STRATEGIC STANDARDIZATION PLAN v2

The D^2EPC project has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement No 892984

Project Acronym:	D^2EPC
Project Full Title:	Next-generation Dynamic Digital EPCs for Enhanced Quality and User Awareness
Grant Agreement:	892984
Project Duration:	36 months (01/09/2020 – 31/08/2023)

DELIVERABLE D6.5

STRATEGIC STANDARDIZATION PLAN V2

Work Package:	Policy-related Implication for the enforcement of the next generation EPCs scheme
Task:	T6.1 Updating of current standards towards dynamic EPCs
Document Status:	FINAL
File Name:	D^2EPC_D6.5_Strategic Standardization Plan V2_ASI
Due Date:	31.08.2023
Submission Date:	28.08.2023
Lead Beneficiary:	Austrian Standards International (ASI)

Dissemination Level	
Public	☒
Confidential, only for members of the Consortium (including the Commission Services)	☐

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Version History

v	Author	Date	Brief Description
1.1	Anita Reiter	31.05.2023	Initial draft based on the previous version
1.3	Anita Reiter	09.06.2023	Document sent to partners for feedback collection
1.6	Anita Reiter	17.07.2023	Updates on standardization plan incorporated
1.7	Anita Reiter, Karl Grun	28.07.2023	Document ready for peer review
1.8	Anita Reiter, Karl Grun	18.08.2023	Document updated based on the peer review feedback
2.0	Anita Reiter	25.08.2023	Final version ready for submission

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Executive Summary

The Standardization Plan provides an overview of standardization activities that have been elicited based on the needs of the D^2EPC project consortium in the area of energy performance certificates (EPC) and could be implemented after the end of the project. During the project, a first plan was prepared by M18. This prepared plan is now adapted and supplemented at the end of the project.

This document provides a summary of activities and how research conducted under the D^2EPC project can support ongoing standardization efforts.

This plan was prepared by Austrian Standards International (ASI) in collaboration with IsZEB (Intelligent Solutions for Zero and Positive Energy Buildings, KTU (Kaunas University of Technology from Lithuania) and UNE (Spanish Association for Standardization from Spain).

It provides an overview of the relevant standards identified during the survey of the standardization landscape. The results of a gap analysis and a summary of priority topics are addressed in future standardization activities.

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List of Acronyms and Abbreviations

Table 1: List of Acronyms and Abbreviations

Term	Description
BAC	Building Automation and Control
BIM	Building Information Modelling
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
CINEA	European Climate, Infrastructure and Environment Executive Agency
DHW	Domestic Hot Water
EC	European Commission
EPB	Energy Performance of Buildings
EPC	Energy Performance Certificate
EU	European Union
hEN	harmonized European standards for products
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
ISO	International Organization for Standardization
JTC	Joint Technical Committee
kW	Kilowatts
LENI	Lighting energy numeric indicator
NGO	Non-Governmental Organization
NSB	National Standardization Body
Pa	Pascal
PEFs	Primary energy factors
PO	Project Officer
prEN	Project EN
PV	Photovoltaics
SRI	Smart Readiness Indicator
TBT	Technical Barriers to Trade

TC	**Technical Committee**
TR	**Technical Report**
TS	**Technical Specification**
WTO	**World Trade Organization**

1 Introduction

1.1 Deliverable Context

The present report is the second of two reports that were developed within the task 6.5 of Work Package 6:

- First report: D6.1 Strategic Standardization Plan (M18, February 2021)
- Second report: D6.5 Strategic Standardization Plan v2 (M36, August 2023)

This second report represents the chronological continuation.

WP6 aims to deliver the practical knowledge which will allow the integration of the produced knowledge of the D^2EPC project into the national and European energy legislative framework. Particularly three topics to be analysed and elaborated in this work package include the delivery of the required framework for upgrading the existing set of standards, used in the calculation process of buildings energy performance.

Practical ways of linking the findings of the D^2EPC project into the national and regional certification schemes will also be emphasized. The work package will also focus on the relation of the D^2EPC scheme with building passports and renovation roadmaps. WP6 will also introduce the "polluter pays" concept into the new EPC schemes, for those users who do not meet their expectations.

To maximize synergies and enhance the impact of the project through standardization, the activities in T6.1 are aligned with the activities undertaken in T7.3, Contribution to standardisation activities, led by UNE. This is also done because one aim of T6.1 is to provide with the gap analysis the basis for taking an informed decision on proposing new work for a European Standardization Deliverable. The findings from the survey suggest that there is a substantial gap in terms of operational rating which was forwarded to T7.3. Under T7.3 this proposal for new work was submitted to CEN/TC 371 "Energy Performance of Buildings", resulting in the creation of CEN/TC 371/WG 5 "Operational rating of energy performance of buildings" and being responsible for the new work item WI=00371012, Energy Performance of Buildings — Operational rating — Requirements for assessing operational rating, approved by CEN/TC 371. More details can be found *in D7.12 Report on the contribution to standardization v2*.

1.1.1 Objectives of the Standardization Plan

Updating of current standards towards dynamic EPCs (M13-M36) include the following activities:

- Screening the work programs of the
    - European Committee for Standardization (CEN),
    - the European Committee for Electrotechnical Standardization (CENELEC),
    - International Organization for Standardization (ISO),
    - the European Telecommunications Standards Institute (ETSI).

A number of Committees and Technical Bodies of ETSI, CEN/CENELEC and ISO jointly work in the relevant areas, for example Energy management and energy savings, calculation methods, thermal performance and energy use in the built environment, building environment design, organization and digitization of information about buildings and civil engineering works, including BIM.

- Identifying other relevant sources of standardization documents (regulations, guidelines etc.)
- Existing CEN/CENELEC, ETSI and ISO/IEEE standards and other documents on buildings energy performance and energy management have been be analysed for relevance.
- The consortium partners will gain access to the relevant standardization committees and contribute to the ongoing work on developing new and revision of the existing standards. If deemed relevant by the consortium members, a New Work Item Proposal will be developed until the end of the project.

2Standardization

2.1 An overview

In ISO/IEC Guide 2:20040F1, standardization is defined as an activity of establishing, regarding actual or potential problems, provisions for common and repeated use, aimed at the achievement of the optimum degree of order in a given context. Important benefits of standardization are improvement of the suitability of products, processes and services for their intended purposes, prevention of barriers to trade and facilitation of technological cooperation. Standardization supports social and economic development by ensuring the safety, quality and competitiveness of products, services, and processes on various levels (e.g., performance, composition, interoperability, applicability and many more). This, in turn, supports the economic activity of businesses of all sizes and allows them to access markets all over the world.

Standardization is governed by the principles of consensus, openness, inclusiveness transparency, national commitment and coherence as outlined in the Agreement on Technical Barriers to Trade of the World Trade Organization (WTO TBT Agreement) and Regulation (EU) No 1025/2012 of the European Parliament and of the Council of 25 October 2012 on European standardization.

The output of standardization is standards. According to ISO/IEC Guide 2:2004, 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 each context. Standards are voluntary in their application and should be based on the consolidated results of science, technology, and experience, and aimed at the promotion of optimum community benefits. Standards are initiated and drafted by stakeholders such as industry, including SMEs (Small and Medium Enterprise), public authorities, research organizations, societal and environmental stakeholders, consumer organizations, trade unions and conformity assessment bodies.

There are numerous organizations developing standards, ranging from companies, consortia, and industry in the private sector, to national, regional and international organizations. The latter three constitute the bulk of the international standardization system, required by the WTO TBT Agreement to follow its principles and requirements for standards development. There are also NGOs with specific socio-economic or environmental goals that develop and publish standards.

National Standardization Bodies (NSB) are standardization organizations located in each country. They bridge the local communities with groups of relevant stakeholders outside of their country and represent the pillars of European and International standardization. Being member of European Standardization Organizations NSBs are

[1] ISO/IEC Guide 2:2004, Standardization and related activities — General vocabulary, is adopted in Europe as European Standard EN 45020:2006.

obliged to implement European Standards as national standards and withdraw any conflicting national standards.

The European standardization activities are conducted within the European Committee for Standardization (CEN), the European Committee for Electrotechnical Standardization (CENELEC), and the European Telecommunications Standards Institute (ETSI).

CEN brings together the national standardization bodies of 34 European countries and provides a platform for standardization in various areas, including products, materials, services, and processes. CENELEC ensures standardization in the electro-technical engineering field, and ETSI produces standards for information and communications technology.

The network of European standardization includes more than 200,000 experts from different countries and from different stakeholders, i.e., business, industry and commerce, service providers, consumers, environmental and societal organizations, public authorities, and regulators, as well as other public and private institutions. The European Standardization Organizations aim to support the needs of the market and different stakeholders, promoting the European Standardization System and leading the implementation of best practices in standardization around the world. They collaborate with key stakeholders' organizations at national, European, and international level, support international Standardization and cooperate closely with international Standardization Organizations such as ISO and IEC. Participation in European Standardization follows the national delegation principle, i. e. national members (NSB, NC) host national committees populated with national stakeholders and these national committees contribute to the elaboration of European Standards.

International standardization activities are conducted in three major international standardization organizations: International Organization for Standardization (ISO), International Electrotechnical Commission (IEC) and International Telecommunication Union (ITU).

ISO is an independent international organization that includes 165 national standards bodies as its members. International standards, produced by ISO, cover a wide variety of areas, and represent a consensus of experts from many countries. All CEN members are also members of ISO.

Members of IEC are 89 National Committees, represented by delegates from industry, research and government bodies of each country. IEC produces standards covering all aspects of production and use of electrical and electronic devices and systems. All CENELEC members are also members of IEC.

CEN and CENELEC have dedicated agreements with ISO and IEC, promoting the benefits of the international standards to international trade and markets harmonization. The high level of convergence between the European and international standards is facilitated by the ongoing technical cooperation between CEN and ISO (Vienna Agreement) and between CENELEC and IEC (Frankfurt Agreement). The main objectives of these agreements are to provide a

- framework for the optimal use of resources and expertise available for standardization work.

- mechanism for information exchange between international and European Standardization Organizations (ESOs) to increase the transparency of ongoing work at international and European levels.

Standards developed under these Agreements have the status of an International Standard as well as of a European Standard (EN ISO, EN IEC). Example: EN ISO 12006-3, Building construction - Organization of information about construction works - Part 3: Framework for object-oriented information.

ITU is an inter-governmental organization belonging to the United Nations and develops technical standards that facilitate the use of public telecommunication services and systems for communications in ICT. Its membership comprises nearly 200 countries and almost 800 private-sector entities and academic institutions.

Participation in the International Standardization of ISO and IEC follows the national delegation principle, i. e. national members (NSB, NC) host national committees populated with national stakeholders. These national committees contribute to the elaboration of International Standards.

A vast array of normative documents is classed under the generic label of "private standards". Generally, a normative document developed and published by an organization outside of the recognized standards development organizations at national, regional, or international level is a private standard. There is not only a vast range of private standards (and growing in number), but there are also significant differences between the bodies and organizations that develop these standards related to such aspects as governance, development approach, stakeholder engagement, transparency, and consensus. Some of these Private Standards Development Organizations liaise with recognized standards development organizations. For instance, buildingSMART International liaises with ISO/TC 59/SC 13, organization, and digitization of information about buildings and civil engineering works, including BIM, and OGC, the Open Geospatial Consortium, liaises with the same ISO/TC 59/SC 13 as well as with other TCs of ISO such as ISO/TC 211, Geographic information/Geomatics. The same applies to OASIS, in which Message Queuing Telemetry Transport (MQTT) specification is adopted by ISO as ISO/IEC 20922:2016, Information technology — Message Queuing Telemetry Transport (MQTT) v3.1.1.

3 D^2EPC Standardization Plan

3.1 Methodology

3.1.1 Meeting and workshops with partners

As task leader, ASI has organized several online meetings with the task partners. In these meetings, the previous steps in the task were summarized for all task partners and the next steps were discussed and defined.

In the kick-off meeting there was a first exchange, the main objectives were presented, the methodology and the corresponding timetable were discussed and the timeline for the first steps was agreed.

In subsequent meetings the desktop research was discussed, and the partners were asked for their input on the standards. In addition, it was asked whether experiences had been made with the listed standards and, if so, which experiences. This was to provide insight into the general awareness and acceptance of a standard, as well as potential gaps and barriers in its application. The input received was incorporated.

For a more in-depth analysis on possible gaps and barriers in the application of standards, a survey was distributed to both experts in the consortium and experts not involved in the project. More details on this survey can be found in Chapter *5.1 Survey*.

The results of the survey were shared with the task partners and opinions were exchanged. Based on the results of the survey, discussions and input from the task partners, the existing Strategic Standardization Plan v01 was revised. For better understanding, the changes made have been summarized again in Chapter *3.3 Changes from D6.1 to D6.5* .

3.1.2 Overview of the standardization landscape

The content of the overview of the standardization landscape is based on a combination of resources, derived from standards databases of the European Committee for Standardization (CEN), International Electrotechnical Commission (IEC), the International Organization for Standardization (ISO), IEEE (Institute of Electrical and Electronics Engineers), as well as contributions from the consortium partners (mainly covering non-formal standards).

The final standardization landscape covers thus European and international standardization communities.

Initial literature review on EPC was conducted by Austrian Standards International (ASI). It identified the broad areas of focus that were further classified according to their scope of application as defined below (general and specific standards).

The content of this report is based on a combination of resources, derived from standards databases of The European Committee for Standardization (CEN), The European Committee for Electrotechnical Standardization

(CENELEC), The International Organization for Standardization (ISO), as well as contributions from the consortium partners.

The database search was performed using the following keywords:

- energy performance,
- energy efficiency,
- energy management,
- smart building,
- BIM,
- building monitoring.

All identified standards were reviewed for their relevance to the project based on the scope.

3.1.3 Analysis of standardization gaps and needs

Based on the very extensive list of potentially relevant standards, the partners were asked for their assessment of the standards listed. The feedback was taken into account and incorporated into the list.

In addition, Austrian Standards International developed an online survey to collect missing standardization elements and identify potential existing gaps. This online survey was sent to all partners. In addition, a somewhat differentiated survey was also distributed to the public.

It is possible that many areas of the building and construction process related to the energy performance certificate are not covered by standards. Such gaps in these areas can be identified by various experts in the D^2EPC consortium.

The survey aimed to:

1. Identify the standards, regulations and frameworks used by the respondents
2. Understand the shortcomings of the available standards, related to Energy Performance Certificate
3. Reveal the areas that are lacking adequate standardization from the point of view of the respondents
4. Identify any information (gaps) that the mentioned documents miss from the point of view of the respondents

The survey aimed to provide qualitative information on standardization gaps and contained both open and multiple-choice questions.

To cover all necessary legal aspects, the survey was supplemented by a consent form section, which was part of the survey and presented to the respondent before the survey started. No personal data (i.e., name, email address or phone number) was collected, respondents were only asked to indicate the type of organization and the country in which they work.

Austrian Standards International distributed a survey to the members of the D^2EPC consortium. In particular, another very similar survey was also distributed to the D^2EPC consortium members with the additional request to be able to forward this link to external partners in order to reach the general public and thereby collect the widest possible range of information.

The survey was posted online in March 2022 (with a turnaround time of approximately 6 weeks). However, the survey remained open. The results, which were still coming in in the meantime, were reviewed again for this final report and compared with those already received.

3.2 Recommendations from the consortium

During the meetings and afterwards, the project partners also made comments and additions to the standards mentioned. These are summarized here:

- It would be good if there were minimum data requirements for exchange documents (not only for the EPC register database, worked out in a standardization exercise)
- it will be complicated to integrate regional or national requirements in the methodology developed by D^2EPC. For the use in the project, recommendation is to focus on European “common” criteria.
- if considered relevant, some documents might be checked, including national standards, like in this context:
    - DIN V 18599 Energy efficiency of buildings - Calculation of the net, final and primary energy demand for heating, cooling, ventilation, domestic hot water and lighting
    - OIB Guideline 6 https://www.oib.or.at/oib-richtlinien/richtlinien/2023 , Using ÖNORM B 8110-5, ÖNORM B 8110-6, ÖNORM H 5050 , ÖNORM H 5056, ÖNORM ISO 9972, (ÖNORM) EN 15316, (ÖNORM) EN 15603
    - The EN are already covered

3.3 Changes from D6.1 to D6.5

The Strategic Standardization Plan (D6.1), delivered in month 18, shows that a very extensive list of standards already exists in the area of EPC and all related areas, such as energy performance certificate. On this basis, a more detailed review for the effectiveness for the specific project was carried out.

At the end of the project, Strategic Standardization Plan (D6.1) was to be revised and made available as update Strategic Standardization Plan (D6.5) in month 36.

The existing list of D6.1 was therefore reviewed in detail again, taking into account the following aspects, and appropriate measures were taken:

- withdrawn standards have been removed
- in the case of revised standards, the current date of issue was used
- if drafts became standards, the code draft was removed
- Standards that were not considered relevant for EPC were removed
- the work program of the CEN- and ISO-committees concerned were reviewed to see whether there are new standards relevant to EPC

The standards are summarized in ANNEX 2.

4 Standardization landscape

4.1 CEN Standards

The list of identified standards from D6.1 (v1) was critically reviewed again in several steps and shortened based on feedback received and considering the scope of application.

For the creation of the questionnaire, the TC identified were clustered into different topics.

- **Energy requirements and thermal quality of buildings**
  - CEN/TC 089 “Thermal performance of buildings and building components”
  - CEN/TC 371 “Energy Performance of Buildings”
- **Heating/cooling systems**
  - CEN/TC 228 “Heating systems and water based cooling systems in buildings”
- **Subject area of control technology and automation systems**
  - CEN/TC 247 “Building Automation, Controls and Building Management”
  - CEN/TC 442 “Building Information Modelling (BIM)”
- **Additional subject areas that influence the energy certificate**
  - CEN/TC 156 “Ventilation for buildings”
  - CEN/TC 169 “Light and lighting”
- **Sustainability**
  - CEN/CLC/JTC 10 “Energy-related products – Material Efficiency Aspects for Ecodesign”
  - CEN/TC 350 “Sustainability of construction works”

At CEN level, 57 standards were identified in the TC.

4.2 ISO Standards

The list of identified standards from D6.1 (v01) was critically reviewed again in several steps and shortened based on feedback received and considering the scope of application.

For the creation of the questionnaire, the TC identified by D6.1 (v01) were clustered into different topics.

- **Energy requirements and thermal quality of buildings**
  - ISO/TC 163 “Thermal performance and energy use in the built environment”
  - ISO/TC 205 “Building environment design”

- **Heating/cooling systems**
    - ISO/TC 86/SC 6 “Testing and rating of air-conditioners and heat pumps”
- **Subject area of control technology and automation systems**
    - ISO/TC 184 “Automation systems and integration”
    - ISO/TC 59/SC 13 “Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM)”
- **Sustainability**
    - ISO/TC 59/SC 17 “Sustainability in buildings and civil engineering works”

At ISO level, 45 standards were identified in the TC.

4.3 IEC Standards

At IEC level, partners have identified further standards relevant to the smartness of the building:

Standards regarding Smart Readiness Indicator: in an effort to better understand the SRI methodology, as well as to potentially identify limitations and opportunities that would allow the alignment mentioned above, a more detailed analysis on the standards used on the methodology, as well as other complementary standards on the field have been briefly performed.

5 Standardization gap analysis

5.1 Survey

Austrian Standards International developed a survey to collect missing standardization elements and identify as many gaps as possible with the help of the project consortium. It is possible that many areas of the building and construction process related to energy product certification are not covered by standards. Therefore, gaps in such areas can be identified by different experts of the D^2EPC consortium.

The survey aims to:

1. Identify the standards, regulations and frameworks used by the respondents
2. Understand the shortcomings of the available standards, related to Energy Performance Certificate
3. Reveal the areas that are lacking adequate standardization from the point of view of the respondents
4. Identify any information (gaps) that the mentioned documents miss from the point of view of the respondents

The survey aimed to provide qualitative information on standardization gaps and contained mainly open and multiple-choice questions. In order to cover all necessary legal aspects, the survey was supplemented by a part of the consent form, which was part of the survey and was presented to the respondent before the survey started. No personal data (i.e., name, email address, or phone number) was collected; respondents were only asked to indicate the organization and country in which they work.

Participants have been advised that their participation is completely voluntary and that they may change their mind about participating at any time before, during or after the survey.

Further, the participants were made aware that the record of their survey responses does not contain any identifying information about them unless a specific survey question explicitly asked for it.

Austrian Standards International has distributed the survey (survey A) to the members of the D^2EPC consortium and requested appropriate participation.

In addition, a second (very similar) survey (survey B) was prepared for distribution to the public. Partners were asked to be able to forward this link to their external partners in order to gather as broad a range of information as possible.

Both surveys were put online in March 2022. The deadlines were set at 6 weeks. However, the surveys remained open to collect possible later contributions. The last polling of results occurred on June 12, 2023, and all responses entered up to that date are included in this report.

Further, the participants were made aware that the record of their survey responses does not contain any identifying information about them unless a specific survey question explicitly asked for it.

The questionnaire of survey A as well as survey B can be found in appendix 1 of this report.

6 Conclusion

This report under WP6 Task 6.5 provides an overview of existing standards and ongoing standardization work in a broad area relevant to the D^2EPC project.

The list of identified standards in this report is intended to serve as a reference for the most relevant standards in the field of EPCs for the members of the consortium as well as for all experts working in the relevant field.

Compliance with standards is critical to the construction and operation of proactive buildings, and the development of such standards is paramount to ensure their optimal performance and efficiency.

In the field of energy requirements and thermal quality of buildings it has been shown that the calculation methods in various EU countries are not transparent and therefore they cannot be compared with each other and that there are no standards for operational rating of an energy certificate. In this context and under the activities of WP7; UNE submitted a proposal for a new working group dealing with operational EPCs to the responsible CEN/TC 371 and it was approved as CEN/TC 371/WG 5. Recently, this WG has started the drafting of a new European Standard under the tile “Energy Performance of Buildings - Operational rating - Requirements for assessing Operational rating” which will deal with the missing operational ratings. More information is provided in D7.12.

Further gaps were identified in the area of intelligent meters/customer information (SRI) and the lack of standards in the area of data exchange. It was also noted that there is no BIM standard for energy certificates.

Improvements have also been identified in the area of evaluation energy demand for lighting: include energy use beyond lighting when it is necessary to operate the building and costs are passed on to tenants (surveillance, elevator, pumps).

Sustainability is also important in D^EPC but lacks a viable method to provide tips for sustainable renovation without life cycle assessment of old, existing building elements.

ANNEX 1: GAP ANALYSIS SURVEY

1 D^2EPC: Standardization Gap Analysis Questionnaire

1.1 Survey A, not intended for the public, only project member

1.1.1 Introduction and foreword for the target audience

Dear Partners,

D^2EPC has the ambitious goal of laying the foundation for the next generation of dynamic energy performance certificates (EPCs) for buildings. This means that an energy certificate is based on the smart readiness level of the building and the corresponding data acquisition infrastructure and management systems. It is to be fed by operational data and adopt the concept of the "digital twin" to advance the modelling of building information, to calculate a novel set of energy, environmental, financial and human comfort/wellbeing indicators.

To gather information from the consortium partners from all over Europe, to help to define the state of the art for EPC and to identify needs we intended survey to reveal the standardization needs and gaps in the current standardization landscape addressing Energy Performance Certificate.

We have started a digital survey and we would be very happy to see a large number of participants. This allows your opinion to feed into a new set of dynamic EPC standards.

The questionnaire contains 13 questions, filling the survey should take you around 15 minutes. All you have to do is click the link below (…) You can also use the QR code below (…)

Please note: Deadline Monday, 25th of April 2022

Although your participation is entirely voluntary, your input is the most valuable information to develop the upcoming deliverables in WP6.

Under the General Data Protection Regulation (GDPR) (EU) 2016/679, it is our legal duty to protect any information collected from you. This data will be hold in compliance with Article 14 of the GDPR. Any responses to the survey and any attachments may be privileged and/or confidential and intended for the exclusive use of the research purposes. Only cumulative results will be published (not personalized answers). As outlined in the privacy information notice, the data you provide will be kept until 12 months after the project ends.

You are provided with certain rights that you may have the right to exercise through this survey. In summary those rights are:

1. To access, correct or erase your data;
2. To object to the processing of your data;

3. To request that our processing of your data is restricted;
4. To request that your data be transferred;
5. To withdraw your consent for us to process your data.

The record of your survey responses does not contain any identifying information about you unless a specific survey question explicitly asked for it.

If you used an identifying token to access this survey, please rest assured that this token will not be stored together with your responses. It is managed in a separate database and will only be updated to indicate whether you did (or did not) complete this survey. There is no way of matching identification tokens with survey responses.

Thank you very much for your contribution. We will be glad to introduce your know-how and input in the new deliverable.

If you have any questions, please do not hesitate to reach out to me (…)

1.1.2 Questions

Question 1: Please indicate your country of residence.

Question 2: What information (data input) is mandatory in your country for the creation of an energy certificate? (Multiple choices possible)

Note: if different types of building (residential buildings, commercial/industrial buildings, infrastructure buildings (schools, hospitals, etc.)) need to be provided to issue an energy performance certificate in your country, please indicate which data is required in total.

I don't know

A. Energy demand data

1. Energy requirement for heating
2. Energy demand for hot water
3. Energy requirement for other, please specify:
4. Consideration of internal profits
5. Consideration of solar gains
6. Consideration of other profits, please specify:
7. Other, please specify:

B. Building data:

1. Use of the building (living, working, leisure)
2. Building configuration (e.g., free-standing/exposed location, closed structure/connected to other buildings)
3. Building envelope information to assess thermal quality
4. Heated area
5. Other, please specify:

C. Other (please specify):

Question 3: From your point of view, what role (relevance) has standardization played so far in the innovation process of D^2EPC?

- High relevance
- Upper intermediate
- Intermediate relevance
- Lower intermediate relevance
- No relevance
- No answer / unknown

Question 3a: In which way has standardization positively contributed so far (M1-18) to the Work Package, Tasks and Deliverables?

- Main contributor
- Advance contribution
- Moderate contribution
- Barely contribution
- No contribution
- No answer / unknown

Question 4: In your view which main areas of knowledge are already mostly covered by standards in the D^2EPC solution?

- I don’t know
- Building and Construction technology
- BIM & Digital Twins
- Thermal performance and Building Energy Certificate
- Electricity and Electrical engineering and Building technology

- Other

Question 5: In your view which main areas of knowledge are most likely to need further development for backing the D^2EPC solution?

- I don't know
- Building and Construction technology
- BIM & Digital Twins
- Thermal performance and Building Energy Certificate
- Electricity and Electrical engineering and Building technology
- Other
- No answer / unknown

Question 6: The committees CEN/TC 089 "Thermal performance of buildings and building components", CEN/TC 371 "Energy Performance of Buildings", ISO/TC 163 "Thermal performance and energy use in the built environment" and ISO/TC 205 – Building environment design" deals with the topics of energy requirements and the thermal quality of buildings. Are the standards from this area useful for the energy certificate?

- None of the above
- Yes, the standards in this area are very extensive and easily applicable
- Yes, the standards in this area are extensive and mostly applicable
- Yes, the standards in this area are applicable, but there are no standards for the area (please specify):
- No, the standards in this area cannot be applied because (please specify):
- Other (please specify):

Question 7: The committees CEN/TC 228 "Heating systems and water based cooling systems in buildings" and ISO/TC 86/SC 6 "Testing and rating of air-conditioners and heat pumps" deal with the topic of heating systems. Are the standards from this area useful for the energy certificate?

- None of the above
- Yes, the standards in this area are very extensive and easily applicable
- Yes, the standards in this area are extensive and mostly applicable
- Yes, the standards in this area are applicable, but there are no standards for the area (please specify):
- No, the standards in this area cannot be applied because (please specify):
- Other (please specify):

Question 8: The committees CEN/TC 247 "Building Automation, Controls and Building Management" and ISO/TC 184 "Automation systems and integration" deal with the subject area of control technology and automation systems. Are the standards from this area useful for the energy certificate?

- None of the above
- Yes, the standards in this area are very extensive and easily applicable
- Yes, the standards in this area are extensive and mostly applicable
- Yes, the standards in this area are applicable, but there are no standards for the area (please specify):
- No, the standards in this area cannot be applied because (please specify):
- Other (please specify):

Question 9: The committees CEN/TC 33 "Doors, windows, shutters, building hardware and curtain walling", CEN/TC 156 "Ventilation for buildings" and CEN/TC 169 "Light and lighting" deal with additional subject areas that influence the energy certificate to take. Are the standards from this area useful for the energy certificate?

- None of the above
- Yes, the standards in this area are very extensive and easily applicable
- Yes, the standards in this area are extensive and mostly applicable
- Yes, the standards in this area are applicable, but there are no standards for the area (please specify):
- No, the standards in this area cannot be applied because (please specify):
- Other (please specify):

Question 10: The committees CEN/CLC/JTC 10 "Energy-related products – Material Efficiency Aspects for Ecodesign", CEN/TC 350 "Sustainability of construction works" and ISO/TC 59/SC 17 Sustainability in buildings and civil engineering works" deal with the topic of sustainability. Are the standards from this area useful for the energy certificate?

- None of the above
- Yes, the standards in this area are very extensive and easily applicable
- Yes, the standards in this area are extensive and mostly applicable
- Yes, the standards in this area are applicable, but there are no standards for the area (please specify):
- No, the standards in this area cannot be applied because (please specify):
- Other (please specify):

Question 12: The committee CEN/TC 442 – Building Information Modelling (BIM) deals with BIM. Can the existing standards for the energy certificate be used?

- I don't know

- This cannot be judged as all the data has to be entered manually
- Some of the standards from the BIM field are helpful in order to be able to use this option efficiently.
- BIM-based data cannot be used because (please specify):
- Missing standards (please specify):
- Other

Question 12: Would you like to add any additional comment?

- please specify:
- No answer / unknown

1.2 Survey B, for the public

1.2.1 Introduction and foreword for the target audience

Dear Sir or Madam,

D^2EPC has the ambitious goal of laying the foundation for the next generation of dynamic energy certificates for buildings. This means that an energy certificate will be based on the smart-readiness level of the building and the corresponding data collection infrastructure and management systems. It will be fed by operational data and adopt the concept of a "digital twin" to drive building data modelling and calculate a novel set of energy, environmental, financial and comfort/wellness indicators.

To gather information from concerned stakeholders across Europe, define the state of the art for energy performance certification, and identify needs, we launched a survey to identify standardization needs and gaps in the current standardization landscape for energy performance certification.

We have launched a digital survey and would appreciate a large number of participants. This way, your opinion can be incorporated into a new set of dynamic EPC standards.

The questionnaire contains 13 questions, filling the survey should take you around 15 minutes. All you have to do is click the link below (…) You can also use the QR code below (…)

Please note: Deadline August 31, 2022

Although your participation is entirely voluntary, your input is the most valuable information to develop the upcoming deliverables in the next generation of dynamic energy certificates for buildings.

Under the General Data Protection Regulation (GDPR) (EU) 2016/679, it is our legal duty to protect any information collected from you. This data will be hold in compliance with Article 14 of the GDPR. Any responses to the survey and any attachments may be privileged and/or confidential and intended for the exclusive use of

the research purposes. Only cumulative results will be published (not personalized answers). As outlined in the privacy information notice, the data you provide will be kept until 12 months after the project ends.

You are provided with certain rights that you may have the right to exercise through this survey. In summary those rights are:

1. To access, correct or erase your data;
2. To object to the processing of your data;
3. To request that our processing of your data is restricted;
4. To request that your data be transferred;
5. To withdraw your consent for us to process your data.

The record of your survey responses does not contain any identifying information about you unless a specific survey question explicitly asked for it.

If you used an identifying token to access this survey, please rest assured that this token will not be stored together with your responses. It is managed in a separate database and will only be updated to indicate whether you did (or did not) complete this survey. There is no way of matching identification tokens with survey responses.

Thank you very much for your contribution. We will be glad to introduce your know-how and input in the new deliverable.

1.2.2 Questions

Since the questionnaire was almost identical, the questions are not listed. Only question 3a was not part of survey B.

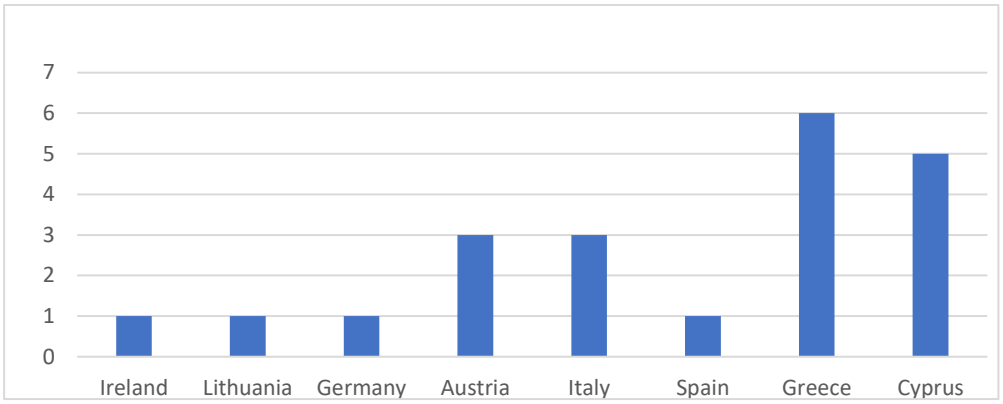
1.3 Survey A und B, answers

Because the questions in the two surveys were nearly identical, the responses from the two surveys are provided together.

In the case of differing questions between survey A and B, a corresponding note is given with the answer.

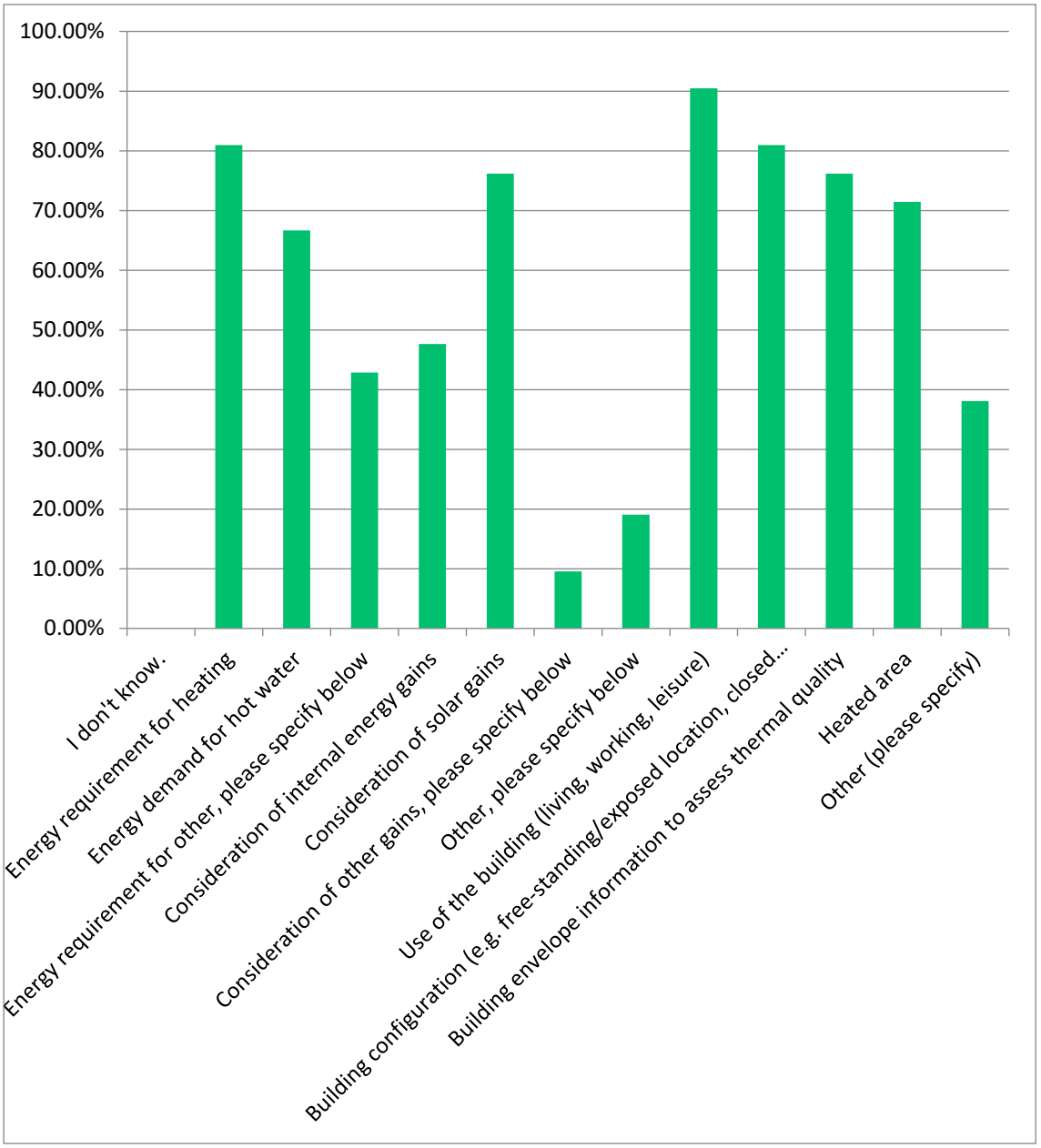
Question 1:

Please indicate your country of residence.	
Answered	21
Skipped	0


7
6
5
4
3
2
1
0
Ireland
Lithuania
Germany
Austria
Italy
Spain
Greece
Cyprus

Question 2:

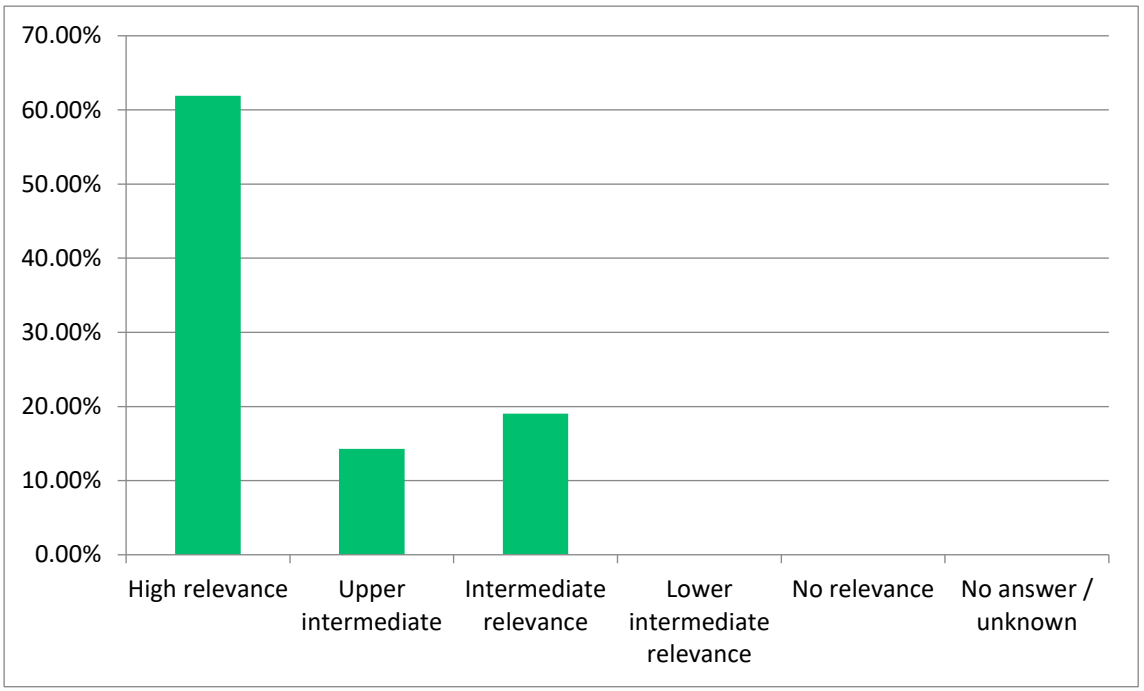
What information (data input) is mandatory in your country for the creation of an energy certificate? (Multiple choices possible)				
Answer Choices	Responses	Total	Survey A	Survey B
I don't know.	0,00%	0,00	0	0
Energy requirement for heating	80,95%	17,00	9	8
Energy demand for hot water	66,67%	14,00	7	7
Energy requirement for other, please specify below	42,86%	9,00	3	6
Consideration of internal energy gains	47,62%	10,00	4	6
Consideration of solar gains	76,19%	16,00	8	8
Consideration of other gains, please specify below	9,52%	2,00	1	1
Other, please specify below	19,05%	4,00	2	2
Use of the building (living, working, leisure)	90,48%	19,00	12	7
Building configuration (e.g., free-standing/exposed location, closed structure/connected to other buildings)	80,95%	17,00	10	7
Building envelope information to assess thermal quality	76,19%	16,00	11	5
Heated area	71,43%	15,00	10	5
Other (please specify)	38,10%	8,00	4	4
	Answered		**13**	**8**
	Skipped		**0**	**0**



Other (please specify)
Energy demand for cooling, Energy demand for lighting (tertiary sector), Ventilation
Cooling, lighting, transport and ventilation systems.
DECs use energy demand data. Primarily on public buildings. An operational rating BERs use Building data primarily, including dwellings and commercial buildings. An asset rating
Energy demand for cooling + Energy demand for illumination (tertiary buildings)
Building data - building systems (including energy carriers), Building data - location (climatic conditions)
demand for cooling, ventilation, lighting, RES
Germany has a new standard simulating the building with a high accuracy
The energy demand for DHW is a default value kWh/m²y

Question 3:

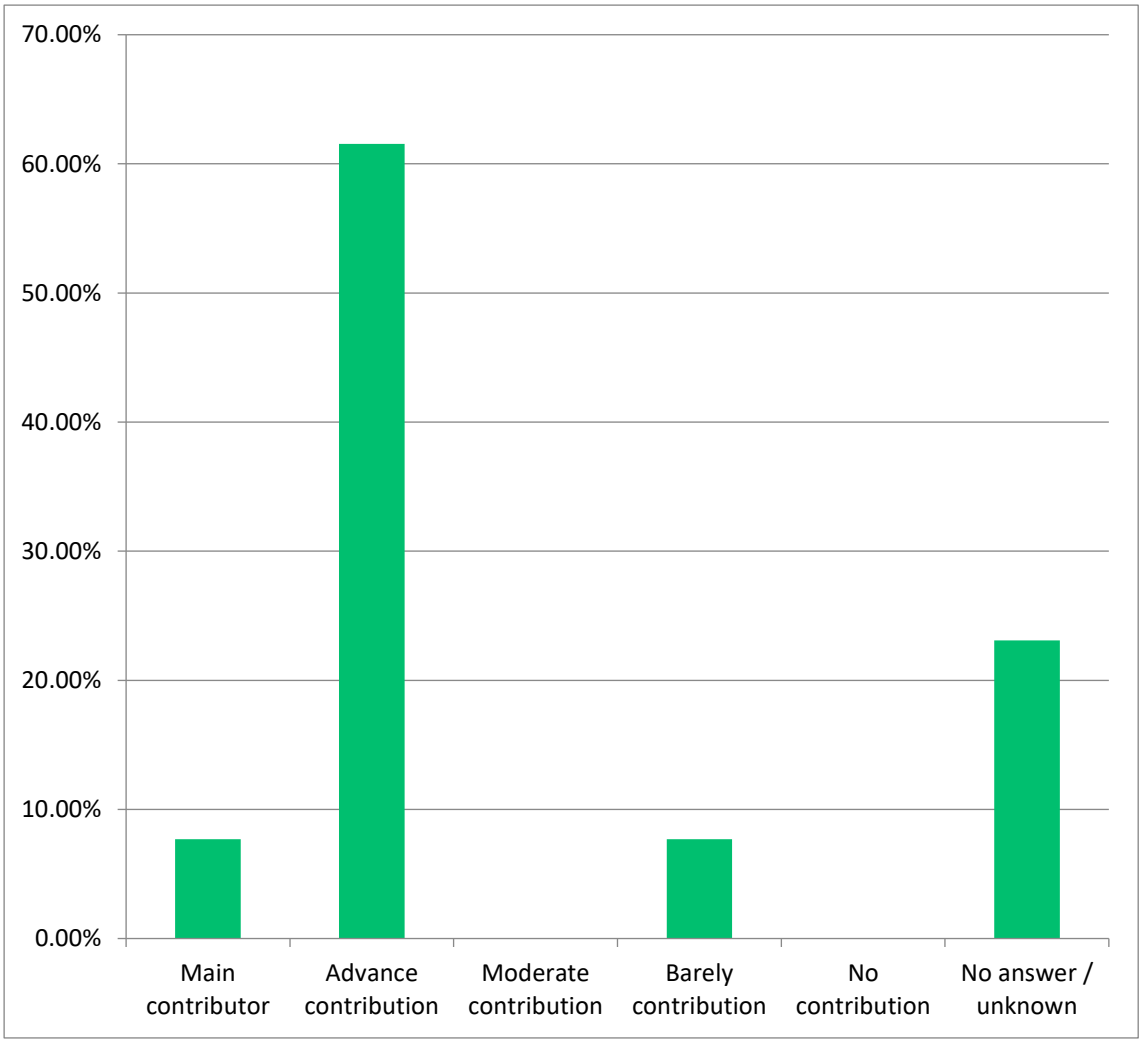
From your point of view, what role (relevance) has standardization played so far in the field of EPC (Energy Performance Certificate)?				
Answer Choices	Responses	Total	Survey A	Survey B
High relevance	61,90%	13,00	7	6
Upper intermediate	14,29%	3,00	2	1
Intermediate relevance	19,05%	4,00	3	1
Lower intermediate relevance	0,00%	0	0	0
No relevance	0,00%	0	0	0
No answer / unknown	0,00%	0	1	0
	Answered		**13**	**8**
	Skipped		**0**	**0**



Question 3a:

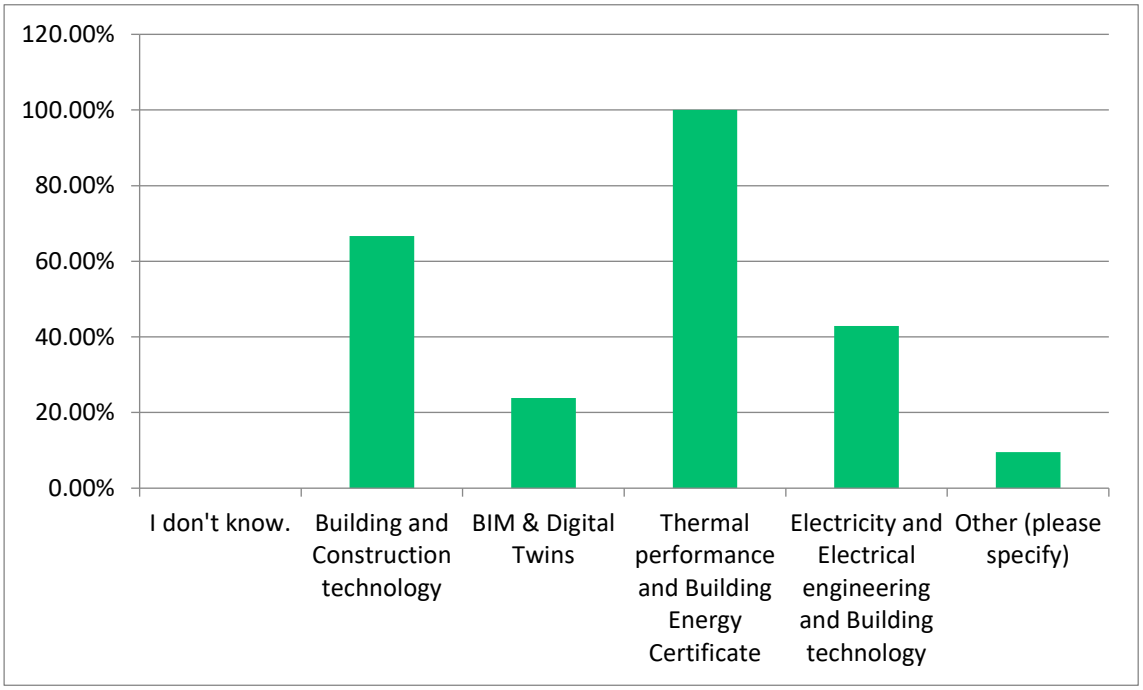
this question was only asked in the questionnaire for DEPC's partners (survey A)

In which way has standardization positively contributed so far (M1-18) to the Work Package, Tasks and Deliverables?		
Answer Choices	Responses	
Main contributor	7,69%	1
Advance contribution	61,54%	8
Moderate contribution	0,00%	0
Barely contribution	7,69%	1
No contribution	0,00%	0
No answer / unknown	23,08%	3
	Answered	**13**
	Skipped	**0**



Question 4:

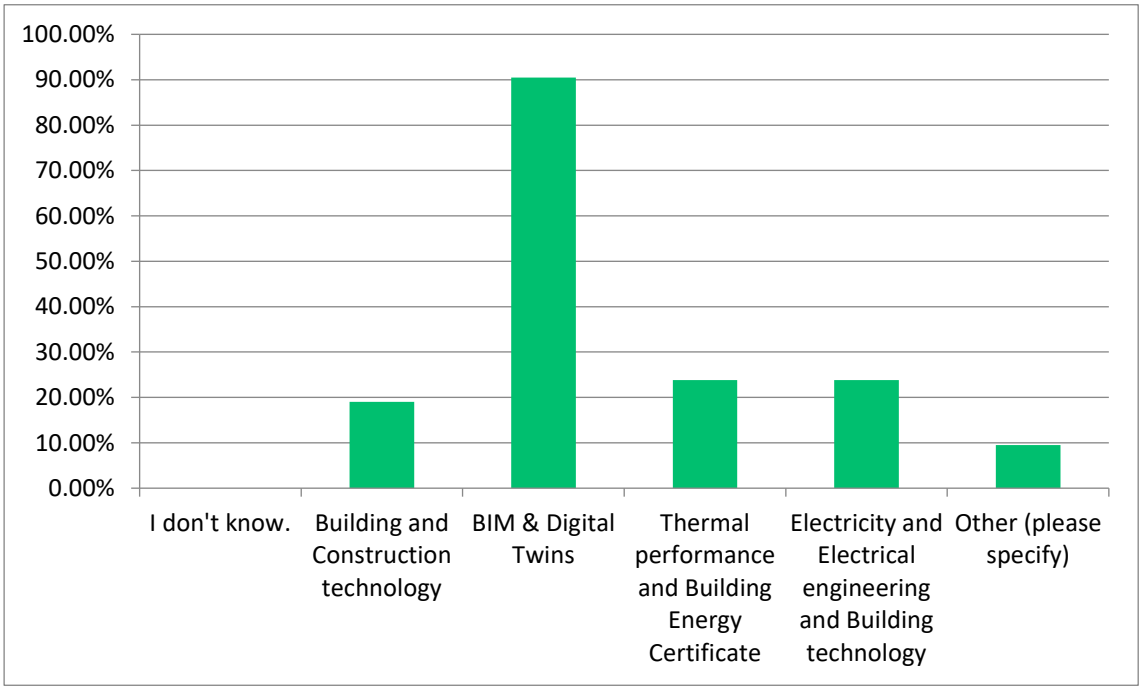
In your view which main areas of knowledge are already mostly covered by standards in the EPC solution? (Multiple choices possible)				
Answer Choices	Responses	Total	Survey A	Survey B
I don't know.	0,00%	0,00	0	0
Building and Construction technology	66,67%	14,00	9	5
BIM & Digital Twins	23,81%	5,00	4	1
Thermal performance and Building Energy Certificate	100,00%	21,00	13	8
Electricity and Electrical engineering and Building technology	42,86%	9,00	4	5
Other (please specify)	9,52%	2,00	1	1
	Answered		**13**	**8**
	Skipped		**0**	**0**



Other (please specify)
A number of relevant renewable technologies. Thermal and electrical.
Degree Days

Question 5:

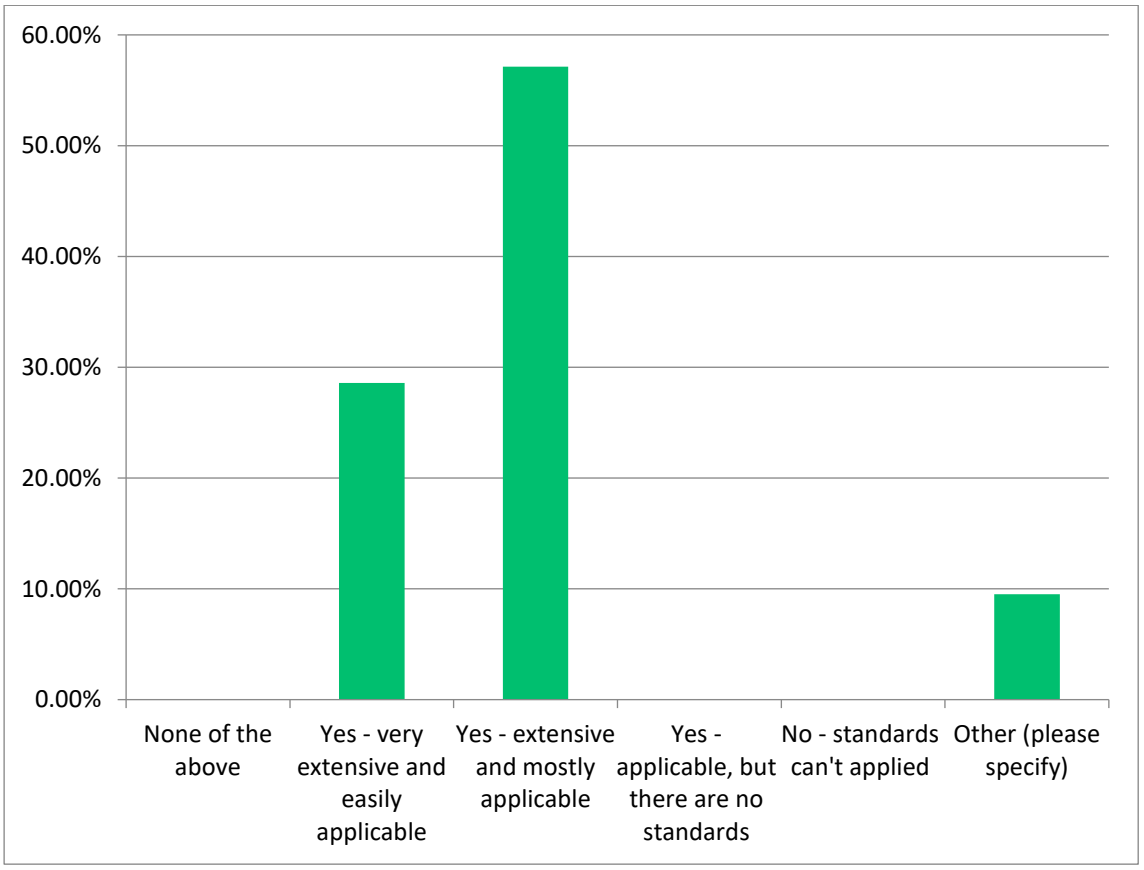
Which knowledge areas do you think are most likely to need further development to support a digital EPC solution? (Multiple answers possible)				
Answer Choices	Responses	Total	Survey A	Survey B
I don't know.	0,00%	0,00	0	0
Building and Construction technology	19,05%	4,00	2	2
BIM & Digital Twins	90,48%	19,00	8	11
Thermal performance and Building Energy Certificate	23,81%	5,00	0	5
Electricity and Electrical engineering and Building technology	23,81%	5,00	0	5
Other (please specify)	9,52%	2,00	2	0
	Answered		**13**	**8**
	Skipped		**0**	**0**



Other (please specify)
If coupling an asset rating with operational aspects, need digital twin
Monitorization

Question 6:

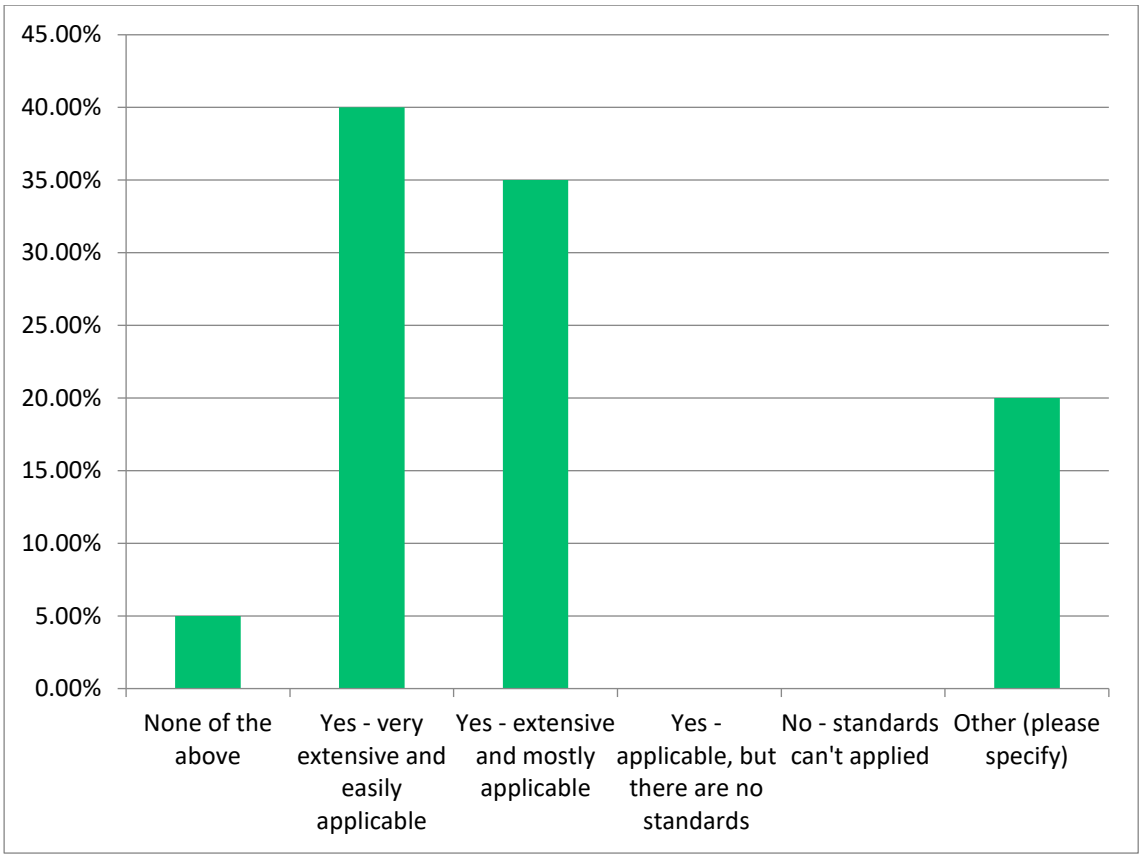
The committees CEN/TC 089 "Thermal performance of buildings and building components", CEN/TC 371 "Energy Performance of Buildings", ISO/TC 163 "Thermal performance and energy use in the built environment" and ISO/TC 205 – Building environment design" deals with the topics of energy requirements and the thermal quality of buildings. Are the standards from this area useful for the energy certificate?				
Answer Choices	Responses	Total	Survey A	Survey B
None of the above	0,00%	0,00	0	0
Yes - very extensive and easily applicable	28,57%	6,00	3	3
Yes - extensive and mostly applicable	57,14%	12,00	7	5
Yes - applicable, but there are no standards	0,00%	0,00	0	0
No - standards can't applied	0,00%	0,00	0	0
Other (please specify)	9,52%	2,00	2	0
	Answered		**13**	**8**
	Skipped		**0**	**0**



Other (please specify)
I am not familiar with these standards. The current development of the Asset Rating module is based on the EN ISO 52000 series of standards.
since they are not free I cannot judge

Question 7:

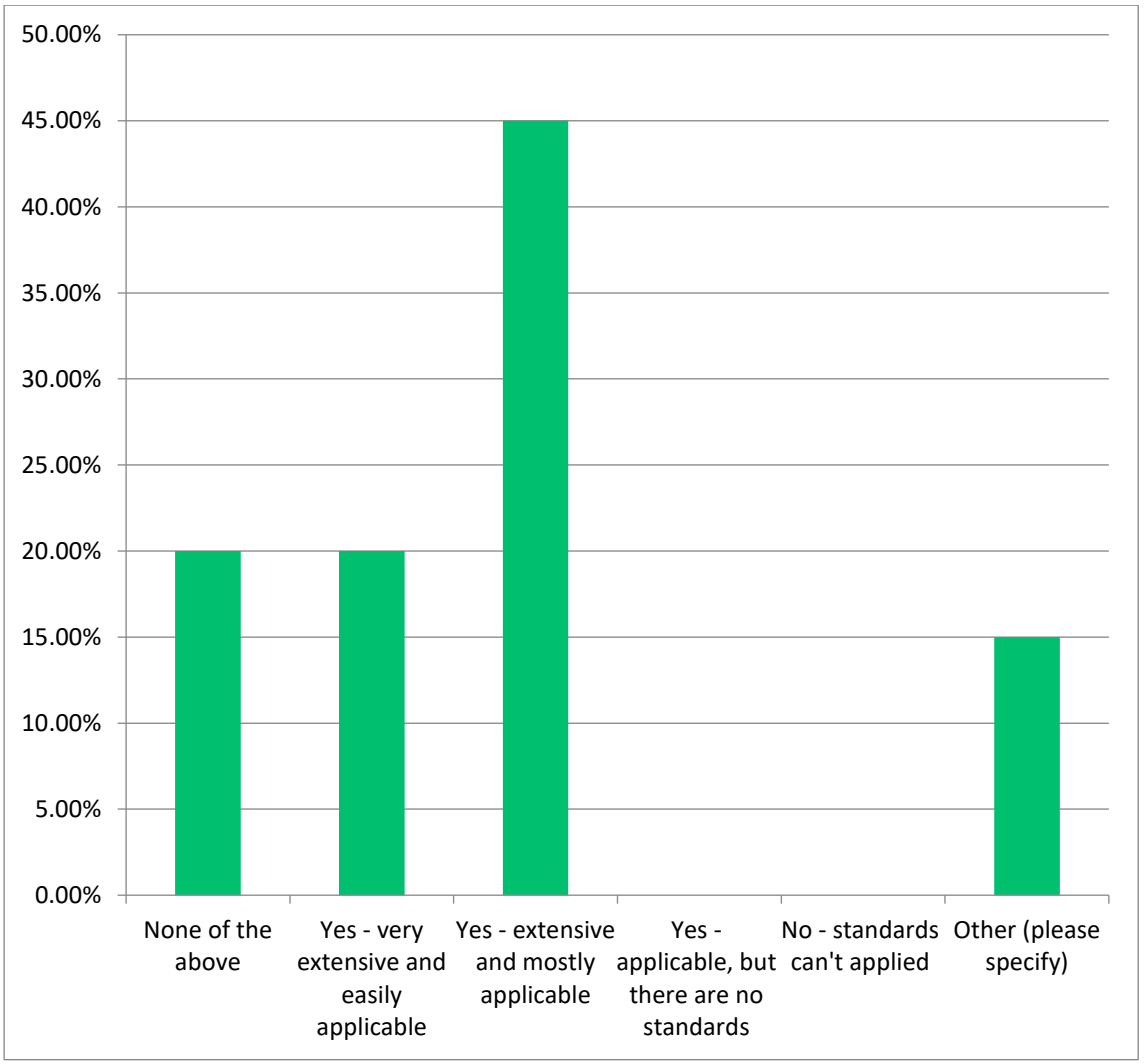
The committees CEN/TC 228 "Heating systems and water based cooling systems in buildings" and ISO/TC 86/SC 6 "Testing and rating of air-conditioners and heat pumps" deal with the topic of heating systems. Are the standards from this area useful for the energy certificate?				
Answer Choices	Responses	Total	Survey A	Survey B
None of the above	5,00%	1,00	0	1
Yes - very extensive and easily applicable	40,00%	8,00	4	4
Yes - extensive and mostly applicable	35,00%	7,00	6	1
Yes - applicable, but there are no standards	0,00%	0,00	0	0
No - standards can't applied	0,00%	0,00	0	0
Other (please specify)	20,00%	4,00	2	2
	Answered		**12**	**8**
	Skipped		**1**	**0**



Other (please specify)
It's so difficult for designers and software users understand data required for HP
Somewhat applicable, but less so for an asset rating. Asset ratings are as important as operational ratings. Both have their place.
I am not familiar with these standards.
since they are not free, I cannot judge

Question 8:

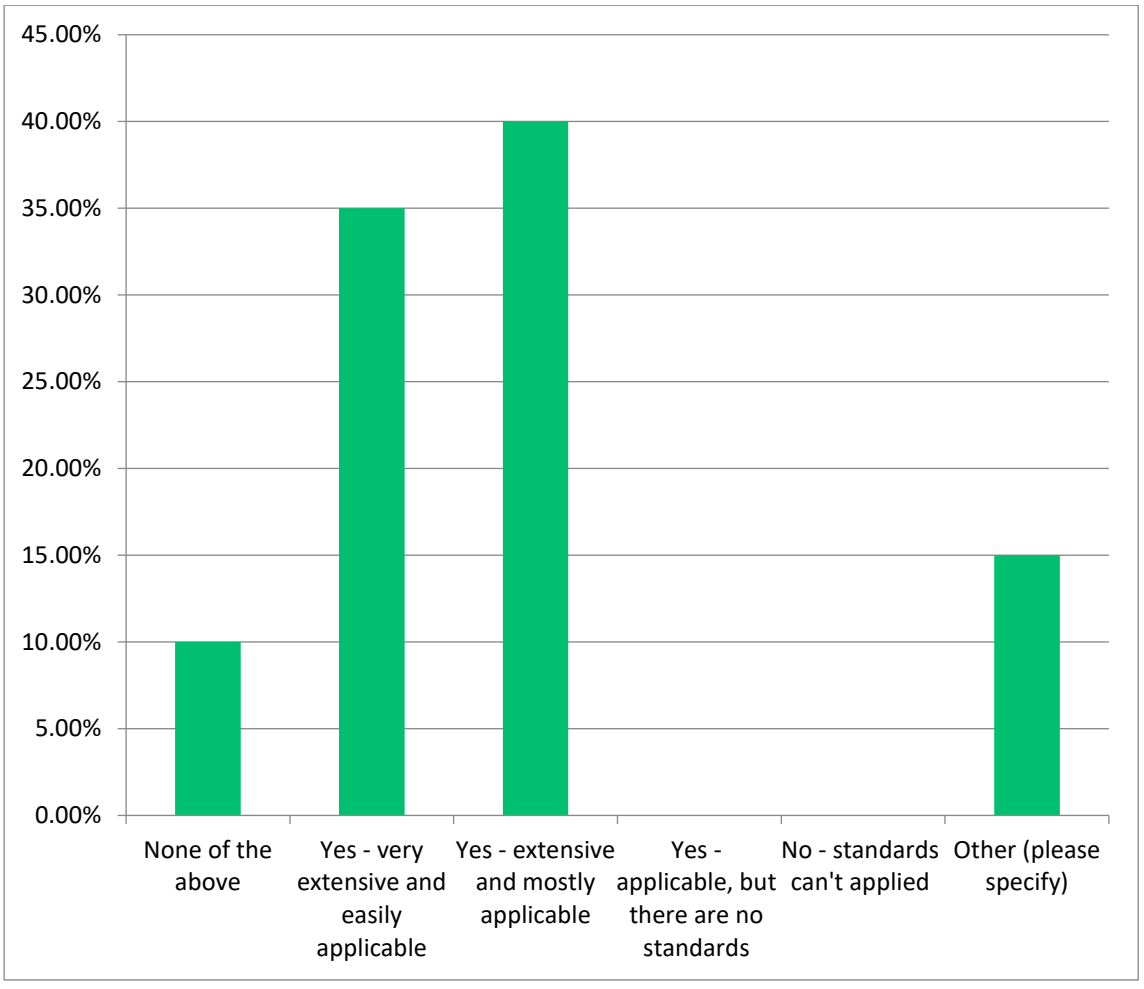
The committees CEN/TC 247 "Building Automation, Controls and Building Management" and ISO/TC 184 "Automation systems and integration" deal with the subject area of control technology and automation systems. Are the standards from this area useful for the energy certificate?				
Answer Choices	Responses	Total	Survey A	Survey B
None of the above	20,00%	4,00	1	3
Yes - very extensive and easily applicable	20,00%	4,00	2	2
Yes - extensive and mostly applicable	45,00%	9,00	6	3
Yes - applicable, but there are no standards	0,00%	0,00	0	0
No - standards can't applied	0,00%	0,00	0	0
Other (please specify)	15,00%	3,00	3	0
	Answered		**12**	**8**
	Skipped		**1**	**0**



Other (please specify)
I am not familiar with these standards.
since they are not free, I cannot judge
have not enough knowledge to answer

Question 9:

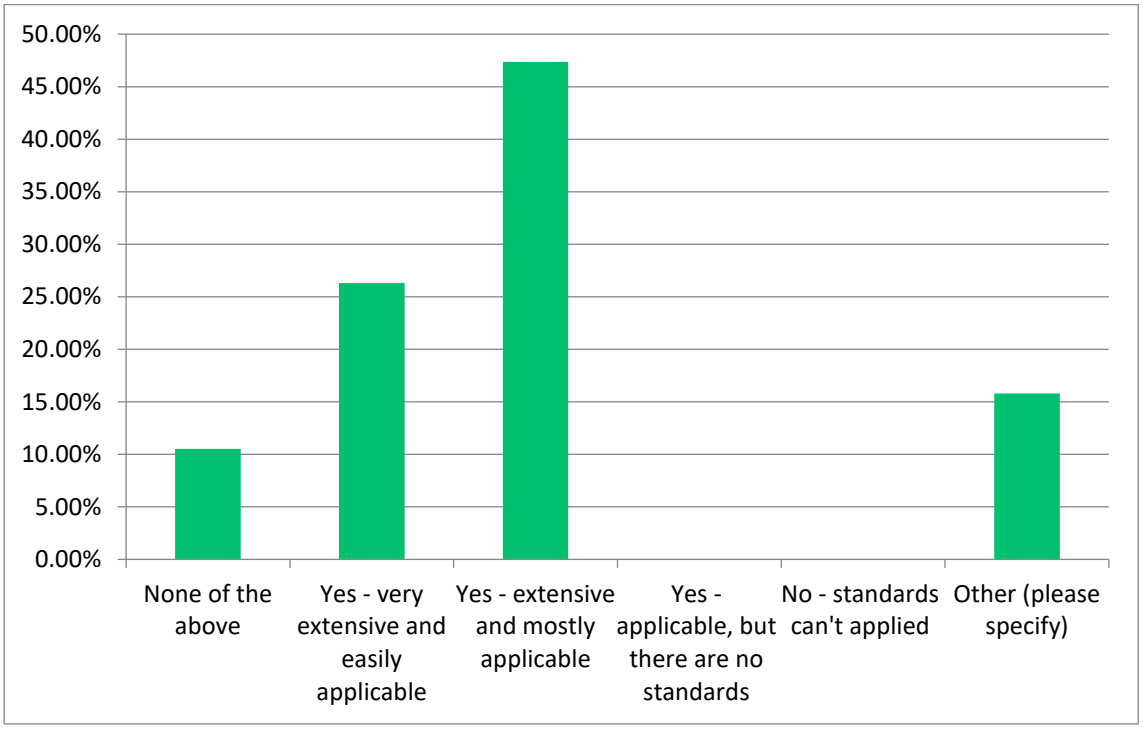
The committees CEN/TC 33 "Doors, windows, shutters, building hardware and curtain walling", CEN/TC 156 "Ventilation for buildings" and CEN/TC 169 "Light and lighting" deal with additional subject areas that influence the energy certificate to take. Are the standards from this area useful for the energy certificate?				
Answer Choices	Responses	Total	Partner	public
None of the above	10,00%	2,00	1	1
Yes - very extensive and easily applicable	35,00%	7,00	3	4
Yes - extensive and mostly applicable	40,00%	8,00	5	3
Yes - applicable, but there are no standards	0,00%	0,00	0	0
No - standards can't applied	0,00%	0,00	0	0
Other (please specify)	15,00%	3,00	3	0
	Answered		**12**	**8**
	Skipped		**1**	**0**



Other (please specify)
I am not familiar with these standards.
since they are not free, I cannot judge
have not enough knowledge to answer

Question 10:

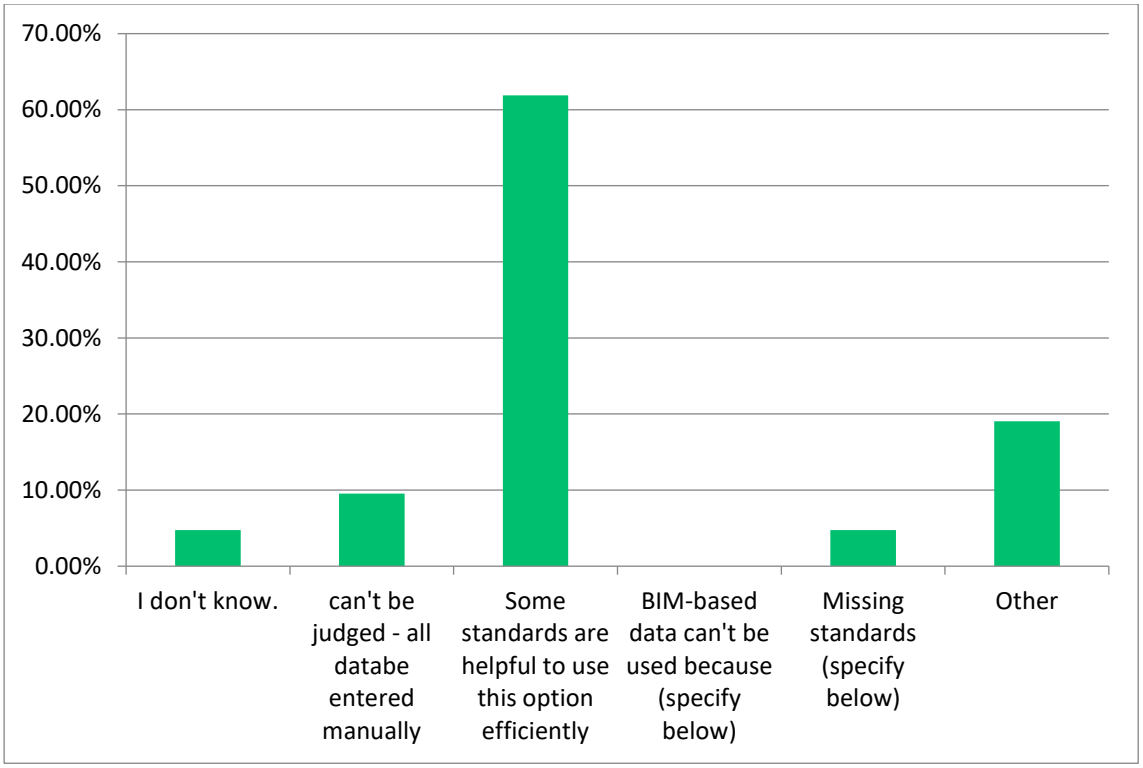
The committees CEN/CLC/JTC 10 "Energy-related products – Material Efficiency Aspects for Ecodesign", CEN/TC 350 "Sustainability of construction works" and ISO/TC 59/SC 17 Sustainability in buildings and civil engineering works" deal with the topic of sustainability. Are the standards from this area useful for the energy certificate?				
Answer Choices	Responses	Total	Survey A	Survey B
None of the above	10,53%	2,00	0	2
Yes - very extensive and easily applicable	26,32%	5,00	2	3
Yes - extensive and mostly applicable	47,37%	9,00	6	3
Yes - applicable, but there are no standards	0,00%	0,00	0	0
No - standards can't applied	0,00%	0,00	0	0
Other (please specify)	15,79%	3,00	3	0
	Answered		**11**	**8**
	Skipped		**2**	**0**



Other (please specify)
I am not familiar with these standards.
since they are not free, I cannot judge
have not enough knowledge to answer

Question 11:

The committee CEN/TC 442 – Building Information Modeling (BIM) deals with BIM (Building Information Modelling). Can the existing standards for the energy certificate be used?				
Answer Choices	Responses	Total	Survey A	Survey B
I don't know.	4,76%	1,00	0	1
can't be judged - all data be entered manually	9,52%	2,00	2	0
Some standards are helpful to use this option efficiently	61,90%	13,00	9	4
BIM-based data can't be used because (specify below)	0,00%	0,00	0	0
Missing standards (specify below)	4,76%	1,00	1	0
Other	19,05%	4,00	1	3
	Answered		**13**	**8**
	Skipped		**0**	**0**



Other (please specify)
BIM-based data cannot be used because there is a lack of technical knowledge on how to integrate them in the EPC's
This depends even from the authoring software and from the knowledge of the users. Revit IFC export is not so useful and complete for energy certification. Users in Italy think “what you see - what you get” but is not so easy to transform a BIM in a BEM
This question is not clear.
since they are not free, I cannot judge

Question 12:

Would you like to add any additional comment?	
Answered	3
Skipped	18

Responses
Why don’t you collaborate more with software houses? We can test the new engine before other and we can discover issues and troubles transforming law in software algorithms
The main focus in D^EPC should be on standardizing the- calculation of both EPC types, the renovation target, CO2 factors and the representation (scales) and the exchange format of data for EPC (XML or JSON)
No, thank you

ANNEX 2: LIST OF IDENTIFIED STANDARDS FOR EPC

The next section considers standards identified in the analysis and outline the relevance and scope of each in relation to building energy performance.

No	Committee	No. of Standard	Name of standards	Scope
1	**CEN/CLC/JTC 14 Energy management and energy efficiency in the framework of energy transition**	EN 15900:2010	Energy efficiency services - Definitions and requirements	This European Standard specifies the definitions and minimum requirements for an energy efficiency service.
2	**CEN/CLC/JTC 14 Energy management and energy efficiency in the framework of energy transition**	EN 16212:2012	Energy Efficiency and Savings Calculation, Top-down and Bottom-up Methods	This European Standard provides a general approach for energy efficiency and energy savings calculations with top-down and bottom-up methods. The general approach is applicable for energy savings in buildings, cars, appliances, industrial processes, etc. This European Standard covers energy consumption in all end-use sectors. The standard does not cover energy supply, e.g., in power stations, as it considers only final energy consumption. This European Standard deals with savings on energy supplied to end-users. Some forms of renewable energy “behind-the-meter” (e.g., from solar water heating panels) reduce supplied energy and therefore can be part of the calculated energy savings. Users of the standard should be aware that this renewable energy behind the meter can also be claimed as energy generated. The standard is meant to be used for ex-post evaluations of realized savings as well as ex-ante evaluations of expected savings. This European Standard provides saving calculations for any period chosen. However, short data series may limit the possible periods over which savings can be calculated. The standard is not intended to be used for calculating energy savings of individual households, companies or other end-users.
3	**CEN/CLC/JTC 14 Energy management and energy efficiency in the framework of energy transition**	EN 16231:2012	Energy efficiency benchmarking methodology	This European Standard specifies requirements and provides recommendations for energy efficiency benchmarking methodology. The purpose of energy efficiency benchmarking is to establish the relevant data and indicators on energy consumption, both technical

				and behavioral, qualitative and quantitative in comparing performance between or within entities. Energy efficiency benchmarking can be either internal (within a specific organization) or external (between organizations including competitors). This standard describes how to establish the boundaries of what is being benchmarked, including for example facilities, activities, processes, products, services and organizations. This European Standard provides guidance on the criteria to be used in order to choose the appropriate level of detail for the data collection, processing and reviewing which suits the objective of the benchmarking. This European Standard does not itself state specific performance requirements with respect to energy use. For all activities related to the continual improvement cycle (such as the Plan-Do-Check-Act methodology) reference shall be made to management systems in the organization.
4	**CEN/CLC/JTC 14 Energy management and energy efficiency in the framework of energy transition**	EN 17267:2019	Energy measurement and monitoring plan - Design and implementation - Principles for energy data collection	This document specifies the requirements and methodology for the design and implementation of an energy measurement and monitoring plan for an organization in order to improve its energy performance. The measurement and monitoring plan defines a measurement system for monitoring and analyzing the energy performance of an organization, taking into account factors that influence its operations. This document applies to all forms of energy, to all energy uses and to all types of organizations. It does not apply to domestic dwellings.
5	**CEN/CLC/JTC 14 Energy management and energy efficiency in the framework of energy transition**	EN ISO 50001:2018	Energy management systems - Requirements with guidance for use (ISO 50001:2018)	This document specifies requirements for establishing, implementing, maintaining and improving an energy management system (EnMS). The intended outcome is to enable an organization to follow a systematic approach in achieving continual improvement of energy performance and the EnMS. This document: a) is applicable to any organization regardless of its type, size, complexity, geographical location, organizational culture or the products and services it provides; b) is applicable to activities affecting energy performance that are managed and controlled by the organization; c) is applicable irrespective of the quantity, use, or types of energy consumed; d) requires demonstration of continual energy performance improvement, but does not define levels of

				energy performance improvement to be achieved; e) can be used independently, or be aligned or integrated with other management systems. Annex A provides guidance for the use of this document. Annex B provides a comparison of this edition with the previous edition.
6	**CEN/TC 089 Thermal performance of buildings and building components**	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)	This document refers to ISO 52003-1. It contains information to support the correct understanding and use of ISO 52003-1 and does not contain any normative provisions.
7	**CEN/TC 089 Thermal performance of buildings and building components**	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)	This document contains information to support the correct understanding and use of ISO 52016-1 and ISO 52017-1. These documents give calculation methods for the assessment of: — the (sensible and latent) energy load and need for heating and cooling, based on hourly calculations; — the (sensible and latent) energy need for heating and cooling, based on monthly calculations (ISO 52016-1); — the internal temperature, based on hourly calculations; and — the design (sensible and latent) heating and cooling load, based on hourly calculations. This document does not contain any normative provisions.
8	**CEN/TC 089 Thermal performance of buildings and building components**	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)	This document refers to ISO 52018-1. ISO 52018-1 gives a succinct enumeration of possible requirements related to thermal energy balance features and to fabric features. It also provides tables for regulators to report their choices in a uniform manner. This document provides many background considerations that can help both private actors and public authorities, and all stakeholders involved, to take informed decisions. This document does not contain any normative provision.

9	**CEN/TC 089 Thermal performance of buildings and building components**	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)	This document contains information to support the correct understanding and use of ISO 10077-1, ISO 10077-2, ISO 12631, ISO 52022-1 and ISO 52022-3. This technical report does not contain any normative provision.
10	**CEN/TC 089 Thermal performance of buildings and building components**	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)	ISO 10077-2:2017 specifies a method and gives reference input data for the calculation of the thermal transmittance of frame profiles and of the linear thermal transmittance of their junction with glazing or opaque panels. The method can also be used to evaluate the thermal resistance of shutter profiles and the thermal characteristics of roller shutter boxes and similar components (e.g., blinds). ISO 10077-2:2017 also gives criteria for the validation of numerical methods used for the calculation. ISO 10077-2:2017 does not include effects of solar radiation, heat transfer caused by air leakage or three-dimensional heat transfer such as pinpoint metallic connections. Thermal bridge effects between the frame and the building structure are not included. NOTE Table 1 in the Introduction shows the relative position of ISO 10077-2:2017 within the set of EPB standards in the context of the modular structure as set out in ISO 52000-1.
11	**CEN/TC 089 Thermal performance of buildings and building components**	EN ISO 10211:2017	Thermal bridges in building construction - Heat flows and surface temperatures - Detailed calculations (ISO 10211:2017)	ISO 10211:2017 sets out the specifications for a three-dimensional and a two-dimensional geometrical model of a thermal bridge for the numerical calculation of - heat flows, in order to assess the overall heat loss from a building or part of it, and - minimum surface temperatures, in order to assess the risk of surface condensation. These specifications include the geometrical boundaries and subdivisions of the model, the thermal boundary conditions, and the thermal values and relationships to be used. ISO 10211:2017 is based upon the following assumptions: - all physical properties are independent of temperature; - there are no heat sources within the building element. ISO 10211:2017 can also be used for the derivation of linear and point thermal transmittances and of surface

				temperature factors. NOTE Table 1 in the Introduction shows the relative position of ISO 10211:2017 within the set of EPB standards in the context of the modular structure as set out in ISO 52000-1.
12	**CEN/TC 089 Thermal performance of buildings and building components**	EN ISO 12631:2017	Thermal performance of curtain walling - Calculation of thermal transmittance (ISO 12631:2017)	ISO 12631:2017 specifies a method for calculating the thermal transmittance of curtain walls consisting of glazed and/or opaque panels fitted in, or connected to, frames. The calculation includes: - different types of glazing, e.g., glass or plastic; single or multiple glazing; with or without low emissivity coating; with cavities filled with air or other gases; - frames (of any material) with or without thermal breaks; - different types of opaque panels clad with metal, glass, ceramics or any other material. Thermal bridge effects at the rebate or connection between the glazed area, the frame area and the panel area are included in the calculation. The calculation does not include: - effects of solar radiation; - heat transfer caused by air leakage; - calculation of condensation; - effect of shutters; - additional heat transfer at the corners and edges of the curtain walling; - connections to the main building structure nor through fixing lugs; - curtain wall systems with integrated heating. NOTE Table 1 in the Introduction shows the relative position of ISO 12631:2017 within the set of EPB standards in the context of the modular structure as set out in ISO 52000-1.
13	**CEN/TC 089 Thermal performance of buildings and building components**	EN ISO 13370:2017	Thermal performance of buildings - Heat transfer via the ground - Calculation methods (ISO 13370:2017)	ISO 13370:2017 provides methods of calculation of heat transfer coefficients and heat flow rates for building elements in thermal contact with the ground, including slab-on-ground floors, suspended floors and basements. It applies to building elements, or parts of them, below a horizontal plane in the bounding walls of the building situated - at the level of the inside floor surface, for slab-on-ground floors, suspended floors and unheated basements; NOTE 1 In some cases, external dimension systems define the boundary at the lower surface of the floor slab. - at the level of the external ground surface, for heated basements. ISO 13370:2017 includes calculation of the steady-state part of the heat transfer (the annual average rate of heat flow) and the part due to annual periodic variations in temperature (the seasonal variations of the heat flow rate about the annual average). These seasonal variations are obtained on a monthly basis and, except for the application to dynamic simulation

				programmes in Annex D, ISO 13370:2017 does not apply to shorter periods of time. NOTE 2 Table 1 in the Introduction shows the relative position of ISO 13370:2017 within the set of EPB standards in the context of the modular structure as set out in ISO 52000-1.
14	**CEN/TC 089 Thermal performance of buildings and building components**	EN ISO 13786:2017	Thermal performance of building components - Dynamic thermal characteristics - Calculation methods (ISO 13786:2017, Corrected version 2018-03)	This document specifies the characteristics related to the dynamic thermal behavior of a complete building component and provides methods for their calculation. It also specifies the information on building materials required for the use of the building component. Since the characteristics depend on the way materials are combined to form building components, this document is not applicable to building materials or to unfinished building components. The definitions given in this document are applicable to any building component. A simplified calculation method is provided for plane components consisting of plane layers of substantially homogeneous building materials. Annex C provides simpler methods for the estimation of the heat capacities in some limited cases. These methods are suitable for the determination of dynamic thermal properties required for the estimation of energy consumption. These approximations are not appropriate, however, for product characterization.
15	**CEN/TC 089 Thermal performance of buildings and building components**	EN ISO 15927-5:2004	Hygrothermal performance of buildings - Calculation and presentation of climatic data - Part 5: Data for design heat load for space heating (ISO 15927-5:2004)	This part of ISO 15927 specifies the definition, method of calculation and method of presentation of the climatic data to be used in determining the design heat load for space heating in buildings. These include ¿ the winter external design air temperatures; ¿ the relevant wind speed and direction, where appropriate. Heat loss through the ground, which also contributes to the heat load for buildings, depends on longer-term temperature changes; methods for calculating ground heat loss are given in ISO 13370.
16	**CEN/TC 089 Thermal performance of buildings and building components**	EN ISO 52003-1:2017	Energy performance of buildings - Indicators, requirements, ratings and certificates - Part 1: General aspects and application to the overall energy	The set of EPB assessment standards produces a great number of overall and partial EPB indicators as outputs. This document provides general insight to both private parties and public regulators (and all stakeholders involved in the regulatory process) on how to make good use of these outputs for different purposes (post-processing). This document describes the relation between the EPB indicators and the EPB requirements and EPB ratings, and it discusses the

			performance (ISO 52003-1:2017)	importance of project-specific, tailored values as requirement or reference for certain EPB indicators. This document also includes a couple of possible EPB labels and it lists the different steps to be taken when establishing an EPB certification scheme. This document provides standardized tables for reporting in a structured and transparent manner the choices that are to be made with respect to overall EPB requirements. The tables are non-restrictive, thus allowing for full regulatory flexibility. This document does not provide such tables for partial EPB requirements (related to the fabric or technical buildings systems), as this is dealt with in other documents.
17	**CEN/TC 089 Thermal performance of buildings and building components**	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)	This document specifies a calculation procedure for the conversion of climatic data for energy calculations. The main element in this document is the calculation of solar irradiance on a surface with arbitrary orientation and tilt. A simple method for conversion of solar irradiance to illuminance is also provided. The solar irradiance and illuminance on an arbitrary surface are applicable as input for energy and daylighting calculations, for building elements (such as roofs, facades and windows) and for components of technical building systems (such as thermal solar collectors, PV panels). Other parameters of climatic data needed to assess the thermal and moisture performance of buildings, building elements or technical building systems [like wind, temperature, moisture and long-wave (thermal) radiation] are to be obtained according to the procedures in ISO 15927-4. These data are listed in this document as input and passed on as output without any conversion.
18	**CEN/TC 089 Thermal performance of buildings and building components**	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	This document specifies calculation methods for the assessment of: a) the (sensible) energy need for heating and cooling, based on hourly or monthly calculations; b) the latent energy need for (de-)humidification, based on hourly or monthly calculations; c) the internal temperature, based on hourly calculations; d) the sensible heating and cooling load, based on hourly calculations; e) the moisture and latent heat load for (de-)humidification, based on hourly calculations; f) the design sensible heating or cooling load and design latent heat load using an hourly calculation interval; g) the conditions of the supply air to provide the necessary humidification

				and dehumidification. The calculation methods can be used for residential or non-residential buildings, or a part of it, referred to as "the building" or the "assessed object". This document also contains specifications for the assessment of thermal zones in the building or in the part of a building. The calculations are performed per thermal zone. In the calculations, the thermal zones can be assumed to be thermally coupled or not. The calculation methods have been developed for the calculation of the basic energy loads and needs, without interaction with specific technical building systems, and for the calculation of the system specific energy loads and needs, including the interaction with specific systems. The hourly calculation procedures can also be used as basis for calculations with more extensive system control options. This document is applicable to buildings at the design stage, to new buildings after construction and to existing buildings in the use phase.
19	**CEN/TC 089 Thermal performance of buildings and building components**	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)	This document specifies the general assumptions, boundary conditions and equations for the calculation, under transient hourly or sub hourly conditions, of the internal temperatures (air and operative) and/or the heating, cooling and humidification and dehumidification loads to hold a specific (temperature, moisture) set point, in a single building zone. No specific numerical techniques are imposed by this document. Specific calculation procedures based on the generic calculation procedures of this document are given in ISO 52016-1. The specific simplifications, assumptions and boundary conditions in ISO 52016-1 are tailored to the respective application areas, such as the energy need for heating and cooling and for humidification and dehumidification, hourly internal temperature, design heating and cooling and humidification and dehumidification load.
20	**CEN/TC 089 Thermal performance of buildings and building components**	EN ISO 52018-1:2017	Energy performance of buildings — Indicators for partial EPB requirements related to thermal energy balance and fabric features —	The set of EPB assessment standards produces a great number of overall and partial EPB indicators as outputs, which can be used for different purposes. This document deals with the use as requirement of partial EPB indicators related to the fabric and related to the thermal balance of the building. Thermal balance aspects concern both the heating and cooling needs and the free floating temperatures, especially with respect to overheating or too

			Part 1: Overview of options	cold indoor temperatures. This document can support both private parties and public regulators (and all stakeholders involved in the regulatory process) with the "post-processing" of these outputs. This document provides standardized tables for reporting, in a structured and transparent manner, the choices that are to be made with respect to the partial EPB requirements covered by this document. The tables are non-restrictive, thus allowing for full regulatory flexibility.
21	**CEN/TC 089 Thermal performance of buildings and building components**	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)	This document specifies a simplified method based on thermal, solar and light characteristics of the glazing and solar and light characteristics of the solar protection device, to estimate the total solar energy transmittance, direct energy transmittance and the light transmittance of a solar protection device combined to a glazing. This document is applicable to all types of solar protection devices parallel to the glazing, such as louvre, venetian or roller blinds. The position of the solar protection device can be interior, exterior or between single panes in a dual glazing system. It is applicable when the total solar energy transmittance of the glazing is between 0,15 and 0,85. Venetian or louvre blinds are assumed to be adjusted so that there is no direct solar penetration. It is assumed that for external solar protection devices and for integrated solar protection devices, the space between the solar protection devices and the glazing is unventilated and for internal solar protection devices this space is ventilated. The resulting g-values of the simplified method given here are approximate and their deviation from the exact values lie within the range between +0,10 and -0,02. The results generally tend to lie on the safe side for cooling load estimations. The results are not intended to be used for calculating beneficial solar gains or thermal comfort criteria. The simplified method is based on the normal incidence of radiation and does not take into account either the angular dependence of transmittance and the reflectance or the differences of spectral distribution. This should be considered when applying the method. The simplified method can also be used for inclined elements.

22	**CEN/TC 089 Thermal performance of buildings and building components**	EN ISO 6946:2017	Building components and building elements - Thermal resistance and thermal transmittance - Calculation methods (ISO 6946:2017)	This document provides the method of calculation of the thermal resistance and thermal transmittance of building components and building elements, excluding doors, windows and other glazed units, curtain walling, components which involve heat transfer to the ground, and components through which air is designed to permeate. The calculation method is based on the appropriate design thermal conductivities or design thermal resistances of the materials and products for the application concerned. The method applies to components and elements consisting of thermally homogeneous layers (which can include air layers). This document also provides an approximate method that can be used for elements containing inhomogeneous layers, including the effect of metal fasteners, by means of a correction term given in Annex F. Other cases where insulation is bridged by metal are outside the scope of this document.
23	**CEN/TC 156 Ventilation for buildings**	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	This document specifies requirements for indoor environmental parameters for thermal environment, indoor air quality, lighting and acoustics and specifies how to establish these parameters for building system design and energy performance calculations. This European Standard includes design criteria for the local thermal discomfort factors, draught, radiant temperature asymmetry, vertical air temperature differences and floor surface temperature. This European Standard is applicable where the criteria for indoor environment are set by human occupancy and where the production or process does not have a major impact on indoor environment. This European Standard also specifies occupancy schedules to be used in standard energy calculations and how different categories of criteria for the indoor environment can be used. The criteria in this European Standard can also be used in national calculation methods. This standard sets criteria for the indoor environment based on existing standards and reports listed under normative references or in the bibliography. This European Standard does not specify design methods, but gives input parameters to the design of building envelope, heating, cooling, ventilation and lighting. Table 1 shows the relative position of this standard within the set of EPB standards in the context of the modular structure as set out in EN ISO 52000-1.

24	**CEN/TC 156 Ventilation for buildings**	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)	This European Standard applies to the design, energy performance of buildings and implementation of ventilation, air conditioning and room conditioning systems for non-residential buildings subject to human occupancy, excluding applications like industrial processes. It focuses on the definitions of the various parameters that are relevant for such systems. The guidance for design given in this European Standard and accompanying CEN/TR 16798-4 are mainly applicable to mechanical supply and/or exhaust ventilation systems. Natural ventilation systems or natural parts of hybrid ventilation systems are not covered by this European Standard. Reference is made to the Technical Report for informative guidance on the design of such systems. Applications for residential ventilation are not dealt with in this European Standard. Performance of ventilation systems in residential buildings are dealt with in EN 15665 and CEN/TR 14788. The classification uses different categories. For some values, examples are given and, for requirements, typical ranges with default values are presented. The default values given in this European Standard are not normative as such, and should be used where no other values are specified. Classification should always be appropriate to the type of building and its intended use, and the basis of the classification should be explained if the examples given in the European Standard are not to be used.
25	**CEN/TC 169 Light and lighting**	CEN/TR 15193-2:2017	Energy performance of buildings - Energy requirements for lighting - Part 2: Explanation and justification of EN 15193-1, Module M9	This Technical Report will provide information to support the correct understanding, use and national implementations of EN 15193–1. It will give explanations on the procedures and background information. It will also provide justifications of the choices that have been made and give validations of the calculation procedures given in the standards.
26	**CEN/TC 169 Light and lighting**	EN 15193-1:2017	Energy performance of buildings - Energy requirements for lighting - Part 1: Specifications, Module M9	This standard specifies the methodology for evaluating the energy performance of lighting systems for providing general illumination in residential and non-residential buildings and for calculating or measuring the amount of energy required or used for lighting in buildings. The method may be applied to new, existing or refurbished buildings. It also provides a methodology (LENI) as the measure of the energy efficiency of the lighting installations in

				buildings. This standard does not cover lighting requirements, the design of lighting systems, the planning of lighting installations, the characteristics of lighting equipment (lamps, control gear and luminaires) and systems used for display lighting, desk lighting or luminaires built into furniture. This standard does not provide any procedure for the dynamic simulation of lighting scene setting. The modules represent EPB standards, although one EPB standard may cover more than one module and one module may be covered by more than one EPB standard, for instance a simplified and a detailed method respectively.
27	**CEN/TC 228 Heating systems and water based cooling systems in buildings**	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	This Technical Report refers to standard EN 12831, module M3-3 (EN 12831-1). It contains information to support the correct understanding, use and national adaptation of standard EN 12831-1.
28	**CEN/TC 228 Heating systems and water based cooling systems in buildings**	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	This technical report refers to EN 15378-1. It contains information to support the correct understanding, use and national adaptation of EN 15378-1.
29	**CEN/TC 228 Heating systems and water based cooling systems in buildings**	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	This Technical Report refers to EN 15378-3:2017, Energy performance of buildings — Heating and DHW systems in buildings — Part 3: Measured energy performance, Module M3-10, M8-10. It contains information to support the correct understanding, use and national adaptation of EN 15378-3:2017.
30	**CEN/TC 228 Heating systems and water based cooling systems in buildings**	EN 12831-1:2017	Energy performance of buildings - Method for calculation of the	This European Standard covers methods for the calculation of the design heat load for single rooms, building entities and buildings, where the design heat load is defined as the heat supply (power)

			design heat load - Part 1: Space heating load, Module M3-3	needed to maintain the required internal design temperature under design external conditions. Table 1 shows the relative position of this standard within the set of EPB standards in the context of the modular structure as set out in EN ISO 52000-1.
31	**CEN/TC 228 Heating systems and water based cooling systems in buildings**	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	This European Standard covers energy performance calculation of water-based storage sub-systems used for heating, for domestic hot water or for combination of these. This standard does not cover sizing or inspection of such storage systems. Table 1 shows the relative position of this standard within the set of EPB standards in the context of the modular structure as set out in EN ISO 52000-1. NOTE 1 In CEN ISO/TR 52000 2 the same table can be found, with, for each module, the numbers of the relevant EPB standards and accompanying technical reports that are published or in preparation. NOTE 2 The modules represent EPB standards, although one EPB standard may cover more than one module and one module may be covered by more than one EPB standard, for instance a simplified and a detailed method respectively. See also Clause 2 and Tables A.1 and B.1.
32	**CEN/TC 228 Heating systems and water based cooling systems in buildings**	EN 15378-3:2017	Energy performance of buildings - Heating and DHW systems in buildings - Part 3: Measured energy performance, Module M3-10, M8-10	This European Standard specifies methods to assess the delivered energy for space heating and domestic hot water energy performance of a building based on measurements during the operation and occupancy phase. This includes: - assessment of the amount of delivered energy carriers for space heating and domestic hot water preparation based on measurement; - assessment of the energy performance indicators of heating and domestic hot water systems and subsystems based on measurements. This standard does not cover the measurement of delivered energy for ventilation, cooling, air conditioning and lighting systems. This standard includes procedures to correct measured delivered energy according to climate and building use. Weighting (e.g., conversion into primary energy, cost, CO2 emission) of the measured delivered energy and assessment of the energy performance are covered in EN ISO 52000-1:2017.
33	**CEN/TC 228 Heating systems and water based cooling systems in buildings**	EN 15459-1:2017	Energy performance of buildings - Economic evaluation procedure	This European Standard provides a calculation method for the economic issues of heating systems and other systems that are involved in the energy demand and consumption of the building. It

			for energy systems in buildings - Part 1: Calculation procedures, Module M1-14	applies to all types of new and existing buildings. The fundamental principles and terminology are explained in the standard. The main items of the standard will be: - the definitions and the structure of the types of costs which should be taken into account for the calculation of the economic efficiency of saving options in buildings; - data needed for definition of costs related to systems under consideration; - the calculation method(s); - expression of the result of the economic study. This European Standard is part of the method for calculation of economic performance of energy saving options in buildings (e.g. insulation, better performing generators and distribution systems, efficient lighting, renewable sources, combined heat and power…). The scope of this specific part is to standardize: - the required inputs; - the required outputs; - the calculation formulas; - the type of energy systems concerned with the energy performance of the building.
34	**CEN/TC 247 Building Automation, Controls and Building Management**	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	This document contains information to support the correct understanding, use and adoption of ISO 52120-1.
35	**CEN/TC 247 Building Automation, Controls and Building Management**	CEN/TR 12098-6:2022	Controls for heating systems - Part 6: Accompanying TR prEN 12098-1:2015 - Modules M3-5,6,7,8	This Technical Report refers to prEN 12098-1:2015, Controls for heating systems — Part 1: Control equipment for hot water heating systems — Modules M3-5,6,7,8. It contains information to support the correct understanding, use and national adaption of prEN 12098 1:2015.
36	**CEN/TC 247 Building Automation, Controls and Building Management**	CEN/TR 12098-7:2022	Controls for heating systems - Part 7: Accompanying TR prEN 12098-3:2015 - Modules M3-5,6,7,8	This Technical Report refers to prEN 12098-3, Controls for heating systems - Part 3: Control equipment for electrical heating systems - Modules M3-5,6,7,8. It contains information to support the correct understanding, use and national adaption of prEN 12098-3:2015.
37	**CEN/TC 247 Building Automation, Controls and Building Management**	CEN/TR 15500-2:2016	Energy Performance of Buildings - Control for heating, ventilating and	This Technical Report refers to prEN 15500 1, Control for heating, ventilating and air-conditioning applications — Part 1: Electronic individual zone control equipment — Modules M3-5,M4-5,M5-5. It

			air-conditioning applications — Part 2: Accompanying TR prEN 15500-1:2015 - Modules M3-5,M4-5,M5-5	contains information to support the correct understanding, use and national adaption of prEN 15500 1:2016.
38	**CEN/TC 247 Building Automation, Controls and Building Management**	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	This Technical Report refers to prEN 16946 1, Inspection of Building Automation, Controls and Technical Building Management — Module M10-11. It contains information to support the correct understanding, use and national adaption of standard prEN 16946 1:2015.
39	**CEN/TC 247 Building Automation, Controls and Building Management**	EN 12098-1:2022	Energy Performance of Buildings - Controls for heating systems - Part 1: Control equipment for hot water heating systems - Modules M3-5, 6, 7, 8	This European Standard applies to electronic control equipment for heating systems with water as the heating medium and a supply water temperature up to 120 °C. This control equipment controls the distribution and/or the generation of heat in relation to the outside temperature and time and other reference variables. This standard covers also controllers that contain an integrated optimum start or an optimum start-stop control function.
40	**CEN/TC 247 Building Automation, Controls and Building Management**	EN 12098-3:2022	Energy Performance of Buildings - Controls for heating systems - Part 3: Control equipment for electrical heating systems - Modules M3-5,6,7,8	This European Standard applies to electronic control equipment for heating systems with direct electrical emission, which have an integrated outside compensated function and or optimum start/stop function. This control equipment controls the distribution and/or the generation of heat in relation to the outside temperature and time and other reference variables. This European Standard also covers controllers that contain an integrated optimum start or an optimum start-stop control function.
41	**CEN/TC 247 Building Automation, Controls and Building Management**	EN 15500-1:2017	Energy Performance of Buildings - Control for heating, ventilating and air conditioning applications - Part 1: Electronic individual zone control equipment	The purpose of this standard is to specify the applications, functionality set and application performance for electronic individual zone control equipment. The applications are for cooling and hot water or electrical heating as described in Annex B. This standard applies specifically to individual zone control equipment for maintaining temperature, humidity and air flow as a function of occupancy and demand operated with auxiliary electrical energy.

			- Modules M3-5, M4-5, M5-5	
42	**CEN/TC 247 Building Automation, Controls and Building Management**	EN 16946-1:2017	Energy Performance of Buildings - Inspection of Automation, Controls and Technical Building Management - Part 1: Module M10-11	This European Standard defines guidelines for the inspection of installed an operational Functions of Building Automation, Controls and Technical Building Management System including its configuration.
43	**CEN/TC 247 Building Automation, Controls and Building Management**	EN ISO 52120-1:2022	Energy performance of buildings - Contribution of building automation and controls and building management - Part 1: Modules M10-4,5,6,7,8,9,10	This International Standard specifies: - a structured list of control, building automation and technical building management functions which contribute to the energy performance of buildings; functions have been categorized and structured according to building disciplines and so called Building automation and control (BAC); - a method to define minimum requirements or any specification regarding the control, building automation and technical building management functions contributing to energy efficiency of a building to be implemented in building of different complexities; - a factor based method to get a first estimation of the effect of these functions on typical buildings types and use profiles; - detailed methods to assess the effect of these functions on a given building. Table 1 shows the relative position of this standard within the set of EPB standards in the context of the modular structure as set out in ISO 52000-1.
44	**CEN/TC 247 Building Automation, Controls and Building Management**	EN ISO 52127-1:2021	Energy performance of buildings - Building management system - Part 1: Module M10-12	This International Standard specifies operational activities, overall alarming, fault detection and diagnostics, reporting, monitoring, energy management functions, functional interlocks and optimizations to set and maintain energy performance of buildings. Table 1 shows the relative position of this standard within the set of EPB standards in the context of the modular structure as set out in ISO 52000-1:2017.
45	**CEN/TC 371 Energy Performance of Buildings**	CEN/TS 16628:2014	Energy Performance of Buildings - Basic Principles for the set of EPB standards	This Technical Specification describes the basic principles to be followed in the development of standards intended to support the assessment of the energy performance of buildings using a holistic approach. The main goal is to obtain a set of EPB-standards that are a systematic, clear and comprehensive package for the benefit of professionals and government entities. This Technical Specification

				gives general, qualitative guidance on the required quality, accuracy, usability and consistency of EPB-standards in order to provide a balance between: - the accuracy and level of detail, and - the simplicity and availability of input data. Hidden complexities are also taken into account, such as the impact of differences in the overall legal frameworks on the national choices and national input data. The basic principles are the basis for detailed technical rules and for a common overarching structure for the set of EPB-standards. The basic principles for EPB-standards cover the following aspects: - the standardization process, including collaborations and consultations; - the application range of the standards; - common general organization of each standard and the national implementation; - the overarching structure for the energy performance assessment; - common model(s) and editorial rules for each standard; - common quality aspects for each standard.
46	**CEN/TC 371 Energy Performance of Buildings**	CEN/TS 16629:2014	Energy Performance of Buildings - Detailed Technical Rules for the set of EPB-standards	This Technical Specification provides guidance in the form of detailed technical rules based on the basic principles, both for the overarching standard and for each standard within the set of EPB-standards. These detailed technical rules give practical rules on the following subjects for EPB-standards: - the standardization process, including collaborations and consultations; - the application range of the standards; - common general organization of each standard and the national implementation; - the overarching structure for the energy performance assessment; - common model(s) and editorial rules for each standard; - common quality aspects for each standard.
47	**CEN/TC 371 Energy Performance of Buildings**	EN 17423:2020	Energy performance of buildings - Determination and reporting of Primary Energy Factors (PEF) and CO2 emission coefficient - General Principles, Module M1-7	This document provides a transparent framework for reporting on the choices related to the procedure to determine primary energy factors (PEFs) and CO2 emission coefficients for energy delivered to and exported from the buildings as described in EN ISO 52000-1. This document specifies the choices to be made to calculate the PEF(s) and CO2 emission coefficients related to different energy carriers. PEFs and CO2 emission coefficients for exported energy can be different from those chosen for delivered energy. This document is primarily intended for supporting and complementing EN ISO 52000-1, as the latter requires values for the PEFs and CO2 emission

				coefficients to complete the EPB calculation. But it can also be used for other applications.
48	**CEN/TC 371 Energy Performance of Buildings**	EN ISO 52000-1:2017	Energy performance of buildings — Overarching EPB assessment — Part 1: General framework and procedures	This document establishes a systematic, comprehensive and modular structure for assessing the energy performance of new and existing buildings (EPB) in a holistic way. It is applicable to the assessment of overall energy use of a building, by measurement or calculation, and the calculation of energy performance in terms of primary energy or other energy-related metrics. It takes into account the specific possibilities and limitations for the different applications, such as building design, new buildings 'as built', and existing buildings in the use phase as well as renovation.
49	**CEN/TC 442 Building Information Modelling (BIM)**	CEN/TR 17439:2020	Guidance on how to implement EN ISO 19650-1 and -2 in Europe	The scope of this guidance is deliberately restricted only to refer to EN ISO 19650-1 and -2, highlighting and describing the manner in which to use it -and not extending or contradicting the scope and content of the standard The document aims simply to provide minimum supporting text to achieve a basic understanding and ability to implement EN ISO 19650-1 and -2.
50	**CEN/TC 442 Building Information Modelling (BIM)**	EN 17412-1:2020	Building Information Modelling - Level of Information Need - Part 1: Concepts and principles	This document specifies concepts and principles to establish a methodology for specifying level of information need and information deliveries in a consistent way when using building information modelling (BIM). This document specifies the characteristics of different levels used for defining the detail and extent of information required to be exchanged and delivered throughout the life cycle of built assets. It gives guidelines for principles required to specify information needs. The concepts and principles in this document can be applied for a general information exchange and whilst in progress, for a generally agreed way of information exchange between parties in a collaborative work process, as well as for an appointment with specified information delivery. The level of information need provides methods for describing information to be exchanged according to exchange information requirements. The exchange information requirements specify the wanted information exchange. The result of this process is an information delivery. This document is applicable to the whole life cycle of any built asset, including strategic planning, initial design, engineering, development, documentation and construction,

				day-to-day operation, maintenance, refurbishment, repair and end-of-life.
51	**CEN/TC 442 Building Information Modelling (BIM)**	EN 17632 -1:2022	Building information modelling (BIM) - Semantic modelling and linking (SML) - Part 1: Generic modelling patterns	This document addresses syntactic and semantic interoperability for information describing assets going through their life cycle in the built environment. It assumes the underlying technical interoperability provided already by the Internet/World Wide Web (WWW) technology-stack. The syntactic aspects relate to the Linked Data (LD)/Semantic Web (SW) formats and the SPARQL direct access method provided. The semantic aspects relate to the LD/SW-based information models in the form of thesauri and ontologies giving meaning to the information. The following information architecture (Figure 1) applies. This document specifies: - a conceptual "L1: Information language" with four RDF-based language bindings being SKOS, RDFS, OWL and SHACL, including: - a choice of 'linked data'/RDF-based formats (to be used for all modelling and language levels); and - a generic Top Level Information Model of a total "M1: Information model", here "an upper ontology", including: - a set of generic information modelling patterns for identification, annotation, enumeration datatypes, complex quality/quantity modelling, decomposition and grouping. This modelling approach for information models and information sets is relevant within the built environment from multiple perspectives such as: - Building information modelling (BIM); - Geographical information systems (GIS); - Systems engineering (SE); - Monitoring & control (M&C); and - Electronic document management (EDM). Annex E discusses in an informative way how the information models and sets relevant for these different worlds can be linked together using LD/SW technology. This document does not specify a full meta-'information model', sometimes referred to as a 'Knowledge Model (KM)'. EN ISO 12006-3 provides such an often used model for the built environment. In Annex D, Subclause D.3 it is shown how this existing model can be made compliant to this document. The only direct support for this meta level comes in the form of the possibility to define 'types' (enumeration types or concept types) and 'objectifications' as metaconcepts. This document does not specify a meta-'information language' since this is already provided by the

				concrete RDF-based language bindings (being RDFS). The scope of this document in general excludes the following: - Business process modelling; - Software implementation aspects; - Information packaging and transportation/transaction aspects already handled by ISO TC59/SC13 Information container for linked document delivery (ICDD) ([13]) respectively various information delivery manual (IDM) / information exchange requirements (EIR)-related initiatives; and - Domain-specific (here: 'built environment'-specific) content modelling in the form of concepts, attributes and relations at end-user level (the actual ontologies themselves) beyond a generic top level information model ('upper ontology') and modelling and linking patterns.
52	**CEN/TC 442 Building Information Modelling (BIM)**	EN ISO 12006-2:2020	Building construction - Organization of information about construction works - Part 2: Framework for classification	It defines a framework for the development of built environment classification systems. It identifies a set of recommended classification table titles for a range of information object classes according to particular views, e.g., by form or function, supported by definitions. It shows how the object classes classified in each table are related, as a series of systems and sub-systems, e.g., in a building information model.
53	**CEN/TC 442 Building Information Modelling (BIM)**	EN ISO 12006-3:2016	Building construction - Organization of information about construction works - Part 3: Framework for object-oriented information	It specifies a language-independent information model which can be used for the development of dictionaries used to store or provide information about construction works. It enables classification systems, information models, object models and process models to be referenced from within a common framework.
54	**CEN/TC 442 Building Information Modelling (BIM)**	EN ISO 16739-1:2020	Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries - Part 1: Data schema	The standard includes definitions that cover data required for buildings over their life cycle.
55	**CEN/TC 442 Building Information Modelling (BIM)**	EN ISO 19650-4	Organization and digitization of information about buildings and civil	ISO 19650-4 provides the detailed process and criteria for the decision points when executing an information exchange as defined by ISO 19650 so as to ensure the quality of the resulting project or asset information model. It promotes a proportional and sustainable

			engineering works, including building information modelling (BIM) - Information management using building information modelling — Part 4: Information exchange	approach to information exchange where the immediate delivery of information does not limit its future use. It details the implementation of the concepts in ISO19650-1 and is applicable to any information exchange within the delivery stages covered by ISO 19650-2 and operational events covered by ISO 19650-3. The use of appropriate quality assurance and quality control measures supports the fulfilment of a specific Exchange Information Requirement related to an individual information exchange by enumerating criteria relating to completeness, compliance to formal exchange schemas, the continuity of concepts between exchanges and the elimination of spatial and specification conflicts.
56	**CEN/TC 442 Building Information Modelling (BIM)**	EN ISO 23387:2020	Building information modelling (BIM) - Data templates for construction objects used in the life cycle of built assets - Concepts and principles	This document sets out the principles and structure for data templates for construction objects. It is developed to support digital processes using machine-readable formats using a standard data structure to exchange information about any type of construction object, e.g., product, system, assembly, space, building etc., used in the inception, brief, design, production, operation and demolition of facilities. This document provides the specification of a taxonomy model that defines concepts from ISO 12006-3:2007, i.e., objects, collections and relationships between them, to support the information need for the specific purpose of the data template.
57	**CEN/TC 442 Building Information Modelling (BIM)**	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	This document specifies the principles and requirements for security-minded information management at a stage of maturity described as "building information modelling (BIM) according to the ISO 19650 series", and as defined in ISO 19650-1, as well as the security-minded management of sensitive information that is obtained, created, processed and stored as part of, or in relation to, any other initiative, project, asset, product or service. It addresses the steps required to create and cultivate an appropriate and proportionate security mindset and culture across organizations with access to sensitive information, including the need to monitor and audit compliance. The approach outlined is applicable throughout the lifecycle of an initiative, project, asset, product or service, whether planned or existing, where sensitive information is obtained, created, processed and/or stored.

			management (ISO 19650-5:2020)	This document is intended for use by any organization involved in the use of information management and technologies in the creation, design, construction, manufacture, operation, management, modification, improvement, demolition and/or recycling of assets or products, as well as the provision of services, within the built environment. It will also be of interest and relevance to those organizations wishing to protect their commercial information, personal information and intellectual property.
58	**IEC**	IEC PT 60364-8-3	Low-voltage electrical installation - Part 8-3: Evolutions of Electrical Installations	
59	**IEC TC 120**	IEC 62933-1:2018	Electrical Energy Storage (EES) systems - Part 3-1: Planning and installation- General specifications	IEC 62933-1:2018 defines terms applicable to electrical energy storage (EES) systems including terms necessary for the definition of unit parameters, test methods, planning, installation, safety and environmental issues. This terminology document is applicable to grid-connected systems able to extract electrical energy from an electric power system, store it internally, and inject electrical power to an electric power system. The step for charging and discharging an EES system may comprise an energy conversion.
60	**IEC TC 64**	IEC 60364-7-712:2017	Low-voltage electrical installations - Part 7-712: Requirements for special installations or locations - Solar photovoltaic (PV) power supply systems.	IEC 60364-7-712:2017 RLV contains both the official IEC International Standard and its Redline version. The Redline version is available in English only and provides you with a quick and easy way to compare all the changes between the official IEC Standard and its previous edition. IEC 60364-7-712:2017 applies to the electrical installation of PV systems intended to supply all or part of an installation. The equipment of a PV installation, like any other item of equipment, is dealt with only so far as its selection and application in the installation is concerned. This new edition includes significant revisions and extensions, taking into account experience gained in the construction and operation of PV installations, and developments made in technology, since the first edition of this standard was published.

61	**IEC TC 69**	IEC 61851-1:2017 on	Electric vehicle conductive charging system - Part 1: General requirements	IEC 61851-1:2017 applies to EV supply equipment for charging electric road vehicles, with a rated supply voltage up to 1 000 V AC or up to 1 500 V DC and a rated output voltage up to 1 000 V AC or up to 1 500 V DC. Electric road vehicles (EV) cover all road vehicles, including plug-in hybrid road vehicles (PHEV), that derive all or part of their energy from on-board rechargeable energy storage systems (RESS). The aspects covered in this standard include: - the characteristics and operating conditions of the EV supply equipment; - the specification of the connection between the EV supply equipment and the EV; - the requirements for electrical safety for the EV supply equipment. This third edition cancels and replaces the second edition published in 2010. It constitutes a technical revision. This edition includes the following significant technical changes with respect to the previous edition: a) The contents of IEC 61851-1:2010 have been re-ordered. Numbering of clauses has changed as new clauses were introduced and some contents moved for easy reading. The following lines give an insight to the new ordering in addition to the main technical changes. b) All requirements from IEC 61851-22 have been moved to this standard, as work on IEC 61851-22 has ceased. c) Any requirements that concern EMC have been removed from the text and are expected to be part of the future version of 61851-21-2. d) Clause 4 contains the original text from IEC 61851-1:2010 and all general requirements from Clause 6 of IEC 61851-1:2010. e) Clause 5 has been introduced to provide classifications for EV supply equipment. f) Previous general requirements of Clause 6 have been integrated into Clause 4. Clause 6 contains all Mode descriptions and control requirements. Specific requirements for the combined use of AC and DC on the same contacts are included. g) Clause 9 is derived from previous Clause 8. Adaptation of the description of DC accessories to allow for the DC charging modes that have only recently been proposed by industry and based on the

				standards IEC 61851-23, IEC 61851-24 as well as IEC 62196-1, IEC 62196-2 and IEC 62196-3. Information and tables contained in the IEC 62196 series standards have been removed from this standard. h) Clause 10 specifically concerns the requirements for adaptors, initially in Clause 6. i) Clause 11 includes new requirements for the protection of the cable. j) Specific requirements for equipment that is not covered in the IEC 62752 remain in the present document. k) Previous Clause 11 is now treated in Clauses 12 to 13. The requirements in 61851-1 cover the EV supply equipment of both mode 2 and mode 3 types, with the exception in-cable control and protection devices for mode 2 charging of electric road vehicles (IC-CPD) which are covered by IEC 62752. l) Clause 14 gives requirements on automatic reclosing of protection equipment. m) Clause 16 gives requirements for the marking of equipment and the contents of the installation and user manual. This makes specific mention of the need to maintain coherence with the standards for the fixed installation. It also contains an important text on the markings for temperature ratings. n) Annex A has been reviewed to introduce complete sequences and tests and to make the exact cycles explicit. Annex A in this edition supersedes IEC TS 62763 (Edition 1). o) Annex B is normative and has requirements for proximity circuits with and without current coding. p) Previous Annex C has been removed and informative descriptions of pilot function and proximity function implementations initially in Annex B are moved to Annex C. q) New informative Annex D describing an alternative pilot function system has been introduced. r) Dimensional requirements for free space to be left around socket-outlets used for EV energy supply are given in the informative Annex E. s) The inclusion of protection devices within the EV supply equipment could, in some cases, contribute to the protection against

				electric shock as required by the installation. This is covered by the information required for the installation of EV supply equipment in Clause 16 (Marking).
62	**IEC TC 8/SC 8B**	IEC TS 62898-1:2017	Microgrids - Part 1: Guidelines for microgrid projects planning and specification	IEC TS 62898-1:2017(E) provides guidelines for microgrid projects planning and specification. Microgrids considered in this document are alternating current (AC) electrical systems with loads and distributed energy resources (DER) at low or medium voltage level. This document does not cover direct current (DC) microgrids. Microgrids are classified into isolated microgrids and non-isolated microgrids. Isolated microgrids have no electrical connection to a wider electric power system. Non-isolated microgrids can act as controllable units to the electric power system and can operate in the following two modes: - grid-connected mode; - island mode. This document will cover the following areas: - microgrid application, resource analysis, generation forecast, and load forecast; - DER planning and microgrid power system planning; - high level technical requirements for DER in microgrids, for microgrid connection to the distribution system, and for control, protection and communication systems; - evaluation of microgrid projects.
63	**ISO/TC 163 Thermal performance and energy use in the built environment**	ISO 12655:2013	Energy performance of buildings — Presentation of measured energy use of buildings	ISO 12655:2013 sets out a consistent methodology to present energy use in buildings, which is specified clearly with the energy usage, corresponding boundary and the energy data (presented with original energy carriers or equivalent energy). ISO 12655:2013 is applicable to the presentation of energy use of civil buildings for data collection, metering, statistics, audit and analysis.
64	**ISO/TC 163 Thermal performance and energy use in the built environment**	ISO 18292:2011	Energy performance of fenestration systems for residential buildings — Calculation procedure	ISO 18292:2011 specifies a procedure for calculation of the energy performance of fenestration systems used in residential buildings, for rating of fenestration systems, doors and skylights, including the effects of frame, sash, glazing, and shading components. ISO 18292:2011 specifies procedures for the calculation of the heating and cooling energy use in residential buildings, internal and external climatic conditions, and relevant building characteristics. These

				procedures can accommodate all climatic conditions and installation details. It is the responsibility of the appropriate regulatory authority to identify the clauses of ISO 18292:2011 to be applied in their area of jurisdiction and the climatic data and reference building specification(s) to be used
65	**ISO/TC 163 Thermal performance and energy use in the built environment**	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 18523-1:2016 specifies the formats to present schedule and condition of building, zone and space usage, which is to be referred to as input data of energy calculations for non-residential buildings. The schedule and condition include schedules of occupancy, operation of technical building systems, ventilation rate, hot water usage and internal heat gains due to occupancy, lighting and equipment. ISO 18523-1:2016 also gives categories of building, zone and space according to differentiating schedule and condition. Depending on necessary minuteness of the energy calculation, different levels of schedule and condition from the view point of time and space averaging are specified. The values and categories for the schedule and condition are given in annexes for more information for the application when the users of this document do not have detailed information on the values and categories for the schedule and condition. The schedule and condition in this document are basically different from assumptions in order to determine the size of technical building systems in the process of design, where possible largest values are to be assumed. Instead, most usual and average values, which are assumed for the building energy calculation, are dealt with in this document.
66	**ISO/TC 163 Thermal performance and energy use in the built environment**	ISO 18523-2:2018	Energy performance of buildings — Schedule and condition of building, zone and space usage for energy calculation — Part 2: Residential buildings	This document specifies the formats to present the schedule and conditions of zone and space usage (referred to as input data of energy calculations) for residential buildings. The schedule and conditions include schedules of occupancy, operation of technical building systems, ventilation rates, hot water usage, usage of appliances and internal heat gains due to occupancy, lighting and appliances. The schedule and conditions for lighting are applicable to fixed installed lighting fixtures. This document also gives categories of residential building, zone and space according to differentiating schedule and condition. For residential buildings or its housing units which contain any category

				of space or zone of non-residential buildings, ISO 18523-1 applies. Depending on necessary minuteness of the energy calculation, different levels of schedule and condition from the view point of time and space averaging are specified. The values and categories for the schedule and condition are included informatively. NOTE The schedule and condition in this document is basically different from assumptions in order to determine the size of technical building systems in the process of design, where possible largest or smallest values are assumed. Instead, most usual and average values, which are assumed for the building energy calculation, are dealt with in this document.
67	**ISO/TC 163 Thermal performance and energy use in the built environment**	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 specifies a detailed method, based on spectral data of the transmittance and reflectance of the constituent materials (solar protection devices and the glazing), to determine the total solar energy transmittance, the total light transmittance and other relevant solar-optical data of the combination. If spectral data are not available, the methodology can be adapted to use integrated data.
68	**ISO/TC 184/SC 4 Industrial data**	ISO 10303-225:1999	Industrial automation systems and integration — Product data representation and exchange — Part 225: Application protocol: Building elements using explicit shape representation	This part of ISO 10303 specifies the use of the integrated resources necessary for the scope and information requirements for the exchange of building element shape, property, and spatial configuration information between application systems with explicit shape representations. Building elements are those physical things of which a building is composed, such as structural elements, enclosing and separating elements, service elements, fixtures and equipment, and spaces. Building element shape, property, and spatial configuration information requirements can be used at all stages of the life cycle of a building, including the design process, construction, and maintenance. Building element shape, property, and spatial configuration information requirements specified in this

				part of ISO 10303 support the following activities: — concurrent design processes or building design iterations; —integration of building structure designs with building systems designs to enable design analysis; — building design visualization; — specifications for construction and maintenance; — analysis and review. The following are within the scope of this part of ISO 10303: — explicit representation of the three-dimensional shape of building elements using boundary representation (B-rep) solid models, swept solid models, or constructive solid geometry (CSG) models. — the spatial configuration of building elements that comprise the assembled building; — building structures that represent physically distinct buildings that are part of a single building complex; — non-structural elements that enclose a building or separate areas within a building; — the shape and arrangement of equipment and service elements that provide services to a building; The following are outside the scope of this part of ISO 10303: — 2D shape representation and draughting presentation; — the contents of building standards; — implicit representation of building elements through selection of standard parameters; — structural analysis of building structures, including loads, connections, and material properties required for analysis; — thermal analysis of buildings; — the assembly process, joining methods, and detailed connectivity of building elements; — building maintenance history, requirements, and instructions; — approval, revision, versioning, and design change histories; — building elements without explicit shape representation; — bills of quantities.

69	**ISO/TC 184/SC 4 Industrial data**	ISO 23247-1:2021	Automation systems and integration — Digital twin framework for manufacturing — Part 1: Overview and general principles	This document provides an overview and general principles of a digital twin framework for manufacturing including: — terms and definitions; — requirements of the digital twin framework for manufacturing.
70	**ISO/TC 184/SC 4 Industrial data**	ISO 23247-2:2021	Automation systems and integration — Digital twin framework for manufacturing — Part 2: Reference architecture	This document provides a reference architecture for the digital twin in manufacturing including; — reference model from domain and entity point of view; — functional view specifying functional entities supported by the entity-based reference model.
71	**ISO/TC 184/SC 4 Industrial data**	ISO 23247-3:2021	Automation systems and integration — Digital twin framework for manufacturing — Part 3: Digital representation of manufacturing elements	This document provides a list of basic information attributes for the OMEs: — examples of information attributes are given; — standards that can define these information attributes are discussed in Annex A.
72	**ISO/TC 184/SC 4 Industrial data**	ISO 23247-4:2021	Automation systems and integration — Digital twin framework for manufacturing — Part 4: Information exchange	This document identifies technical requirements for information exchange between entities within the reference architecture. The requirements for information exchange in the following networks are within the scope of this document: — user network that connects the user entity and the digital twin entity; — service network that connects sub-entities within the digital twin entity; — access network that connects the device communication entity to the digital twin entity and to the user entity; — proximity network that connects the device communication entity to the observable manufacturing elements.
73	**ISO/TC 184/SC 4 Industrial data**	ISO/TR 24464:2020	Automation systems and integration — Industrial data —	This document analyses visualization elements that are key components of the interface between the physical asset and the avatar (digital replica of the physical asset).

			Visualization elements of digital twins	
74	**ISO/TC 184/SC 4 Industrial data**	ISO/TS 10303-1143:2005	Industrial automation systems and integration — Product data representation and exchange — Part 1143: Application module: Building component	ISO 10303-1143:2005 specifies the application module for Building component. The following are within the scope of ISO 10303-1143:2005: - the characterization of a component of a building element.
75	**ISO/TC 184/SC 4 Industrial data**	ISO/TS 10303-1144:2005	Industrial automation systems and integration — Product data representation and exchange — Part 1144: Application module: Building item	ISO/TS 10303-1144:2005 specifies the application module Building item. The following are within the scope of ISO/TS 10303-1144:2005: - the characterization of building elements such as walls, beams and columns; - the characterization of space elements such as rooms and gangways.
76	**ISO/TC 184/SC 4 Industrial data**	ISO/TS 10303-1145:2005	Industrial automation systems and integration — Product data representation and exchange — Part 1145: Application module: Building structure	ISO/TS 10303-1145:2005 specifies the application module Building structure. The following are within the scope of ISO/TS 10303-1145:2005: - the characterization of elements which define the structure of buildings as building sections, building levels and assemblies of building elements.
77	**ISO/TC 184/SC 4 Industrial data**	ISO/TS 10303-1146:2005	Industrial automation systems and integration — Product data representation and exchange — Part 1146: Application module: Location in building	ISO/TS 10303-1146:2005 specifies the application module Location in building. The following are within the scope of ISO/TS 10303-1146:2005: - the characterization of the location of building items; - the characterization of the location of components of building items; - the characterization of the location of building sections.
78	**ISO/TC 184/SC 5 Interoperability, integration, and architectures for enterprise systems and automation applications**	ISO 15746-1:2015	Automation systems and integration — Integration of advanced process control and optimization capabilities for	This part of ISO 15746 establishes a framework and general functionality of a method for integration of advanced process control and optimization (APC-O) capabilities for manufacturing systems. The goal is to reduce the cost and risk associated with developing and implementing integrated APC-O capabilities. The scope of this part of ISO 15746 is limited to specifying the set of

			manufacturing systems — Part 1: Framework and functional model	concepts, terms, definitions and the associated rules for describing the required functional capabilities of APC-O units. The following are outside the scope of this part of ISO 15746: — definition and specification of an interface or communication protocol between APC-O capabilities; — requirement and restriction of a specific technical specification when developing and implementing APC-O systems; — strategy and method of a certain APC-O system.
79	**ISO/TC 184/SC 5 Interoperability, integration, and architectures for enterprise systems and automation applications**	ISO 15746-2:2017	Automation systems and integration — Integration of advanced process control and optimization capabilities for manufacturing systems — Part 2: Activity models and information exchange	This document defines: — activity models to describe the dynamic aspects of the APC-O modules; — information exchange requirements of the dynamic aspects of the APC-O modules; — workflows and lifecycles of APC-O elements; — service definitions to support the following information exchanges between: — Level 3 and APC-O components; — Level 2 and APC-O components; — APC-O components within one or more APC-O systems.
80	**ISO/TC 184/SC 5 Interoperability, integration, and architectures for enterprise systems and automation applications**	ISO 15746-3:2020	Automation systems and integration — Integration of advanced process control and optimization capabilities for manufacturing systems — Part 3: Verification and validation	This document defines the principle of verification and validation according to the activity models and workflow of an advanced process control and optimization (APC-O) system, analyses and defines the general process for verification and validation of APC-O systems, and specifies a set of indicators and checkpoints used for verification and validation.
81	**ISO/TC 205 Building environment design**	ISO 11855-7:2019	Building environment design — Design, dimensioning, installation and control of embedded radiant heating and cooling systems — Part 7: Input	This document specifies procedures and conditions to enable the heat flow in water-based and electrical surface heating and cooling systems to be determined relative to the medium differential temperature for systems. The determination of thermal performance of water-based surface heating and cooling systems and their conformity to this document is carried out by calculation in accordance with design documents and a model. This enables a uniform assessment and calculation of water-based surface heating

			parameters for the energy calculation	and cooling systems. The surface temperature and the temperature uniformity of the heated/cooled surface, nominal heat flow density between water or electrical heated layer and space, the associated nominal medium differential temperature, and the field of characteristic curves for the relationship between heat flow density and the determining variables are given as the result. This document is applicable to water-based embedded surface heating and cooling systems in residential, commercial and industrial buildings. This document is also applicable for electrical heated embedded systems. The methods apply to systems integrated into the wall, floor or ceiling construction without any open air gaps. It does not apply to ceiling mounted panel systems with open air gaps which are not integrated into the building structure.
82	**ISO/TC 205 Building environment design**	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 13612 is applicable to heat pumps for space heating and cooling, heat pump water heaters (HPWH), and heat pumps with combined space heating and/or cooling and domestic hot water production, in alternate or simultaneous operation, where the same heat pump is used for space heating and domestic hot water heating. ISO 13612-2:2014 provides a calculation method under steady conditions that corresponds to one calculation step. The results of this calculation are incorporated in larger building models and take into account the influence of the external conditions and building control that influence the energy requirements for heating and cooling supplied by the heat pump system. ISO 13612-2:2014 specifies the required inputs, calculation methods, and required outputs for output thermal power generation for space heating and cooling and domestic hot water production of the following heat pump systems, including control: electrically driven vapour compression cycle (VCC) heat pumps; combustion engine-driven vapour compression cycle heat pumps; thermally driven vapour absorption cycle (VAC) heat pumps; using combinations of heat source and heat distribution.
83	**ISO/TC 205 Building environment design**	ISO 13675:2013	Heating systems in buildings — Method and design for calculation of the system energy	ISO 13675:2013 is the general standard on generation by combustion sub-systems (boilers) for oil, gas, coal and biomass burning. It specifies the required inputs, calculation method, and resulting outputs for space heating generation by combustion sub-systems (boilers) including control. ISO 13675:2013 is also intended

			performance — Combustion systems (boilers)	for the case of generation for both domestic hot water production and space heating
84	**ISO/TC 205 Building environment design**	ISO 18566-6:2019	Building environment design — Design, test methods and control of hydronic radiant heating and cooling panel systems — Part 6: Input parameters for the energy calculation	This document establishes guidelines for the determination of input parameters for ceiling mounted radiant heating and cooling panels in relation to ISO 52031. The requirements specified by this document are applicable only to the components of the heating/cooling systems and the elements which are part of the heating/cooling panels and which are installed to provide heating and/or cooling. This document is applicable to water-based ceiling mounted radiant heating and cooling panels in residential, commercial and industrial buildings. The methods apply to systems mounted under the ceiling with an open air gap between the panels and the ceiling. This document also applies, as appropriate, to the use of fluids other than water as a heating or cooling medium. This document is also applicable for testing of systems. The methods do not apply to heated or chilled ceiling beams.
85	**ISO/TC 205 Building environment design**	ISO 23045:2008	Building environment design — Guidelines to assess energy efficiency of new buildings	ISO 23045:2008 gives guidelines related to energy efficiency in buildings as introduced in ISO 16813. The objectives of ISO 23045:2008 are to assist designers and practitioners when collecting and providing the useful data that are required at different stages of the design process and to fulfil the definitions of the building as prepared by building designers. This International Standard applies to new buildings and is applicable to space air-conditioning equipment and the heating plant in new buildings
86	**ISO/TC 205 Building environment design**	ISO 52031:2020	Energy performance of buildings — Method for calculation of system energy requirements and system efficiencies — Space emission systems (heating and cooling)	This document establishes the required inputs, outputs and links (structure) of the calculation method for heating and cooling space emission systems. This document is applicable to the energy performance calculation of heating systems and water-based cooling space emission sub-systems
87	**ISO/TC 211 Geographic information/Geomatics**	ISO/TS 19166:2021	Geographic information — BIM to GIS	This document defines the conceptual framework and mechanisms for mapping information elements from Building Information Modelling (BIM) to Geographic Information Systems (GIS) to access

			conceptual mapping (B2GM)	the required information based on specific user requirements. The conceptual framework for mapping BIM information to GIS is defined with the following three mapping mechanisms: — BIM to GIS Perspective Definition (B2G PD); — BIM to GIS Element Mapping (B2G EM); — BIM to GIS LOD Mapping (B2G LM). This document does not describe physical schema integration or mapping between BIM and GIS models because the physical schema integration or mapping between two heterogeneous models is very complex and can cause a variety of ambiguity problems. Developing a unified information model between BIM and GIS is a desirable goal, but it is out of the scope of this document. The scope of this document includes the following: — definition for BIM to GIS conceptual mapping requirement description; — definition of BIM to GIS conceptual mapping framework and component; — definition of mapping for export from one schema into another. The following concepts are outside the scope: — definition of any particular mapping application requirement and mechanism; — bi-directional mapping method between BIM and GIS; — definition of physical schema mapping between BIM and GIS; — definition of coordinate system mapping between BIM and GIS. NOTE For cases involving requirements related to Geo-referencing for providing the position and orientation of the BIM model based on GIS, there exist other standards such as ISO 19111 and the Information Delivery Manual (IDM) from buildingSMART on Geo-referencing BIM. — definition of relationship mapping between BIM and GIS; — implementation of the application schema.
88	**ISO/TC 59/SC 13 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM)**	ISO/TR 23262:2021	GIS (geospatial) / BIM interoperability	This document investigates barriers and proposes measures to improve interoperability between geospatial and BIM domains, namely, to align GIS standards developed by ISO/TC 211 and BIM standards developed by ISO/TC 59/SC 13. Where relevant this document takes into account work and

				documents from other organizations and committees, such as buildingSMART, International (bSI), Open Geospatial Consortium (OGC) and Comité Européen de Normalisation (CEN). The focus is to identify future topics for standardization and possible revision needs of existing standards. This document investigates conceptual and technological barriers between GIS and BIM domains at the data, service and process levels, as defined by ISO 11354 (all parts).
89	**ISO/TC 59/SC 14 Design life**	ISO 15686-4:2014	Building Construction — Service Life Planning — Part 4: Service Life Planning using Building Information Modelling	ISO 15686-4:2014 provides information and guidance on the use of standards for information exchange for service life planning of buildings and constructed assets and their components as well as the required supporting data. It provides guidance on structuring information from existing data sources to enable delivery of their information content in a structure that conforms to international standards for information exchange. In particular, reference is made to ISO 16739. The Construction Operations Building Information Exchange (COBie) standard for the exchange of facility information in tabular data are used as an alternative representation. COBie is a tabular representation of a handover view of the IFC schema. ISO 15686-4:2014 is also applicable to the exchange of service life information between categories of design and information management software applications that have standards-based information exchange interfaces including: a) Building construction Information Modelling (BIM); b) Computer Aided Facilities Management (CAFM).
90	**ISO/TC 59/SC 14 Design life**	ISO 15686-5:2017	Buildings and constructed assets — Service life planning — Part 5: Life-cycle costing	ISO 15686-5:2017 provides requirements and guidelines for performing life-cycle cost (LCC) analyses of buildings and constructed assets and their parts, whether new or existing.
91	**ISO/TC 59/SC 14 Design life**	ISO 15686-7:2017	Buildings and constructed assets — Service life planning — Part 7: Performance evaluation for feedback	ISO 15686-7:2017 provides a generic basis for performance evaluation for feedback of service life data from existing buildings and constructed assets, including a definition of the terms to be used and the description of how the (technical) performance can be described and documented to ensure consistencies. The purpose of this document is to describe the principles for service

			of service life data from practice	life performance surveys and evaluation with an emphasis on technical recommendations. It describes a generic methodology, including the terms to be used, that provides guidance on the planning, documentation and inspection phases, as well as on analysis and interpretation of performance evaluations, both on the object (single building) and network (stock of buildings) level. While maintenance planning is outside the scope of this document, maintenance-driven inspections and subsequent recommended actions could have significant effects upon service life and performance.
92	**ISO/TC 59/SC 17 Sustainability in buildings and civil engineering works**	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 21929-1:2011 establishes a core set of indicators to take into account in the use and development of sustainability indicators for assessing the sustainability performance of new or existing buildings, related to their design, construction, operation, maintenance, refurbishment and end of life. Together, the core set of indicators provides measures to express the contribution of a building(s) to sustainability and sustainable development. These indicators represent aspects of buildings that impact on areas of protection related to sustainability and sustainable development. The object of consideration in ISO 21929-1:2011 is a building or a group of buildings and the external works within the site (curtilage). ISO 21929-1:2011 follows the principles set out in ISO 15392 and, where appropriate, is intended for use in conjunction with, and following the principles set out in, ISO 26000, ISO 14040 and the family of International Standards that includes ISO 14020, ISO 14021, ISO 14024 and ISO 14025. Where deviation occurs or where more specific requirements are stated, ISO 21929-1:2011 takes precedence. ISO 21929-1:2011 adapts general sustainability principles for buildings; includes a framework for developing sustainability indicators for use in the assessment of economic, environmental and social impacts of buildings; determines the aspects for consideration when defining a core set of sustainability indicators for buildings; establishes a core set of indicators; describes how to use sustainability indicators; and gives rules for establishing a system of indicators.

				ISO 21929-1:2011 does not give guidelines for the weighting of indicators or the aggregation of assessment results.
93	**ISO/TC 59/SC 17 Sustainability in buildings and civil engineering works**	ISO 21931-1:2022	Sustainability in building construction — Framework for methods of assessment of the environmental performance of construction works — Part 1: Buildings	ISO 21931-1:2010 provides a general framework for improving the quality and comparability of methods for assessing the environmental performance of buildings and their related external works. It identifies and describes issues to be taken into account in the use and development of methods of assessment of the environmental performance for new or existing buildings in their design, construction, operation, maintenance and refurbishment, and in the deconstruction stages. The object of assessment in ISO 21931-1:2010 is the building and the external works within its site (curtilage). Under review, currently in DIS stage.
94	**ISO/TC 59/SC 17 Sustainability in buildings and civil engineering works**	ISO 22057:2022	Sustainability in buildings and civil engineering works – Data templates for the use of EPDs for construction products in BIM	Provides product data template for Environmental Product Declarations (EPD), to be used in BIM.
95	**ISO/TC 86/SC 6 Testing and rating of air-conditioners and heat pumps**	ISO 13253:2017	Ducted air-conditioners and air-to-air heat pumps — Testing and rating for performance	This document specifies performance testing, the standard conditions and the test methods for determining the capacity and efficiency ratings of air-cooled, air-conditioners and air-to-air heat pumps. This document is applicable to the following equipment: — ducted air-cooled air conditioners and ducted air to air heat pumps. This document is limited to — residential, commercial and industrial single-package, and split-system air conditioners and heat pumps, — factory-made, electrically driven and use mechanical compression, — utilizing single, multiple and variable capacity components, and — multiple split-system utilizing one or more refrigeration systems,

				one outdoor unit and one or more indoor units, controlled by a single thermostat/controller. The requirements of testing and rating contained in this document are based on the use of matched assemblies. This document is not applicable to the rating and testing of the following: a) water-source heat pumps or water-cooled air-conditioners; b) multi-split-system air-conditioners and air-to-air heat pumps (see ISO 15042 for testing of such equipment); c) mobile (windowless) units having a condenser exhaust duct; d) individual assemblies not constituting a complete refrigeration system; e) equipment using the absorption refrigeration cycle; f) non-ducted equipment (see ISO 5151 for testing of such equipment); g) ducted air conditioners and/or ducted heat pumps, rated at less than 8 kW and intended to operate at external static pressures of less than 25 Pa, controlled by a single thermostat/controller (refer to ISO 5151). This document does not cover the determination of seasonal efficiencies, which can be required in some countries because they provide a better indication of efficiency under actual operating conditions. NOTE Throughout this document, the terms “equipment” and “systems” mean “air-conditioners” and/or “heat pumps”.
96	**ISO/TC 86/SC 6 Testing and rating of air-conditioners and heat pumps**	ISO 13256-1:2021	Water-source heat pumps — Testing and rating for performance — Part 1: Water-to-air and brine-to-air heat pumps	1.1 This document establishes performance testing and rating criteria for factory-made residential, commercial and industrial, electrically-driven, mechanical- compression type, water-to-air and brine-to-air heat pumps. The requirements for testing and rating contained in this document are based on the use of matched assemblies. 1.2 Equipment designed for rating at one liquid temperature range under this document may not be suitable at all liquid temperature ranges covered in this document. 1.3 This document does not apply to the testing and rating of

				individual assemblies for separate use, nor to the testing and rating of heat pumps covered in ISO 5151, ISO 13253 or ISO 13256-2.
97	**ISO/TC 86/SC 6 Testing and rating of air-conditioners and heat pumps**	ISO 13256-2:2021	Water-source heat pumps — Testing and rating for performance — Part 2: Water-to-water and brine-to-water heat pumps	1.1 This document establishes performance testing and rating criteria for factory-made residential, commercial and industrial, electrically-driven, mechanical- compression type, water-to-water and brine-to-water heat pumps. The requirements for testing and rating contained in this document are based on the use of matched assemblies. 1.2 Equipment may be designed for rating at one or several source and load side temperature conditions described in this document. 1.3 This document does not apply to the testing and rating of individual assemblies for separate use, nor to the testing and rating of heat pumps covered in ISO 5151, ISO 13253 or ISO 13256-1.
98	**ISO/TC 86/SC 6 Testing and rating of air-conditioners and heat pumps**	ISO 15042:2017	Multiple split-system air conditioners and air-to-air heat pumps — Testing and rating for performance	This document specifies the performance testing, the standard conditions and the test methods for determining the capacity and efficiency ratings of air-cooled air conditioners and air-to-air heat pumps. This document is applicable to the following equipment: — basic multi-split systems, modular multi-split systems and modular heat recovery multi-split systems. These multi-split systems include air-to-air systems with non-ducted and/or ducted indoor units with integral fans and indoor units supplied without fans. This document is limited to: — residential, commercial and industrial split-system air conditioners and heat pumps; — factory-made, electrically driven and use mechanical compression; — single- and multiple-circuit split-systems which utilize one or more compressors with no more than two steps of control of the outdoor unit; or — split-systems with a single refrigeration circuit which utilize one or more variable-speed compressors or alternative compressor combinations for varying the capacity of the system by three or more steps. These split-systems are designed to operate with a combination of

				one or more outdoor units and two or more indoor units designed for individual operation, and such modular systems are capable of transferring recovered heat from one or more indoor units to other units in the same system. The requirements of testing and rating contained in this document are based on the use of matched assemblies. This document is not applicable to the rating and testing of the following: a) water-cooled or water source equipment; b) mobile (single-duct) units having a condenser exhaust duct; c) individual assemblies not constituting a complete refrigeration system; d) equipment using the absorption refrigeration cycle. e) ducted air conditioners and/or ducted heat pumps, rated at less than 8 kW and intended to operate at external static pressures of less than 25 Pa, controlled by a single thermostat/controller (refer to ISO 5151); f) multiple split-system utilizing one or more refrigeration systems, one outdoor unit and one or more indoor units, controlled by a single thermostat/controller (refer to ISO 5151 or ISO 13253). This document does not cover the determination of seasonal efficiencies or seasonal part-load performances, which can be required in some countries because they provide a better indication of efficiency under actual operating conditions. NOTE Throughout this document, the terms “equipment” and “systems” mean “multi-split air conditioners” and/or “multi-split heat pumps”.
99	**ISO/TC 86/SC 6 Testing and rating of air-conditioners and heat pumps**	ISO 16358-1:2013	Air-cooled air conditioners and air-to-air heat pumps — Testing and calculating methods for seasonal performance factors — Part 1: Cooling seasonal performance factor	1.1 This part of ISO 16358 specifies the testing and calculating methods for seasonal performance factor of equipment covered by ISO 5151, ISO 13253 and ISO 15042. 1.2 This part of ISO 16358 also specifies the seasonal performance test conditions and the corresponding test procedures for determining the seasonal performance factor of equipment, as specified in 1.1, under mandatory test conditions and is intended for use only in marking, comparison, and certification purposes.

				For the purposes of this part of ISO 16358, the rating conditions are those specified under T1 in the reference standards in 1.1. The procedures in this part of ISO 16358 may be used for other temperature conditions. 1.3 This part of ISO 16358 does not apply to the testing and rating of: a) water-source heat pumps or water-cooled air conditioners; b) portable units having a condenser exhaust duct; c) individual assemblies not constituting a complete refrigeration system; or d) equipment using the absorption refrigeration cycle.
100	**ISO/TC 86/SC 6 Testing and rating of air-conditioners and heat pumps**	ISO 16358-1:2013 COR 1:2013	Air-cooled air conditioners and air-to-air heat pumps — Testing and calculating methods for seasonal performance factors — Part 1: Cooling seasonal performance factor — Technical Corrigendum 1	Technical Corrigendum
101	**ISO/TC 86/SC 6 Testing and rating of air-conditioners and heat pumps**	ISO 16358-2:2013	Air-cooled air conditioners and air-to-air heat pumps — Testing and calculating methods for seasonal performance factors — Part 2: Heating seasonal performance factor	1.1 This part of ISO 16358 specifies the testing and calculating methods for seasonal performance factor of equipment covered by ISO 5151, ISO 13253 and ISO 15042. For the purposes of this part of ISO 16358, it is assumed that any make-up heating will be provided by electric heaters running concurrently with the heat pump. 1.2 This part of ISO 16358 also specifies the seasonal performance test conditions and the corresponding test procedures for determining the seasonal performance factor of equipment, as specified in 1.1, under mandatory test conditions and is intended for use only in marking, comparison, and certification purposes. 1.3 This part of ISO 16358 does not apply to the testing and rating of: a) water-source heat pumps or water-cooled air conditioners; b) portable units having a condenser exhaust duct;

				c) individual assemblies not constituting a complete refrigeration system; or d) equipment using the absorption refrigeration cycle.
102	**ISO/TC 86/SC 6 Testing and rating of air-conditioners and heat pumps**	ISO 16358-3:2013	Air-cooled air conditioners and air-to-air heat pumps — Testing and calculating methods for seasonal performance factors — Part 3: Annual performance factor	1.1 This part of ISO 16358 specifies the testing and calculating methods for seasonal performance factor of equipment covered by ISO 5151, ISO 13253 and ISO 15042. 1.2 This part of ISO 16358 also specifies the seasonal performance test conditions and the corresponding test procedures for determining the seasonal performance factor of equipment, as specified in 1.1., under mandatory test conditions and is intended for use only in marking, comparison, and certification purposes. 1.3 This part of ISO 16358 does not apply to the testing and rating of: a) water-source heat pumps or water-cooled air conditioners; b) portable units having a condenser exhaust duct; c) individual assemblies not constituting a complete refrigeration system; or d) equipment using the absorption refrigeration cycle.
103	**ISO/TC 86/SC 6 Testing and rating of air-conditioners and heat pumps**	ISO 16494-1:2022	Heat recovery ventilators and energy recovery ventilators — Method of test for performance — Part 1: Development of metrics for evaluation of energy related performance	This International Standard prescribes a method of testing the ventilation and energy related performance of heat recovery ventilators (HRVs)and energy recovery ventilators (ERVs) that do not contain any supplemental heating (except for defrost), cooling, humidification or dehumidification components.
104	**ISO/TC 86/SC 6 Testing and rating of air-conditioners and heat pumps**	ISO 18326:2018	Non-ducted portable air-cooled air conditioners and air-to-air heat pumps having a single exhaust duct — Testing and rating for performance	This document specifies the standard conditions for capacity and efficiency ratings of non-ducted portable air-cooled air conditioners having a single exhaust duct and non-ducted portable air-cooled heat pumps having a single exhaust duct. Such air conditioners and heat pumps may include an evaporatively cooled condenser cooled by air and the evaporation of: a) condensate collected from the evaporator; b) external supplementary water stored in a supplementary water tank; or c) both a) and b).

				This document also specifies the test methods for determining the capacity and efficiency ratings. This document applies to equipment that is factory-made, electrically driven and uses mechanical compression. This document is applicable to equipment utilizing one or more refrigeration systems. This document is not applicable to the rating and testing of the following: i) Water-source heat pumps or water-cooled air conditioners; ii) Multi-split-system air conditioners and air-to-air heat pumps (see ISO 15042:2017 for the testing of such equipment); iii) Individual assemblies not constituting a complete refrigeration system; iv) Equipment using the absorption refrigeration cycle; v) Ducted equipment (see ISO 13253:2017 for the testing of such equipment); vi) Evaporative coolers or any other cooling systems that are not of the vapour compression type; vii) Dehumidifiers; viii) Spot coolers.
105	**ISO/TC 86/SC 6 Testing and rating of air-conditioners and heat pumps**	ISO 19967-1:2019	Heat pump water heaters — Testing and rating for performance — Part 1: Heat pump water heater for hot water supply	This document specifies test conditions and test procedures for determining the performance characteristics of air source heat pump water heaters for hot water supply with electrically driven compressors with or without supplementary electric heater and connected to or including only one hot water storage tank. Hot water storage tanks that are connected in series or parallel and behave hydronically as one single tank are considered as one hot water storage tank. In the case of heat pump water heaters consisting of several parts with refrigerant or water connections, this document applies only to those designed and supplied as a complete package. NOTE This document is not applicable to testing procedures for simultaneous operation for hot water supply and space heating. "Simultaneous" means that hot water supply and space heating generation occur at the same time and may interact.

106	**ISO/TC 86/SC 6 Testing and rating of air-conditioners and heat pumps**	ISO 19967-2:2019	Heat pump water heaters — Testing and rating for performance — Part 2: Heat pump water heaters for space heating	This document specifies test conditions and test procedures for determining the performance characteristics of air source heat pump water heaters for space heating with electrically driven compressors with or without supplementary heater. The purpose of this document is to rate the performance of the heat pump water heaters for space heating with no operation of any supplementary heater. In the case of heat pump water heaters for space heating consisting of several parts with refrigerant or water connections, this document applies only to those designed and supplied as a complete package. NOTE Testing procedures for simultaneous operation for hot water supply and space heating are not treated in this document. Simultaneous means that hot water supply and space heating generation occur at the same time and can interact.
107	**ISO/TC 86/SC 6 Testing and rating of air-conditioners and heat pumps**	ISO 21978:2021	Heat pump water heater — Testing and rating at part load conditions and calculation of seasonal coefficient of performance for space heating	The document specifies test conditions for determining the seasonal performance characteristics of air source heat pump water heaters for space heating with electrically driven compressors with or without supplementary heater. The purpose of this document is to rate performance of the heat pump water heaters for space heating with no operation of any supplementary heater. In the case of heat pump water heaters for space heating consisting of several parts with refrigerant or water connections, this document applies only to those designed and supplied as a complete package. The seasonal coefficient of performance depends, inter alia, on the climate conditions and temperature regime of the space heating distribution network. This document defines: — three design conditions, each of them being characterized by a design temperature which represents the lowest temperature that can occur in that design condition; — three water temperature distribution regimes, namely "temperature application" in the text. The user of this document is free to determine the seasonal coefficient of performance for one or more of the defined design conditions and for one or more of the defined temperature applications. This document also provides a full description of three heating seasons that can be used with the associated design conditions

108	**ISO/TC 86/SC 6 Testing and rating of air-conditioners and heat pumps**	ISO 5151:2017	Non-ducted air conditioners and heat pumps — Testing and rating for performance	This document specifies performance testing, the standard conditions and the test methods for determining the capacity and efficiency ratings of air-cooled air conditioners and air-to-air heat pumps. This document is applicable to the following equipment: — non-ducted air-cooled air conditioners and non-ducted air-to-air heat pumps; or — ducted air conditioners and/or ducted heat pumps rated at less than 8 kW and intended to operate at an external static pressure of less than 25 Pa. This document is limited to: — residential, commercial and industrial single-package and split-system air conditioners and heat pumps; — factory-made, electrically driven and use mechanical compression; — utilizing single, multiple and variable capacity components; — multiple split-system utilizing one or more refrigeration systems, one outdoor unit and one or more indoor units, controlled by a single thermostat/controller. The requirements of testing and rating contained in this document are based on the use of matched assemblies. This document is not applicable to the rating and testing of the following: a) water-source heat pumps or water cooled air conditioners; b) multi-split-system air conditioners and air-to-air heat pumps (follow ISO 15042 for the testing of such equipment); c) mobile (windowless) units having a condenser exhaust duct; d) individual assemblies not constituting a complete refrigeration system; e) equipment using the absorption refrigeration cycle; f) ducted equipment except for those specified in this clause (follow ISO 13253 for the testing of such equipment). This document does not cover the determination of seasonal efficiencies, which can be required in some countries because they provide a better indication of efficiency under actual operating conditions.

				NOTE Throughout this document, the terms “equipment” and “systems” mean “air conditioners” and/or “heat pumps”.

2References

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