Report on the contribution to standardization v1

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DELIVERABLE D7.4 Report on the contribution to standardization v1

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Executive Summary

Standardisation provides a strong link between research and current *state of the art* in industry. D^2EPC has taken actions within the standardisation system to facilitate and promote the acceptance and utilisation of the project results, and to gather information about in force standards, projects under development or feedback from experts in technical committees (TCs).

This deliverable assesses the standards identified in D6.1, and other standardisation documents identified as relevant, to focus the activities on a limited range of documents and TCs. This deliverable also explains the actions taken by D^2EPC regarding standardisation contributions until M24 and outlines the actions to be taken before (and after) the end of the project.

The main activity, the creation of a new standardisation group dealing with operational EPCs, is explained in clauses 5.2 and 5.3.

The main objective of this deliverable is to guide D^2EPC members in the following months, to ensure a positive result of the standardisation contributions made by the project.

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List of Acronyms and Abbreviations

Term	Description
CD	International Committee Draft (stage in ISO)
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardisation
CIB	Committee Internal Ballot (internal ballot in a standardisation TC or SC)
CWA	CEN Workshop Agreement (document issued by CEN)
DIS	Draft International Standard (stage in ISO)
EN	European Standard issued by CEN or CENELEC
EPB	Energy Performance of Buildings
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Certificate
ESO	European Standardisation Organizations
ESS	European Standardisation System
FDIS	Final Draft International Standard (stage in ISO)
FprEN	Final Project of European Standard (stage in CEN)
IEC	International Electrotechnical Commission; and International standard issued by IEC
ISO	International Organization for Standardization; and International standard issued by ISO
IWA	International Workshop Agreement (type of standardisation document in ISO)
NSB	National Standardisation Body
PAS	Publicly Available Specification (type of standardisation document in ISO)

prEN	Project of European Standard (in CEN and CENELEC)
SC	Subcommittee
TC	Technical Committee
TR	Technical Report
TS	Technical Specification
UNE	Spanish Association for Standardization; and Spanish standard issued by UNE
WD	Working Draft
WG	Working Group
WI	Work Item (stage in which a standardisation document is registered and the drafting starts)

1 Introduction

1.1 Scope and objectives of the deliverable

This deliverable explains the approach taken in D^2EPC regarding contributions within the standardisation system to facilitate and promote the acceptance and utilisation of the project results. The dissemination of the results of D^2EPC in the European and International standardisation *environment* is a primary objective, to make available the information generated by the project to industry and other market stakeholders (like architects, facility managers, construction companies, etc.), to public administrations and the end users of the building, and to society as a whole. This dissemination should promote the use of D^2EPC results in public and private procurement and to constitute the basis for future developments. The standardisation system can also be used as a source of information, gathering feedback and peer-review.

Standardisation documents are, by definition, voluntary, but it is quite common that, for certain uses, public administration enforce their application via regulations. An example can be the harmonised standards, used for CE marking purposes, test standards or the Eurocodes. In the context of energy efficiency, standards are used in relation with EPBD or energy efficiency of several products (for example, lighting or air conditioners). Thus, including the result in an existing standardisation document [EN or ISO standard, a Technical Specification (TS) or Report (TR) or a Workshop Agreement (CWA)] can have an especially important impact in the market.

A CEN (or ISO) document should promote the use of the methodologies developed by D^2EPC in public and private procurement, industry internal processes and, in some cases, can be cited in European, national or regional regulations, like the EPBD.

The approach for the standardisation of the results of the project is based on the assessment of the *state of the art* in the European and International standardisation community and in the information gathered via formal and informal contacts with experts and members of standardisation committees, documents (drafts, minutes of the meeting, etc) and attending to meetings.

This deliverable also explains the actions taken by D^2EPC regarding standardisation contributions and outlines the actions to be taken before (and after) the end of the project.

The main objective of this deliverable is to guide D^2EPC members in the following months, to ensure a positive result of the standardisation contributions made by the project.

1.2 Structure of the deliverable

This document identifies the most relevant standardisation committees and documents (subclause 5.1), provides information about the work made until M24 (subclause 5.2) and defines proposed actions to be launched until M36 (subclause 5.3).

To identify the most relevant standardisation committees and documents (subclause 5.1), T7.3 started with a full list of potential standards, standardisation projects (subclause 3.3) and committees (subclause 3.2). An assessment was made, based on the criteria given in 5.1.1 to reduce these lists and provide a manageable number of documents and working groups.

Based on that identification, a set of potential actions was defined for the main committee, CEN/TC 371 (subclause 5.1.2), and other committees (subclause 5.1.3). Some of these actions were taken before M24 (subclause 5.2) and other will be launched after M24 (subclause 5.3).

To help D^2EPC partners in their participation in the standardisation system, clause 2 explains the organizations working at International, European and National level; and the relations between standards and regulations (subclause 2.7), in particular the EPBD (subclause 2.8).

1.3 Relation with other tasks and deliverables

Task 6.1 “Updating of current standards towards dynamic EPCs”, led by ASI, has a strong relation with T7.3. The identification of standards and projects included in D6.1 Strategic *Standardization Plan v1* has been used as a source for the identification of committees and potential activities made in this deliverable.

WP 2 will provide a document based on the deliverables generated within their tasks, as a proposal to be circulated to CEN/TC 371. This document will propose one or several standardisation documents. The goal is to promote the methodologies developed in D2EPC and receive feedback from industry, public administrations and other stakeholders participating in the standardisation community.

2 The standardisation system

2.1 Description

Standards are voluntary technical documents that set out requirements for a specific item, material, component, system or service, or describes in detail a particular method, procedure or best practice. Standards are developed and defined through a process of sharing knowledge and building consensus among technical experts nominated by interested parties and other stakeholders - including businesses, consumers and environmental groups, among others.

Participation is structured in Technical Committees (TCs), which are subdivided in Subcommittees (SCs) and/or Working Groups (WGs). For these technical groups, each National Standardisation Body (NSB) create a *mirror group*, to establish the national position.

The standardisation system is based, both at International (ISO and IEC) and at European (CEN/CENELEC and ETSI) level, on a **national delegation principle**. More details in clause 2.5.

The standardisation system as a tool to provide relevant methodologies and information during the early stages of the project, feedback and peer-review during the development of the reseach results, and to disseminate the project results within industry and public bodies. UNE participated in these tasks since the start of the project, together with ASI, the standardisation body of Austria.

2.2 European standardisation bodies

At European level, the framework of European standardisation policy is defined in Regulation (EU) 1025/2012, which sets certain obligations for the european standardisation bodies (CEN, CENELEA and ETSI):

- Transparency and stakeholder participation (Articles 3 to 7)
- European standards and other deliverables in support of Union legislation and policies (Articles 8 to 12)
- Identification of ICT technical specifications (Articles 13 and 14):
- Financing European standardisation (Articles 15 to 19)

The following table contains some general information about these standardisation bodies.

Table 1. European standardisation bodies

Standardisation body	Description
European Committee for Standardization	CEN is a non-profit association whose members are the national standards bodies of 33 European countries. It develops standards in fields not related to electrotechnology nor telecommunications. It is the counterpart at European level of ISO.
European Committee for Electrotechnical Standardization	CENELEC is a non-profit association whose members are the national standards bodies of 33 European countries. It develops standards in fields related to electrotechnology. It is the counterpart at European level of IEC.
European Telecommunications Standards Institute	ETSI is a non-profit organization with more than 800 member organizations worldwide. It develops standards for Information and Communications Technologies (ICT).

The list below includes the CEN Standardisation bodies (National Members), with links to their website.

1. **Austria - Austrian Standards International (ASI)**
2. Belgium - Bureau de Normalisation/Bureau voor Normalisatie (NBN)
3. Bulgaria - Bulgarian Institute for Standardization (BDS)
4. Croatia - Croatian Standards Institute (HZN)
5. Cyprus - Cyprus Organization for Standardisation (CYS)
6. Czech Republic - Czech Office for Standards, Metrology and Testing (UNMZ)
7. Denmark - Dansk Standard (DS)
8. Estonia - Estonian Centre for Standardisation and Accreditation (EVS)
9. Finland - Suomen Standardisoimisliitto r.y. (SFS)

10. France - Association Française de Normalisation (AFNOR)
11. Germany - Deutsches Institut für Normung (DIN)
12. Greece - National Quality Infrastructure System (NQIS/ELOT)
13. Hungary - Hungarian Standards Institution (MSZT)
14. Iceland - Icelandic Standards (IST)
15. Ireland - National Standards Authority of Ireland (NSAI)
16. Italy - Ente Italiano di Normazione (UNI)
17. Latvia - Latvian Standard Ltd. (LVS)
18. Lithuania - Lithuanian Standards Board (LST)
19. Luxembourg - Organisme Luxembourgeois de Normalisation (ILNAS)
20. Malta - The Malta Competition and Consumer Affairs Authority (MCCAA)
21. Netherlands - Nederlands Normalisatie-instituut (NEN)
22. Norway - Standards Norway (SN)
23. Poland - Polish Committee for Standardization (PKN)
24. Portugal - Instituto Português da Qualidade (IPQ)
25. Republic of North Macedonia - Standardization Institute of the Republic of North Macedonia (ISRSM)
26. Romania - Romanian Standards Association (ASRO)
27. Serbia - Institute for Standardization of Serbia (ISS)
28. Slovakia - Slovak Office of Standards Metrology and Testing (UNMS SR)
29. Slovenia - Slovenian Institute for Standardization (SIST)
30. **Spain - Asociación Española de Normalización (UNE)**
31. Sweden - Swedish Institute for Standards - SIS (SIS)
32. Switzerland - Schweizerische Normen-Vereinigung (SNV)
33. Turkey - Turkish Standards Institution (TSE)

34. United Kingdom - British Standards Institution (BSI)

The rules to develop documents within CEN and CENELEC are defined in the part 2 of their internal regulations (see reference [9]).

2.3 International standardisation bodies

The following table contains some general information about these standardisation bodies.

Table 2. International standardisation bodies

Standardisation body	Description
International Standardization Organization	ISO is an independent, non-governmental international organization with a membership of 163 national standards bodies. ISO develops standards mainly in fields not related to electrotechnology nor telecommunications.
International Electrotechnical Commission	IEC is a not-for-profit, non-governmental organization with a membership of 84 national standards bodies. IEC develops standards in fields related to electrotechnology.

The committees in ISO are, in general, more relevant for D^2EPC than those within IEC (see clause 3.2 for the TC identified as more relevant for the project). The following table link provides information about ISO members (in July 2022: 167 standardisation bodies / countries), identifying the type of member and the number of technical committees (TCs) in which the National Standardisation Body (NSB) is participating.

List of ISO members

There are several differences between the type of membership, for example correspondent or subscriber members cannot be the Secretariat of a TC or propose new projects, but these details are considered out of the scope of this deliverable, as NSB from EU members are member bodies in ISO (with *full rights*).

To remove technical barriers to trade, the international standardisation process ensures the compliance with the requirements of the Technical Barriers to Trade Agreement (TBT Agreement) of the World Trade

Organization (WTO), namely: transparency, openness, impartiality, consensus, effectiveness, relevance, coherence and consideration of the concerns of developing countries.

2.4 Cooperation between European and International standardisation bodies

CEN and ISO has an agreement for technical co-operation to develop common documents. The **Vienna Agreement (VA)** was drawn up with the aim of preventing duplication of effort and reducing time when preparing standards. This agreement allows expertise to be focused and used in an efficient way to the benefit of international standardization.

Some of the standards relevant for D^2EPC have been developed under VA, for example:

- EN ISO 52000-1:2017 *Energy performance of buildings - Overarching EPB assessment - Part 1: General framework and procedures*
- CEN ISO/TR 52000-2:2017 *Energy performance of buildings - Overarching EPB assessment - Part 2: Explanation and justification of ISO 52000*-1

Thus, this agreement might be relevant for the project. If needed, further information will be provided, but the following documents help undestanding the scope and basic procedures:

- Guidelines supporting the practical implementation of the Vienna Agreement
- The Vienna Agreement - FAQs

2.5 National standardisation bodies

The National Standardization Organizations (e.g. UNE, ASI, AFNOR, BSI, DIN, etc.) are the organizations officially recognized at national level as being able to represent all standardization interests in their country. They are responsible for developing national standards in their countries and they are the members of ISO, IEC and CEN/CENELEC (note that ITU and ETSI have a different membership policy). National stakeholders interested in standardization activities are able to take part in the process at European or International level through their national standardization organization.

The standardisation system is based on a national delegation principle. This means that the NSB of each country is a member of the supra-national standardisation organizations and defines its position based on the input from industry, research bodies, NGO, public administrations, etc. The standars are thus approved by a consensus based process between NSB.

The National Standardization Bodies (NSB) members of CEN and ISO are listed in clauses 2.2 and 2.3. In Spain, the NSB is UNE (Spanish Association for Standardisation) and, in Austria, ASI (Austrian Standards International). Both organizations are members of D^2EPC.

The legal status of National Standardization Organizations varies from one country to another. The most typical status is a private non-profit organization whose members are national business associations and companies, but sometimes the National Standardization Organization is a part of the Public Administration.

As stated in clause 2.2, the European Standardization System guarantees that European Standards are identically adopted by all the National Standardization Organizations and any national conflicting standard is withdrawn, through the commitment of the *Standstill Agreement*. This means the national catalogues of standards have a big level of coherence across Europe and that the European Standardization System helps to achieve the goal of the single market objetive. This requirement

(adoption withdrawning any conflicting standard) is only a requirement for EN standards, not for technical specifications of reports (CEN/TR or CEN/TR) or CEN Workshop Agreements (CWA).

2.6 Standardisation documents

The formal definition of a Standard is a "document, established by consensus and approved by a recognized body that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context". These include requirements and/or recommendations in relation to products, systems, processes or services:

- European Standards are documents that have been ratified by one of the three European Standardization Organizations, CEN, CENELEC or ETSI; recognized as competent in the area of voluntary technical standardization as for the EU Regulation 1025/2012 (see subclause 2.2 and reference [1]). As mentioned, the principle is one standard for all Europe. Their application is voluntary, but the adoption at national level as standard is mandatory.
- International Standards are documents that have been ratified by one of the two International Standardization Organizations, ISO or IEC (see subclause 2.3). Their application is voluntary, and the adoption at national level is also voluntary.

All the **standards**, independently of their origin (national, european or international) are developed under the basis of **consensus** and approved by the members of the organization according to strict, defined procedures and strict drafting timeframes. Other types of documents are **Technical Specifications (TS)**, **Technical Reports (TR)** which have lower level of consensus and a faster drafting timeframe. These documents are explained, with the timeframe in CEN (Europe) below

EN standard

Standards are the most relevant deliverables, developed as the result of a transparent, open and consensual process with national commitment at European or International level. The process, in theory takes between 2 and 3 years. In practice, it can need more time, as the defined methodology requires consensus.

In Europe, the implications CEN members are severe, as a EN standard requires that all NSB adopt the document at national level and shall **supersede** their national standards in conflict with the EN.

The results of a research project are usually beyond the *state of the art* of industry and will take some years to become a EN standard, due to the high level of consensus needed between dozens of national standardisation bodies.

Technical Specification (CEN/TS)

The process usually takes between 15 and 21 months since activation. In theory, it is possible to deliver it but, as the results of the project usually need around 18 months to be *mature enough*, it is complicated. In addition, these documents require a high level of consensus in an established standardisation body.

Technical Report (CEN/TR)

As in the case of TS, requires certain level of consensus in a standardisation body, but the process is faster and for some projects might be feasible.

Publicly Available Specification (ISO/PAS)

An international committee may decide to prepare and publish a **Publicly Available Specification (PAS)** when there is an **urgent market need** and, either there is a need for a preliminary document prior to the development of a full International Standard, or they wish to adopt a published document from an

external organization, which in the IEC may result in a dual logo publication with the external organization.

The **Workshop Agreements (WA)** are explained in subclause 4.3.

A summary of the characteristics of the different standardization documents can be found in the following table.

Table 3. Types and characteristics of the different standardization documents

Type	International code	European code	National code	Main characteristics
Standard	ISO IEC	EN	UNE, NF, BS, DIN, etc. When adopting EN or ISO standards: UNE-EN, NF-EN, UNE-ISO, NF-ISO, etc.	Elaboration: 3 years 2 official ballots in the TC. European: **compulsory** national adoption Revision: every 5 years
Technical Specification	ISO/TS IEC/TS	CEN/TS CLC/TS	When adopting: UNE-CEN/TS, NF-CEN/TS, UNE-ISO/TS, NF-ISO/TS, etc.	Elaboration: 21 months 1 official ballot or internal approval in TC European: **optional** national adoption Revision: at 3 years (upgrading to EN or deletion)
Technical Report	ISO/TR IEC/TR	CEN/TR CLC/TR	When adopting: UNE-CEN/TR, NF-CEN/TR, UNE-ISO/TR, NF-ISO/TR, etc.	Elaboration: free timeframe Internal approval in TC European: **optional** national adoption No revision required

Type	International code	European code	National code	Main characteristics
Publicly Available Specification	ISO/PAS IEC PAS	*Not applicable*	When adopting: UNE-ISO/PAS, UNE-IEC/PAS, etc.	Elaboration: free timeframe Based on a consensus - in an organization external to ISO or IEC; or - consensus of the experts within a working group Decision in 3 years: confirmation for other 3 years, revision or deletion. In year 6, upgrade to other type of standardisation document or deletion
Workshop Agreement	IWA	CWA	Variable	Elaboration: free timeframe (usually between 12 and 18 months) Internal approval in the Workshop European: **optional** national adoption Decision in 3 years: confirmation for other 3 years, revision or deletion. In year 6, upgrade to other type of standardisation document or deletion

2.7 Standardisation and EU regulations

During the discussion about the possibilities of participation in the standardisation system, some questions arose about the relation between standards and regulations in Europe; among others topics:

- Relation between EU regulations and standards
- Are standards mandatory or binding in some cases?
- How can standards help the implementation of EU regulations? Examples of sectors

To help D^2EPC partners in the standardisation process, these questions are tackled in the following paragraps.

Standards are **voluntary** documents providing technical specifications for products, services, and processes. Standards are developed by one of the 3 European standardisation organisations (ESOs), see subclause 2.2.

Technical requirements given in EU legislation are **mandatory** for certain uses or cases. These technical requirements included in the legislation can make reference to standards for test methods or other criteria.

The relation between the EU Commission and the ESOs is defined **in Regulation (EU) No 1025/2012 on European standardisation** (see reference [1]), which provides a legal framework allowing the European Commission to request ESOs to draft standards and standardisation deliverables for goods and services in support of EU policies and EU law, defines the support to the functioning of the European Standardisation System (ESS) and set outs key criteria for the functioning of the ESS.

The use of standards in implementing legislation and public policy brigns benefits to policy makers, including:

- broad market acceptance;
- simplification of legislation or policy;
- support to emerging technologies and the promotion of innovative approaches, without the need to change the regulatory framework;
- a close link to international standards, enabling international market access and thus promoting the global competitiveness of the European industry.

A particular case of standards included in EU legislation is **harmonised standards**, developed by an ESO following a Request (or Mandate) from the European Commission. 20% of all European standards are developed following a standardisation request. More information can be found in the website of the European Commission covering standardisation requests / mandates.

Manufacturers, other economic operators, or conformity assessment bodies can use **harmonised standards** to **demonstrate** that products, services, or processes **comply with relevant EU legislation**. The publication of the reference of the harmonised standard in the Official Journal of the European Union (OJEU) is foreseen as a precondition for presumption of conformity or for other legal effect.

An example of harmonised standards related with building products (relevant for energy efficiency of buildings) are the CE marking according to Regulation 305/2011 (Construction Products Regulation), see [6]. These standards define:

- requirements for the products;
- how the product's performance is declared by manufacturers (a *common language* for construction industry);
- how the compliance with the requirements is verified (in some cases, by a notified body).

Other examples can be found in the website of the European Commission for harmonised standards.

2.8 Standardisation and the EPBD

In December 2010, the European Commission approved the mandate Mandate M/480 (see reference [7]) for the elaboration of standards for a methodology calculating the integrated energy performance of buildings and promoting the energy efficiency of buildings, in accordance with Directive 2010/31/EU.

The list of standards developed based on this Mandate and supporting the EPBD are identified in table 4 (subclause 3.3).

Some of the EPB standards allows the definition of certain parameters or criteria in national annexes, which provide flexibility with respect to specific national or regional choices. The harmonized procedures in the EPB standards, defined at european level, need to be separated from the national or regional options (choices). There are two annexes:

- Annex A (normative): mandatory (empty) framework template for choices and input data and references to other EPB standards
- Annex B (informative): framework template of Annex A completed with one set of voluntary default choices and input data and references to other EPB standards.

As an example, in Spain an annex to be used with the Buildings Techincal Code was published as "Common general framework for the calculation of EPB". It describes Spain´s national calculation methodology and provides *choices* for the following standards: EN ISO 52000-1, EN ISO 52003-1, EN ISO 52010-1, ISO 52016-1 and EN ISO 52018-1.

The following figure provide a detailed overview of EPB standards, i.e. those directly used for the overall EPB assessment by calculation and those containing EP calculation, pre- processing procedures or post-processing procedures.

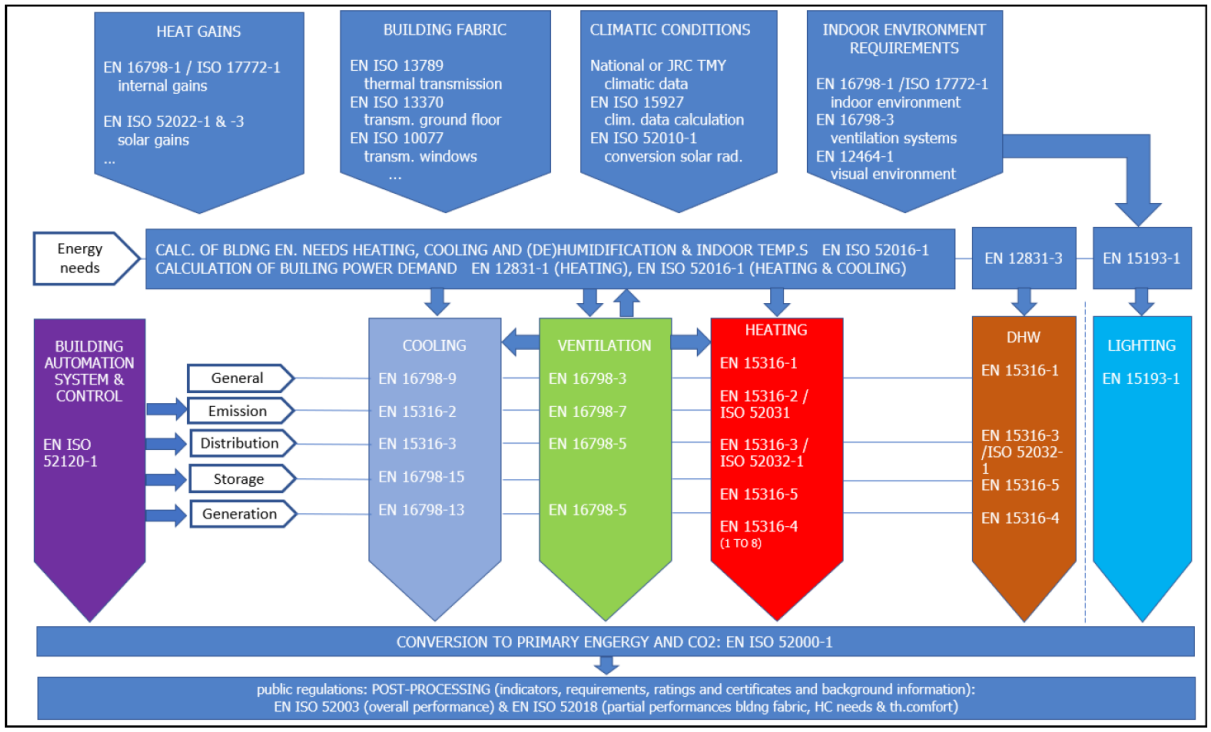


Figure 1. Overview of EPB standards needed for the overall EPB assessment by calculation. Source: [18]

An important topic is the revision of current EPBD-related standards. In 2017 a high number of (EN) ISO and CEN standards were published to collectively assess the overall Energy Performance of Buildings: the set of EPB standards. In the course of 2022 (5 years after publication) many of these documents will, individually, be subject to systematic review (SR). This process of SR starts a ballot in which National Standardisation Bodies assess if a published standard should be revised, maintained or supereseded. To provide meaningful information for this revision, CEN/TC 371, ISO/TC 205 and ISO/TC 163 developed a guidance document. UNE, as member of D^2EPC, has been following this process, in order to include operational assessments in the set of standards (see 5.2.1).

3 State of the art for EPCs

3.1 Approach

Deliverable D6.1 *Standardization Plan v1* identified several standardisation groups and documents. In addition, other groups and documents were identified in the following topics:

- Energy efficiency assessment.
- Building products relevant for energy efficiency (refrigeration, heating appliances, insultation, etc.).
- Digitization: BIM, digital twins, IoT, GIS or energy-related information exchange, among other technologies.
- Environmental assessment: sustainability assessment and building level, evaluation of the environmental performance of construction products and buildings, etc.

Standards about cyber security has been included as it might have a big impact in the users of a *connected building*. IoT systems present a challenge for information security because they are highly distributed and involve a large number of diverse entities. Potential impacts include privacy or personally identifiable information (PII) leaks. As an example, one of the standards identified below, ISO/IEC 27400:2022, provides guidelines on IoT-related risks, principles and controls for security and privacy. For smart grids, digital twins should use a common information model (CIM), defined in the series of standards IEC 61850 and IEC 61970. Some of the protocols and criteria can be applicable to energy-related digital twins.

For the identification of european and international standardisation groups, the list provided in D6.1 has been used and updated. The most relevant identified standardisation groups and documents are summarized in clauses 3.2 and 3.3. For each TC, the most relevant subcommittees (SC) and working groups (WG) have been identified. This assessment intends not to identify many standardisation groups, as the approach is to focus in those with more potential impact for D^2EPC. For some TC, no SC or WG has been identified as relevant.

For the identification of the standards relevant for the project, the the list provided in D6.1 was updated, adding new documents. After an assement, the list was reduced to target relevant documents and standardisation groups. In general, only **european standardisation documents** have been listed (including standards developed simultaneously in CEN and ISO using the Vienna Agreement). This list can be found in clause 3.3.

Based on the elements above (standardisation documents and groups), a limited range of TC, SC and WG has been identified in subclause 5.1, based on the following criteria:

a) Relevance for the project: relation with D^2EPC results.
b) Relation between particular standards or projects and D^2EPC activities.
c) Ongoing projects and meetings.
d) Potencial impact.

3.2 Identified technical groups

3.2.1 International standardisation

IEC/TC 57 Power systems management and associated information exchange

- WG 3 Telecontrol protocols.

- WG 10 Power system IED communication and associated data models.
- WG 13 Software interfaces for operation and planning of the electric grid.
- WG 15 Data and communication security.
- WG 21 Interfaces and protocol profiles relevant to systems connected to the electrical grid.

ISO/TC 59 Buildings and civil engineering works

- SC 13 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM):
  - JWG 14 GIS-BIM interoperability.
  - WG 8 Information delivery manual.
  - WG 11 Product data for building services systems model.
- SC 17 Sustainability in buildings and civil engineering works:
  - WG 4 Environmental performance of buildings.

ISO/TC 86 Refrigeration and air-conditioning

- ISO/TC 86/SC 6 Testing and rating of air-conditioners and heat pumps.
  - TG 13 Next generation of performance standards.

ISO/TC 163 Thermal performance and energy use in the built environment

- WG 4 Joint group with CEN for energy performance of buildings using holistic approach.
- WG 6 Vocabulary for thermal insulation.
- SC 1 Test and measurement methods.
- SC 2 Calculation methods.
- SC 3 Thermal insulation products, components and systems.

ISO/TC 184 Automation systems and integration

- AG 2 Digital Twin.
- SC 4 Industrial data:
  - JWG 16 Formats for visualization and other derived forms of product data.
  - JWG 24 Use of IEC CDD for ISO data dictionaries and ontologies.
- SC 5 Interoperability, integration, and architectures for enterprise systems and automation applications:
  - SG 7 Interoperability of simulation models on different platforms.
  - WG 1 Modelling and architecture.
  - WG 5 Open systems application frameworks.
  - WG 10 Evaluation of energy efficiency and other relevant factors of a manufacturing system with respect to its environmental influence.
  - WG 12 Convergence of informatization and industrialization.
  - WG 15 Model-based standards authoring.
  - WG 16 Supply chain interoperability and integration (SCII).

ISO/TC 205 Building environment design

- WG 2 Design of energy-efficient buildings.
- WG 3 Building Automation and Control System (BACS) Design.

- WG 5 Indoor thermal environment.

ISO/TC 207 Environmental management

- SC 4 Environmental performance evaluation.
- SC 5 Life cycle assessment.

ISO/TC 211 Geographic information/Geomatics

ISO/TC 268 Sustainable cities and communities

- WG 2 Integration and interaction framework for smart community infrastructures
- WG 4 Data exchange and sharing for smart community infrastructures

ISO/IEC JTC 1 Information technology

- WG 11 Smart cities
- SC 7 Software and systems engineering
  - JWG 28 Common industry formats for usability-related information
  - WG 7 Life cycle management
  - WG 21 Information technology asset management
- SC 27 Information security, cybersecurity and privacy protection
- SC 41 Internet of things and digital twin
  - WG 3 IoT Architecture
  - WG 4 IoT Interoperability
  - WG 5 IoT Applications
  - WG 6 Digital twin

3.2.2 European standardisation

CEN/CLC/JTC 14 Energy management and energy efficiency in the framework of energy transition

- WG 1 Energy audits

CEN/TC 89 Thermal performance of buildings an buildings components

- WG 8 Thermal test methods

CEN/TC 156 Ventilation for buildings

- WG 20 Ventilation and Room-Conditioning Systems in non-Residential Buildings
- WG 21 Energy performance calculation of ventilation and cooling systems

CEN/TC 228 Heating systems and water-based cooling systems in buildings

- CEN/TC 228/WG 1 General performance requirements of heating systems and sub-systems in buildings
- CEN/TC 228/WG 4 Calculation methods and system performance and evaluation

CEN/TC 247 Building Automation, Controls and Building Management

- WG 4 Open System Data Transmission
- WG 6 Electronic control equipment for HVAC applications, integrated room automation, controls and management systems

CEN/TC 350 Sustainability of construction works

- WG 1 Environmental performance of buildings
- WG 7 Framework and Coordination
- WG 8 Sustainable refurbishment

CEN/TC 371 Energy performance of buildings

- WG 1 EPBD Standards group

CEN/TC 442 Building Information Modelling (BIM)

- WG 2 Exchange information
- WG 3 Information Delivery Specification
- WG 4 Support Dictionaries
- WG 8 Competence
- WG 9 Digital twins in the built environment

3.3 Identified standardisation documents

The relevant standardisation documents has been divided in tables according to the following criteria:

1. European published standardisation documents, separting those directly related with the EPBD and others relevant for the project, which might be related with the EPBD but not directly;
2. European ongoing projects, also separated based on the relation with the EPBD;
3. International published standardisation documents;
4. International ongoing projects, separting those directly related with energy efficiency of builgins and others relevant for the project (for example, digitization). Compared to D6.1, some standards or WGs covering data structures based on IoT, digital twins or cybersecurity has been added.

The goals of this identification are:

- Provide standards and projects which define the state of the art of industry in topics related to D^2EPC: energy efficiency for buildings, technology applicable for operational EPCs (like IoT or BIM), etc.
- Identify standardisation groups to participate providing input based on D2PC results for ongoing projects or future revision of in force standards.

Table 4. European standards linked to the EPBD

Reference	Title	Drafting Body
CEN/TR 16798-2:2019	Energy performance of buildings - Ventilation for buildings - Part 2: Interpretation of the requirements in EN 16798-1 - Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics (Module M1-6)	CEN/TC 156
EN 16798-1:2019	Energy performance of buildings - Ventilation for buildings - Part 1: Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics - Module M1-6	CEN/TC 156
CEN/TR 16798-4:2017	Energy performance of buildings - Ventilation for buildings - Part 4: Interpretation of the requirements in EN 16798- 3 - For non-residential buildings - Performance requirements for ventilation and room-conditioning systems(Modules M5-1, M5-4)	CEN/TC 156/WG 20
EN 16798-3:2017	Energy performance of buildings - Ventilation for buildings - Part 3: For non-residential buildings - Performance requirements for ventilation and room-conditioning systems (Modules M5-1, M5-4)	CEN/TC 156/WG 20
CEN/TR 16798-10:2017	Energy performance of buildings - Ventilation for buildings - Part 10: Interpretation of the requirements in EN 16798-9 - Calculation methods for energy requirements of cooling systems (Module M4-1,M4-4, M4-9) - General	CEN/TC 156/WG 21
CEN/TR 16798-14:2017	Energy performance of buildings - Ventilation for buildings - Part 14: Interpretation of the requirements in EN 16798-13 - Calculation of cooling systems (Module M4-8) - Generation	CEN/TC 156/WG 21
CEN/TR 16798-16:2017	Energy performance of buildings - Ventilation for buildings - Part 16: Interpretation of the requirements in EN 16798-15 - Calculation of cooling systems (Module M4-7) - Storage	CEN/TC 156/WG 21
CEN/TR 16798-6:2017	Energy performance of buildings - Ventilation for buildings - Part 6: Interpretation of the requirements in EN 16798-5 - 1 and EN 16798-5-2 - Calculation methods for energy requirements of ventilation and air conditioning systems (Modules M5-6, M5-8, M 6-5, M6-8 , M7-5, M7-8)	CEN/TC 156/WG 21
CEN/TR 16798-8:2017	Energy performance of buildings - Ventilation for buildings - Part 8: Interpretation of the requirements in EN 16798-7 - Calculation methods for the determination of air flow rates in buildings including infiltration - (Module M5-5)	CEN/TC 156/WG 21

Reference	Title	Drafting Body
EN 16798-13:2017	Energy performance of buildings - Ventilation for buildings - Part 13: Calculation of cooling systems (Module M4-8) - Generation	CEN/TC 156/WG 21
EN 16798-15:2017	Energy performance of buildings - Ventilation for buildings - Part 15: Calculation of cooling systems (Module M4-7) - Storage	CEN/TC 156/WG 21
EN 16798-5-1:2017	Energy performance of buildings - Ventilation for buildings - Part 5-1: Calculation methods for energy requirements of ventilation and air conditioning systems (Modules M5-6, M5-8, M6-5, M6-8, M7-5, M7-8) - Method 1: Distribution and generation	CEN/TC 156/WG 21
EN 16798-5-2:2017	Energy performance of buildings - Ventilation for buildings - Part 5-2: Calculation methods for energy requirements of ventilation systems (Modules M5-6, M5-8, M6-5, M6-8, M7-5, M7-8) - Method 2: Distribution and generation	CEN/TC 156/WG 21
EN 16798-7:2017	Energy performance of buildings - Ventilation for buildings - Part 7: Calculation methods for the determination of air flow rates in buildings including infiltration (Modules M5-5)	CEN/TC 156/WG 21
EN 16798-9:2017	Energy performance of buildings - Ventilation for buildings - Part 9: Calculation methods for energy requirements of cooling systems (Modules M4-1, M4-4, M4-9) - General	CEN/TC 156/WG 21
CEN/TR 16798-18:2017	Energy performance of buildings - Ventilation for buildings - Part 18: Interpretation of the requirements in EN 16798-17 - Guidelines for inspection of ventilation and air-conditioning systems (Modules M4-11, M5-11, M6-11, M7-11)	CEN/TC 156/WG 23
EN 16798-17:2017	Energy performance of buildings - Ventilation for buildings - Part 17: Guidelines for inspection of ventilation and air conditioning systems (Module M4-11, M5-11, M6-11, M7-11)	CEN/TC 156/WG 23
CEN/TR 15193-2:2017	Energy performance of buildings - Energy requirements for lighting - Part 2: Explanation and justification of EN 15193-1, Module M9	CEN/TC 169/WG 9
EN 15193-1:2017+A1:2021	Energy performance of buildings - Energy requirements for lighting - Part 1: Specifications, Module M9	CEN/TC 169/WG 9
CEN/TR 12831-2:2017	Energy performance of buildings - Method for calculation of the design heat load - Part 2: Explanation and justification of EN 12831-1, Module M3-3	CEN/TC 228/WG 4
CEN/TR 12831-4:2017	Energy performance of buildings - Method for calculation of the design heat load - Part 4: Explanation and justification of EN 12831-3, Module M8-2, M8-3	CEN/TC 228/WG 4

Reference	Title	Drafting Body
CEN/TR 15316-6-1:2017	Energy performance of buildings- Method for calculation of system energy requirements and system efficiencies - Part 6-1: Explanation and justification of EN 15316-1, Module M3-1, M3-4, M3-9, M8-1, M8-4	CEN/TC 228/WG 4
CEN/TR 15316-6-10:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-10: Explanation and justification of EN 15316-5, Module M3-7, M8-7	CEN/TC 228/WG 4
CEN/TR 15316-6-2:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-2: Explanation and justification of EN 15316-2, Module M3-5, M4-5	CEN/TC 228/WG 4
CEN/TR 15316-6-3:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-3: Explanation and justification of 15316-3, Module M3-6, M4-6, M8-6	CEN/TC 228/WG 4
CEN/TR 15316-6-4:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-4: Explanation and justification of EN 15316-4-1, Module M3-8-1, M8-8-1	CEN/TC 228/WG 4
CEN/TR 15316-6-5:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-5: Explanation and justification of EN 15316-4-2, Module M3-8	CEN/TC 228/WG 4
CEN/TR 15316-6-6:2017	Energy performance of buildings - Method for calculation of system energy performance and system efficiencies - Part 6-6: Explanation and justification of EN 15316-4-3, Module M3-8-3, M8-8-3	CEN/TC 228/WG 4
CEN/TR 15316-6-7:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-7: Explanation and justification of EN 15316-4-4, Module M8-3-4, M8-8-4, M8-11-4	CEN/TC 228/WG 4
CEN/TR 15316-6-8:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-8: Explanation and justification of EN 15316-4-5 (District heating and cooling), Module M3-8-5, M4-8-5, M8-8-5, M11-8-5	CEN/TC 228/WG 4
CEN/TR 15316-6-9:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 6-9: Explanation and justification of EN 15316-4-8, Module M3-8-8	CEN/TC 228/WG 4

Reference	Title	Drafting Body
CEN/TR 15378-2:2017	Energy performance of buildings - Heating systems and DHW in buildings - Part 2: Explanation and justification of EN 15378-1, Module M3-11 and M8-11	CEN/TC 228/WG 4
CEN/TR 15378-4:2017	Energy performance of buildings - Heating systems and DHW in buildings - Part 4: Explanation and justification of EN 15378-3, Module M3-10, M8-10	CEN/TC 228/WG 4
CEN/TR 15459-2:2017	Energy performance of buildings - Economic evaluation procedure for energy systems in buildings - Part 2: Explanation and justification of EN 15459-1, Module M1-14	CEN/TC 228/WG 4
EN 12831-1:2017	Energy performance of buildings - Method for calculation of the design heat load - Part 1: Space heating load, Module M3-3	CEN/TC 228/WG 4
EN 12831-3:2017	Energy performance of buildings - Method for calculation of the design heat load - Part 3: Domestic hot water systems heat load and characterisation of needs, Module M8-2, M8-3	CEN/TC 228/WG 4
EN 15316-1:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 1: General and Energy performance expression, Module M3-1, M3-4, M3-9, M8-1, M8-4	CEN/TC 228/WG 4
EN 15316-2:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 2: Space emission systems (heating and cooling), Module M3-5, M4-5	CEN/TC 228/WG 4
EN 15316-3:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 3: Space distribution systems (DHW, heating and cooling), Module M3-6, M4-6, M8-6	CEN/TC 228/WG 4
EN 15316-4-1:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-1: Space heating and DHW generation systems, combustion systems (boilers, biomass), Module M3-8-1, M8-8-1	CEN/TC 228/WG 4
EN 15316-4-10:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-10: Wind power generation systems, Module M11-8-7	CEN/TC 228/WG 4
EN 15316-4-2:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-2: Space heating generation systems, heat pump systems, Module M3-8-2, M8-8-2	CEN/TC 228/WG 4

Reference	Title	Drafting Body
EN 15316-4-2:2017/AC:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-2: Space heating generation systems, heat pump systems, Module M3-8-2, M8-8-2	CEN/TC 228/WG 4
EN 15316-4-3:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-3: Heat generation systems, thermal solar and photovoltaic systems, Module M3-8-3, M8-8-3, M11-8-3	CEN/TC 228/WG 4
EN 15316-4-4:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-4: Heat generation systems, building-integrated cogeneration systems, Module M8-3-4, M8-8-4, M8-11-4	CEN/TC 228/WG 4
EN 15316-4-5:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-5: District heating and cooling, Module M3-8-5, M4-8-5, M8-8-5, M11-8-5	CEN/TC 228/WG 4
EN 15316-4-8:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-8: Space heating generation systems, air heating and overhead radiant heating systems, including stoves (local), Module M3-8-8	CEN/TC 228/WG 4
EN 15316-5:2017	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 5: Space heating and DHW storage systems (not cooling), Module M3-7, M8-7	CEN/TC 228/WG 4
EN 15378-1:2017	Energy performance of buildings - Heating systems and DHW in buildings - Part 1: Inspection of boilers, heating systems and DHW, Module M3-11, M8-11	CEN/TC 228/WG 4
EN 15378-3:2017	Energy performance of buildings - Heating and DHW systems in buildings - Part 3: Measured energy performance, Module M3-10, M8-10	CEN/TC 228/WG 4
EN 15459-1:2017	Energy performance of buildings - Economic evaluation procedure for energy systems in buildings - Part 1: Calculation procedures, Module M1-14	CEN/TC 228/WG 4
CEN ISO/TR 52120-2:2022	Energy performance of buildings - Contribution of building automation, controls and building management - Part 2: Explanation and justification of ISO 52120-1 (ISO/TR 52120-2:2021)	CEN/TC 247/WG 6
CEN ISO/TR 52127-2:2021	Energy performance of buildings - Building automation, controls and building management - Part 2: Explanation and justification of ISO 52127-1 (ISO/TR 52127-2:2021)	CEN/TC 247/WG 6
CEN/TR 12098-6:2016	Controls for heating systems - Part 6: Accompanying TR prEN 12098-1:2015 - Modules M3-5,6,7,8	CEN/TC 247/WG 6

Reference	Title	Drafting Body
CEN/TR 12098-7:2016	Controls for heating systems - Part 7: Accompanying TR prEN 12098-3:2015 - Modules M3-5,6,7,8	CEN/TC 247/WG 6
CEN/TR 12098-8:2016	Controls for heating systems - Part 8: Accompanying TR prEN 12098-5:2015 - Modules M3-5,6,7,8	CEN/TC 247/WG 6
CEN/TR 15500-2:2016	Energy Performance of Buildings - Control for heating, ventilating and air-conditioning applications - Part 2: Accompanying TR prEN 15500-1:2015 - Modules M3-5,M4-5,M5-5	CEN/TC 247/WG 6
CEN/TR 16946-2:2016	Energy Performance of Buildings - Inspection of Building Automation, Controls and Technical Building Management - Part 2: Accompanying TR prEN 16946-1:2015 - Modules M10-11	CEN/TC 247/WG 6
EN 12098-1:2017	**Energy Performance of Buildings - Controls for heating systems - Part 1: Control equipment for hot water heating systems - Modules M3-5, 6, 7, 8**	CEN/TC 247/WG 6
EN 12098-3:2017	Energy Performance of Buildings - Controls for heating systems - Part 3: Control equipment for electrical heating systems - Modules M3-5,6,7,8	CEN/TC 247/WG 6
EN 12098-5:2017	Energy Performance of Buildings - Controls for heating systems - Part 5: Start-stop schedulers for heating systems - Modules M3-5,6,7,8	CEN/TC 247/WG 6
EN 15500-1:2017	Energy Performance of Buildings - Control for heating, ventilating and air conditioning applications - Part 1: Electronic individual zone control equipment - Modules M3-5, M4-5, M5-5	CEN/TC 247/WG 6
EN 16946-1:2017	Energy Performance of Buildings - Inspection of Automation, Controls and Technical Building Management - Part 1: Module M10-11	CEN/TC 247/WG 6
EN ISO 52120-1:2022	**Energy performance of buildings - Contribution of building automation, controls and building management - Part 1: General framework and procedures** (ISO 52120-1:2021)	CEN/TC 247/WG 6
EN ISO 52127-1:2021	Energy performance of buildings - Building management system - Part 1: Module M10-12 (ISO 52127-1: 2021)	CEN/TC 247/WG 6
CEN ISO/TR 52000-2:2017	**Energy performance of buildings - Overarching EPB assessment - Part 2: Explanation and justification of ISO 52000-1** (ISO/TR 52000-2:2017)	CEN/TC 371/WG 1
CEN/TS 16628:2014	**Energy Performance of Buildings - Basic Principles for the set of EPB standards**	CEN/TC 371/WG 1
CEN/TS 16629:2014	**Energy Performance of Buildings - Detailed Technical Rules for the set of EPB-standards**	CEN/TC 371/WG 1

Reference	Title	Drafting Body
EN 17423:2020	Energy performance of buildings - Determination and reporting of Primary Energy Factors (PEF) and CO2 emission coefficient - General Principles, Module M1-7	CEN/TC 371/WG 1
EN ISO 52000-1:2017	**Energy performance of buildings - Overarching EPB assessment - Part 1: General framework and procedures** (ISO 52000-1:2017)	CEN/TC 371/WG 1
CEN ISO/TR 52003-2:2017	**Energy performance of buildings - Indicators, requirements, ratings and certificates - Part 2: Explanation and justification of ISO 52003-1** (ISO/TR 52003-2:2017)	CEN/TC 89
CEN ISO/TR 52010-2:2017	Energy performance of buildings - External climatic conditions - Part 2: Explanation and justification of ISO 52010-1 (ISO/TR 52010-2:2017)	CEN/TC 89
CEN ISO/TR 52016-2:2017	Energy performance of buildings - Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads - Part 2: Explanation and justification of ISO 52016-1 and ISO 52017-1 (ISO/TR 52016-2:2017)	CEN/TC 89
CEN ISO/TR 52018-2:2017	Energy performance of buildings - Indicators for partial EPB requirements related to thermal energy balance and fabric features - Part 2: Explanation and justification of ISO 52018-1 (ISO/TR 52018-2:2017)	CEN/TC 89
CEN ISO/TR 52019-2:2017	Energy performance of buildings - Hygrothermal performance of building components and building elements - Part 2: Explanation and justification (ISO/TR 52019-2:2017)	CEN/TC 89
EN ISO 10211:2017	Thermal bridges in building construction - Heat flows and surface temperatures - Detailed calculations (ISO 10211:2017)	CEN/TC 89
EN ISO 13370:2017	Thermal performance of buildings - Heat transfer via the ground - Calculation methods (ISO 13370:2017)	CEN/TC 89
EN ISO 13786:2017	Thermal performance of building components - Dynamic thermal characteristics - Calculation methods (ISO 13786:2017, Corrected version 2018-03)	CEN/TC 89
EN ISO 13789:2017	Thermal performance of buildings - Transmission and ventilation heat transfer coefficients - Calculation method (ISO 13789:2017)	CEN/TC 89
EN ISO 14683:2017	Thermal bridges in building construction - Linear thermal transmittance - Simplified methods and default values (ISO 14683:2017)	CEN/TC 89

Reference	Title	Drafting Body
EN ISO 52003-1:2017	**Energy performance of buildings - Indicators, requirements, ratings and certificates - Part 1: General aspects and application to the overall energy performance** (ISO 52003-1:2017)	CEN/TC 89
EN ISO 52010-1:2017	**Energy performance of buildings - External climatic conditions - Part 1: Conversion of climatic data for energy calculations** (ISO 52010-1:2017)	CEN/TC 89
EN ISO 52016-1:2017	Energy performance of buildings - Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads - Part 1: Calculation procedures (ISO 52016-1:2017)	CEN/TC 89
EN ISO 52017-1:2017	Energy performance of buildings - Sensible and latent heat loads and internal temperatures - Part 1: Generic calculation procedures (ISO 52017-1:2017)	CEN/TC 89
EN ISO 52018-1:2017	Energy performance of buildings - Indicators for partial EPB requirements related to thermal energy balance and fabric features - Part 1: Overview of options (ISO 52018-1:2017)	CEN/TC 89
EN ISO 6946:2017	Building components and building elements - Thermal resistance and thermal transmittance - Calculation methods (ISO 6946:2017, Corrected version 2021-12)	CEN/TC 89
CEN ISO/TR 52022-2:2017	Energy performance of buildings - Thermal, solar and daylight properties of building components and elements - Part 2: Explanation and justification (ISO/TR 52022-2:2017)	CEN/TC 89/WG 7
EN ISO 10077-1:2017	Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 1: General (ISO 10077-1:2017, Corrected version 2020-02)	CEN/TC 89/WG 7
EN ISO 10077-2:2017	Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 2: Numerical method for frames (ISO 10077-2:2017)	CEN/TC 89/WG 7
EN ISO 12631:2017	Thermal performance of curtain walling - Calculation of thermal transmittance (ISO 12631:2017)	CEN/TC 89/WG 7
EN ISO 52022-1:2017	Energy performance of buildings - Thermal, solar and daylight properties of building components and elements - Part 1: Simplified calculation method of the solar and daylight characteristics for solar protection devices combined with glazing (ISO 52022-1:2017)	CEN/TC 89/WG 7
EN ISO 52022-3:2017	Energy performance of buildings - Thermal, solar and daylight properties of building components and elements - Part 3: Detailed calculation method of the solar and daylight characteristics for solar protection devices combined with glazing (ISO 52022-3:2017)	CEN/TC 89/WG 7

Table 5. European active projects linked to the EPBD

Reference	Title	Drafting Body
prEN 16798-3 rev	Energy performance of buildings - Ventilation for buildings - Part 3: For non-residential buildings - Performance requirements for ventilation and room-conditioning systems (Modules M5-1, M5-4)	CEN/TC 156/WG 20
EN 12831-3:2017/prA1	Energy performance of buildings - Method for calculation of the design heat load - Part 3: Domestic hot water systems heat load and characterisation of needs, Module M8-2, M8-3	CEN/TC 228/WG 4
prEN 15316-4-2	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-2: Space heating generation systems, heat pump systems, Module M3-8-2, M8-8-2	CEN/TC 228/WG 4
prEN 15316-5	Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 5: Space heating and DHW storage systems (not cooling), Module M3-7, M8-7	CEN/TC 228/WG 4
FprCEN/TR 12098-6	**Energy performance of buildings - Controls for heating systems - Part 6: Accompanying TR EN 12098-1:2022 - Modules M3-5,6,7,8**	CEN/TC 247/WG 6
FprCEN/TR 12098-7	**Energy performance of buildings - Controls for heating systems - Part 7: Accompanying TR EN 12098-3:2022 - Modules M3-5,6,7,8**	CEN/TC 247/WG 6
FprEN 12098-1	**Energy performance of buildings - Controls for heating systems - Part 1: Control equipment for hot water heating systems - Modules M3-5, 6, 7, 8**	CEN/TC 247/WG 6
FprEN 12098-3	**Energy performance of buildings - Controls for heating systems - Part 3: Control equipment for electrical heating systems - Modules M3-5,6,7,8**	CEN/TC 247/WG 6
prCEN/TS 16628 rev	**Energy Performance of Buildings - Basic Principles for the set of EPB standards**	CEN/TC 371/WG 1
prCEN/TS 16629 rev	**Energy Performance of Buildings - Detailed Technical Rules for the set of EPB-standards**	CEN/TC 371/WG 1
prCEN ISO/TR 52016-4	Energy performance of buildings - Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads - Part 4: Explanation and justification of ISO 52016-3	CEN/TC 89

Reference	Title	Drafting Body
prEN ISO 52016-3	Energy performance of buildings - Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads - Part 3: Calculation procedures regarding adaptive building envelope elements (ISO/DIS 52016-3:2022)	CEN/TC 89
prEN 17887-1	Thermal performance of buildings - In situ testing of completed buildings - Part 1: Data collection for aggregate heat loss test	CEN/TC 89/WG 13
prEN 17887-2	Thermal performance of buildings - In situ testing of completed buildings - Part 2: Steady-state data analysis for aggregate heat loss test	CEN/TC 89/WG 13
prEN 17888-1	Thermal performance of buildings - In situ measurement of building test structures - Part 1: Data collection for aggregate heat loss test	CEN/TC 89/WG 13
prEN 17888-2	Thermal performance of buildings - In situ testing of building test structures - Part 2: Steady-state data analysis for aggregate heat loss test	CEN/TC 89/WG 13

Table 6. European standards linked to digitization, energy performance or sustainability assessment of buildings

Reference	Title	Drafting Body
EN 17267:2019	Energy measurement and monitoring plan - Design and implementation - Principles for energy data collection	CEN/CLC/JTC 14
EN 16247-1:2012	Energy audits - Part 1: General requirements	CEN/CLC/JTC 14/WG 1
EN 16247-2:2014	**Energy audits - Part 2: Buildings**	CEN/CLC/JTC 14/WG 1
EN 16247-5:2015	**Energy audits - Part 5: Competence of energy auditors**	CEN/CLC/JTC 14/WG 1
EN 15900:2010	Energy efficiency services - Definitions and requirements	CEN/CLC/JWG 3
EN 16212:2012	Energy Efficiency and Savings Calculation, Top-down and Bottom-up Methods	CEN/CLC/JWG 3
EN 17609:2022	Building automation and control systems - Control applications	CEN/TC 247
EN 16883:2017	Conservation of cultural heritage - Guidelines for improving the energy performance of historic buildings	CEN/TC 346

Reference	Title	Drafting Body
CEN/TR 17005:2016	Sustainability of construction works - Additional environmental impact categories and indicators - Background information and possibilities - Evaluation of the possibility of adding environmental impact categories and related indicators and calculation methods for the assessment of the environmental performance of buildings	CEN/TC 350/WG 1
EN 15978:2011	**Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method**	CEN/TC 350/WG 1
CEN/TR 15941:2010	Sustainability of construction works - Environmental product declarations - Methodology for selection and use of generic data	CEN/TC 350/WG 3
CEN/TR 16970:2016	Sustainability of construction works - Guidance for the implementation of EN 15804	CEN/TC 350/WG 3
EN 15804:2012+A2:2019	Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products	CEN/TC 350/WG 3
EN 15942:2021	**Sustainability of construction works - Environmental product declarations - Communication format business-to-business**	CEN/TC 350/WG 3
EN ISO 22057:2022	**Sustainability in buildings and civil engineering works - Data templates for the use of environmental product declarations (EPDs) for construction products in building information modelling (BIM)** (ISO 22057:2022)	CEN/TC 350/WG 3
EN 16627:2015	Sustainability of construction works - Assessment of economic performance of buildings - Calculation methods	CEN/TC 350/WG 4
EN 16309:2014+A1:2014	Sustainability of construction works - Assessment of social performance of buildings - Calculation methodology	CEN/TC 350/WG 5
EN 17472:2022	Sustainability of construction works - Sustainability assessment of civil engineering works - Calculation methods	CEN/TC 350/WG 6
EN 15643:2021	**Sustainability of construction works - Framework for assessment of buildings and civil engineering works**	CEN/TC 350/WG 7
EN ISO 21597-1:2020	Information container for linked document delivery - Exchange specification - Part 1: Container	CEN/TC 442
EN ISO 21597-2: 2021	Information container for linked document delivery - Exchange specification - Part 2: Link types	CEN/TC 442
EN 17412-1:2020	**Building Information Modelling - Level of Information Need - Part 1: Concepts and principles**	CEN/TC 442/WG 2

Reference	Title	Drafting Body
EN ISO 19650-1:2018	Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 1: Concepts and principles (ISO 19650-1:2018)	CEN/TC 442/WG 3
EN ISO 19650-2:2018	Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 2: Delivery phase of the assets (ISO 19650-2:2018)	CEN/TC 442/WG 3
EN ISO 19650-3:2020	**Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 3: Operational phase of the assets** (ISO 19650-3:2020)	CEN/TC 442/WG 3
EN ISO 19650-5:2020	Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 5: Security-minded approach to information management (ISO 19650-5:2020)	CEN/TC 442/WG 3
EN ISO 23386:2020	Building information modelling and other digital processes used in construction - Methodology to describe, author and maintain properties in interconnected data dictionaries (ISO 23386:2020)	CEN/TC 442/WG 4
EN ISO 23387:2020	Building information modelling (BIM) - Data templates for construction objects used in the life cycle of built assets - Concepts and principles (ISO 23387:2020)	CEN/TC 442/WG 4
EN ISO 50001:2018	Energy management systems - Requirements with guidance for use (ISO 50001:2018)	CLC/TC 17

Table 7. European active projects related to digitization, energy performance or sustainability assessment of buildings

Reference	Title	Drafting Body
FprEN 16247-1	Energy audits - Part 1: General requirements	CEN/CLC/JTC 14/WG 1
FprEN 16247-2	**Energy audits - Part 2: Buildings**	CEN/CLC/JTC 14/WG 1

Reference	Title	Drafting Body
prEN 15978-1	**Sustainability of construction works - Methodology for the assessment of performance of buildings - Part 1: Environmental Performance**	CEN/TC 350/WG 1
prEN 15941	**Sustainability of construction works - Data quality for environmental assessment of products and construction works - Selection and use of data**	CEN/TC 350/WG 3
prEN 15978-2	Sustainability of construction works - Methodology for the assessment of buildings - Part 2: Social performance	CEN/TC 350/WG 5
PWI	Connection between the contributions of CEW to sustainability and achievement of the SDGs	CEN/TC 350/WG 6
prEN 17680	**Sustainability of construction works - Evaluation of the potential for sustainable refurbishment of buildings**	CEN/TC 350/WG 8
FprEN ISO 19650-4	**Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 4: Information exchange** (ISO/FDIS 19650-4:2022)	CEN/TC 442
prEN ISO 22014	**Library objects for architecture, engineering, and construction**	CEN/TC 442
prEN 17549-1	**Building information modelling - Information structure based on EN ISO 16739 1 to exchange data templates and data sheets for construction objects - Part 1: Data templates and configured construction objects**	CEN/TC 442/WG 2
prEN 17549-2	**Building information modelling - Information structure based on EN ISO 16739 1 to exchange data templates and data sheets for construction objects - Part 2: Configurable construction objects and requirements**	CEN/TC 442/WG 2
prEN ISO 19650-6	ISO 19650-6: Organization and digitization of information about buildings and civil engineering works, including building information modelling -- Information management using building information modelling - Part 6: Health and Safety	CEN/TC 442/WG 3
FprEN 17632-1	Building information modelling (BIM) - Semantic modelling and linking (SML) - Part 1: Generic modelling patterns	CEN/TC 442/WG 4
prEN 17632-2	Building Information Modelling (BIM) - Semantic Modelling and Linking (SML), Part 2: Domain-specific modelling patterns	CEN/TC 442/WG 4
prEN XXX	**Building information modelling (BIM) - Data templates for construction objects used in the life cycle of built assets - Data templates based on European standards and technical specifications**	CEN/TC 442/WG 4

Table 8. International standards, not published as European standards, related with energy performance or sustainability assessment of buildings

Reference	Title	Drafting Body
ISO 12655:2013	**Energy performance of buildings — Presentation of measured energy use of buildings**	ISO/TC 163
ISO 17772-1:2017	**Energy performance of buildings — Indoor environmental quality — Part 1: Indoor environmental input parameters for the design and assessment of energy performance of buildings**	ISO/TC 163
ISO 18523-1:2016	Energy performance of buildings — Schedule and condition of building, zone and space usage for energy calculation — Part 1: Non-residential buildings	ISO/TC 163
ISO 18523-2:2018	Energy performance of buildings — Schedule and condition of building, zone and space usage for energy calculation — Part 2: Residential buildings	ISO/TC 163
ISO 7345:2018	**Thermal performance of buildings and building components — Physical quantities and definitions**	ISO/TC 163
ISO 9229:2020	Thermal insulation — Vocabulary	ISO/TC 163
ISO 9972:2015	Thermal performance of buildings — Determination of air permeability of buildings — Fan pressurization method	ISO/TC 163/SC
ISO 16956:2015	Thermal performance in the built environment — Determination of air flow rate in building applications by field measuring methods	ISO/TC 163/SC 1
ISO 19467:2017	Thermal performance of windows and doors — Determination of solar heat gain coefficient using solar simulator	ISO/TC 163/SC 1
ISO 19467-2:2021	Thermal Performance of windows and doors — Determination of solar heat gain coefficient using solar simulator — Part 2: Centre of glazing	ISO/TC 163/SC 1
ISO 9869-1:2014	Thermal insulation — Building elements — In-situ measurement of thermal resistance and thermal transmittance — Part 1: Heat flow meter method	ISO/TC 163/SC 1
ISO 9869-2:2018	Thermal insulation — Building elements — In-situ measurement of thermal resistance and thermal transmittance — Part 2: Infrared method for frame structure dwelling	ISO/TC 163/SC 1

Reference	Title	Drafting Body
ISO 9869-2:2018/Amd 1:2021	Thermal insulation — Building elements — In-situ measurement of thermal resistance and thermal transmittance — Part 2: Infrared method for frame structure dwelling — Amendment 1: Example of calculation of uncertainty analysis	ISO/TC 163/SC 1
ISO 12241:2022	Thermal insulation for building equipment and industrial installations — Calculation rules	ISO/TC 163/SC 2
ISO 12241:2022	**Thermal insulation for building equipment and industrial installations — Calculation rules**	ISO/TC 163/SC 2
ISO 13370:2017	Thermal performance of buildings — Heat transfer via the ground — Calculation methods	ISO/TC 163/SC 2
ISO 13786:2017	Thermal performance of building components — Dynamic thermal characteristics — Calculation methods	ISO/TC 163/SC 2
ISO 13787:2003	Thermal insulation products for building equipment and industrial installations — Determination of declared thermal conductivity	ISO/TC 163/SC 2
ISO 15099:2003	Thermal performance of windows, doors and shading devices — Detailed calculations	ISO/TC 163/SC 2
ISO 6946:2017	Building components and building elements — Thermal resistance and thermal transmittance — Calculation methods	ISO/TC 163/SC 2
ISO 21105-1:2019	Performance of buildings — Building enclosure thermal performance verification and commissioning — Part 1: General requirements	ISO/TC 163/SC 3
ISO 11855-6:2018	Building environment design — Design, dimensioning, installation and control of embedded radiant heating and cooling systems — Part 6: Control	ISO/TC 205
ISO 11855-7:2019	Building environment design — Design, dimensioning, installation and control of embedded radiant heating and cooling systems — Part 7: Input parameters for the energy calculation	ISO/TC 205
ISO 13153:2012	Framework of the design process for energy-saving single-family residential and small commercial buildings	ISO/TC 205
ISO 13612-1:2014	Heating and cooling systems in buildings — Method for calculation of the system performance and system design for heat pump systems — Part 1: Design and dimensioning	ISO/TC 205
ISO 13612-2:2014	Heating and cooling systems in buildings — Method for calculation of the system performance and system design for heat pump systems — Part 2: Energy calculation	ISO/TC 205

Reference	Title	Drafting Body
ISO 13675:2013	Heating systems in buildings — Method and design for calculation of the system energy performance — Combustion systems (boilers)	ISO/TC 205
ISO 16813:2006	**Building environment design — Indoor environment — General principles**	ISO/TC 205
ISO 16814:2008	Building environment design — Indoor air quality — Methods of expressing the quality of indoor air for human occupancy	ISO/TC 205
ISO 16817:2017	Building environment design — Indoor environment — Design process for the visual environment	ISO/TC 205
ISO 16818:2008	**Building environment design — Energy efficiency — Terminology**	ISO/TC 205
ISO 17800:2017	Facility smart grid information model	ISO/TC 205
ISO 19454:2019	Building environment design — Indoor environment — Daylight opening design for sustainability principles in visual environment	ISO/TC 205
ISO 23045:2008	**Building environment design — Guidelines to assess energy efficiency of new buildings**	ISO/TC 205
ISO 52031:2020	Energy performance of buildings — Method for calculation of system energy requirements and system efficiencies — Space emission systems (heating and cooling)	ISO/TC 205
ISO 52032-1:2022	Energy performance of buildings — Energy requirements and efficiencies of heating, cooling and domestic hot water (DHW) distribution systems — Part 1: Calculation procedures	ISO/TC 205
ISO/TR 16822:2016	Building environment design — List of test procedures for heating, ventilating, air-conditioning and domestic hot water equipment related to energy efficiency	ISO/TC 205
ISO/TS 23764:2021	Methodology for achieving non-residential zero-energy buildings (ZEBs)	ISO/TC 205
ISO 15686-1:2011	Buildings and constructed assets — Service life planning — Part 1: General principles and framework	ISO/TC 59/SC 14
ISO 15686-4:2014	**Building Construction — Service Life Planning — Part 4: Service Life Planning using Building Information Modelling**	ISO/TC 59/SC 14
ISO 15686-5:2017	Buildings and constructed assets — Service life planning — Part 5: Life-cycle costing	ISO/TC 59/SC 14
ISO 15928-5:2013	**Houses — Description of performance — Part 5: Operating energy**	ISO/TC 59/SC 15

Reference	Title	Drafting Body
ISO 15392:2019	Sustainability in buildings and civil engineering works — General principles	ISO/TC 59/SC 17
ISO 16745-1:2017	Sustainability in buildings and civil engineering works — Carbon metric of an existing building during use stage — Part 1: Calculation, reporting and communication	ISO/TC 59/SC 17
ISO 21678:2020	Sustainability in buildings and civil engineering works — Indicators and benchmarks — Principles, requirements and guidelines	ISO/TC 59/SC 17
ISO 21929-1:2011	Sustainability in building construction — Sustainability indicators — Part 1: Framework for the development of indicators and a core set of indicators for buildings	ISO/TC 59/SC 17
ISO 21931-1:2022	**Sustainability in buildings and civil engineering works — Framework for methods of assessment of the environmental, social and economic performance of construction works as a basis for sustainability assessment — Part 1: Buildings**	ISO/TC 59/SC 17
ISO 6707-1:2020	Buildings and civil engineering works — Vocabulary — Part 1: General terms	ISO/TC 59/SC 2
ISO 6707-3:2017	Buildings and civil engineering works — Vocabulary — Part 3: Sustainability terms	ISO/TC 59/SC 2
ISO 6707-4:2021	Buildings and civil engineering works — Vocabulary — Part 4: Facility management terms	ISO/TC 59/SC 2

Table 9. International active projects, not linked with a European active project, related with energy performance or sustainability assessment of buildings

Reference	Title	Drafting Body
ISO/DIS 24144	Thermal insulation — Test methods for specific heat capacity of thermal insulation for buildings in the high temperature range — Differential scanning calorimetry (DSC) method	ISO/TC 163
ISO/PWI 52007-1	Energy performance of buildings — Indoor environmental quality — Part 1: Indoor environmental input parameters for the design and assessment of energy performance of buildings	ISO/TC 163
ISO 11855-6:2018/AWI Amd 1	Building environment design — Design, dimensioning, installation and control of embedded radiant heating and cooling systems — Part 6: Control — Amendment 1	ISO/TC 205

Reference	Title	Drafting Body
ISO 11855-7:2019/AWI Amd 1	Building environment design — Design, dimensioning, installation and control of embedded radiant heating and cooling systems — Part 7: Input parameters for the energy calculation — Amendment 1	ISO/TC 205
ISO/AWI TR 52032-2	Energy performance of buildings — Energy requirements and efficiencies of heating, cooling and domestic hot water (DHW) distribution systems — Part 2: Explanation and justification of ISO 52032-1	ISO/TC 205
ISO/AWI TR 5242	Technical analysis for a new perspective on thermal comfort	ISO/TC 205
ISO/CD 11855-8	Building environment design — Design, dimensioning, installation and control of embedded radiant heating and cooling systems — Part 8: Electrical heating systems	ISO/TC 205
ISO/PWI 20734	Building environment design — Daylighting design procedure for indoor visual environment	ISO/TC 205
ISO/PWI 22511	Design process of natural ventilative cooling in non-residential buildings	ISO/TC 205
ISO/PWI 24359-1	Building commissioning process planning — Part 1: New buildings	ISO/TC 205
ISO/WD 16813	Building environment design — Indoor environment — General principles	ISO/TC 205
ISO/WD TR 5863	Integrative design of the building envelope — General principles	ISO/TC 205
ISO/PWI 15686-4	Building Construction — Service Life Planning — Part 4: Service Life Planning using Building Information Modelling	ISO/TC 59/SC 14
ISO/FDIS 15928-6	Houses — Description of performance — Part 6: Sustainable development contributions	ISO/TC 59/SC 15
ISO/DIS 21928-2	Sustainability in buildings and civil engineering works — Sustainability indicators — Part 2: Framework for the development of indicators for civil engineering works	ISO/TC 59/SC 17
ISO/FDIS 6707-3	Buildings and civil engineering works — Vocabulary — Part 3: Sustainability terms	ISO/TC 59/SC 2

Table 10. International standards, not published as European standards, related with digitization

Reference	Title	Drafting Body
ISO/IEC 10165-1:1993	Information technology — Open Systems Interconnection — Management Information Services — Structure of management information: Management Information Model	ISO/IEC JTC 1
ISO/IEC 10165-2:1992	Information technology — Open Systems Interconnection — Structure of management information: Definition of management information	ISO/IEC JTC 1
ISO/IEC 24643:2020	Architecture for a distributed real-time access system	ISO/IEC JTC 1
ISO/IEC 14762:2009	Information technology — Functional safety requirements for Home and Building Electronic Systems (HBES)	ISO/IEC JTC 1/SC 25
ISO/IEC TR 10192-2:2000	Information technology — Home Electronic System (HES) interfaces — Part 2: Simple Interfaces Type 1	ISO/IEC JTC 1/SC 25
ISO/IEC TR 14543-4:2002	Information technology — Home Electronic System (HES) architecture — Part 4: Home and building automation in a mixed-use building	ISO/IEC JTC 1/SC 25
ISO/IEC TR 15044:2000	Information technology — Terminology for the Home Electronic System (HES)	ISO/IEC JTC 1/SC 25
ISO/IEC TR 29108:2013	Information technology — Terminology for intelligent homes	ISO/IEC JTC 1/SC 25
ISO/IEC 19086-4:2019	Cloud computing — Service level agreement (SLA) framework — Part 4: Components of security and of protection of PII	ISO/IEC JTC 1/SC 27
ISO/IEC 27400:2022	Cybersecurity — IoT security and privacy — Guidelines	ISO/IEC JTC 1/SC 27
ISO/IEC 27555:2021	Information security, cybersecurity and privacy protection — Guidelines on personally identifiable information deletion	ISO/IEC JTC 1/SC 27
ISO/IEC TS 27570:2021	Privacy protection — Privacy guidelines for smart cities	ISO/IEC JTC 1/SC 27
ISO/IEC 22603-1:2021	Information technology — Digital representation of product information — Part 1: General requirements	ISO/IEC JTC 1/SC 31
ISO/IEC 19637:2016	Information technology — Sensor network testing framework	ISO/IEC JTC 1/SC 41
ISO/IEC 20005:2013	Information technology — Sensor networks — Services and interfaces supporting collaborative information processing in intelligent sensor networks	ISO/IEC JTC 1/SC 41

Reference	Title	Drafting Body
ISO/IEC 20924:2021	**Information technology — Internet of Things (IoT) — Vocabulary**	ISO/IEC JTC 1/SC 41
ISO/IEC 21823-1:2019	**Internet of things (IoT) — Interoperability for IoT systems — Part 1: Framework**	ISO/IEC JTC 1/SC 41
ISO/IEC 21823-2:2020	Internet of things (IoT) — Interoperability for IoT systems — Part 2: Transport interoperability	ISO/IEC JTC 1/SC 41
ISO/IEC 21823-3:2021	Internet of things (IoT) — Interoperability for IoT systems — Part 3: Semantic interoperability	ISO/IEC JTC 1/SC 41
ISO/IEC 21823-4:2022	Internet of things (IoT) — Interoperability for IoT systems — Part 4: Syntactic interoperability	ISO/IEC JTC 1/SC 41
ISO/IEC 29182-1:2013	Information technology — Sensor networks: Sensor Network Reference Architecture (SNRA) — Part 1: General overview and requirements	ISO/IEC JTC 1/SC 41
ISO/IEC 29182-2:2013	Information technology — Sensor networks: Sensor Network Reference Architecture (SNRA) — Part 2: Vocabulary and terminology	ISO/IEC JTC 1/SC 41
ISO/IEC 29182-3:2014	Information technology — Sensor networks: Sensor Network Reference Architecture (SNRA) — Part 3: Reference architecture views	ISO/IEC JTC 1/SC 41
ISO/IEC 29182-4:2013	Information technology — Sensor networks: Sensor Network Reference Architecture (SNRA) — Part 4: Entity models	ISO/IEC JTC 1/SC 41
ISO/IEC 29182-5:2013	Information technology — Sensor networks: Sensor Network Reference Architecture (SNRA) — Part 5: Interface definitions	ISO/IEC JTC 1/SC 41
ISO/IEC 29182-6:2014	Information technology — Sensor networks: Sensor Network Reference Architecture (SNRA) — Part 6: Applications	ISO/IEC JTC 1/SC 41
ISO/IEC 29182-7:2015	Information technology — Sensor networks: Sensor Network Reference Architecture (SNRA) — Part 7: Interoperability guidelines	ISO/IEC JTC 1/SC 41
ISO/IEC 30128:2014	Information technology — Sensor networks — Generic Sensor Network Application Interface	ISO/IEC JTC 1/SC 41
ISO/IEC 30141:2018	**Internet of Things (IoT) — Reference Architecture**	ISO/IEC JTC 1/SC 41
ISO/IEC 30147:2021	Information technology — Internet of things — Methodology for trustworthiness of IoT system/service	ISO/IEC JTC 1/SC 41
ISO/IEC 30149 ED1	Internet of Things (IoT) - Trustworthiness Principles	ISO/IEC JTC 1/SC 41

Reference	Title	Drafting Body
ISO/IEC 30161:2020	**Internet of Things (IoT) — Requirements of IoT data exchange platform for various IoT services**	ISO/IEC JTC 1/SC 41
ISO/IEC 30161-2 ED1	Internet of Things (IoT) – Data exchange platform for IoT services – Part 2: Transport interoperability between nodal points	ISO/IEC JTC 1/SC 41
ISO/IEC 30162:2022	Internet of Things (IoT) — Compatibility requirements and model for devices within industrial IoT systems	ISO/IEC JTC 1/SC 41
ISO/IEC 30162:2022 ED1	Internet of Things (IoT) - Compatibility requirements and model for devices within Industrial IoT systems	ISO/IEC JTC 1/SC 41
ISO/IEC 30163:2021	Internet of Things (IoT) — System requirements of IoT/SN technology-based integrated platform for chattel asset monitoring supporting financial services	ISO/IEC JTC 1/SC 41
ISO/IEC 30165:2021	**Internet of Things (IoT) — Real-time IoT framework**	ISO/IEC JTC 1/SC 41
ISO/IEC 30173 ED1	**Digital Twin - Concepts and terminology**	ISO/IEC JTC 1/SC 41
ISO/IEC 30178 ED1	**Internet of Things (IoT) - Data format, value and coding**	ISO/IEC JTC 1/SC 41
ISO/IEC 30179 ED1	Internet of Things (IoT) - Overview and general requirements of IoT system for ecological environment monitoring	ISO/IEC JTC 1/SC 41
ISO/IEC 30181 ED1	Internet of Things (IoT) – Functional architecture for resource ID interoperability	ISO/IEC JTC 1/SC 41
ISO/IEC TR 22417:2017	**Information technology — Internet of things (IoT) use cases**	ISO/IEC JTC 1/SC 41
ISO/IEC TR 30148:2019	**Internet of Things (IoT) — Technical requirements and application of sensor network for wireless gas meters.**	ISO/IEC JTC 1/SC 41
ISO/IEC TR 30166:2020	**Internet of things (IoT) — Industrial IoT**	ISO/IEC JTC 1/SC 41
ISO/IEC TR 30172 ED1	**Digital Twin - Use cases**	ISO/IEC JTC 1/SC 41
ISO/IEC TR 30174:2021	Internet of Things (IoT) — Socialized IoT system resembling human social interaction dynamics	ISO/IEC JTC 1/SC 41
ISO/IEC TR 30176:2021	Internet of Things (IoT) —- Integration of IoT and DLT/blockchain: Use cases	ISO/IEC JTC 1/SC 41
ISO/IEC/IEEE 24765:2017	Systems and software engineering — Vocabulary	ISO/IEC JTC 1/SC 7
ISO 10303-1:2021	Industrial automation systems and integration — Product data representation and exchange — Part 1: Overview and fundamental principles	ISO/TC 184/SC 4

Reference	Title	Drafting Body
ISO 10303-42:2019	Industrial automation systems and integration — Product data representation and exchange — Part 42: Integrated generic resource: Geometric and topological representation	ISO/TC 184/SC 4
ISO 10303-43:2018	Industrial automation systems and integration — Product data representation and exchange — Part 43: Integrated generic resource: Representation structures	ISO/TC 184/SC 4
ISO 10303-44:2019	Industrial automation systems and integration — Product data representation and exchange — Part 44: Integrated generic resource: Product structure configuration	ISO/TC 184/SC 4
ISO 10303-45:2019	Industrial automation systems and integration — Product data representation and exchange — Part 45: Integrated generic resource: Material and other engineering properties	ISO/TC 184/SC 4
ISO 15531-1:2004	Industrial automation systems and integration — Industrial manufacturing management data — Part 1: General overview	ISO/TC 184/SC 4
ISO 15531-31:2004	Industrial automation systems and integration — Industrial manufacturing management data — Part 31: Resource information model	ISO/TC 184/SC 4
ISO 15531-32:2005	Industrial automation systems and integration — Industrial manufacturing management data: Resources usage management — Part 32: Conceptual model for resources usage management data	ISO/TC 184/SC 4
ISO 15531-42:2005	Industrial automation systems and integration — Industrial manufacturing management data — Part 42: Time Model	ISO/TC 184/SC 4
ISO 23247-1:2021	Automation systems and integration — Digital twin framework for manufacturing — Part 1: Overview and general principles	ISO/TC 184/SC 4
ISO 23247-2:2021	Automation systems and integration — Digital twin framework for manufacturing — Part 2: Reference architecture	ISO/TC 184/SC 4
ISO 23247-3:2021	Automation systems and integration — Digital twin framework for manufacturing — Part 3: Digital representation of manufacturing elements	ISO/TC 184/SC 4
ISO 23247-4:2021	**Automation systems and integration — Digital twin framework for manufacturing — Part 4: Information exchange**	ISO/TC 184/SC 4
ISO 23952:2020	Automation systems and integration — Quality information framework (QIF) — An integrated model for manufacturing quality information	ISO/TC 184/SC 4

Reference	Title	Drafting Body
ISO/DTR 17999	Reference model for industrial data	ISO/TC 184/SC 4
ISO/TR 18828-1:2018	Industrial automation systems and integration — Standardized procedures for production systems engineering — Part 1: Overview	ISO/TC 184/SC 4
ISO/TR 24463:2021	Digital validation by effective use of simulation	ISO/TC 184/SC 4
ISO/TR 24464:2020	Automation systems and integration — Industrial data — Visualization elements of digital twins	ISO/TC 184/SC 4
ISO/TS 29002-10:2009	Industrial automation systems and integration — Exchange of characteristic data — Part 10: Characteristic data exchange format	ISO/TC 184/SC 4
ISO/TS 29002-20:2010	Industrial automation systems and integration — Exchange of characteristic data — Part 20: Concept dictionary resolution services	ISO/TC 184/SC 4
ISO/TS 29002-31:2009	Industrial automation systems and integration — Exchange of characteristic data — Part 31: Query for characteristic data	ISO/TC 184/SC 4
ISO/TS 29002-4:2009	Industrial automation systems and integration — Exchange of characteristic data — Part 4: Basic entities and types	ISO/TC 184/SC 4
ISO/TS 29002-5:2009	Industrial automation systems and integration — Exchange of characteristic data — Part 5: Identification scheme	ISO/TC 184/SC 4
ISO/TS 29002-6:2010	Industrial automation systems and integration — Exchange of characteristic data — Part 6: Concept dictionary terminology reference model	ISO/TC 184/SC 4
ISO 20140-1:2019	Automation systems and integration — Evaluating energy efficiency and other factors of manufacturing systems that influence the environment — Part 1: Overview and general principles	ISO/TC 184/SC 5
ISO 20140-2:2018	Automation systems and integration — Evaluating energy efficiency and other factors of manufacturing systems that influence the environment — Part 2: Environmental performance evaluation process	ISO/TC 184/SC 5
ISO 20140-3:2019	Automation systems and integration — Evaluating energy efficiency and other factors of manufacturing systems that influence the environment — Part 3: Environmental performance evaluation data aggregation process	ISO/TC 184/SC 5
ISO 20140-5:2017	Automation systems and integration — Evaluating energy efficiency and other factors of manufacturing systems that influence the environment — Part 5: Environmental performance evaluation data	ISO/TC 184/SC 5

Reference	Title	Drafting Body
ISO/PAS 19450:2015	Automation systems and integration — Object-Process Methodology	ISO/TC 184/SC 5
ISO/TR 11065:1992	Industrial automation glossary	ISO/TC 184/SC 5
ISO 19104:2016	Geographic information — Terminology	ISO/TC 211
ISO 19150-2:2015	Geographic information — Ontology — Part 2: Rules for developing ontologies in the Web Ontology Language (OWL)	ISO/TC 211
ISO 19150-2:2015/Amd 1:2019	Geographic information — Ontology — Part 2: Rules for developing ontologies in the Web Ontology Language (OWL) — Amendment 1	ISO/TC 211
ISO 19150-4:2019	Geographic information — Ontology — Part 4: Service ontology	ISO/TC 211
ISO/TR 19167:2019	Application of ubiquitous public access to-geographic information to an air quality information service	ISO/TC 211
ISO/TS 19115-3:2016	Geographic information — Metadata — Part 3: XML schema implementation for fundamental concepts	ISO/TC 211
ISO/TS 19150-1:2012	Geographic information — Ontology — Part 1: Framework	ISO/TC 211
ISO/TS 19157-2:2016	Geographic information — Data quality — Part 2: XML schema implementation	ISO/TC 211
ISO/TS 19158:2012	**Geographic information — Quality assurance of data supply**	ISO/TC 211
ISO/TS 19166:2021	**Geographic information — BIM to GIS conceptual mapping (B2GM)**	ISO/TC 211
ISO 37100:2016	Sustainable cities and communities — Vocabulary	ISO/TC 268
ISO 37105:2019	Sustainable cities and communities — Descriptive framework for cities and communities	ISO/TC 268
ISO 37106:2021	Sustainable cities and communities — Guidance on establishing smart city operating models for sustainable communities	ISO/TC 268
ISO 37110:2022	Sustainable cities and communities — Management requirements and recommendations for open data for smart cities and communities — Overview and general principles	ISO/TC 268
ISO 37122:2019	Sustainable cities and communities — Indicators for smart cities	ISO/TC 268
ISO 37156:2020	**Smart community infrastructures — Guidelines on data exchange and sharing for smart community infrastructures**	ISO/TC 268/SC 1

Reference	Title	Drafting Body
ISO 37160:2020	Smart community infrastructure — Electric power infrastructure — Measurement methods for the quality of thermal power infrastructure and requirements for plant operations and management	ISO/TC 268/SC 1
ISO/DTS 37172	**Smart community infrastructures — Data exchange and sharing for community infrastructures based on geographic information**	ISO/TC 268/SC 1
ISO/TR 37150:2014	Smart community infrastructures — Review of existing activities relevant to metrics	ISO/TC 268/SC 1
ISO/TR 37152:2016	Smart community infrastructures — Common framework for development and operation	ISO/TC 268/SC 1
ISO/TS 37151:2015	Smart community infrastructures — Principles and requirements for performance metrics	ISO/TC 268/SC 1
ISO 22263:2008	Organization of information about construction works — Framework for management of project information	ISO/TC 59/SC 13
ISO/TR 23262:2021	**GIS (geospatial) / BIM interoperability**	ISO/TC 59/SC 13
ISO/TS 12911:2012	**Framework for building information modelling (BIM) guidance**	ISO/TC 59/SC 13

Table 11. International active projects, not linked with a European active project, related

Reference	Title	Drafting Body
ISO/IEC CD 5087-2	Information technology — City data model — Part 2: City level concepts	ISO/IEC JTC 1
ISO/IEC DIS 17917	Smart cities — Guidance to establishing a decision-making framework for sharing data and information services	ISO/IEC JTC 1
ISO/IEC PWI 5217	**Guidance on smart city digital infrastructure design**	ISO/IEC JTC 1
ISO/IEC PWI TS 10267-3	**Information technology—Data use in smart cities — Part 3: Measurement, evaluation and reporting**	ISO/IEC JTC 1
ISO/IEC CD 27031	Information technology — Cybersecurity — Information and communication technology readiness for business continuity	ISO/IEC JTC 1/SC 27
ISO/IEC CD 27402.2	Cybersecurity — IoT security and privacy — Device baseline requirements	ISO/IEC JTC 1/SC 27

Reference	Title	Drafting Body
ISO/IEC CD 27403.2	Cybersecurity – IoT security and privacy – Guidelines for IoT-domotics	ISO/IEC JTC 1/SC 27
ISO/IEC DIS 27032	Cybersecurity — Guidelines for Internet security	ISO/IEC JTC 1/SC 27
ISO/IEC FDIS 27001	Information security, cybersecurity and privacy protection — Information security management systems — Requirements	ISO/IEC JTC 1/SC 27
ISO/IEC FDIS 27005	Information security, cybersecurity and privacy protection — Guidance on managing information security risks	ISO/IEC JTC 1/SC 27
ISO/IEC AWI 30149	Internet of things (IoT) — Trustworthiness framework	ISO/IEC JTC 1/SC 41
ISO/IEC AWI 30172	**Digital Twin — Use cases**	ISO/IEC JTC 1/SC 41
ISO/IEC AWI 30173	**Digital twin — Concepts and terminology**	ISO/IEC JTC 1/SC 41
PWI JTC1-SC41-7	Digital Twin – Maturity model	ISO/IEC JTC 1/SC 41
PWI TR JTC1-SC41-11	Digital Twin - Correspondence measure of DT twinning	ISO/IEC JTC 1/SC 41
ISO/AWI 8000-2	Data quality — Part 2: Vocabulary	ISO/TC 184/SC 4
ISO/AWI 8000-210	Data quality — Part 210: Part 210: Sensor data: Data quality characteristics	ISO/TC 184/SC 4
ISO/DIS 29002	Industrial automation systems and integration — Exchange of characteristic data	ISO/TC 184/SC 4
ISO/NP 8000-200	Data quality — Part 200: Transaction data: Quality of transaction data	ISO/TC 184/SC 4
ISO/PWI TR 4758	Ontology for geometry and topology	ISO/TC 184/SC 4
ISO/CD 20140-5	Automation systems and integration — Evaluating energy efficiency and other factors of manufacturing systems that influence the environment — Part 5: Environmental performance evaluation data	ISO/TC 184/SC 5
ISO/PWI 16518	Cooperative digital networking for manufacturing software systems	ISO/TC 184/SC 5
ISO/PWI 19171	**Geographic information — Handling urban objects in smart cities**	ISO/TC 211
ISO/PWI TR 37115	Sustainable cities and communities — Use Cases on Lower-Carbon Emission Cities	ISO/TC 268

Reference	Title	Drafting Body
ISO/AWI 37151	Smart community infrastructures — Principles and requirements for performance metrics	ISO/TC 268/SC 1
ISO/CD 37173	**Smart city infrastructure — Development guidelines for information-based system of smart building**	ISO/TC 268/SC 1
ISO/DIS 37170	**Smart community infrastructures — Data framework for infrastructure governance based on digital technology in smart cities**	ISO/TC 268/SC 1
ISO/PWI 37185	Smart community infrastructures — Requirements for credible supply and use of renewable energy	ISO/TC 268/SC 1
ISO/AWI TR 16214	**Geospatial and BIM review of vocabularies**	ISO/TC 59/SC 13
ISO/DIS 12911	**Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Framework for specification of building information modelling (BIM) implementation**	ISO/TC 59/SC 13
ISO/DIS 7817	**Building information modelling — Level of information need — Concepts and principles**	ISO/TC 59/SC 13
ISO/NP 16757-4	**Product Data for Building Services System Models — Part 4: Dictionaries for product catalogues**	ISO/TC 59/SC 13
ISO/NP 16757-5	**Product Data for Building Services System Models — Part 5: Product catalogue exchange format**	ISO/TC 59/SC 13

4 Options for the contribution to standardisation activities

4.1 General

This clause explains the main options for contributing to the development of standardisation documents.

Based on the option cited below and in the assessment of standards and working groups included in clause 2, a proposal for the dissemination of D^2EPC results is presented in clause 5.

4.2 Options inside existing technical bodies

D^2EPC can contribute to the standardisation system via technical committees (TC), subcommittees (SC) or working groups (WG). The main options are summarised below:

1) **Participation** of D^2EPC partners as experts or guests in current standardization working groups, or establishment of a Project Liaison with the Technical Committee for the participation as consortium in their works: This option is most suitable when new EN standards or TS (technical specifications) or TR (technical reports) start their development and the project timeframe allows for a participation of several years. However, the timespan of the document development can be different to that of the project and the timing for the availability of suitable project results can be not the most adequate.
2) **Proposal** (and if relevant**, leadership**) of modifications to **existing** EN standards or TS (technical specifications) or TR (technical reports): Suitable when some existing standard(s) can be improved with contributions from the project or need to be modified, for instance, to remove an existing technical barrier. As in the previous option, the timing of this action will require its conclusion after the project end. Thus, if necessary, it usually will depend on the commercial interest of the relevant partners.
3) **Proposal** (and if relevant**, leadership**) of the elaboration of **new** standards: This option is most adequate when there is a Technical Committee covering the scope of the project contribution, especially when this Technical Committee does not allow the elaboration of faster documents outside its structure (like the Workshop Agreement explained below). Usually, the full development of these documents takes a time which is not compatible with the normal project duration, so it is not a suitable option. This option (C) is more time consuming than options A and B and was not considered feasible due to time restrictions.
4) Submission of **proposals for future consideration** in standardization works: This option is only recommended when none of the other options can be used, as there is no guarantee that this information will effectively be used in the future to take part of a new standard and could be finally disregarded. However, it if linked with a CWA (see below), it can be an interesting option, as a CEN document is issued (the draft) and existing Technical Bodies can decide to “upgrade” the document to EN standard in the future, using the CWA as a draft.

The standardisation documents that can be developed in these standardisation groups were summarised in subclause 2.6.

4.3 Options outside existing Technical Committees: CWA

CEN/CENELEC Workshop Agreement (CWA) is the most widely used option for research and innovation projects. It is *designed for them*, due the *fast* drafting and decision process. In theory, CWA can also be developed in a TC, but it is not usually the case.

It implies the constitution of a new working group (Workshop) which works indepently from existing Technical Committees, but coordinated with them. The document is approved directly by the members of the Workshop. Relevant TC are informed and any organization can participate.

The resulting document, the Workshop Agreements, are published by the Standards Organizations, can be made freely available to the public (see the CWA download area). The main requirement is that their content cannot conflict with existing standards and if the scope is under an existing TC, coordination with the committee is needed.

The process and criteria to to develop a CEN/CENELEC Workshop Agreement (CWA) is defined in CEN/CENELEC Guide 29 (see reference [13]) and summarised below.

1. To develop a CWA, any organization can contact a CEN Member. With the assistance of the CEN Member, the Proposer of a CWA prepares the Workshop Proposal Form, if possible, with a Project Plan including a tentative calendar and the proposed content for the CWA.
2. The information above is sent to CEN Technical Board and to relevant CEN and/or CENELEC Technical Committees (TCs), if identified in the Workshop Proposal Form.
3. CEN/CENELEC Management Centre (CCMC) announces the proposal for a new CEN Workshop (CEN/WS) on its website at least 30 days before the kick-off meeting, including the draft Project Plan, the Agenda and Venue, the proposed Chairperson and the proposed Secretariat, with information on how to submit comments to the Workshop Draft Project Plan.
4. Kick-off meeting: The CEN Member and CCMC explains how the CEN/WS will operate, and the Workshop Project Plan is revised and approved. The proposed Chairman should also be approved by participants.
5. Draft and meetings: The Secretariat will make available the drafts, the agenda and minutes of the meetings and any other relevant document. To ensure transparency the documents of are uploaded on CEN Documents (an electronic platform in which the documents generated are made available to experts). The WS will meet until consensus on a draft is achieved.
6. Public consultation (optional): If foreseen in the Final Workshop Project Plan, and in any case if the draft CWA covers safety aspects, an open commenting phase (minimum 30 days and 60 days if it covers safety aspects) is launched. CCMC will make the draft CWA available for external comments on the CEN Website and the CEN-CENELEC Website. CCMC will also notify the CEN Members. The comments are considered by the CEN/WS participants.
7. If agreement is reached amongst the WS participants on the final text of the CWA, the Secretariat submits the approved CWA to CCMC, to publish the document.
8. Revision of the validity of the CWA: Once published, a TC can decide to take on the responsibility for the maintenance of the CWA. In this case, the TC Secretariat will conduct the consultation for the review of the CWA after 3 years. After this period, the CWA can be confirmed for another 3 years, revised, withdrawn from the market. CWAs have a maximum lifetime of 6 years.

At any point in its lifecycle, a CWA can be transformed into another standardization deliverable (e.g. a TS or an EN), at the initiative of CEN Members or of a CEN and/or CENELEC Technical Body.

There were also options at international level, like the IWA (equivalent to the CWA) or the Publicly Available Specification (PAS) (see 2.6), but due to the relations of the topics covered by D^2EPC with European Directives and policies, the CEN route was prefered. At European level, we do not have a direct

equivalent to the PAS, but this type of document is developed in some NSB, like BSI or DIN. It should be noted that CWA can be delivered free of charge to end users, with an agreement with CEN/CENELEC.

5 Contribution from D^2EPC to the standardisation system

5.1 Identification of standardisation groups and documents

5.1.1 Approach

Based on the standardisation technical committees, subcommittees and working groups identified in 3.2, together with the list of relevant standards identified in 3.3, an assessment was made to focus the efforts of D^2EPC according to the following criteria:

a) Relevance for the project: relation with D^2EPC results and forecast needs
b) Relation between each particular standard or project under development in the TC, or intended to be revised soon, and D^2EPC activities and results.
c) Scheduled meetings for the relevant TC, SC or WG.
d) Potential impact for D^2EPC if the inclusion of D^2EPC results is achieved.

5.1.2 Main committee: CEN/TC 371

CEN/TC 371 *Energy performance of buildings* is concerned with *standardization related to the energy performance of buildings (EPB)* and it this considered the most relevant standardisation committee for D^2EPC.

This TC ensures the development, alignment and maintenance of a **coherent set of standards for the determination of the EPB**. It does so by:

I. developing standards at overarching EPB level; and by
II. coordinating the activities of related and specialized TCs that are responsible for the development of EPB standards within their scope, thereby ensuring harmonisation.

CEN/TC 371 produced and maintains documents providing guidance and requirements to be met by EPB standards.

1. Developing standards at overarching EPB level

The scope of EPB consists of the interrelated energy effects of indoor environmental quality, outdoor climate, thermal properties, heating and cooling systems, domestic hot water, ventilation, lighting, (de)humidification, building automation and control, energy sources and connected energy grid, and related environmental and economic impacts, and not of these topics themselves. CEN/TC 371 focusses on systems' standards limited to buildings and the direct environment of the building if it effects the energy performance of that building. Product standards and non-EPB parameters are not part of its scope.

2. Coordinating the activities of related and specialized TCs

The following specialised TCs are responsible for the development of the specialized standards that together, using a holistic or systematic approach, make up the set of EPB standards. These TCs have the responsibility for subjects on technical issues that belong exclusively to them even if it is an EPB standard. Requirements for indoor environmental quality (IEQ) parameters are fully within the responsibility of the related and specialized CEN/TCs and are not within the scope of this committee.

CEN/TC 371 is coordinated with the TCs listed below, to prevent overlap:

- CEN/TC 089 *Thermal performance of buildings and building components*;
- CEN/TC 156 *Ventilation for buildings*;
- CEN/TC 169 *Light and lighting*;
- CEN/TC 228 *Heating systems and water based cooling systems in buildings*;
- CEN/TC 247 *Building automation, control and building management*.

Thus, is considered that coordination with these TCs can be achieved via CEN/TC 371. CEN/TC 371 is also considered a useful committee to follow the activities of ISO/TC 163 *Thermal performance and energy use in the built environment* and ISO/TC 205 *Building environment design*.

The main current standardisation documents and projects in CEN/TC 371 are:

- prCEN/TS 16628 Basic Principles for the set of EPB standards.
- prCEN/TS 16629 Detailed Technical Rules for the set of EPB-standards.
- CEN/TS 16628:2014 Basic Principles for the set of EPB standards.
- CEN/TS 16629:2014 Detailed Technical Rules for the set of EPB-standards.
- EN ISO 52000-1:2017 General framework and procedures for EPB assessment.

POTENTIAL ACTIONS

D^2EPC assessed the following interactions with CEN/TC 371:

1) Participating in their plenary meetings.
2) Participating in its WG 1 *EPBD Standards group*, if a meeting is convened.
3) Following their documentation to use it as feedback for D^2EPC research activities.
4) Providing input based on D^2EPC results for new or ongoing standardisation projects, via standards to be published by CEN/TC 371 or via CEN Workshop Agreements (CWA).

5.1.3 Other committees

The following European technical committees were also identified:

- CEN/TC 350 Sustainability of construction works
- CEN/TC 442 Building Information Modelling (BIM)

CEN/TC 350 is responsible for the development of horizontal standardized methods for the assessment of the sustainability aspects of new and existing construction works (buildings and civil engineering works).

The standards describe coherent methodologies for the assessment of sustainability of construction works covering the assessment of environmental, social and economic performance (aspect and impacts) of buildings and civil engineering works, with a full life cycle approach.

For D^2EPC, the following CEN/TC 350 working groups are highlighted:

- **WG 1 Environmental performance of buildings**
- WG 8 Sustainable refurbishment

The most relevant standardisation documents and projects for D^2EPC developed in CEN/TC 350 are:

- EN 15978:2011 Calculation method for the **assessment of environmental performance of buildings** (CEN/TC 350 WG 1)
- prEN 15978-1 Methodology for the **assessment of the environmental performance of buildings** (CEN/TC 350 WG 1)
- prEN 15941 Data quality for environmental assessment of products and construction works (CEN/TC 350 WG 3)
- EN 15643:2021 Framework for assessment of buildings and civil engineering works (CEN/TC 350 WG 3)
- prEN 17680 Evaluation of the potential for **sustainable refurbishment** of buildings (CEN/TC 350 WG 8)

CEN/TC 442 is responsible for the development of standards in the field of structured semantic life-cycle information for the built environment. The committee specify methodologies to define, describe, exchange, monitor, record and securely handle asset data, semantics and processes with links to geospatial and other external data. It if focus on Building Information Modelling (BIM) and recently includes digital twins.

For D^2EPC, the following CEN/TC 442 working groups are highlighted:

- WG 2 Exchange information.
- WG 8 Competence.
- **WG 9 Digital twins in the built environment** (first meeting in June, 2022).

The most relevant standardisation documents and projects for D^2EPC developed in CEN/TC 442 are:

- FprEN ISO 19650-4 Information exchange for the information management in BIM.
- EN 17412-1:2020 Concepts and principles for the level of information need in BIM.
- EN ISO 19650-3:2020 Information management in BIM during the **operational phase** of the assets.

POTENTIAL ACTIONS

D^2EPC assessed the following interactions with CEN/TC 350 and CEN/TC 442:

1) Participating in their plenary meetings.
2) Following the activities of certain working groups (documentation and participation in meetings) to decide if certain results of D^2EPC will be provided as input for future standards. In particular, the following working groups:
    a. CEN/TC 350/ WG 1 Environmental performance of buildings
    b. CEN/TC 442/WG 9 Digital twins in the built environment
3) Following their documentation to use it as feedback for D^2EPC research activities.
4) If relevant, based on the assessment of the activities in item 2) above, active participation in the development of standards.

UNE is following other committees listed in subclause 3.2 to identify other opportunities for the dissemination of D^2EPC results. Together with T6.1, more interactions with the standardisation system will be assessed.

5.2 Actions with technical committees taken until M24

5.2.1 CEN/TC 371

UNE assessed the latest documents issued by CEN/TC 371 to gather information about ongoing activities and shared the information with some D^2EPC partners.

UNE participated in the plenary meeting convened in December, 2021. During the meeting, the revision of the EPBD (because of the European Green Deal and the renovation wave) was covered. The related standards will need a review, and some of the documents were commented in relation with other TCs involved, like CEN/TC 156 or ISO/TC 163.

In February 2022, a proposal to develop a CEN Workshop Agreement for operational EPCS, developed by KTU (represented by Paris Fokaides) and UNE (represented by Aitor Aragón), was sent to CEN/TC 371 Chairman and Secretariat. The draft project plan is included as **annex A**.

In March, 2022, Paris Fokaides (KTU) and Aitor Aragón (UNE) had a meeting with CEN/TC 371 Chairman and Secretariat, to assess possibilities. It was agreed that a document developed within CEN/TC 371 (EN, TS or TR) was the best way forward. It was also agreed to make a presentation of D^2EPC and this proposal in next CEN/TC 371 plenary meeting.

Paris Fokaides (KTU) and Aitor Aragón (UNE) attended CEN/TC 371 plenary meeting convened for March, 24th.

The minutes reflect the following in the item "**Presentation of D2EPC**":

> *Aragón presents the EU project **D2EPC** aiming at setting the grounds for the next generation of dynamic Energy Performance Certificates for buildings, see N 756.*
>
> *Socal agrees that it is a very important step to relate the design of the building to the actual measurements. The current standard on measurement should be extended. We should standardize how to identify this. If you want to compare measured with calculated, then the measurements should be calibrated, and we need far more information, sensors and other hardware. Also, we need to extract the data that we need, the information needs to be presentable.*
>
> *CEN/TC 247 agrees that these plans are useful, to show the direction. Napar states that the building should not be looked at as a "consumer" but as interactive system where technology can serve to balance with the grid. The technology is not the problem, there are already BACS that can offer real time information on health and comfort, but not all building information can be measured yet. The interaction with the utility is another challenge. Country by country there is a request for different information by national regulation. So, to make a standard for measurement it is nice to have, but not all technology is available. If you miss one variable, you will not have a complete picture.*
>
> *This is accepted by Socal, Napar, Hogeling, Engel, Speelman, Moghtader.*

> ***Action:** Aragón to organize an informal meeting about the D2EPC project, be circulated by the TC 371 secretariat. Socal, Napar, Hogeling, Engel, Speelman and Moghtader will join.*

The presentation from D^2EPC to CEN/TC 371 was circulated to all members as N756. The document is included in **annex B** of this deliverable.

During the meeting, the Systematic Review of the EPB standards was commented and the relations with LCA standards developed by CEN/TC 350. prEN 157978-1 will be assessed by the TC, to check synergies with module B6, *operational energy use*.

As a result of the plenary meeting, UNE convened a dedicated meeting in March, 20th, to assess possibilities for operational EPCs with the members appointed by CEN/TC 371.

After the meeting, **a proposal from D^2EPC for a new working group covering *Operational assessment of buildings energy performance for energy classification purposes*** was circulated within the task group for comments.

The appointed experts from CEN/TC 371 provided feedback, which was assessed by KTU and UNE.

After a revision via email, a final meeting was convened on June, 9th, to approve a proposal for a new working. With the modifications approved during the meeting, the final text was sent to CEN/TC 371 Secretariat the same June, 9th. A summary can be found below:

- **Title:** Operational rating of energy performance of buildings.
- **Scope:** Standardization in the field of the energy assessment of buildings during the use stage (operation), focused on energy use for EPB services.
- **Convenor:** Paris A. Fokaides (KTU).
- **Secretariat:** Aitor Aragón (UNE).

Based on this proposal, a ballot to create the new working group was launched in July, 4th. The deadline was August, 8th. The document is included as **annex C** of this deliverable. The result of the ballot is included as **annex D**.

A T7.3 meeting, dedicated to this potential WG, was convened in July. The scope:

- Explain the balloting process in CEN.
- Explain how partners should gather the support of their NSB.
- Explain the process after the ballot, if the WG is approved.

Some partners contacted their national standardisation bodies and/or joined the national mirror committee for CEN/TC 371 (for example, CLEO). For the revision of this deliverable (due for M36), a map of this participation will be included.

In August, 10th, CEN/TC 371 sent the result of the ballot for the creation of the WG: 18 positive votes and cero negating votes (see **annex D** for more information). Thus, the CEN/TC 371 WG 5 “Operational rating of energy performance of buildings” was approved.

Some standardisation bodies appointed experts with the ballot and UNE received other requests. Thus, the WG is expected to have an intense activity.

The Secretariat launched a poll to define a tentative date for the kick-off meeting in October. The Secretariat and the convenor met last August, 25th, to define the schedule and draft a first proposal for standardisation based on D2EPC results, to be presented in the first meeting.

In addition, UNE participated in a joint group between ISO/TC 205, ISO/TC 163 and CEN/TC 371 to prepare *Guidance Document for Systematic Review on EPB standards*. A meeting was convened on 2022-04-13. The intention was to consider in the review the methodologies for operational EPCs. This group is drafting the document, which should be ready for ballot before the end of the year.

The following question was added to the document *Informal guidance document on the Systematic Review (SR) of EPB standards published in 2017* (CEN/TC 371 - N763), in relation with operational EPCs:

Question 3 (operational rating):

Consideration: *The set of EPB standards contains only 1 standard on EPB assessment based on measurements (operational rating). This is EN 15387-3, that deals only with heating and domestic hot water systems.*

Question: *is there a need for a more comprehensive EPB standard on overall EPB assessment based on measurements (operational rating) in the context of the national or regional building regulations?*

And if so: *is it needed for the prime EP indicator (to check compliance with minimum EP requirements) or only as information for the EP certificate (as information tailored to the actual conditions and use of the building.*

D^2EPC will keep following these documents, to promote the inclusion of operational EPCs in the next generation of EPBD-related standards.

The same question was included in the document *Fillable chapter 9 (Questions) from the Informal guidance document on the Systematic Review (SR) of EPB standards published in 2017* (CEN/TC 371 - N769) as ***Question 4***. The document was circulated with an explanation, indicating that TC 371 "are highly interested in obtaining feedback from the National Standards Bodies and national regulators how the quality, consistency, and usability of the EPB standards as a set can be improved". The deadline for the systematic review (SR) is **December 2nd, 2022**.

In addition, a presentation was also made to the Spanish mirror Committee of CEN/TC 371 (UNE-CTN 100) in April, 28th, to present D^2EPC and gather feedback for the proposal of a new working group.

5.2.2 Other TCs

UNE (represented by Aitor Aragón) participated in the several standardisation meetings and gathered information relevant for D^2EPC, to assess the potential participation in ongoing developments and prepare future actions. The main meetings are listed below:

CEN/TC 350:

- 2021-10-22 Plenary meeting.
- 2022-05-24 WG 7 "Framework and coordination".
- 2022-06-24 Plenary meeting.

CEN/TC 442:

- 2021-06-16 WG 7 "Horizontal role".
- 2021-11-10 Plenary meeting.
- 2022-06-07 WG 9 "Digital twins" (as Secretariat).
- 2022-06-14 Plenary meeting.

Special attention was given to the project prEN 15978-1, for environmental assessment of buildings, the new WG for digital twins and the future international standard for data exchange in BIM (FprEN ISO 19650-4).

5.3 Proposed actions with technical committees after M24

5.3.1 CEN/TC 371

The Convenor (Paris A. Fokaides) and the Secretariat (Aitor Aragón) will define a date for the kick off meeting; if possible, in **October**.

Experts from different European countries has already asked for registration in the working group. UNE will contact other sister projects working on operational EPCs or energy efficiency of buildings, to invite their experts to register in this WG.

Based on D2EPC published or ongoing deliverables (mainly from WP 2), a proposal will be presented in the kick off meeting of the newly created CEN/TC 371/WG 5. This proposal will define one or more standardisation documents. During the kick off meeting, it is expected to receive feedback from other participants.

It should be noted that, due to the length of the process within CEN, this document will not be published before the end of D2EPC (M36). As an example, a EN standard usually takes between two and three years to develop.

In addition, D^2EPC will assess a reply to the consultation from CEN/TC 371, ISO/TC 205 & ISO/TC 163, regarding the systematic review of the EPB standards (see 5.2.1), i.e. CEN/TC 371 - N769. Special attention will be given to the following items:

Question 4 (operational rating):

Consideration: *The set of EPB standards contains only 1 standard on EPB assessment based on measurements (operational rating). This is EN 15387-3, that deals only with heating and domestic hot water systems.*

Question: *is there a need for a more comprehensive EPB standard on overall EPB assessment based on measurements (operational rating) for use in the context of the national or regional building regulations?*

And if so: *is it needed for the prime EP indicator (to check compliance with minimum EP requirements) or only as information for the EP certificate (as information tailored to the actual conditions and use of the building).*

Question 9 (digitization, machine readable standards):

Consideration: *in chapter 6 a preliminary outlook is given on the plans for digitization of ISO and CEN standards and how this could become important for the usability and use of the set of EPB standards.*

Question: *Do you consider it important for the set of EPB calculation standards to become (more) machine readable (with a stronger role for the accompanying technical reports to provide explanation)?*

Question 10 (digitization, digitized description of objects):

Consideration: *in chapter 6 a preliminary outlook is given on the plans for digitization of ISO and CEN standards and how this could become important for the usability and use of the set of EPB standards.*

Question: *Do you consider it important for the validation of the set of EPB calculation standards and the conversion into software, that in the future all objects and their (also time varying) properties are described according to data templates and dictionaries that have been developed in the BIM committees ISO/TC 59/SC 13 and CEN/TC 442)?*

Question 11 (digitization, software engine):

Consideration: *in chapter 6 a preliminary outlook is given on the plans for digitization of ISO and CEN standards and how this could become important for the usability and use of the set of EPB standards.*

Question: *Do you consider it important for the wide roll-out and implementation of the set of EPB calculation standards, that a common software engine or 'framework' is made available?*

5.3.2 Other TCs

The main actions will be coordinated in the new WG for operational assessment of energy performance. However, coordination with some identified committees will provide more dissemination of D^2EPC results.

CEN/TC 350

As the drafting of prEN 15978-1 (environmental assessment of buildings) is nearly closed, the inclusion of operational parameters for energy consumption in the use stage (module B6 in CEN/TC 350 standards) in this future standard is considered not feasible. However, the input from D^2EPC can be considered relevant for a future revision or other standardisation documents.

Actions: UNE, together with WP 2, will assess the feasibility of delivering document summarising the findings related to LCA and operational EPCs to CEN/TC 350/WG 1. A presentation can also be made, if relevant. T2.3 is considered the most related task, but the topic or delivery in which this potential document will be based is also part of the assessment.

CEN/TC 442

WG 9 for digital twins is starting with framework (horizontal) standards. A development for particular (vertical) topics. Such as energy assessment, is not under consideration for the following years. However, analysis of use cases and examples is considered relevant for this WG. D^2EPC can provide examples of the actual use of BIM and digital twins for operational energy assessment.

Actions: UNE will propose a presentation wo WG 9, to be made before M36, with a summary of the use of digital twins for operational EPCs.

6 Conclusions

Until M24, task 7.3 successfully performed the main identified actions:

- Assessment of the state of the art to provide input for D^2EPC.
- Identification of working groups and committees, for dissemination of feedback purposes.
- Start contacts with the main committees or working groups related with the activity and results of D^2EPC.
- **Creation of a new standardisation working group covering operational rating of energy performance of buildings, with members of D2EPC acting as Convenor (coordinator) and Secretariat**.

In addition, the foundations of the activities to be launched after M24 have a solid planification. As examples, a kick off meeting for the new WG launched in CEN/TC 371 in the 4th quarter of 2022, and the identification of CEN/TC 250/WG 1 and CEN/TC 442/WG 9 as potential vectors for dissemination of the results.

Thus, we can conclude that standardisation has been a particularly useful tool to gather knowledge for D2EPC and, in particular, for future dissemination of the results during the next year, until M36, and beyond.

7 References

[1]. Regulation (EU) No 1025/2012 on European standardisation, amending Council Directives 89/686/EEC and 93/15/EEC and Directives 94/9/EC, 94/25/EC, 95/16/EC, 97/23/EC, 98/34/EC, 2004/22/EC, 2007/23/EC, 2009/23/EC and 2009/105/EC and repealing Council Decision 87/95/EEC and Decision 1673/2006/EC

[2]. Directive 2010/31/EU on the energy performance of buildings

[3]. Directive 2012/27/EU on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC

[4]. Directive (EU) 2018/844 amending Directive 2010/31/EU and Directive 2012/27/EU

[5]. Proposal for a Directive on the energy performance of buildings (recast) (COM/2021/802 final)

[6]. Regulation (EU) No 305/2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

[7]. M/480 Mandate to CEN, CENELEC and ETSI for the elaboration and adoption of standards for a methodology calculating the integrated energy performance of buildings and promoting the energy efficiency of buildings, in accordance with the terms set in the recast of the Directive on the energy performance of buildings (2010/31/EU)

[8]. CEN/CENELEC Internal Regulations. Part 1: Organization and Structure (2022)

[9]. CEN/CENELEC Internal Regulations. Part 2: Common Rules for Standards Work (2022)

[10]. CEN/CENELEC Internal Regulations. Part 3: Principles and rules for the structure and drafting of CEN and CENELEC documents (2019)

[11]. CEN/CENELEC Internal Regulations. Part 4: Certification (2018)

[12]. CEN/CENELEC Guide 10. Policy on dissemination, sales and copyright of CEN-CENELEC Publications (2017)

[13]. CEN/CENELEC Guide 29. A rapid way to standardization. Edition 2 (October 2020)

[14]. CEN/CENELEC Guide 30. European Guide on Standards and Regulation - Better regulation through the use of voluntary standards - Guidance for policy makers. Edition 1 (June 2015)

[15]. CEN Guide 4: Guide for addressing environmental issues in product standards (2008)

[16]. CEN Guide 14: Common policy guidance for addressing standardisation on qualification of professions and personnel (2010)

[17]. The Vienna Agreement: CEN Cooperation with ISO. CEN website

[18]. Informal guidance document on the Systematic Review (SR) of EPB standards published in 2017. ISO and CEN committee document (May 2022).

ANNEX A: Project plan for a CWA on operational EPCs

14.02.2022

DRAFT

Project Plan for the CEN-CENELEC Workshop on

Operational Rating Methodology

CEN/CLC/WS code to be defined

Workshop

1. Status of the Project Plan

The first draft is based on the research developed within the D2EPC H2020 project, in particular the following reports:

- D2EPC: Next Generation Digital and Dynamic Energy Performance Certificates
- Operational rating for users' technical manual

The goal is to identify the additional information required for actual building ratings, as well as the essential cutting-edge digital technologies that will not only enhance the energy performance certification process, but will also promote and accelerate related processes while also providing more context to users, increasing comprehension, awareness, and thus actual interaction.

In these reports, the following organizations have participated:

1. Frederick Research Center – FRC
2. Spanish Association for Standardization – UNE
3. The Centre for Research & Technology, Hellas – CERTH
4. Kaunas Technological University – KTU
5. Geosystems Hellas SA – GSH
6. Cleopa GmbH – CLEO
7. SEnerCon GmbH – SEC
8. Demo Consultants BV – DMO

9. SGS Tecnos SA – SGS
10. Hypertech SA – HYP
11. Austrian Standards International – ASI
12. Austrian Energy Agency - AEA

A draft will be submitted before the kick-off meeting.

2. Background to the Workshop

Energy Performance Certificates (EPCs) are important instruments for the enhancement of the energy performance of buildings. Despite the positive contribution that current EPCs have had on improving the energy performance of buildings, experience has revealed a number of constraints and limitations. Although cutting-edge monitoring technologies allow the real-time integration of measured data into the calculation process of EPCs, this has still not been regulated either by existing EPC tools or methodologies. By providing creative and cost-effective techniques to measuring the energy performance of building envelopes and systems, there is a need for a holistic framework for strengthening and improving the quality and implementation of EPCs. This report attempts to assess current EPC drawbacks as well as market and stakeholder future developments. D^2EPC project aspires to define the required framework to empower the regular energy classification of buildings based on their operational performance. Based on the continuous improvement of the minimum energy requirements of EU MSs for new buildings, and in view of the nearly Zero Energy Buildings era, which started on the 31st of December 2020, this development will lead to the enhancement of the actual energy performance of EU MSs' building stocks. In this manner, a more active role of next-generation EPCs in policy making will be enabled. The findings of this research are expected to indicate the needs and prerequisites for implementing next-generation EPCs successfully.

D2EPC is a European Union-funded research project aimed at laying the groundwork for the next generation of dynamic Energy Performance Certificates (EPCs) for buildings. The proposed framework is built on the smart-readiness level of buildings, as well as the data gathering infrastructure and management systems that go along with it. Unlike Asset Rating, the Operational Rating is defined based in the 52000-standard series as the energy rating based on measured amounts of delivered and exported energy (CEN (European Committee for Standardization), 2017). It is driven by operational data and uses the “digital twin” approach to enhance Building Information Modelling and determine a new set of human comfort/wellbeing, environmental, energy, and financial indicators, as well as the buildings’ EPC classification. Due to the fact that the operational rating delivers far more reliable data since the classification is based on real amount of energy consumption instead of the use of standard data sets, as well as the use of special equipment and smart meters, which are not available in the majority of existing buildings in the Union, D2EPC suggests a digital platform that will allow for the regular issuance and updating of new EPCs, as well as the integration of a GIS environment and the provision of value added services such as user-centred energy renovation recommendations, performance verification services, as well as benchmarking and forecasting of building performance.

The core process for the EPCs calculation lies in calculating the heating and cooling loads of buildings, with the use of Building Energy Performance Simulation (BEPS) tools. BEPS tools conduct energy performance calculations either based on buildings design values (known as asset rating) or based on the actual energy consumption of the building (known as the operational rating) [1]. While the methodology based on asset rating considers the primary energy needs without taking into account all the losses derived from the production of energy, the operational rating is based on the energy delivered to the buildings and therefore includes users' behaviours [2]. Existing buildings tend to undergo performance degradations, change in use, and unexpected faults or malfunctions over time [3,4] These events often result in significant deterioration of the overall system performance, inefficient operation, and unacceptable human comfort conditions. These facts underline the necessity of the employment of operational rating, as well as the deficiencies of asset rating. Among the 27 EU MSs, 11 have adopted the methodology exclusively based on asset rating. In some MSs, both the actual and calculated energy consumptions are foreseen. D^2EPC scheme will be based on the relevant EU standards and the Energy Performance of Buildings Directive in order to allow for an EU-wide deployment. One of the project's main objectives is to conclude a specific series of recommendations for the required upgrade of existing ISO/CEN standards under Commission mandate M/480 and enable the integration of the dynamic EPC concept.

Although EPCs disclose significant data concerning the energy performance of buildings, in some EU MSs, they have currently considered an additional building document that fails to deliver valuable and interpretable information, awareness, quality, and user-friendliness, resulting in a limited acceptance among users [5] [6] [7].This discrepancy is attributed to the following causes [8]:

1. Regarding the modelling software and design assumptions:
   - Inaccuracies [9] and uncertainties in the implementation of the modelling inputs [10]

[1] Fokaides, P. A., Maxoulis, C. N., Panayiotou, G. P., Neophytou, M. K. A., & Kalogirou, S. A. (2011). Comparison between measured and calculated energy performance for dwellings in a summer dominant environment. Energy and Buildings, 43(11), 3099-3105.

[2] Energy Performance Certificates Across the EU- A mapping of national approaches,BPIE

[3] Y. Heo, R. Choudhary, G.A. Augenbroe, Calibration of building energy models for retrofit analysis under uncertainty, Energy and Buildings 47 (2012) 550–560.

[4] ZJ Ma, S.W. Wang, Online fault detection and robust control of condenser cooling water systems in building central chiller plants, Energy and Buildings 43 (2011) 153–165.

[5] Sesana MM, Salvalai G. A review on Building Renovation Passport: Potentialities and barriers on current initiatives. Energy Build 2018;173:195–205. https://doi.org/10.1016/J.ENBUILD.2018.05.027.

[6] Farahani A, Wallbaum H, Dalenbäck J-O. The importance of life-cycle based planning in maintenance and energy renovation of multifamily buildings. Sustain Cities Soc 2019;44:715–25. https://doi.org/10.1016/J.SCS.2018.10.033.

[7] Amecke H. The impact of energy performance certificates: a survey of German home owners. Energy Policy 2012;46:4–14. https://doi.org/10.1016/j.enpol.2012.01.064.

[8] Burman E, Mumovic D, Kimpian J. Towards measurement and verification of energy performance under the framework of the European directive for energy performance of buildings. Energy 2014;77:153–63.

[9] Menezes AC, Cripps A, Bouchlaghem D, Buswell R. Predicted vs. actual energy performance of non-domestic buildings: using post-occupancy evaluation data to reduce the performance gap. Appl Energy 2012;97:355–64

[10] Ahmad M, Culp CH. Uncalibrated building energy simulation modeling results. HVAC&R Res 2006;12:1141–55.

- Simplifications and inadequacies of the simulation tool [11], which can lead to unrealistic inputs concerning the building design, as well as user behaviour, occupancy patterns, and building management [12]
- The quality of input data used for the simulation depends on the choices made by the model operator (e.g., design weather data, regulation type, shading factor, calculated surfaces, etc.) [13]

2. Construction quality: Deficiencies and provisioning issues during the construction process and commissioning, such as gaps in the insulation and thermal bridges, which usually are not considered in the calculation of the energy consumption [14]

3. Discrepancies also arise during the usage stage of the building. These may include unsuitable building management and energy-unconscious users [15]

Also, the revised Energy Performance of Buildings Directive (EPBD) calls for benchmarking of buildings through Building Automation and Control System. This approach would require extensive sharing of information between buildings [16].

The methodology employed for this task included the collection of primary resources, the synthesis of current status as well as the comparative assessment of the current EPC rating methodology. The preliminary desk research on the topic, the communication with competent bodies, the targeted questionnaire, and finally, the information provided by experts were the stages followed in order for this research to be accomplished. Subsequently, the collective analysis of the energy performance class of buildings data and the definition of innovative aspects that could be integrated into the D^2EPC project were the composing elements of the current status.

In this project, two European standardisation bodies are participating: Austrian Standards and the Spanish Association for Standardisation (UNE).

Based on the results of the project, this proposal is intended to define a set of indicators that will be more representative in terms of actual building operation and will represent the energy behaviour of the building unit in a more thorough manner.

The standardization bodies with relation with this WS are defined in clause 8.

[11] Lomas KJ. The UK applicability study: an evaluation of thermal simulation programs for passive solar house design. Build Environ 1996;31:197–206.

[12] Raslan R, Davies M. Results variability in accredited building energy performance compliance demonstration software in the UK: an inter-model comparative study. J Build Perform Simul 2010;3:63–85.

[13] Jad Khoury, Zeinab Alameddine, Pierre Hollmuller, Understanding and bridging the energy performance gap in building retrofit, Energy Procedia 122 (2017) 217-222

[14] Bordass B, Cohen R, Field J. Energy performance of non-domestic buildings – closing the credibility gap. In: Int conf improv energy effic commer build, Frankfurt, Germany. p. 1–10.

[15] Menezes AC, Cripps A, Bouchlaghem D, Buswell R. Predicted vs. actual energy performance of non-domestic buildings: using post-occupancy evaluation data to reduce the performance gap. Appl Energy 2012;97:355–64.

[16] Dasgupta A, Prodromou A, Mumovic D. Operational versus designed performance of low carbon schools in England: bridging a credibility gap. HVAC&R Res 2012;18:37–50.

3. Workshop proposers and Workshop participants

The CEN-CENELEC Workshop is proposed by the D2EPC project consortium. This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No. 892984.

The following members of the D2EPC project have stated their intention to participate in the WS:

1. Frederick Research Center – FRC
2. Spanish Association for Standardization – UNE
3. The Centre for Research & Technology, Hellas – CERTH
4. Kaunas Technological University – KTU
5. Geosystems Hellas SA – GSH
6. Cleopa GmbH – CLEO
7. SEnerCon GmbH – SEC
8. Demo Consultants BV – DMO
9. SGS Tecnos SA – SGS
10. Hypertech SA – HYP
11. Austrian Standards International – ASI
12. Austrian Energy Agency - AEA

Participation in the CEN-CENELEC Workshop is open to everyone, and the opportunity to participate is advertised prior to the kick-off meeting by its proposers and the CEN-CENELEC official channels.

The Secretariat will be held by the Spanish Association for Standardization (UNE).

4. Workshop scope and objectives

The purpose of this CEN-CENELEC Workshop is to discuss the need for operational rating standards concerning the building sector. One of the main problems in the attempt to improve not only energy efficiency but also to achieve zero and positive energy buildings has been highlighted as building stock energy performance. With the recasting of the Energy Performance of Buildings Directive, Europe has made it quite clear that better schemes are needed for a more realistic assessment of actual energy performance, examining the elements that affect both asset and operational rating in a holistic manner. Various standards and directives have been published with regard to the asset rating. It has been noted that around 11 EU Member States take measures according to the actual energy performance of their buildings. Moreover, no standard or directive has been formed in the direction of operational rating methodology in the European region. The tentative scope of this CEN-CENELEC Workshop is to bring to the table the challenges and demands that arise by using the operational rating methodology and classification for the EPCs of the buildings; how this methodology could be included in the EU Member States since energy consumption is adjusted to the operations of the occupants and varies greatly depending on the type of building.

The tentative title is: **Operational Rating Methodology Standards Workshop**

The agreement will be formalized by one CEN-CENELEC Workshop agreements (CWA), which is intended to be available free of charge.
The proposed CWAs will not define requirements related to safety aspects.

5. Workshop program

The WS is expected to publish one CWA defining the steps to measure and set targets for the related indicators to be provided during the issuance of EPCs in Europe. The CWA will be drafted and published in English.
The estimated duration of this workshop is 15 months (from the kick-off meeting).
Due to the travel restrictions related to COVID-19, all meetings are intended to be virtual. If a physical meeting is convened, the possibility of virtual participation will be granted, if possible.
The program to reach the CEN-CENELEC Workshop Agreements entails the following steps:

5.1. Invitation for the kick-off meeting and call for experts

The CEN-CENELEC Management Centre (CCMC) will post the Project Plan, the invitation and the agenda for the kick-off meeting on the CEN-CENELEC Website for a period of 30 days. The interested parties will be able to register by email. In parallel, the invitation is forwarded to stakeholders or potentially interested experts previously identified.
Participation in the development of the CEN-CENELEC Workshop Agreement is open to anyone, and the opportunity to participate will be advertised in advance by its proposers and by CEN-CENELEC. The Workshop Secretariat will register all interested participants.
The kick-off meeting of the CEN-CENELEC Workshop is intended took place on **to be defined**, by teleconference.

5.2. Circulation of the first draft

The first draft is intended to be circulated to the experts registered in before the kick-off meeting. The comments will be addressed during the meeting.

5.3. Kick-off meeting

During the kick-off meeting, the participants will:

- approve the Workshop Project Plan;
- appoint the Workshop Chair and Secretariat;
- approve the planning (tentative schedule) for the development of the CWA;
- present and discuss the first draft of the CWA, with the collated comments and any other comment from the attendances;
- decide further actions.

5.4. 2nd meeting and other meetings, if necessary

After the kick-off meeting, a new draft will be circulated for comments. A new meeting will be convened to deal with the second round of comments issued by the WS participants. The date for this meeting will be established in the kick-off meeting.

- This step will be repeated until the Chair considers a consensus on the document has been reached among the WS participants.

5.5. Public commenting phase

CEN-CENELEC will publish the draft in its website and circulate it within the standardization environment, to gather comments for at least 6 weeks.

Comments received during the public commenting phase shall be addressed. A meeting can be organized if comments cannot be resolved via email.

5.6. Publication of the CWA

If consensus is achieved, the CWA will be published by CEN-CENELEC.

5.7 Schedule

The following table provides a tentative schedule, considering two meetings before the public commenting period. If more meetings are needed, the schedule will be updated.

Activities	Date
Official WS announcement and call for experts	To be defined
Circulation of the first draft to experts	
Kick-off meeting	
Comments to the first draft, using CEN template	
Second meeting	
If needed, circulation of the new draft, for comments	
If needed, **third meeting for resolution of comments**	
Circulation of the final draft, based on the comments received and the feedback during the kick-off meetings, to be approved by correspondence (if possible)	
Opening of **public commenting phase**	
Closing of public commenting phase	
Comments analysis and implementation (by correspondence or in a meeting)	
Delivery of CWAs to CCMC for **publication**	

6. Workshop structure

The CEN-CENELEC Workshop will operate using the CEN-CENELEC rules for the CEN-CENELEC Workshop Agreement.

6.1 CEN-CENELEC Workshop Chair

The chairperson will be formally appointed at the kick-off meeting by the parties present. The chairperson has five main responsibilities.

1. Organization of communication with CEN-CENELEC Workshop participants via the Secretariat;
2. Monitoring CEN-CENELEC Workshop processes and CWA development progress;
3. Managing and accessing the consensus process;
4. Chairing the CEN-CENELEC Workshop meetings;
5. Representation of the CEN-CENELEC Workshop and its results towards the external interested parties.

6.2 CEN-CENELEC Workshop Secretariat

After the formal announcement of the proposed CEN-CENELEC Workshop, UNE (Spanish Standardization Body, CEN-CENELEC national member) will assume the Secretariat with the next duties:

1. Responsibility for administrative tasks of the CEN-CENELEC Workshop Agreement;
2. Forming the administrative contact point for CWA projects;
3. Follow up of Workshop decisions;
4. Advising on the requirements of the CEN-CENELEC Internal Regulations;
5. Keeping a list of parties to be consulted in view of the maintenance phase and updating it with new expressions of interest.

The Secretariat will ensure transparency, openness and equal treatment of all stakeholders.

7. Resource requirements

7.1 Costs of the CEN-CENELEC Workshop

Organizations participating in the Workshop's activities must cover all their costs, i.e. at their own expense. UNE will provide the Workshop Secretariat subject to formal approval of the Project Plan at the kick-off meeting. Secretariat costs will be covered by D2EPC.

The copyright of the final CEN-CENELEC Workshop Agreement will be at CEN-CENELEC.

7.2 Participation and registration fee

Registration as well as participation at the CEN-CENELEC Workshop described here are free of charge. As previously stated, virtual meetings will be preferred. However, physical meetings will be held in Europe, with each participant responsible for their own travel, accommodation, and subsistence costs.

8. Related activities, liaisons, etc.

UNE and Austrian Energy Standards made an assessment of existing ENs and TSs related to the scope of the WS. No standards or standards under development have been found, neither at European nor International level, with the same scope. To avoid overlap with other standardization activities, contacts have been made with the following Committees.

Information will be sent to several technical bodies (CEN and ISO):

- CEN/TC 371 Energy performance of buildings
- CEN/CLC/JTC 14 Energy management and energy efficiency in the framework of energy transition
- ISO/TC 163 Thermal performance and energy use in the built environment
- CEN/TC 442 Building Information Modelling (BIM)
- ISO/TC 59/SC 13 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM)
- ISO/IEC JTC 1/SC 41 Internet of Things and Digital Twin
- ISO/TC 211 Geographic information/Geomatics

9. Contact points

Chairperson:

Name: Paris A. Fokaides
Company: Frederick University
7, Frederickou Str., 1036, Nicosia, Cyprus
+357 22394394
eng.fp@frederick.ac.cy
https://frederick.ac.cy/

Secretariat:

Name: Aitor Aragón
CEN or CENELEC Member: UNE
Génova st. 6
91 439 7897
aaragonb@une.org
www.une.org

ANNEX B: Presentation from D^2EPC to CEN/TC 371 in March 2022

D2EPC

CEN/TC 371

Operational EPCs

Ass. Prof. Paris A. Fokaides, Frederick Research Center
Aitor Aragón, Spanish Association for Standardisation

24 March 2022

Summary of D^2EPC

D^2EPC - Dynamic Digital Energy Performance Certificates project aims to set the grounds for the next generation of dynamic Energy Performance Certificates (EPCs) for buildings.

D^2EPC project is one of the 12 research projects funded under the LC-SC3-EE-5-2018-2019-2020 - Next-generation of Energy Performance Assessment and Certification call, with the aim to deliver the next generation EPCs for the EU MS (Grant agreement ID: 892984).

CEN workshop, 24 March, page 2

Partners of D^2EPC

PARTNERS

- CENTRE FOR RESEARCH AND TECHNOLOGY HELLAS, INFORMATION TECHNOLOGIES INSTITUTE* - GREECE
- KAUNAS UNIVERSITY OF TECHNOLOGY* - LITHUANIA
- GEOSYSTEMS HELLAS A.E.* - GREECE
- CLEOPA GMBH* - GERMANY
- SENERCON GMBH* - GERMANY
- ASOCIACION ESPANOLA DE NORMALIZACION* - SPAIN
- DEMO CONSULTANTS BV* - NETHERLANDS
- SGS TECNOS SA* - SPAIN
- HYPERTECH ENERGY LABS* - GREECE
- AUSTRIAN STANDARDS INTERNATIONAL* - AUSTRIA
- FREDERICK RESEARCH CENTER* - CYPRUS
- AUSTRIAN ENERGY AGENCY* - AUSTRIA
- ISZEB - INTELLIGENT SOLUTIONS FOR ZERO AND POSITIVE ENERGY BUILDINGS* - GREECE

CEN workshop, 24 March, page 3

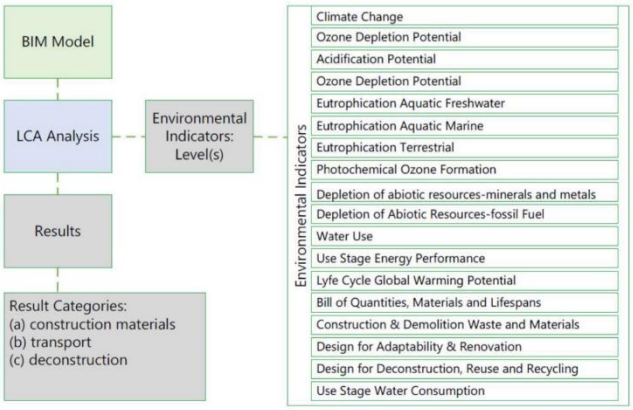
D^2EPC Breakthrough

D2EPC envisions:

- A real time, regularly issued EPC, exploiting Industry 4.0 practices including BIM and digital twins, to inform the users on the actual performance of buildings – operational rating
- An indicators enriched EPC, including information related to the energy performance and other related aspects (embodied environmental resources, human comfort, smartness, life cycle performance)

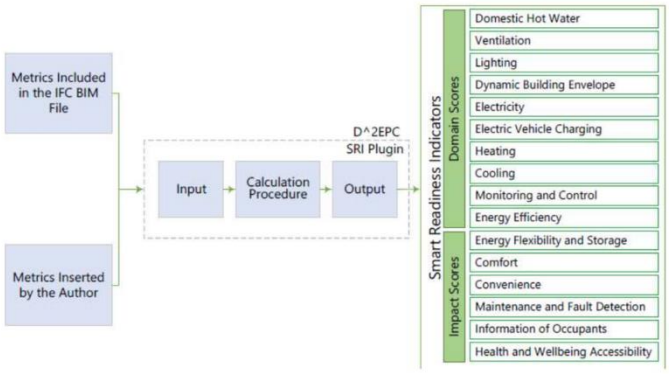
CEN workshop, 24 March, page 4

D2EPC Indicators – LCA indicators



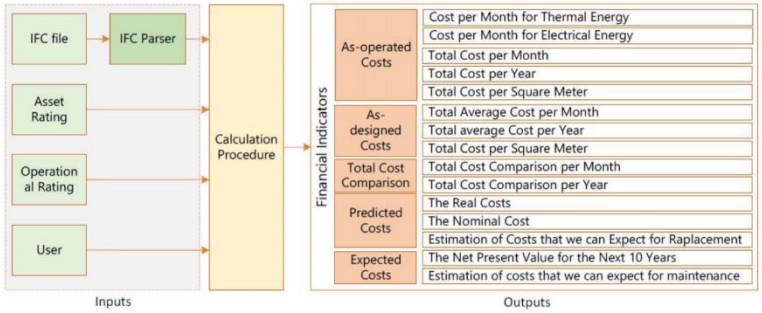
CEN workshop, 24 March, page 5

D2EPC Indicators – Smartness indicators



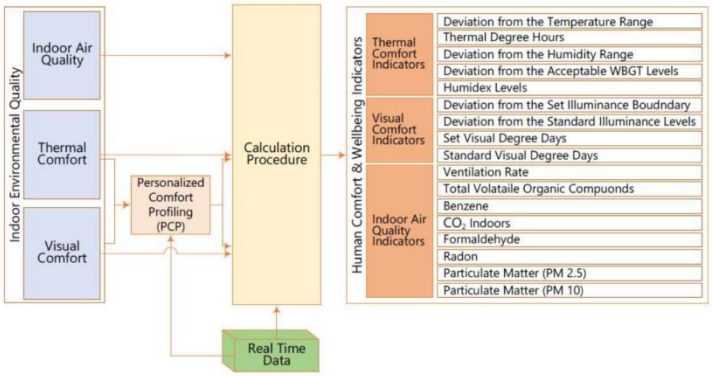
CEN workshop, 24 March, page 6

D2EPC Indicators – LCC indicators



CEN workshop, 24 March, page 7

D2EPC Indicators – Human comfort indicators



CEN workshop, 24 March, page 8

D2EPC Indicators – Operational energy indicators

Energy Indicators	Total Power/Occupancy	kWh/occupants
	Total Power/Occupancy Hours	kWh/h*occupants
	Total Power/Area	kWh/m²
	Total Power/Volume	kWh/m³
	Heating Consumption per Energy Carrier/Occupancy	kWh/occupants
	Heating Consump per Energy Carrier/Occupancy-hours	kWh/h*occupants
	Heating Consumption per Energy Carrier/Area	kWh/m²
	Heating Consumption per Energy Carrier/Volume	kWh/m³
	Cooling Consumption per Energy Carrier/Occupancy	kWh/occupants
	Cooling Consump per Energy Carrier/Occupancy-hours	kWh/h*occupants
	Cooling Consumption per Energy Carrier/Area	kWh/m²
	Cooling Consumption per Energy Carrier/Volume	kWh/m³
	Weather-Normalized Heating & Cooling Energy Cons.	---
	Lightning/Occupancy	kWh/occupants
	Lightning/Occupanc-Hours	kWh/h*occupants
	Lightning/Area	kWh/m2
	Lightning/Volume	kWh/m³
	Electrical Appliances Energy Consumption/Occupancy	kWh/occupants
	Electrical Appliances Energy Cons./Occupancy-hours	kWh/h*occupants
	Electrical Appliances Energy Consumption/Area	kWh/m²
	Electrical Appliances Energy Consumption/Volume	kWh/m³
	DHW Consumption per Energy Carrier/Occupancy	kWh/occupants
	DHW Consump. per Energy Carrier/Occupancy-Hours	kWh/h*occupants
	DHW Consumption per Energy Carrier/Area	kWh/m²
	DHW Consumption per Energy Carrier/Volume	kWh/m³

CEN workshop, 24 March, page 9

D2EPC Indicators – Operational energy indicators

Operational Rating

- As of 2022, only 11 MS have in force an operational rating scheme for the energy assessment of buildings.
- A lack of standards is observed, towards delivering a methodological framework for operational rating

CEN workshop, 24 March, page 10

Advantages for industry and society

- Promotion of Industry 4.0 practices (smart sensors, real time monitoring) into the EPC assessment – digitization – towards smart cities
- Improvement of the accuracy of the energy certification, with operational instead of design values
- Improved monitoring of the actual energy consumption of buildings through certification procedure.
- Integration of EPC into energy saving policies

CEN workshop, 24 March, page 11

Some Open Topics for Operational Rating

1. Type of buildings for which operational rating applies
2. Energy carriers, consumptions flows and indicators (eg heating, cooling, domestic hot water, lighting etc.)
3. Reference values for classification
4. Normalization practices for weather and other parameters affecting the operational energy performance of a building.
5. The frequency of issuance/update of operational EPC.
6. Energy consumption measurement, minimum requirements, equipment

CEN workshop, 24 March, page 12

Standardization for operational EPCs

EPB – building level

- CEN/TC 371 Energy performance of buildings

EPB – specialized topics

- CEN/TC 089 'Thermal performance of buildings and building components'
- CEN/TC 156 'Ventilation for buildings'
- CEN/TC 169 'Light and lighting'
- CEN/TC 228 'Heating systems and water, based cooling systems in buildings'
- CEN/TC 247 'Building automation, control and building management'

Related topics

BIM and digital twins

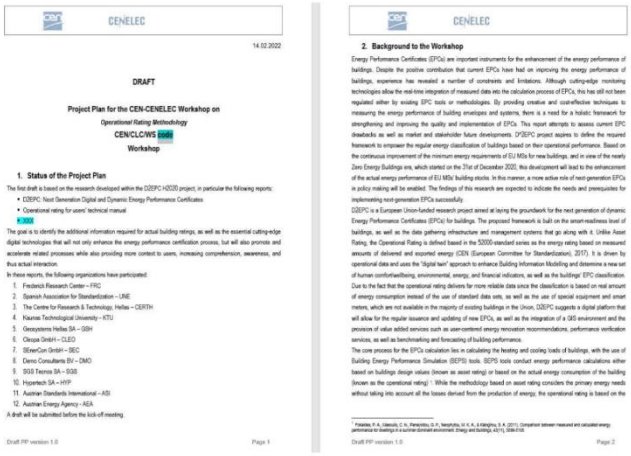
- CEN/TC 442
- ISO/TC 59/SC 13

Sustainability in construction

- CEN/TC 350
- ISO/TC 59/SC 17

CEN workshop, 24 March, page 13

Proposal for CEN Workshop Proposal



CENELEC

14.02.2022

DRAFT

Project Plan for the CEN-CENELEC Workshop on
Operational Rating Methodology
CEN/CLC/WS XXXX
Workshop

1. Status of the Project Plan

The first draft is based on the research developed within the D2EPC H2020 project, in particular the following reports:

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- Operational rating for users' technical manual

XXXX

The goal is to identify the additional information required for actual building ratings, as well as the essential cutting-edge digital technologies that will not only enhance the energy performance certification process, but will also promote and accelerate related processes while also providing more context to users, increasing comprehension, awareness, and thus actual interaction.

In these reports, the following organizations have participated:

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10. Hypertech SA – HYP
11. Austrian Standards International – ASI
12. Austrian Energy Agency - AEA

A draft will be submitted before the kick-off meeting.

Draft PP version 1.0 Page 1

CENELEC

2. Background to the Workshop

Energy Performance Certificates (EPCs) are important instruments for the enhancement of the energy performance of buildings. Despite the positive contribution that current EPCs have had on improving the energy performance of buildings, experience has revealed a number of constraints and limitations. Although cutting-edge monitoring technologies allow the real-time integration of measured data into the calculation process of EPCs, this has still not been regulated either by existing EPC tools or methodologies. By providing creative and cost-effective techniques to measuring the energy performance of building envelopes and systems, there is a need for a holistic framework for strengthening and improving the quality and implementation of EPCs. This report attempts to assess current EPC drawbacks as well as market and stakeholder future developments. D'2EPC project aspires to define the required framework to empower the regular energy classification of buildings based on their operational performance. Based on the continuous improvement of the minimum energy requirements of EU MSs for new buildings, and in view of the nearly Zero Energy Buildings era, which started on the 31st of December 2020, this development will lead to the enhancement of the actual energy performance of EU MSs' building stocks. In this manner, a more active role of next-generation EPCs in policy making will be enabled. The findings of this research are expected to indicate the needs and prerequisites for implementing next-generation EPCs successfully.

D2EPC is a European Union-funded research project aimed at laying the groundwork for the next generation of dynamic Energy Performance Certificates (EPCs) for buildings. The proposed framework is built on the smart-readiness level of buildings, as well as the data gathering infrastructure and management systems that go along with it. Unlike Asset Rating, the Operational Rating is defined based in the 52000-standard series as the energy rating based on measured amounts of delivered and exported energy (CEN (European Committee for Standardization), 2017). It is driven by operational data and uses the "digital twin" approach to enhance Building Information Modelling and determine a new set of human comfort/wellbeing, environmental, energy, and financial indicators, as well as the buildings' EPC classification. Due to the fact that the operational rating delivers far more reliable data since the classification is based on real amount of energy consumption instead of the use of standard data sets, as well as the use of special equipment and smart meters, which are not available in the majority of existing buildings in the Union, D2EPC suggests a digital platform that will allow for the regular issuance and updating of new EPCs, as well as the integration of a GIS environment and the provision of value added services such as user-centered energy renovation recommendations, performance verification services, as well as benchmarking and forecasting of building performance.

The core process for the EPCs calculation lies in calculating the heating and cooling loads of buildings, with the use of Building Energy Performance Simulation (BEPS) tools. BEPS tools conduct energy performance calculations either based on buildings design values (known as asset rating) or based on the actual energy consumption of the building (known as the operational rating) [1]. While the methodology based on asset rating considers the primary energy needs without taking into account all the losses derived from the production of energy, the operational rating is based on the

[1] Fokaides, P. A., Ioannou, C. H., Panteliou, G. P., Neophytou, M. K. A., & Kalogirou, S. A. (2011). Comparison between measured and calculated energy performance for dwellings in a summer dominant environment. Energy and Buildings, 43(11), 3306-3310.

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Proposal relevant contacts

Technical topics
Paris A. Fokaides
Assistant Professor at Frederick University, Cyprus
Chief Researcher at Kaunas University of Technology, Lithuania

Standardisation
Aitor Aragón
Responsible for BIM and sustainability in construction at UNE
(Spanish Associacion for Standardisation)

ANNEX C: Proposal for a new WG in CEN/TC 371 covering operational rating of energy performance of buildings

CEN/TC 371 **N 766**

CEN/TC 371 "Energy Performance of Buildings"
Secretariat: **NEN**
Secretary: **van der Horn-de Vries Annet Mrs.**

Creation of new Working Group on Operational rating of energy performance of buildings

Document type	Related content	Document date	Expected action
Recommendation **2022**		2022-07-04	**VOTE** by 2022-08-08

Proposal for a new Working Group on Operational rating of energy performance of buildings

In the last CEN/TC 371 meeting Aragón presented the EU project D2EPC aiming at setting the grounds for the next generation of dynamic Energy Performance Certificates for buildings, see N 756. The TC was positive about the project and related projects on operational rating. It was seen as a very important step to relate the design of the building to the actual measurements. The CEN/TC 248 (BACS) representative warned that for most parameters the technology is available, but not for all. It was decided that Aragón would organize an informal meeting about the D2EPC project. This informal task group met twice, and came up with the proposal to set up a new Working Group on Operational rating of energy performance of buildings.
The first meeting might be at the end of September of October 2022. The idea is to set a "prioritization of activities" in this first meeting.

Please submit your vote by **2022-08-08**

DRAFT Decision CEN/TC 371 02/2022 taken on 2022-xx-xx

Subject: CEN/TC *371* – Creation of new Working Group on Operational rating of energy performance of buildings

The CEN/TC *371 Energy performance of buildings*,
- considering the CEN/CENELEC Internal Regulations - Part 2, clause 3.4.2 and BT Decision C24/2012, which lay down the rules for the appointment and responsibilities of a Working Group
Convenor;
- agrees on the creation of **WG 5 "Operational rating of energy performance of buildings";**
- agrees on the following scope of WG 5:
Standardization in the field of the energy assessment of buildings during the use stage (operation), focused on energy use for EPB services.
- agrees that the Secretariat of the WG is to be held by Spain (UNE);
- agrees to appoint Prof. Paris A. Fokaides as Convenor.

The Working Group will be open to all members and liaisons.

The decision was taken by unanimity/ x positive votes/ x negative votes/ x abstain

PROPOSAL for a NEW WORKING GROUP	
Date of circulation	CEN/TC 371 / N
Secretariat: NEN Secretary: Mrs A. van der Horn	

Title of the proposed new subject

Operational rating of energy performance of buildings

Scope statement of the proposed new subject

Standardization in the field of the energy assessment of buildings during the use stage (operation), focused on energy use for EPB services.

Purpose and justification for the proposal.

On 15 December 2021, the European Commission presented a proposal for revision (recast) of the Energy Performance of Buildings Directive (EPBD), as part of the 'Fit for 55' package, to achieve the EU objective of a minimum 55 % reduction in greenhouse gas (GHG) emissions by 2030 compared to 1990. The recast EPBD aims to accelerate building renovation rates, reduce GHG emissions and energy consumption, and promote the uptake of renewable energy in buildings.

The integration of real-time of measured data can provide cost-effective techniques to measuring the energy performance of building envelopes and systems. The working group should provide methodologies to measure (assess) the energy use of buildings as targeted in the proposed EPBD revision.

In the document "Revision of the Energy Performance of Buildings Directive: Fit for 55 package", the European Parliament stated:

> *New residential buildings and residential buildings undergoing major renovations would need to be equipped with certain **monitoring** and **control functionalities** to improve and optimise their management and **operation**.*

To promote this integration, there is a need for a holistic framework for strengthening and improving the quality and implementation of the data gathering, its processing and assessment, and the relation with current EPCs and calculation methods. Currently, there are several active Union-funded research projects developing technology and methodologies for this integration, like D2EPC. Cooperation between these research projects and TC 371 can boost the development of processes, technologies and calculation methods for energy performance assessment based on real-time data.

This WG will create the platform to develop these "operational EPCs", based on the assessment of the energy performance of buildings during the "use stage". A presentation was made in last CEN/TC 371 meeting is available in CEN Documents as **N756**. The TC agreed to create a task group to deal with the proposal and to assess the "way forward". Based on the assessment made, this proposal for a new working group is presented to CEN/TC 371.

The first meeting is intended to define the first WI (or Wis) to be developed, based on the feedback from experts and delegates.

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Related groups in CEN, CENELEC, ISO and IEC

Energy efficiency:

- CEN/CLC/JTC 14 Energy management and energy efficiency in the framework of energy transition
- CEN/TC 089 Thermal performance of buildings and building components
- CEN/TC 156 Ventilation for buildings
- CEN/TC 169 Light and lighting systems
- CEN/TC 228 Heating systems for buildings
- CEN/TC 247 Building automation, control and building
- ISO/TC 163 Thermal performance and energy use in the built environment
- ISO/TC 205 Building environment design

Information Technologies:

- ISO/IEC JTC 1/SC 41 Internet of Things and Digital Twin
- CEN/TC 442 Building Information Modelling (BIM)
- ISO/TC 59/SC 13 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM)
- ISO/TC 184/SC 5 Interoperability, integration, and architectures for enterprise systems and automation applications
- ISO/TC 211 Geographic information/Geomatics

Proposed Secretariat	Proposed Convenor
Aitor Aragón Spanish Association for Standardisation, UNE ✉ aaragonb@une.org	Paris A. Fokaides

Annex(es) are included with this proposal (give details)

A CV of Paris A. Fokaides (proposed Convenor)

Annex A

Short CV of Paris A. Fokaides

Prof. Paris Fokaides

Frederick University. Nicosia, Cyprus

Dr.-Ing. Paris A. Fokaides is an Associate Professor at the School of Engineering of Frederick University, Cyprus, and a research mentor at Kaunas University of Technology, Lithuania. In Frederick University, Paris is lecturing the courses of Fluid Mechanics and Heat Transfer at the Department of Mechanical Engineering, as well as the courses of Sustainable Energy Resources, and Energy Design of Buildings in the Masters Programme of Energy Engineering, which he also coordinates. He is also the supervisor of 5 PhD students and 2 PhD graduates. Paris holds a PhD from the University of Karlsruhe, in Germany in the field of Process Engineering and a Diploma in Mechanical Engineering of Aristotle University in Thessaloniki, Greece.

Paris research is mainly related to sustainable energy technologies for the built environment, as well as novel energy related applications in constructions. Paris is involved in research, having actively participated in over 25 research projects related to the field of sustainable built environment over the past 10 years. His research projects are related to the promotion of Industry 4.0 practices for the assessment of the energy performance of the built environment, smart buildings, as well as the field of digitization and analysis of energy related processes. Currently he is actively involved in five (5) ongoing Horizon projects related with operational energy assessment of buildings (D2EPC GA 892984, PRECEPT GA 958284, eUMaP GA 101007641, STABLE GA 823966, SmartLivingEPC), related with the digitization of the energy assessment of the built environment. Paris has also served as consultant of the Republic of Cyprus in numerous projects related to the transposition of the European Acquis into the national legislation, in the policy fields of energy, environment and transportation.

Paris leads the Sustainable Energy Research Group at Frederick University, an ISO 9000 certified self-funded research team consisting of 11 FTE researchers, involved in European and national funded R&I activities. He is also actively involved in the publications section, being the Editor in Chief of the International Journal of Sustainable Energy (Taylor and Francis) as well as an editorial board member in four Q2 and Q3 Springer, Taylor and Francis and MDPI journals in the field of sustainable energy. As of early 22, Paris has authored and co-authored over 125 Scopus indexed studies, and has an h-index of 30.

ANNEX D: Result of the ballot for a new WG in CEN/TC 371 covering operational rating of energy performance of buildings

CEN/TC 371 **N 771**

CEN/TC 371 "Energy Performance of Buildings"
Secretariat: **NEN**
Secretary: **van der Horn-de Vries Annet Mrs.**

Result of voting Creation of new Working Group on Operational rating of energy performance of buildings

Document type	Related content	Document date	Expected action
Ballot / Result of voting	Ballot: CEN/TC 371 Creation of NWI Operational rating of EPB (restricted access)	2022-08-10	

Result of voting

Ballot Information	
Ballot reference	CEN/TC 371 Creation of NWI Operational rating of EPB
Ballot type	CENCIB
English title	**Creation of new Working Group on Operational rating of energy performance of buildings**
Opening date	2022-07-04
Closing date	2022-08-08
Note	

Member responses	
Votes cast (26)	Austria (ASI) Belgium (NBN) Bulgaria (BDS) Cyprus (CYS) Czech Republic (UNMZ) Denmark (DS) Estonia (EVS) Finland (SFS) France (AFNOR) Germany (DIN) Greece (NQIS ELOT) Hungary (MSZT) Ireland (NSAI) Italy (UNI) Lithuania (LST) Malta (MCCAA) Netherlands (NEN) Norway (SN) Portugal (IPQ) Romania (ASRO) Slovenia (SIST) Spain (UNE) Sweden (SIS) Switzerland (SNV) Türkiye (TSE) United Kingdom (BSI)
Comments submitted (0)	
Votes not cast (8)	Croatia (HZN) Iceland (IST) Latvia (LVS) Luxembourg (ILNAS) North Macedonia (ISRSM) Poland (PKN) Serbia (ISS) Slovakia (UNMS SR)

Questions	
Q.1	We agree with draft resolution 02/2022
Q.2	We would like to appoint the following experts to the new WG
Q.3	We have additional comments or information

Votes by members	
Austria (ASI) Cast by Reiter, Anita Ms	
Q.1	yes
Q.2	no
Q.3	no
Belgium (NBN) Cast by Corten, Tamara Mrs	
Q.1	yes
Q.2	yes
Q.3	yes
Bulgaria (BDS) Cast by Aleksandrova, Velichka Mrs	
Q.1	yes
Q.2	no
Q.3	no

Votes by members	
Cyprus (CYS) Cast by Nicolaou, Marilena Ms	
Q.1	yes
Q.2	yes
Q.3	no
Czech Republic (UNMZ) Cast by Kuklova, Lydie Mrs	
Q.1	abstain
Q.2	no
Q.3	no
Denmark (DS) Cast by Stawicki, Henryk Mr.	
Q.1	yes
Q.2	yes
Q.3	no
Estonia (EVS) Cast by Kurnitski, Jarek Mr	
Q.1	yes
Q.2	yes
Q.3	no
Finland (SFS) Cast by Tommila, Tuire Ms	
Q.1	yes
Q.2	no
Q.3	no
France (AFNOR) Cast by Gnaly, Salimata Stéphanie Mme	
Q.1	yes
Q.2	yes
Q.3	yes

Votes by members	
Germany (DIN) Cast by Wienen, Benjamin Mr Dipl.-Ing.	
Q.1	yes
Q.2	no
Q.3	no
Greece (NQIS ELOT) Cast by Velli, Kirki Ms	
Q.1	yes
Q.2	no
Q.3	no
Hungary (MSZT) Cast by Bernáth, Csaba Mr	
Q.1	abstain
Q.2	no
Q.3	abstain
Ireland (NSAI) Cast by Nevin, Sharon Ms	
Q.1	abstain
Q.2	no
Q.3	no
Italy (UNI) Cast by Luppino, Lucilla Ms	
Q.1	yes
Q.2	yes
Q.3	no
Lithuania (LST) Cast by Simutis, Vytautas Mr	
Q.1	abstain
Q.2	no
Q.3	no

Votes by members	
Malta (MCCAA) Cast by Farrugia, Francis P. Mr	
Q.1	yes
Q.2	no
Q.3	no
Netherlands (NEN) Cast by van den Handel, I.B. Mevr.	
Q.1	yes
Q.2	yes
Q.3	no
Norway (SN) Cast by Gran, Jens O Mr	
Q.1	yes
Q.2	no
Q.3	no
Portugal (IPQ) Cast by Isidoro, Alexandra Mrs	
Q.1	abstain
Q.2	no
Q.3	abstain
Romania (ASRO) Cast by STANISTEANU, Cristina Mrs	
Q.1	yes
Q.2	no
Q.3	abstain
Slovenia (SIST) Cast by Korosec, Mateja Mrs	
Q.1	abstain
Q.2	no
Q.3	no

Votes by members	
Spain (UNE) Cast by Jorquera, José Mr	
Q.1	yes
Q.2	no
Q.3	no
Sweden (SIS) Cast by Lindor Norén, Anette Ms	
Q.1	yes
Q.2	yes
Q.3	no
Switzerland (SNV) Cast by Martino, Giuseppe Mr	
Q.1	abstain
Q.2	no
Q.3	no
Türkiye (TSE) Cast by Arslan, Ferhat Mr	
Q.1	abstain
Q.2	no
Q.3	abstain
United Kingdom (BSI) Cast by Conlon, Stephanie Ms	
Q.1	yes
Q.2	no
Q.3	no

Answers to Q.1: "We agree with draft resolution 02/2022"		
18	**yes**	Austria (ASI), Belgium (NBN), Bulgaria (BDS), Cyprus (CYS), Denmark (DS), Estonia (EVS), Finland (SFS), France (AFNOR), Germany (DIN), Greece (NQIS ELOT), Italy (UNI), Malta (MCCAA), Netherlands (NEN), Norway (SN), Romania (ASRO), Spain (UNE), Sweden (SIS), United Kingdom (BSI)
0 x	**no**	
8 x	**abstain**	Czech Republic (UNMZ), Hungary (MSZT), Ireland (NSAI), Lithuania (LST), Portugal (IPQ), Slovenia (SIST), Switzerland (SNV), Türkiye (TSE)

Answers to Q.2: "We would like to appoint the following experts to the new WG"		
8 x	**yes**	Belgium (NBN), Cyprus (CYS), Denmark (DS), Estonia (EVS), France (AFNOR), Italy (UNI), Netherlands (NEN), Sweden (SIS)
18	**no**	Austria (ASI), Bulgaria (BDS), Czech Republic (UNMZ), Finland (SFS), Germany (DIN), Greece (NQIS ELOT), Hungary (MSZT), Ireland (NSAI), Lithuania (LST), Malta (MCCAA), Norway (SN), Portugal (IPQ), Romania (ASRO), Slovenia (SIST), Spain (UNE), Switzerland (SNV), Türkiye (TSE), United Kingdom (BSI)

Answers to Q.3: "We have additional comments or information"		
2 x	**yes**	Belgium (NBN), France (AFNOR)
20	**no**	Austria (ASI), Bulgaria (BDS), Cyprus (CYS), Czech Republic (UNMZ), Denmark (DS), Estonia (EVS), Finland (SFS), Germany (DIN), Greece (NQIS ELOT), Ireland (NSAI), Italy (UNI), Lithuania (LST), Malta (MCCAA), Netherlands (NEN), Norway (SN), Slovenia (SIST), Spain (UNE), Sweden (SIS), Switzerland (SNV), United Kingdom (BSI)
4 x	**abstain**	Hungary (MSZT), Portugal (IPQ), Romania (ASRO), Türkiye (TSE)

Comments from Voters	
Belgium (NBN) Cast by Corten, Tamara Mrs	
Comment to Q.2	Mr. Piet Vitse (Piet.Vitse@owenscorning.com)
Comment to Q.3	Since EPC's are the future drivers to recognise the EPBD-implementation, besides the energy drivers, the connection with sustaionability (eg TC350 B2B & B2C) should be included as far as possible to become recognised by the local member states/countries/regions).
Cyprus (CYS) Cast by Nicolaou, Marilena Ms	

Comments from Voters	
Cyprus (CYS) Cast by Nicolaou, Marilena Ms	
Comment to Q.2	Dr Paris Fokaides (eng.fp@frederick.ac.cy)
Denmark (DS) Cast by Stawicki, Henryk Mr.	
Comment to Q.2	Ms. Fanny Guay
Estonia (EVS) Cast by Kurnitski, Jarek Mr	
Comment to Q.2	Jarek Kurnitski, Tallinn University of Technology
France (AFNOR) Cast by Gnaly, Salimata Stéphanie Mme	
Comment to Q.2	CATHERINE RALINCOURT
Comment File	CEN_TC 371 Creation of NWI Operational rating of EPB_AFNOR.doc
Italy (UNI) Cast by Luppino, Lucilla Ms	
Comment to Q.2	Our expert is: Mr. Laurent Socal
Netherlands (NEN) Cast by van den Handel, I.B. Mevr.	
Comment to Q.2	Bert Elkhuizen, BElkhuizen@innax.nl and Dick van Dijk (EPB-research@dickvandijk.nl)
Sweden (SIS) Cast by Lindor Norén, Anette Ms	
Comment to Q.2	Mr. Kjell-Åke Henriksson, kjell-ake.henriksson@jm.se

Template for comments and secretariat observations

Date:2022-08-09	Document:	Project:

MB/ NC[1]	Line number	Clause/ Subclause	Paragraph/ Figure/Table	Type of comment[2]	Comments	Proposed change	Observations of the secretariat
FR-001					Limitation of the work of CEN/TC 371/WG 5		
FR-002					The "operational rating" concerns a single standard. Does this justify the creation of a WG?		

1 **MB** = Member body / **NC** = National Committee (enter the ISO 3166 two-letter country code, e.g. CN for China; comments from the ISO/CS editing unit are identified by **)
2 **Type of comment:** **ge** = general **te** = technical **ed** = editorial