonization of EPCs with the smart city concept, need for human-centric certificate, higher software credibility and quality.
Short description of practice as implemented	Current implementation of the EPC and related schemes and tools in EU countries. Examination of the integration of the NG EPCs into the national/regional schemes of the partner countries.
Evidence on impact	Testing and validation on 6 pilot sites
Lessons learnt / recommendations for large-scale roll-out:	The EPC is an important and effective tool for informing end-users about the performance of a building. An EPC can be based on calculated pre-defined parameters or on actual energy consumption.
Policy measures required for large-scale deployment	Collect Real Energy Consumption Data: understand current EPC systems and identify gaps, address the lack of real-time data collection, ensuring access for end-users. Provide easily understandable information in the EPC; use actual energy consumption data for performance assessment; establish a dedicated platform for building users to monitor and regulate energy habits. Integrate SRI with EPC for smarter, low-energy buildings; use SRI as a monitor linked to the current EPC for understanding building potential; visualise EPCs in a GIS environment for efficient energy planning. Integrate Infrastructure and Human-Centric Indicators: use additional indicators for a dynamic EPC; utilise 6D Level 3 BIM and cloud-based environments for improved effectiveness. Improve EPC accuracy by linking to IoT and providing BIM documentation. Combine EPC calculation with building energy performance simulation, ensure BIM models include energy-related information for an as-built model. Conduct regular training for energy consultants and assessors, emphasising digitalisation. Integrate LCA-based indicators into EPCs for environmental impact assessment. Develop standard procedures for operational rating applicable across all Member States; establish standardisation working groups for operational rating.

Commented [Ga10]: Limited information on the actual energy performance of buildings, insufficient information to building users and limited user-friendliness, need for harmonization of EPCs with the smart city concept, need for human-centric certificate, higher software credibility and quality (AEA)

	Implement stricter motivational schemes to address building energy consumption, use EU Emissions Trading Scheme infrastructure for financial penalties and rewards based on real energy consumption.
Evaluation	Stakeholder meetings and workshops: Stakeholders from most EU countries; 22 workshops with 690 participants in the 7 D^2EPC MSs about the D^2EPC framework in relation to the currently implemented EPC schemes.

E-learning program on SRI assessments.

Country(s)	Austria, Croatia, Cyprus, France, Portugal, Spain
Source (project info links)	https://ieecp.org/projects/sri2market/
Contact details	Dimitris Athanasiou: dimitris@ieecp.org
LATER: EPBD Recast	
Problem/Motivation	The lack of standardized vocational training materials in multiple languages hinders effective evaluation and improvement of smart readiness in buildings. Additionally, there is a need for practical, hands-on training that incorporates real-world examples to enhance understanding and competency in SRI assessments.
Short description of practice as implemented	The SRI2MARKET project is implementing a comprehensive e-learning program aimed at providing training on SRI assessments. This program includes multilingual training materials covering various aspects of the SRI methodology, such as background information, assessment guidelines, and compliance requirements. The training materials will be delivered through a user-friendly online platform and incorporate both video tutorials and text documents. Practical examples and case studies are included to enhance learning and comprehension.
Evidence on impact	The implementation of the e-learning program is expected to have a significant impact on the competency and effectiveness of SRI assessors. By providing standardized training materials in multiple languages and incorporating practical examples, the program aims to improve the quality and consistency of SRI assessments conducted across different countries and regions (1200 buildings across 8 EU pilot countries will be implemented to test the SRI assessment process under real life conditions). Additionally, by engaging participants in hands-on learning activities and

	assessments, the program seeks to enhance their understanding and application of SRI methodologies in real-world scenarios. Overall, the e-learning program is anticipated to contribute to the advancement of sustainable renovation practices and the promotion of energy-efficient building solutions.
Lessons learnt / recommendations for large-scale roll-out:	*To be developed*
Policy measures required for large-scale deployment	*To be developed*
Evaluation	*To be developed*

Development of digital building logbooks - new generation of EPCs

Country(s)	Austria, Croatia, France, Germany, Hungary, Ireland, Italy
Source	https://eubsuperhub.eu/
Contact details	Peter Gyuris - Project Coordinator coordinator@eubsuperhub.eu
LATER: EPBD Recast	EPBD (December 2023)
Problem/Motivation	In the era of developed digitalisation, it is obvious that digitalisation in the construction sector is still lagging behind other sectors. There are already many different databases in EU countries, which focus primarily on one topic area. A database that covers the entire building life cycle, from the design phase through the construction, operation, performance, maintenance, and deterioration is needed, to consolidate all relevant building data across the EU. A digital building logbook is becoming a necessity in the era of digitalisation, containing all relevant building-related data over the whole life cycle of a building, providing different types of stakeholders with different information for different purposes at the right time.
Short description of practice	The elaborated EUB SuperHub digital building logbook data structure contains the following eight main categories: 1. Administrative Information, 2. General Building Information, 3. Building Element Information, 4. Building Operation and Use, 5. Building Performance, 6. Smart Readiness, 7. Finance, 8. Building Documentation BIM. Out of the eight categories of the digital building logbook, the largest one in terms of information volume is the specific building element information. This category covers the building envelope and the technical building systems. The second largest category pertains to information regarding building performance and certificates across various metrics, such as energy, sustainability, and selected key performance indicators like lifecycle cost and global warming potential, indoor air quality, thermal comfort, and greenhouse gas emissions, among others. These categories of the digital building logbook are designed to contain all information possibly necessary for any work related to a building's life cycle, to facilitate availability and flow of information and to improve the overview of building stock, energy efficiency upgrades where applicable, data-informed decision-making and policy development, and ultimately, the monitoring of progress towards decarbonisation of the sector.
Evidence on impact	The EUB Superhub project aims to implement 100 case studies to test the developed EUB SuperHub online platform, which is based on the digital building logbook.
Lessons learnt / recommendations for large-scale roll-out:	The main goal is not to establish another new database, which would be both time and cost consuming. The digital building logbook needs to act as a common gateway to access data and bring data from different sources together by linking with existing,

	reliable, building information databases (e.g., national EPC database, regular inspections of heating and AC systems, national cadastre, property price/leases register, etc.). Based on the Article 19 of the newest proposal for a directive on the energy performance of buildings, published in December 2023, the national database for energy performance of buildings needs to be interoperable and integrated with digital building logbook. The EUB SuperHub digital building logbook needs to: • be applicable for the entire building stock (residential and non-residential buildings), • collect and monitor all relevant building data within the entire building life cycle, • be ease of use (simplicity, user friendly), • be easily understandable and usable by different stakeholders who have different information needs, use data in different ways and for different purposes, • become a common gateway to access data and bring data from different data sources together by linking with other existing reliable building information databases, • use hybrid approach to data storage, • comprise at least the following data (elements, indicators) within DBL data structure: physical accessibility (design for all), history about any major renovation or replacement, records about materials used (material passport), energy efficiency classes (EU energy labels), BACS efficiency class (EN 15232-1, building maintenance history, Smart Readiness Indicator (SRI), E-mobility – infrastructure for electric vehicle recharging, operational costs, Life cycle Global Warming Potential (GWP).
Policy measures required for large-scale deployment	Make digital building logbooks mandatory for all new buildings and existing buildings undergoing renovation.
Evaluation of policy measure	Monitoring data entered in digital building logbooks. Monitoring of progress towards decarbonisation of the construction sector.

4 Databases and Tools

4.1 Summary – to follow

4.2 Practices

Characteristics of a successful EPC scheme

Country(s)	Bulgaria, Germany, Greece, Hungary, Latvia, Spain, Sweden
Source (project info links)	https://qualdeepc.eu/ QualDeEPC – Deliverable D2.2 Report on EPC best practices, p.9-21; 45-53
Contact details	mail@qualdeepc.eu
LATER: EPBD Recast	
Problem/Motivation	High-quality Energy Performance Assessment and Certification in Europe Accelerating Deep Energy Renovation.
Short description of practice as implemented	The existing EPC schemes and their characteristics are analysed to identify the key success factors to deliver a high-quality EPC scheme.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	The most important successful factors for EPC scheme are Transparency, Reliability and Functionality/Usability. The other factors: Cost-effectiveness, Comparability and Neutrality, are estimated with medium importance for the success of EPC schemes.
Policy measures required for large-scale deployment	For a successful EPC scheme, EU Member States should combine many different individual measures and tools towards enhanced EPC schemes fulfilling the four main functions: Improving the usefulness and use of EPCs for supporting deep renovation Usefulness and use of EPCs in building markets Improving the quality and precision of EPCs in general Certification and training of EPC assessors/issuers
Evaluation	

Commented [Ga11]: High-quality Energy Performance Assessment and Certification in Europe Accelerating Deep Energy Renovation (AEA)

Implementation of a Semantically Enriched Building Information Modelling Based Common Data Environment (CDE)

Country(s)	Denmark, Ireland, Spain, Greece, Switzerland
Source (project info links)	https://www.chronicle-project.eu/
Contact details	Leon Nielsen – Project Manager lnielsen@fcire.es
LATER: EPBD Recast	
Problem/Motivation	Enhancing the efficiency and effectiveness of data management and collaboration in building lifecycle management, with a focus on improving building performance in terms of sustainability and energy efficiency.
Short description of practice as implemented	The CHRONICLE Common Data Environment (CDE) is a semantically enriched, BIM-based tool designed for the efficient management of both static and dynamic building information throughout the building's lifecycle. It facilitates the sharing, management, and storage of relevant data among various stakeholders, such as AEC, building owners, etc., and integrates with other CHRONICLE tools.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

3D Visualisation & Monitoring Platform (ChroViewFM) for monitoring real-time data from smart equipment

Country(s)	Denmark, Ireland, Spain, Greece, Switzerland
Source (project info links)	https://www.chronicle-project.eu/
Contact details	Leon Nielsen – Project Manager lnielsen@fcire.es
LATER: EPBD Recast	
Problem/Motivation	Enhancing the monitoring and management of building performance, particularly focusing on real-time data capture for energy efficiency, comfort, and maintenance planning.
Short description of practice as implemented	ChroViewFM is an online BIM-based tool enabling 3D visualisation of buildings and monitoring of near-real-time data from smart equipment. This includes energy consumption, environmental conditions, and other performance indicators. It provides a user-friendly interface for tracking energy use, comfort levels, and identifying significant changes over time, facilitating predictive and preventive maintenance of buildings.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Knowledge Exchange Centre for EPCs

Commented [PP12]: Maybe it should be in the databases and tools building block

Country(s)	European Union
Source (project info links)	https://crosscert.unizar.es/
Contact details	Eva Suba: e.suba@klimabuendnis.org
LATER: EPBD Recast	
Problem/Motivation	The need for a centralised repository of information on next-generation EPCs for buildings in the EU. Need to improve the accuracy, usability, and harmonisation of EPCs, as well as to facilitate knowledge exchange among stakeholders.
Short description of practice as implemented	The Knowledge Exchange Centre is a web-based repository of information on next-generation EPCs for buildings in the EU. It serves as a centralised platform for sharing knowledge, research findings, and best practices related to EPCs. It includes themes such as the analysis of current EPC methodologies, legislation, EU projects, and a building repository. Additionally, the Centre hosts a community forum for stakeholders involved in EPC implementation.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Interoperability of EPC Databases

Country(s)	Spain, Croatia, Malta, UK, Slovenia, Greece, Poland, Bulgaria, Denmark, Austria
Source (project info links)	Expected: D4.2 Analysis of the current integration of EPC data
Contact details	Eva Suba: e.suba@klimabuendnis.org
Problem/Motivation	Identification of the current status of the existing databases and the barriers and challenges still to overcome to achieve fully interoperable and useful EPC databases.
Short description of practice as implemented	D4.2 has been planned to focus and expand the information on the potential uses for EPC databases
Evidence on impact	The concepts of EPC storage, processing, interaction, and interoperability are readily understood. In addition, dividing concepts and tools allows the generation of tailor-made guidelines for each stage of the EPC life cycle.
Lessons learnt / recommendations for large-scale roll-out:	To be developed
Policy measures required for large-scale deployment	Different guidelines have been proposed as a common road map to achieve harmonisation and potential value for the existing databases
Evaluation	

Integrating Implemented Building Performance Tools into a Digital Building Logbook

Country(s)	Denmark, Ireland, Spain, Greece, Switzerland
Source (project info links)	https://www.chronicle-project.eu/
Contact details	Leon Nielsen – Project Manager lnielsen@fcire.es
LATER: EPBD Recast	
Problem/Motivation	Many buildings have separate assessments and certificates, such as EPC and SRI, which may not be readily accessible or integrated. The integration of these tools into a 'Digital Building Logbook' aims to streamline data management and improve decision-making regarding building performance.
Short description of practice as implemented	The practice involves methodologically integrating existing building performance tools, such as dynamic EPC and SRI, into a centralized 'Digital Building Logbook.' This logbook serves as a comprehensive repository for building performance data, enabling easy access and analysis of information related to energy efficiency and readiness indicators. The integration process ensures that data from these tools can be effectively utilized for building management and optimization.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Building Repository-Enhanced EPC Management

Country(s)	Austria, Bulgaria, Spain, Greece, Poland
Source (project info links)	https://www.crosscert.eu/ https://crosscert.unizar.es/building-repository/ CrossCERT – Deliverable D2.8 crossCert Benchmark Repository p.3
Contact details	Eva Suba: e.suba@klimabuendnis.org
LATER: EPBD Recast	
Problem/Motivation	The level of detail offered by other existing databases is not sufficient for the development of building energy models (for validation or sensitivity analysis) or for use as a testbench of new EPC procedures.
Short description of practice as implemented	The crossCert building repository provides very detailed building data (such as (building envelope characteristics and technical systems), results of energy certificates, energy consumption data and even examples of dynamic models for some of the buildings. These data have been curated and, where needed, anonymised to circumvent restrictions on its use.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Characteristics of a successful EPC database

Country(s)	Italy
Source (project info links)	SIAPE public portal (implemented by ENEA in 2020): https://siape.enea.it/ Annual reports on building energy certification: https://www.efficienzaenergetica.enea.it/pubblicazioni/rapporto-annuale-sulla-certificazione-energetica-degli-edifici.html
Contact details	Info -> Contact section in https://siape.enea.it/
Problem/Motivation	SIAPE is the Italian National Informative System on EPC (Sistema informativo sugli APE, in Italian). It was established by the Italian government through the Ministerial Decree 26/06/2015, implementing the Directive 2010/31/EU. The primary purpose of SIAPE is to return a detailed picture of the state of the art of energy refurbishment in the national building stock.
Short description of practice as implemented	Italian EPCs are issued by Regions and Autonomous Provinces (21 entities in total) and collected in their local registers. By March 31st of each year, Regions and Autonomous Provinces should send EPCs issued the previous year to the national EPC DataBase Management System (DBMS), which is part of SIAPE. SIAPE was developed by ENEA in 2016, which also is the authority entitled to maintain it. Furthermore, the SIAPE structure was updated in 2020 by ENEA which is in charge of ensuring and facilitating the connection between SIAPE and the local energy registers. ENEA also supports some of the Italian Regions in developing their EPC register and performs several analyses on the EPC information.
Evidence on impact	From 2016 to the end of 2023, SIAPE has collected data on the certified building stock of 19 Italian Regions and Autonomous Provinces, reaching the amount of about 5,300,000 EPCs. The data collected in SIAPE allow to carry out studies and analyses, the results of which are mainly published in the National reports on building energy certification of buildings in Italy, published every year from 2020 by ENEA and the Italian Thermotecnical Committee (CTI). Through the SIAPE Portal, part of the data collected in the Italian national EPC DBMS is publicly available and the results obtained through their analysis can be consulted in an aggregated form. This tool allows any kind of user to share information on the energy performance of the Italian building stock and to increase awareness of building energy consumption.
Lessons learnt / recommendations for large-scale roll-out:	The management of EPC data at both the local and national levels has pros and cons: on one side it allows more control of the territory and greater communication with the stakeholders involved in the certification process; on the other side, it can lead to

	harmonization problems, especially when the national laws are implemented differently. The quality of the EPC data is another crucial point. Currently, the official control systems are at the regional level and in most cases are applied only after the EPC is issued. Lastly, the EPC registry should be able to dialogue with other national and local systems, to connect different data from different sources.
Policy measures required for large-scale deployment	Promotion of more stringent national guidelines to harmonize the EPC scheme, output, and control system. Development of control systems to be applied also before the EPC is collected in the registry. A higher involvement of significant stakeholders that are part of the certification process (Regions and Autonomous Provinces, software houses, assessors, citizens). Promotion of protocols to facilitate the connection between different databases.
Evaluation of policy measure	Data monitoring and interviews with the relevant stakeholders.

Development of digital One-stop-shop platform built upon Digital Building Logbook

Country(s)	Austria, Croatia, France, Germany, Hungary, Ireland, Italy
Source	https://eubsuperhub.eu/
Contact details	Peter Gyuris - Project Coordinator coordinator@eubsuperhub.eu
LATER: EPBD Recast	One-stop-shop EPBD (December 2023)
Problem/Motivation	Meeting the demands of all the construction sector value chain in one place and connecting all stakeholders, from developers and contractors to tenants and maintenance teams.
Short description of practice	The EUB SuperHub project supports the evolvement of the next generation of building certification: moving towards sustainability and smartness by developing the EUB SuperHub online platform based on the digital building logbook. The envisioned EUB SuperHub online platform contains four separate modules representing different activities and stakeholders relevant to a building: the planning and verification tool (PVT), the E-cockpit, the virtual marketplace (VM), and the E-training module. The e-cockpit is a multi-scale cloud-based geo-referenced interactive database, that will allow a wide array of stakeholders to view key information about the existing building stock and related certificates (e.g., EPC, sustainability certificates, SRI, etc.). The planning and verification tool (PVT) module is an extension of the e-cockpit module, enabling building owners to upload, share, and store all building-related information. The PVT module provides building data entry and stores them in a digital building logbook and simulations (what-if scenarios). The virtual marketplace (VM) facilitates the match-making connection between the building users, auditors, and solution and funding providers, as well as other market actors and service providers. The e-training module is an independent part of the EUB SuperHub platform, providing training material for the platform users. All four modules act together and create a digital one-stop-shop accessible to all building stakeholders to address barriers relevant to building renovation and smartness, sustainability, and energy efficiency of the building.
Evidence on impact	The EUB Superhub project aims to implement 100 case studies to test the developed EUB SuperHub online platform and roll-out the next generation certification and EUB e-passport. All selected case studies will be registered using the developed online platform.

Lessons learnt / recommendations for large-scale roll-out:	To be developed
Policy measures required for large-scale deployment	To be developed
Evaluation of policy measure	To be developed

5 SRI Development and Deployment

5.1 Summary – to follow

5.2 Practices

Development of Web-based SRI Assessment Toolkit

Country(s)	Bulgaria, Latvia, Czech Republic, Romania, Greece, Croatia, Spain, Austria
Source (project info links)	
Contact details	Stamatia Rizou: srizou@singularlogic.eu
LATER: EPBD Recast	
Problem/Motivation	The need for a unified and efficient approach to SRI assessment across different EU Member States.
Short description of practice as implemented	The SRI-ENACT assessment tool will facilitate the calculation of the SRI and enable the issuing of the SRI assessments. The tool will provide access to several stakeholders (assessors, residents, national authorities, and EU stakeholders) providing different functionalities, such as the tailoring of the SRI methodology at national level, the SRI assessment of buildings, the analysis of the SRI assessments at different scales (national, EU).
Evidence on impact	SRI-ENACT solution will be assessed in 1200 different types of buildings across EU.
Lessons learnt / recommendations for large-scale roll-out:	*To be developed* – The project will actively develop policy recommendations for a global improvement of smart readiness of European buildings, develop concepts for the financing of building smartness upgrades and demonstrate the potential market value of smart readiness of buildings
Policy measures required for large-scale deployment	*To be developed*
Evaluation	

Commented [Ga13]: Also, policy recommendations for a global improvement of smart readiness of European buildings, develop concepts for the financing of building smartness upgrades and demonstrate the potential market value of smart readiness of buildings (AEA)

Commented [GV14R13]: Added in lessons learnt as smething to come

SRI Decision Support Tool

Country(s)	Bulgaria, Latvia, Czech Republic, Romania, Greece, Croatia, Spain, Austria
Source (project info links)	https://srienact.eu/sri-enact-tools/
Contact details	Stamatia Rizou: srizou@singularlogic.eu
LATER: EPBD Recast	
Problem/Motivation	Complexities in assessing SRIs for buildings in various scenarios, considering energy efficiency measures and technology adoption preparing the training of SRI auditors.
Short description of practice as implemented	The SRI-ENACT decision support tool will enable the evaluation of SRI in different scenarios, considering the potential adoption of energy efficiency measures and technologies. It will provide quantified assessments of different scenarios by estimating the impact of proposed measures in the SRI and the associated financial costs and required investments. Thus, the proposed solution will support informed decision making for building users/owners (incl. tenants), facility managers, energy auditors and other relevant stakeholders during the construction and renovation of buildings.
Evidence on impact	SRI-ENACT solution will be assessed in 1200 different types of buildings across EU.
Lessons learnt / recommendations for large-scale roll-out:	*To be developed*
Policy measures required for large-scale deployment	*To be developed*
Evaluation	

Commented [Ga15]: Also, training of SRI auditors

Training and Capacity Building for SRI Auditors in SRI-ENACT

Country(s)	Bulgaria, Latvia, Czech Republic, Romania, Greece, Croatia, Spain, Austria
Source (project info links)	https://srienact.eu/sri-enact-tools/
Contact details	Stamatia Rizou: srizou@singularlogic.eu
LATER: EPBD Recast	
Problem/Motivation	The need for skilled professionals capable of accurately assessing buildings' SRI.
Short description of practice as implemented	SRI-ENACT provides a comprehensive training package, including guidebooks and capacity modules, for SRI auditors. This initiative aims to build a network of 120 trained auditors across 8 EU countries.
Evidence on impact	Training sessions, practical SRI test covering in total 130 different types of buildings.
Lessons learnt / recommendations for large-scale roll-out:	*To be developed*
Policy measures required for large-scale deployment	*To be developed*
Evaluation	

Stakeholder Engagement in Co-creation of SRI-ENACT Tools and Services

Country(s)	Bulgaria, Latvia, Czech Republic, Romania, Greece, Croatia, Spain, Austria
Source (project info links)	https://srienact.eu/sri-enact-tools/
Contact details	Stamatia Rizou: srizou@singularlogic.eu
LATER: EPBD Recast	
Problem/Motivation	Need for collaborative development of tools and services to support the uptake and implementation of SRI across varied EU Member States.
Short description of practice as implemented	Engaging a diverse group of stakeholders in the co-creation process for SRI-ENACT, leading to the design of tools and services that enable effective SRI assessment and smart readiness improvement in buildings.
Evidence on impact	SRI-ENACT solution will be assessed in 1200 different types of buildings across EU.
Lessons learnt / recommendations for large-scale roll-out:	*To be developed*
Policy measures required for large-scale deployment	*To be developed*
Evaluation	

Making Energy Efficiency visible

Country(s)	Austria, Croatia, Cyprus, France, Portugal, Spain
Source (project info links)	IEECP – Report Make Energy Efficiency Visible in the Energy Mix, p.14-45
Contact details	Jean-Sébastien Broc: jsb@ieecp.org
LATER: EPBD Recast	
Problem/Motivation	
Short description of practice as implemented	Review on how energy efficiency is represented (or not) in the energy mix, at national and EU level, and exploration of alternative ways to make the energy efficiency contribution more visible.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	Energy efficiency is not included in the headline figures of the energy balances, energy statistics or other similar reports. The most advanced graphs showing the quantitative contribution of energy efficiency to the energy balance are based on decomposition analysis. International standards or methodologies on energy statistics do not impede public authorities to select the data to highlight and the way to display them. Therefore, the main barrier is not the limitation about what could be presented / published, but rather what data can be used
Policy measures required for large-scale deployment	Suggested actions for raising visibility of energy efficiency after the workshop discussion: Integrating energy efficiency in the energy mix Integrating the energy mix in the energy efficiency publications Making energy efficiency visible in forward-looking scenarios Allocate means to data collection in line with data needs Establish a European working group on energy efficiency data Improving the visibility of the results of energy efficiency policies Highlighting the topical impacts of energy efficiency
Evaluation	

Commented [PP16]: Does it even belong in the SRI building block? I scanned the document and the website, didn't find anything related to SRI

Commented [GV17R16]: Could be understanding EPC if the result comes from EPC or does it come from SRI?

Recommendations on introducing SRI into national regulation

Country(s)	Austria, Croatia, Cyprus, France, Portugal, Spain
Source (project info links)	https://ieecp.org/projects/sri2market/
Contact details	Dimitris Athanasiou: dimitris@ieecp.org
LATER: EPBD Recast	
Problem/Motivation	Addressing regional disparities in SRI application and supporting Member States in integrating SRI into their national regulations to achieve energy and climate goals.
Short description of practice as implemented	Development of recommendations for each of the targeted Member States on: integrating the SRI into the current national regulatory framework for buildings (including performance requirements and building certification schemes), evaluating whether the default SRI calculation methodology is appropriate or whether adaptations are required, using the SRI as an effective policy instrument to achieve the national energy and climate policy goals.
Evidence on impact	1200 buildings across 8 EU pilot countries will be implemented to fuel the interest of the national market actors in the SRI instrument.
Lessons learnt / recommendations for large-scale roll-out:	*To be developed*
Policy measures required for large-scale deployment	*To be developed*
Evaluation	

Public Funding Schemes for SRI Upgrades

Country(s)	Austria, Croatia, Cyprus, France, Portugal, Spain
Source (project info links)	https://ieecp.org/projects/sri2market/
Contact details	Dimitris Athanasiou: dimitris@ieecp.org
LATER: EPBD Recast	
Problem/Motivation	The need to incentivise energy efficiency measures in buildings, reducing reliance on old polluting power generation plants, and addressing peak demand issues.
Short description of practice as implemented	SRI2MARKET proposes public funding schemes to finance SRI upgrades. The project facilitates stakeholder dialogue to define how improvements in SRI rating should be compensated, aiming to incentivise the building renovation market.
Evidence on impact	1200 buildings across 8 EU pilot countries will be implemented.
Lessons learnt / recommendations for large-scale roll-out:	*To be developed*
Policy measures required for large-scale deployment	*To be developed*
Evaluation	

SRI2MARKET Tool Suite

Country(s)	Austria, Croatia, Cyprus, France, Portugal, Spain
Source (project info links)	https://ieecp.org/projects/sri2market/
Contact details	Dimitris Athanasiou: dimitris@ieecp.org
LATER: EPBD Recast	
Problem/Motivation	
Short description of practice as implemented	Tools will guide SRI assessors and streamline building assessments.
Evidence on impact	1200 buildings across 8 EU pilot countries will be implemented to test the SRI assessment process under real life conditions
Lessons learnt / recommendations for large-scale roll-out:	*To be developed*
Policy measures required for large-scale deployment	*To be developed*
Evaluation	

Automated SRI Calculation and Machine Learning Services

Country(s)	Greece, Cyprus, Italy, Spain, Austria, Ireland, Netherlands
Source (project info links)	https://www.easysri.eu/en
Contact details	Dimosthenis Ioannidis: djoannid@iti.gr
LATER: EPBD Recast	
Problem/Motivation	The need for an effective and user-friendly platform for SRI calculation that incorporates energy efficiency and financial dimensions.
Short description of practice as implemented	easySRI offers a web platform for automated SRI calculation, integrating energy efficiency and financial aspects. It includes ML-based tools for performance evaluation and recommendations for smart upgrades. The platform will combine: - An SRI Calculation engine, - An SRI Wizard tool, - An SRI-to-energy efficiency tool, and - An easySRI Repository
Evidence on impact	Demonstration cases in six European countries. The selected project demonstration cases will allow a fine calibration of the tools to be developed, and a demonstration of the methodology adopted by easySRI, by enabling the validation of different building typologies in different climatic regions, substantiating also on a highly participatory community engagement, and strong SME participation, which can promote further the awareness and scalability of the proposed solutions.
Lessons learnt / recommendations for large-scale roll-out:	*To be developed*
Policy measures required for large-scale deployment	*To be developed*
Evaluation	

Advanced SRI Assessment and Ethical Conduct in TIMEPAC Project

Country(s)	Austria, Croatia, Cyprus, Italy, Slovenia, Spain
Source (project info links)	TIMEPAC Code of Conduct for Smart Readiness and Sustainability Rating, TIMEPAC case studies
Contact details	Leandro Madrazo Agudin – Project Coordinator leandro.madrazo@salle.url.edu
LATER: EPBD Recast	
Problem/Motivation	The need for unbiased, efficient, and sustainable approaches in SRI assessments to enhance building energy performance and sustainability.
Short description of practice as implemented	The TIMEPAC Code of Conduct introduces ethical principles, efficiency, and transparency in SRI assessments. It incorporates modern tools like Building Energy Models (BEMs) and Building Information Modelling (BIM), ensuring auditors are current with technology and best practices.
Evidence on impact	Various case studies in the project.
Lessons learnt / recommendations for large-scale roll-out:	Site visit is essential for the effective and transparent SRI and sustainability rating. Avoid conflicts of interest and never try to sell products or services. Respect the privacy and confidentiality of the client's information. The SRI and sustainability auditor supports the application of innovative tools such as Building Energy Models (BEMs) and Building Information Modelling (BIM). The SRI and sustainability auditor supports long-term use of energy-management systems. key element of efficient demand-side management (DSM) is the proper identification of controllable and uncontrollable loads. Recommendations should be tailored to the specific building and its unique characteristics and needs. Always be transparent about the methods and assumptions used during the SRI and sustainability rating. The SRI and sustainability rating should be unbiased and objective, focused on providing accurate and reliable information. Always try to understand operational practices about how the building is used and operated, including occupancy, operating hours, and behaviour of occupants. The SRI and sustainability auditor must ensure that all collected data are accurate, reliable and relevant. Before submitting an official report always discuss your findings with the client.
Policy measures required for large-scale deployment	
Evaluation	

Smart readiness and Life Cycle Analysis Integration

Country(s)	EU countries
Source (project info links)	https://www.smartlivingepc.eu/en/ D2.1 Asset methodology assessment in building level
Contact details	Borges Cruz cruz.borges@deusto.es
LATER: EPBD Recast	
Problem/Motivation	
Short description of practice as implemented	LCA tools facilitate a holistic examination of a building's environmental footprint over its entire life cycle, from construction to end-of-life considerations.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Integration of SRI Indicators into next generation EPCs

Country(s)	Austria, Greece, Germany, Lithuania, Netherlands, Cyprus, Spain
Source	D^2EPC - DELIVERABLE D2.6 SRI Indicators for next generation EPCs v2
Contact details	Panagiota Chatzipanagiotidou: phatzip@iti.gr
LATER: EPBD Recast	
Problem/Motivation	Establishing the framework and scope of SRI's integration in the proposed dynamic digital EPC scheme of the D^2EPC web platform
Short description of practice	Research regarding coverage of SRI functionalities by the IFC based BIM models (IFC4) and scope of need of input data; development of SRI calculation sub module
Evidence on impact	Tool tested by all pilots (6 case studies)
Lessons learnt / recommendations for large-scale roll-out:	

Policy measures required for large-scale deployment	
Evaluation of policy measure	

Policy implications and national priorities

Country(s)	Greece, Cyprus, Italy, Spain, Austria, Ireland, Netherlands
Source (project info links)	Expected: D6.1 easySRI policy implications and national priorities report v1 (M18) D6.2 easySRI policy implications and national priorities report v2 (M36)
Contact details	Dimosthenis Ioannidis: djoannid@iti.gr
Problem/Motivation	Define practical ways in which the findings of the easySRI project can be incorporated into existing European policies and initiatives as well as in support of national level priorities (EPC, Renovation Passport, Green Deal, etc.).
Short description of practice as implemented	The procedure consists of two main parts and their work steps: (1) SRI impact indicators are mapped to the EU policy framework and policy instruments to identify which SRI impacts are relevant to which specific policy frameworks, instruments, and initiatives; (2) National priorities and possible ways forward to translate SRIs into improvements for EU policies and initiatives are identified.
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	To be developed
Policy measures required for large-scale deployment	
Evaluation	

Training packages and guidance for certification

Country(s)	Greece, Cyprus, Italy, Spain, Austria, Ireland, Netherlands
Source (project info links)	Expected: D6.4 Training packages and guidance for certification v1 D6.5 Training packages and guidance for certification v2
Contact details	Dimosthenis Ioannidis: djoannid@iti.gr
Problem/Motivation	Development of training and guidance to engineers, auditors, assessors etc. to be able to use the easySRI services and implement the principles of easySRI in buildings certification.
Short description of practice as implemented	A technical manual and training material will be drafted and delivered, addressed to SRI and EPC assessors
Evidence on impact	
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Preliminary evaluation of the Smart Readiness Indicator of existing buildings in the Italian building stock

Country(s)	Italy
Source (project info links)	https://www2.enea.it/it/ricerca-di-sistema-elettrico/accordo-di-programma-MiSE-ENEA-2019-2021/tecnologie/efficienza-energetica-e-risparmio-di-energia-negli-usi-finali-elettrici-degli-edifici Project info: Funding scheme: ACCORDO DI PROGRAMMA MISE-ENEA 2019-2021 Title: “Efficienza energetica e risparmio di energia negli usi finali elettrici degli edifici” WP3
Contact details	Biagio Di Pietra (biagio.dipietra@enea.it)

LATER: EPBD Recast	
Problem/Motivation	To develop a preliminary analysis of the Smart readiness indicator in buildings representative of the Italian building stock in different scenarios (i.e., current state and after smart retrofit).
Short description of practice as implemented	The project developed an analysis of the existing residential building stock and the regulatory context regarding the building technical systems affecting the SRI. 8 representative residential buildings typologies were identified and characterized in terms of domains and smart functionalities. The standard SRI calculation methodology was used to derive the SRI in three scenarios: i) "as-is" (buildings in their current state); ii) "energy" (buildings retrofitted according to the current market trend) and iii) "smart energy" (same retrofits of the "energy" scenario but revised from a smart perspective).
Evidence on impact	It was possible to calculate an SRI value ranging from 0% to 23% for the building typologies ("as is" scenario). The results were then extended to the entire residential building stock using ISTAT (national statistical institute) data to estimate an average SRI value of the existing building stock of approximately 5.2%. From the simulation of "energy" and "smart energy" scenarios, it emerged that the average national SRI would be equal to 15.8% and 27.6%, respectively.
Lessons learnt / recommendations for large-scale roll-out:	n.a.
Policy measures required for large-scale deployment	n.a.
Evaluation	n.a.

Analysis, application and validation of the Smart Readiness Indicator calculation methodology in the Italian building context

Country(s)	Italy
Source (project info links)	https://www.csea.it/wp-content/uploads/RDS-docs/esperti/2023/All_E-Schema-Piano-RdS-2022-2024_2.0.pdf (Italian language) Project info: Funding scheme: ACCORDO DI PROGRAMMA MISE-ENEA 2022-2024 Title: "Progetto 1.5 "Edifici ad alta efficienza per la transizione energetica"

	WP4
Contact details	Biagio Di Pietra (biagio.dipietra@enea.it)
LATER: EPBD Recast	
Problem/Motivation	There is a limited knowledge about the technical implementation of the SRI calculation in the national context. Most studies reported inconsistencies and methodological gaps in the calculation of the SRI, as well as subjectivity and problematic interpretation in the selection of relevant services for the calculation of the indicator. The SRI calculation methodology needs to be tailored to the specific national context.
Short description of practice as implemented	The project aims to: i) analyse the technical and regulatory framework regarding the SRI throughout Europe (i.e., research projects, new experiments and scientific studies, etc.); ii) develop an optimized SRI calculation methodology for the national building stock, iii) apply and validate the standard and optimized SRI calculation methodologies to a sample of buildings in the Italian building stock; iv) develop a preliminary format of SRI certificate; v) perform a preliminary analysis of the correlation between the energy performance of buildings (e.g., measured in Asset Rating and/or Operational Rating) and the SRI in the Italian context; vi) analyse costs to achieve higher SRI for existing buildings.
Evidence on impact	n.a.
Lessons learnt / recommendations for large-scale roll-out:	(The project is currently under development). The project expects to: i) gather indications on the technical and regulatory framework regarding the SRI throughout Europe, in order to identify a suitable implementation strategy in the Italian context; ii) consolidate the SRI calculation methodology, taking into account the peculiarities of the Italian building stock both in residential and non-residential buildings; iii) provide a very first analysis of the integration between EPC and SRI, as well as a preliminary assessment of the existing correlation between the two indicators in Italy; iv) make available a SRI format for the national testing phase; v) provide reference costs to improve SRI level in existing Italian buildings. All those results constitute basic technical evidence for a possible national implementation phase of the SRI.
Policy measures required for large-scale deployment	n.a.
Evaluation	n.a.

Conceptualization of the benefits of building smartness from the perspectives of carbon-neutral energy system in the Smart-Ready Buildings project

Country(s)	Finland
Source (project info links)	https://www.aalto.fi/en/smart-ready-buildings
Contact details	Eerika Borgentorp (eerika.borgentorp@aalto.fi)
LATER: EPBD Recast	
Problem/Motivation	Measuring the benefits of the building smartness to achieve carbon emissions targets in the Nordics.
Short description of practice as implemented	This project has two primary objectives: to explore, by utilizing concrete real-life cases, how commercially viable "smart readiness" can be defined in buildings and cities in such a way that it supports the flexible utilization of the resources in urban and energy networks. to define from the customer's point of view the central drivers, which motivate the users to deploy the smart ready services and to improve the resource efficiency in buildings and cities and eventually improve customer experience and create new business opportunities.
Evidence on impact	n.a.
Lessons learnt / recommendations for large-scale roll-out:	Differences have been highlighted between the Nordic power market and the SRI's baseline design. The highest level of smartness does not necessarily lead to reduced carbon emissions. The climate mitigation implications – one of the main drivers behind the SRI rating system's development work – are not fully fulfilled in the Nordics. [1] Identified benefits related to: i) Benchmarking; ii) Financial benefits; iii) Energy saving; iv) practical suggestions for smart retrofits; v) standardization[2]. Identified threats related to: i) SRI assessors (will be they able to suggest practical smart retrofit interventions?); ii) SRI to be only a mandatory "piece of paper"?; iii) increased expenses in building assessment; iv) possibilities in reaching high SRI in old existing buildings (old buildings depreciation)[3]

[1] https://iopscience.iop.org/article/10.1088/1755-1315/1101/2/022010/pdf

[2] https://aaltodoc.aalto.fi/server/api/core/bitstreams/8ce4b1b9-c337-45b9-9115-98e82369e14d/content

[3] https://aaltodoc.aalto.fi/server/api/core/bitstreams/8ce4b1b9-c337-45b9-9115-98e82369e14d/content

Policy measures required for large-scale deployment	Considering building type when assessing the SRI Suggested the creation of a country specific assessment spreadsheet
Evaluation	n.a.

6 Integration of Instruments

6.1 Summary – to follow

6.2 Practices

Use of Smart Readiness Indicator methodology for Integration in EPC schemes

Country(s)	Austria, Denmark, Estonia, Greece, Romania
Source (project info links)	https://x-tendo.eu/ X-tendo feature 1: smart readiness indicator (SRI) p. 9-21
Contact details	Lukas Kranzl – Project Coordinator Lukas.Kranzl@tuwien.ac.at
LATER: EPBD Recast	
Problem/Motivation	
Short description of practice as implemented	The X-tendo project integrates the Smart Readiness Indicator (SRI) into EPCs, advancing building assessments in Europe. This integration enhances the visibility of smart technologies within European buildings, offering users, owners, and tenants a tangible way to assess and improve energy efficiency, indoor comfort, and adaptability while promoting renewable and flexible energy systems.
Evidence on impact	In-building tests in three countries: Romania, Greece, and Estonia through various building types, including single-family homes, multifamily homes, offices, and schools, were assessed using the SRI evaluation methodology.
Lessons learnt / recommendations for large-scale roll-out:	Simplified method suitable for initial SRI implementation, cost-effective, and requires minimal training. Large, high-energy-demand non-residential buildings may need a more detailed approach later. Include three sub-indicators within SRI when integrated into EPC but not on the first certificate page. Connect SRI and EPC recommendations to enhance user understanding. In residential buildings, simplified method raises awareness of energy-saving automation and comfort benefits for homeowners.
Policy measures required for large-scale deployment	Define national strategies for implementation as voluntary or mandatory schemes of the two methods depending on the building typology. Test communications strategies of the indicators, to make them relevant for the end user.
Evaluation	

Cross-assessment of EPC

Country(s)	Spain, Croatia, Malta, UK, Slovenia, Greece, Poland, Bulgaria, Denmark, Austria
Source (project info links)	https://www.crosscert.eu/ CrossCERT
Contact details	Eva Suba: e.suba@klimabuendnis.org
LATER: EPBD Recast	
Problem/Motivation	
Short description of practice as implemented	Cross-testing between the current energy certificates and the new approaches/concepts/initiatives and creating a public benchmarking database of test cases.
Evidence on impact	Cross-testing of 147 buildings in 10 European countries.
Lessons learnt / recommendations for large-scale roll-out:	*To be developed*
Policy measures required for large-scale deployment	*Policy recommendations that include potential improvements in accuracy, usability and harmonisation will be developed*
Evaluation	

Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation of policy measure	

Development and Implementation of a Digital Twin Framework for Building Performance Monitoring and Simulation

Country(s)	Denmark, Ireland, Spain, Greece, Switzerland
Source (project info links)	https://www.chronicle-project.eu/
Contact details	Leon Nielsen – Project Manager lnielsen@fcire.es
LATER: EPBD Recast	
Problem/Motivation	Traditional building management systems often lack real-time data and predictive capabilities, which lead to energy wastage and suboptimal building conditions. The Digital Twin mechanism aims to solve these issues by providing an accurate simulation of building performance based on real-time data.
Short description of practice as implemented	CHRONICLE's Digital Twin framework serves as the core for project activities, modelling and simulating building processes using real-time IoT data. Leveraging advanced thermal modelling and machine learning, it forecasts building conditions, mimics occupants' behaviour, and maintains accuracy through ongoing IoT data updates.
Evidence on impact	Through the CHRONICLE tools, Herning Social Housing in Denmark will assess all stages of the planned renovations, gain insights to building performance and environmental impact under different renovation scenarios and minimize the post-renovation mismatch between the predicted asset and operational rating, thanks to its human-centred digital twin.
Lessons learnt / recommendations for large-scale roll-out:	
Policy measures required for large-scale deployment	
Evaluation	

Development of a holistic and modular EPC methodology

Country(s)	Austria, Belgium, Finland, Germany, Greece, Spain
Source (project info links)	https://epanacea.eu/, ePANACEA – Methodology Evaluation (D5.4)
Contact details	contact@epanacea.eu
LATER: EPBD Recast	
Problem/Motivation	Need to develop more reliable, user-friendly, and cost-effective assessment process and certificate, and be compliant with EU legislation in order to instil trust in the market.
Short description of practice as implemented	The practice entailed the possible implementation of advanced occupant models into the assessment methods developed under the ePANACEA.
Evidence on impact	• The project performed a comparison between the ePANACEA methodology consisted of three methods (M1, M2, M3) and the national EPC methodology. A total of 15 buildings was selected from 5 countries (AT, BE, FI, GR, ES). Differences between the various methods' outputs and the outputs derived from the current EPC were identified, as were the number and the quality of the outputs. The purpose was to perform a qualitative and quantitative cross-analysis of results in the pilot countries.
Lessons learnt / recommendations for large-scale roll-out:	• M1 is easy to implement and complements the current EPC methodology. • M2 utilises a monthly calculation basis provided by the standard 52016. • M3 uses an advanced & automated simulation modelling based on hourly calculations and its calibration procedures covering all the needs of the next generation of energy assessment and certification, and beyond.
Policy measures required for large-scale deployment	
Evaluation	

Use of Smart Readiness Indicator methodology into EUB digital passport

Country(s)	Austria, Croatia, France, Germany, Hungary, Ireland, Italy
Source	https://eubsuperhub.eu/
Contact details	Peter Gyuris - Project Coordinator coordinator@eubsuperhub.eu
LATER: EPBD Recast	EPBD (December 2023)
Problem/Motivation	Current EPCs don't provide data during the operation of buildings, new technologies (smart buildings), life cycle thinking (LCA, whole life costing…), or carbon footprint management. Furthermore, current EPCs don't assess a building in the field of sustainability and smartness. Current EPCs don't consider indoor environmental quality. The objective is to harmonize, improve, extend, and make reliable European EPCs.
Short description of practice	The final output of the EUB SuperHub project is the EUB e-passport (European Building electronic passport). It is noteworthy, that this EUB e-passport doesn't represent a renovation passport that provides a clear roadmap for staged deep renovation. The envisioned EUB e-passport assesses a building in the field of energy efficiency, sustainability and smartness built upon the EUB SuperHub digital building logbook (DBL) and based on the proposed system of 21 Key Performance Indicators (KPIs), establishing a comprehensive framework for achieving carbon neutrality in the building sector throughout a building's life cycle. The selected KPIs cover thematic areas such as energy consumption, renewable energy, GHG emissions, thermal comfort, indoor air quality, costs, smart buildings, resilience to climate change, E-mobility, and daylight sufficiency. On the list of the proposed system of Key Performance Indicators (KPIs) is KPI 18 – Smart Readiness Indicator.
Evidence on impact	The EUB Superhub project aims to implement 100 case studies to roll-out the next generation certification and EUB e-passport as the final output of the EUB SuperHub project.
Lessons learnt / recommendations for large-scale roll-out:	To be developed
Policy measures required for large-scale deployment	To be developed
Evaluation of policy measure	To be developed