EUB SuperHub

European Building Sustainability performance and energy certification Hub

D2.4 – The digital logbook, definition of data requirements, sources, and collection process

This project has received funding from the European Union's H2020 research and innovation programme under Grant Agreement No. 101033916.

Project no. 101033916

Project acronym: EUB SuperHub

Project title: European Building Sustainability performance and energy certification Hub

Call: H2020-LC-SC3-B4E-4-2020

Start date of project: 01.06.2021.

Duration: 36 months

Deliverable title: D2.4 – The digital logbook, definition of data requirements, sources, and collection process

Due date of deliverable: January 2023

Organisation name of lead contractor for this deliverable: Energy Institute Hrvoje Požar (*PARTNER NUMBER 10*)

Name of author(s)	Organization
Peter Gyuris	*Geonardo Environmental Technologies - GEO, Hungary*
Ahmed Khoja	*Munich University of Applied Sciences (Hochschule für angewandte Wissenschaften München) - HM, Germany*
Elena Bazzan ***Paola Borgaro*** ***Andrea Moro***	*International Initiative for a Sustainable Built Environment Research & Development - iiSBE, Italy*
Sabine Erber ***Johanna Müller***	*Energy Institute Voralberg (Energieinstitut Vorarlberg) - EIV, Austria*
Bese Pál	*FeliCITY-Tools Engineering Ltd., Hungary*
Lilia Galai Dol	*Scientific and Technical Center for Building (Centre Scientifique et Technique du Bâtiment) - CSTB, France*
Breffní Lennon	*University College Cork - UCC, Ireland*
Marina Malinovec Puček	*Energy Institute Hrvoje Požar (Energetski institut Hrvoje Požar) - EIHP, Croatia*

Dissemination level		
PU	Public	PU

History			
Version	Date	Reason	Revised by
01	20/01/2023	Draft for review	*EIHP*
02	14/02/2023	Draft reviewed	*iiSBE, FeliC*
03	14/02/2023	Final version after review	*EIHP*
04	17/02/2023	Review and submission	*GEO*

Table of contents

Table of figures

List of tables

Project partners involved

Partner number	Acronym	Partner name	Country	Country code
1	**GEO**	Geonardo Environmental Technologies	Hungary	HU
2	**HM**	Hochschule für angewandte Wissenschaften München	Germany	DE
3	**iiSBE**	International Initiative for a Sustainable Built Environment	Italy	IT
4	**UNI**	UNI Ente Italiano di Normazione	Italy	IT
5	**EIV**	Energieinstitut Vorarlberg	Austria	AT
6	**FeliCity**	FeliCITY-Tools Engineering Ltd.	Hungary	HU
7	**CaR**	Calabria Regione	Italy	IT
8	**CSTB**	Centre Scientifique et Technique du Bâtiment	France	FR
9	**UCC**	University College Cork	Ireland	IE
10	**EIHP**	Energetski institut Hrvoje Požar	Croatia	HR

Abbreviations

AHU	air-handling unit
ALDREN	ALliance for Deep RENovation in buildings
APE	Attestato di Prestazione Energetica (Italian EPC)
API	Application Programming Interface
APN	Agencija za pravni promet i posredovanje nekretninama (The Croatian Government Real Estate Agency)
AQUA+	Portuguese Water Performance Classification Database
ARERA	Autorità di regolazione per Energia, Reti e Ambiente (Regulatory Authority for Energy, Networks and Environment – Italy)
BACS	Building Automation and Control System
BER	Building Energy Rating Certificate (Ireland)
BIM	Building Information Modelling
BIS	Building Information System
BOS	Building Operation System
BREEAM	Building Research Establishment Environmental Assessment Method
BRM	Building Renovation Passport
CDD	Cooling Degree Days
CENED	Certificazione ENergetica degli EDifici (Energy Certification for Buildings – Lombardy Region in Italy)
CHP	Combined Heat and Power
CIT	Catasto Impianti Termici (Cadastre of Thermal Installations – Italy)
CMR VOCs	Carcinogenic, Mutagenic, Reprotoxic Volatile Organic Compounds
CPR	Construction Product Regulation
CSV	Comma-Separated Values
CTI	Comitato Termotecnico Italiano (Italian Thermo-technical Committee – Italy)
D	Deliverable
D	discontinued
DBL	Digital Building Logbook

DEC	Display Energy Certificate (Ireland)
DGNB	Deutsche Gessellschaft für Nachhaltiges Bauen (German Sustainable Building Council - Germany)
DHW	Domestic Hot Water
DPO	Data Protection Officer
EA	Energieausweis (Austrian EPC)
EADB	Energieausweisdatenbank (Energy Performance Certificate Database in Austria)
EAWZ	EnergieAusWeis-Zentrale (Energy certificate centre in Vorarlberg - Austria)
EC	European Commission
EE	Energy Efficiency
EED	Energy Efficiency Directive
EMIS	Energy Management Information System (Croatia)
EN	European Norm
ENEA	Italian National Agency for New Technologies, Energy and Sustainable Economic Development
EP	Energy Performance
EPB services	Energy performance of buildings services
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Certificate
EPD	Environmental Product Declaration
EPREL	European Product Registry for Energy Labelling
ESUCO	European SUstainable COnstruction
EU	Europe
EUB SuperHub	European Building Sustainability performance and energy certification Hub
EV	Electrical Vehicle
EVCS	European Voluntary Certification Scheme
GBC	Green Building Council
GDPR	General Data Protection Regulation
GEG	Gebäudeenergiegesetz (Building Energy act – Germany)
GHG	Greenhouse Gases
GIS	Geographic Information System
GSE	Gestore Servizi Energetici (Energy Services Manager – Italy)
GTIN	Global Trade Item Number
GWP	Global Warming Potential
HDD	Heating Degree Days
HIP	Home Information Pack (United Kingdom)
HTC	Ηλεκτρονικής Ταυτότητας Κτιρίου (Electronic Building Identity in Greece)
HVAC	Heating, Ventilation, and Air Conditioning
IAQ	Indoor Air Quality
iBRoad	Individual Building Renovation Roadmaps
ICT	Information and Communication Technology
ID	IDentification
IEC	Informacijski sustav energetskih certifikata (national EPC database in Croatia)
IP	in place
ISPRA	istituto Superiore per la Protezione e la Ricerca Ambientale (Higher institute for the protection and environmental research – Italy)

ISPU	Informacijski Sustav Prostornog Uređenja (Physical Planning Information System – Croatia)
JRC	Joint Research Centre
KPI	Key Performance Indicator
LCA	Life Cycle Assessment
LCC	Life Cycle Cost
LEED	Leadership in Energy and Environmental Design
LNG	Liquified Natural Gas
LPG	Liquefied Petroleum Gas
MS	Mass Spectrometric detector
MS FID	Mass Spectrometric detector with an additional Flame Ionisation Detector
nZEB	nearly-Zero Energy Building
OA	Outside Air
OiB	Österreichisches Institut für Bautechnik (Austrian Institute of Construction Engineering)
OMI	Cadastre of Thermal Installations (Real estate Market observatory)
P2E	Passport Efficacité Energétique (Building Renovation Passport in France)
PERT	Total Renewable Primary Energy
PENRT	Total non-Renewable Primary Energy
PTNB	Plan de Transition Numérique du Bâtiment (Building Digital Transition Plan - France)
PV	Photovoltaic
PVT	Planning and Verification Tool
QDF	Qualitätsgemeinschaft Deutscher Fertigbau (Quality Association of German Prefabricated Buildings)
R2S	Ready to Services French label delivered by Certivea
R&I	Research and Innovation
SBA	Smart Building Alliance in France
SCE	Sistema de Certificação Energética dos Edifícios (Portuguese EPC Registry Database)
SIAPE	Sistema Informativo sugli Attestati di Prestazione Energetica (Information System on Energy Performance Certificates – Italy)
SIPEE	Sistema Informativo per la Prestazione Energetica degli Edifici (Building Energy Performance Information System – Piedmont Region in Italy)
SRI	Smart Readiness Indicator
SVOC	Semi-Volatile Organic Compounds
T	Tested
TERNA	Rete Elettrica Nazionale (National Electricity Network – Italy)
TBM	Technical Building Management
TBS	Technical Building System
TES	Thermal Energy Storage
UD	under development
UK	United Kingdom
UNDP	United Nations Development Programme
VM	Virtual Marketplace
VOC	Volatile Organic Compounds
VVOC	Very Volatile Organic Compounds
WP	Work Package

WUKSEA	Wiener Unabhängiges Kontrollsystem für Energieausweise
XML	eXtensible Markup Language
X-tendo	eXTENDing the energy performance assessment and certification schemes via a mOdular approach
yr	year
ZEUS	Zentrale Energieausweis Umgebung Steiermark (central energy certificate environment Styria)

Symbols

Symbol	Quantity	Unit
A	area	m^2
CO_2	CO_2 emission	kg CO_2 eq./(m^2yr)
E	energy	kWh
EP	energy price with VAT included	€/kWh
f	primary energy factor, CO_2 emission factor	–
N	number of items (integer only)	–
OEC	operational energy costs	€/(m^2yr)
PENRT	total use of non-renewable primary energy resources used as raw materials (also called embodied non-renewable primary energy)	MJ
RER	renewable energy ratio	–
SRI	smart readiness indicator	%

Subscripts

calc	calculated
CO_2	CO_2 emission
cr	energy carrier
del	delivered
meas	measured
nrby	nearby
nren	non-renewable
onst	on site
P	primary energy
Ptot	total primary energy
Pnren	non-renewable primary energy
Pren	renewable primary energy
ren	renewable
RER	renewable energy ratio
use	useful (floor area)

Executive summary

In the era of developed digitalisation, it is obvious that digitalisation in the construction sector is still lagging behind other sectors.

Although there are already many different databases in EU countries, which are focussing mostly on one topic area, there is no database in place that contains all relevant building data within entire building life cycle.

Thanks to the European directive on the energy performance of buildings (EPBD directive) in most EU countries a national database for energy performance of buildings is set up. The latest proposal of EPBD directive published in December 2021 goes a step forward requiring that database should allow data to be gathered not only related to energy performance certificates (EPCs) and regular inspections of heating and cooling, but also to the building renovation passport, the smart readiness indicator and the calculated or metered energy consumption.

A digital building logbook is becoming a necessity in the era of digitalisation containing all relevant building-related data over all life cycles of a building, providing different types of stakeholders with different information for different purposes at the right time.

Introduction

The concept of a Digital Building logbook (DBL) was first introduced with the European strategy 'Renovation wave' published by the European Commission on October 14th, 2020. The Renovation Wave strategy proposed the introduction of digital building logbooks that will integrate all building related data provided by the upcoming Building Renovation Passports, Smart Readiness Indicators, Level(s) and EPCs to ensure compatibility and integration of data throughout the renovation journey. It is stated within this strategy that "*digital building logbooks will serve as repositories for data on individual buildings and facilitate information sharing within the construction sector, and between building owners and tenants, financial institutions and public authorities*".

In December 2021, the European Commission proposed the 3rd revision of the Energy Performance of Buildings Directive (EPBD) to upgrade the existing regulatory framework. The newest proposal gives the following definition of a digital building logbook:

'digital building logbook' means a common repository for all relevant building data, including data related to energy performance such as energy performance certificates, renovation passports and smart readiness indicators, which facilitates informed decision making and information sharing within the construction sector, among building owners and occupants, financial institutions and public authorities

Article 19 (Databases for energy performance of buildings) of the 3rd EPBD revision states that, Member States shall ensure that the national database for energy performance of buildings is interoperable and integrated with other administrative databases containing information on buildings, such as the national building cadastre and digital building logbooks.

A database is interoperable if it can exchange, interpret, and present shared data in a way that is understood by other databases. This aspect of databases interoperability is crucial since the DBL should be seen as a common gateway linked to existing databases, i.e., as a piece of networking that should be able to connect the existing heterogeneous databases on buildings, allowing the visualization of all the information available in the different sources through a single application.

Why are digital building logbooks becoming a necessity nowadays?

There are so many building information databases already in place in each project partner country referring to building stock (e.g., EPC database, Property price register or Real estate information system). When working on Task 1.4 (*Impact of energy efficiency improvements and certifications on the value of buildings*) it was concluded that there is no interconnection between all those databases containing valuable data. For example, existing databases containing transaction values of sold properties and rent prices of rented properties do not contain EPC labels of building being sold or rented or any other data related to building energy efficiency. In project partner countries it was not possible to quantify the increase or decrease of property value linked to energy efficiency (e.g., EPC label). Also, in some countries, there are no unified database at the national level, but rather individual ones for

each region or federal state (e.g., regional coverage for EPC in Austria and Italy, federal state coverage for property price register in Germany).

One of tasks within second work package (WP2 EUB SuperHub Framework development) named *Task 2.4 The digital logbook: data requirements, sources and collection process* is referred to digital building logbook.

The following seven EUB SuperHub partner countries are involved in this task: Austria, Croatia, France, Germany, Hungary, Ireland, and Italy.

Within this task the following topics will be analysed:

1. Elaboration of the digital building logbook (DBL) data structure,
2. Identification of all input parameters for each KPI (Key Performance Indicator) defined within Task 2.2 (*Task 2.2 Definition of common transnational indicators and assessment metrics for the E-passport*),
3. Data extraction for each KPI,
4. Elaboration of mechanisms for the integration of data originating from national databases,
5. Interaction between the gathered data values and the digital building logbook,
6. Interaction of the digital building logbook with the PVT (Planning and Verification Tool) and VM (Virtual Market place) module.

This Task 2.4 interconnects with most of the other tasks in WP2 (Figure 1).

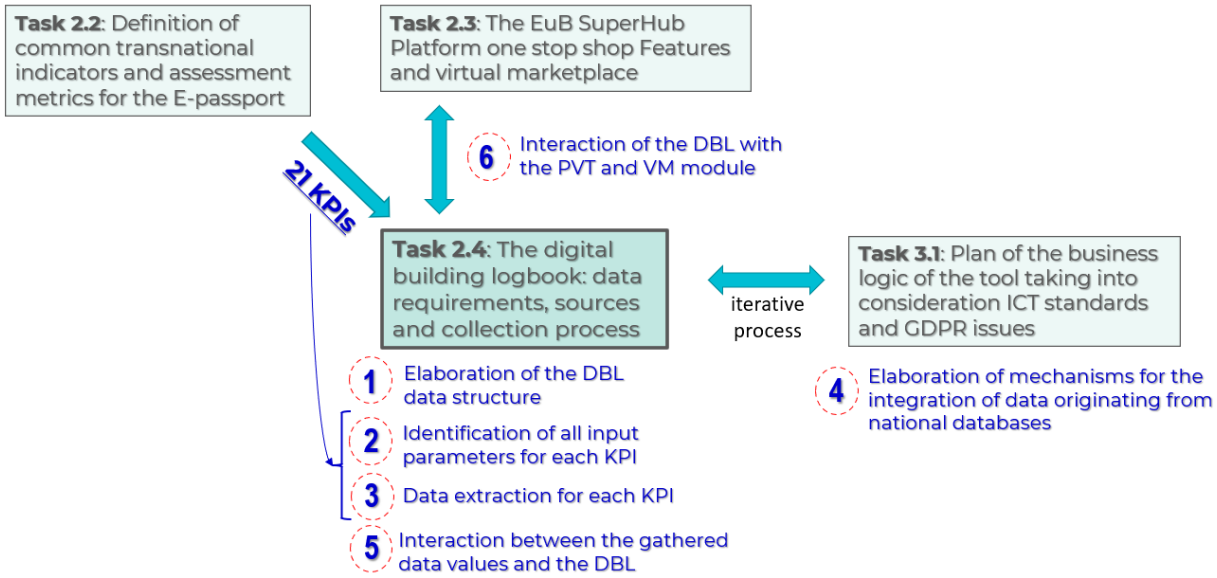


Figure 1: Interconnections of Task 2.4 with other tasks

Within Task 2.2 the most helpful 21 KPIs to calculations and building assessments are found. One of the subtasks of Task 2.4 is to identify all input parameters for each KPI (Key Performance Indicator) defined within Task 2.2 (*Task 2.2 Definition of common transnational indicators and assessment metrics for the E-passport*), and to explore the possible sources for each KPI within each project partner country.

The EUB SuperHub digital building logbook needs to support the EUB SuperHub E-passport with the main aim to boost the establishment of the transparency, reliability, comparable good quality of certifications across the EU.

The digital EUB SuperHub passport is collection of certifications that represent the building performance in the following three main domains:

- **EPC,**
- **sustainability,**
- **smartness.**

The EUB SuperHub digital building logbook needs to act as the digital container in which all input data calculating the passport rating in the domains mentioned above (EPC, sustainability, smartness) are documented.

An increasing amount of building data must be available so that many stakeholders can observe the buildings through their entire lifecycle.

The **first chapter** (*1. Literature review on building logbooks and initiatives across Europe*) gives the brief overview of already existing logbooks and initiatives in Europe and a more detailed description of building logbooks and initiatives in EUB SuperHub partner countries (Croatia, France, Germany, Italy). This literature review identified also several European projects dealing with digital building logbooks (e.g., iBRoad, ALDREN, X-tendo). Three reports published by the European Commission in the year 2020 in the frame of a study on the "EU-wide Framework for a Digital Building Logbook (DBL)" were of utmost importance for this deliverable providing valuable inputs. The main goal of this chapter was to analyse existing building logbooks and initiatives and detect the main findings when defining and implementing a new digital building logbook.

Based on the key findings from the conducted literature review in the first chapter, the **second chapter** (*2. Elaboration of the digital building logbook data structure*) elaborates the EUB Superhub digital building logbook data structure and provides a detail description of each of in total eight modules of the elaborated EUB SuperHub digital building logbook data structure.

The **third chapter** (*3. Key performance indicators – identification of input parameters and data extraction*) is devoted to 21 KPIs, selected within Task 2.2 (*Definition of common transnational indicators and assessment metrics for the E-passport*), identification of all input parameters for each KPI, and data extraction for each KPI in all project partner countries involved in this project. This chapter also elaborates mechanisms for the integration of data originating from national databases, as well as the interaction between the gathered data values and the DBL.

Brief description of interaction of digital building logbook with the PVT and VM module is given within **fourth chapter** (*4. Interaction of the digital building logbook with the PVT and VM module*).

Chapter 5 summarizes the main findings.

1 Literature review on building logbooks and initiatives across Europe

This chapter gives a brief overview of building logbooks and initiatives across Europe at different maturity levels (UD - under development, IP - in place, D - discontinued) and a more detailed description of building logbooks in EUB SuperHub partner countries involved in this task (Croatia, France, Germany, and Italy).

The Croatian Energy Management Information System is a web application primarily used for monitoring and analysing energy and water consumption in public buildings.

The national authorities in France have launched a testing phase of different logbook concepts organised in the framework of PTNB – Plan de Transition Numérique du Bâtiment (Building Digital Transition Plan).

There are several digital building logbooks in place in Germany, such as Eigenheim Manager, Gëbaudepass, Hausakte, and QDF Hausakte mostly intended for individual houses. ImmoPass was a quality assurance system providing prospective real estate buyers with information about the sustainability and energy performance of the building launched in 2001 by HypoVereinsbank. However, ImmoPass is currently discounted in Germany for unknown reasons.

A building logbook named "Fascicolo del Fabbricato" from Italy is not mandatory. It contains all the information related to the usability status of a building, its security, stability, plant engineering, and eventually, its maintenance plan.

This literature review identified several European projects dealing with digital building logbooks (e.g., iBRoad, ALDREN, X-tendo).

The following three reports published by the European Commission in the year 2020 in the frame of a study on the "**EU-wide Framework for a Digital Building Logbook (DBL)**" are of utmost importance for this deliverable providing valuable inputs:

- DEFINITION OF THE DIGITAL BUILDING LOGBOOK – **Report 1** of the Study on the development of a European Union Framework for Buildings' Digital Logbook, July 2020,
- BUILDING LOGBOOK STATE OF PLAY – **Report 2** of the Study on the development of a European Union Framework for Buildings' Digital Logbook, July 2020,
- Study on the Development of a European Union Framework for Digital Building Logbooks **FINAL REPORT**, December 2020.

At the end of this chapter the main findings from analysed building logbooks and initiatives across Europe, from identified EU projects dealing with digital building logbooks and those three reports published by the European Commission in 2020 are summarized, providing a base for developing a digital building logbook within the EUB SuperHub project.

NOTE: This literature review focuses only on Europe.

1.1 Brief overview of building logbooks and initiatives across Europe

Table 1 provides list of in total 38 building logbooks and initiatives across Europe at different maturity levels (UD - under development, IP - in place, D - discontinued). This table certainly does not contain all building logbooks and initiatives across Europe.

Some of the logbooks and initiatives were taken from *Report 2 of the Study on the development of a European Union Framework for Buildings' Digital Logbook* published by the European Commission in July 2020. The list is extended with some new logbooks and initiatives discovered when working on this task (e.g., E-construction platform in Estonia, Energiamonitor in Estonia, Energy Management Information System in Croatia, CasA+ in Portugal).

For each building logbook / initiative the following data are visible:

- DBL name,
- Name of organisation /ministry/company responsible,
- Initiative type – mandatory of voluntary,
- Initiative type – paper or digital,
- Initiative type – public or private,
- Type of buildings covered,
- Maturity level (UD- under development, IP-in place, D-discontinued).

NOTE: A brief description of each logbook and initiative listed in Table 1 is not given. See chapter 1.2 for a more detailed description of building logbooks in EUB SuperHub partner countries involved in this task (Croatia, France, Germany, and Italy).

The following two building logbooks already discontinued (D) are also on the list:

- ImmoPass from Germany, and
- Home Information Pack (HIP) from the UK.

It is important to know the reason for being discontinued to avoid the same problems when developing and implementing a new digital building logbook. ImmoPass is discounted in Germany for unknown reasons.

Home Information Pack (HIP) from UK was launched in 2007 and was mandatory for anyone selling a home. The HIP pack was set of documents that included local authority searches, title documents, guarantees and Energy performance certificates (EPC). Real estate agents complained describing HIP as expensive and unnecessary which has increased the cost and hassle of selling homes and was stifling a fragile housing market. After three year of use HIP was also discontinued in May 2010. The only remainder from HIP legislation nowadays in the UK is the EPC (Energy Performance Certificate), and sellers do have to arrange one of these prior to marketing their home for sale, showing how energy efficient a property is.

A common objective of all developed and implemented DBL-type initiatives is to increase data availability and transparency to a broad range of market players because the construction sector is underdeveloped in terms of overall digitalisation and data applications. Building related data are scarce, of unreliable quality and limited accessibility.

All listed logbooks and initiatives in Table 1 differ in terms of:

- **focus or area covering** (e.g., Energy Management Information System in Croatia and Energiamonitor in Estonia are primarily intended to be used for energy monitoring, Madaster in the Netherlands records all materials and products that are incorporated in a real estate, Wohningpas in Flanders (Belgium) features information on energy performance, renovation advice, the housing quality, and data on the environment),
- **types of buildings covering** (e.g., Woningpas in Belgium covers only individual houses and multi apartment buildings, whereas Eigenheim Manager in Germany, Madaster in the Netherlands, Basta Logbook in Sweden, Produktkolen in Sweden cover all types of buildings),
- **initiative type** (voluntary/mandatory, paper/digital, private, public),
- **maturity level** (UD-under development, IP-in place, D-discontinued).

Following the table more detailed overview is given only for some building logbooks/initiatives.

Chapter 1.2 gives more detailed overview of building logbooks in EUB SuperHub partner countries (Croatia, France, Germany, and Italy) involved in this project.

Table 1: Overview of building logbooks and initiatives across Europe

	Country/ region	DBL name	Name of organisation/ ministry/ company responsible	Initiative: -mandatory -voluntary	Initiative: -paper -digital	Initiative: -public -private	Type of buildings	Maturity level: UD - under development, IP - in place, D - discontinued
1	BELGIUM/ Flanders	**Woningpas**	Flemish Energy Agency, Flemish Government	mandatory	digital		Individual houses and multi-apartment buildings	IP
2	BELGIUM	**Dossier d'intervention ultérieure**	Belgian Federal Government	mandatory	paper		Individual houses and multi-apartment buildings	IP
3	CROATIA	**Informacijski Sustav za Gospodarenje Energijom (ISGE)**[1]	Croatian Government Real Estate Agency (Agencija za pravni promet i posredovanje nekretninama)	mandatory	digital	public	public buildings	IP
4	DENMARK	**Bedrebolig**	Danish Energy Agency	voluntary	paper		Individual houses and multi-apartment buildings	IP
5	ESTONIA	**E-construction platform**	Ministry of Economic Affairs and Communications			public		
6	ESTONIA	**Energiamonitor**	Tartu Regional Energy Agency (Tartu Regiooni Energiaagentuur)		digital			UD
7	FINLAND	**Building passport GBC**	Green Building Council (GBC) Finland					UD
8	FINLAND	**Ilmastoviisaat Taloyhtiöt**	GBC Finland in partnership with private companies					UD
9	FINLAND	**Real estate service manual**	Government/Ministry of Environment	mandatory	paper		All types of buildings	IP
10	FRANCE	**CLEA**	QUALLITEL	Voluntary between 2016 and 2018- Mandatory Since 2023	digital	Public and Private since 2018	–	IP
11	FRANCE	**Mon carnet logement**	DIGILOGEMENT	Voluntary end since 2013 mandatory	digital	Public and Private since 2018	Individual houses and multi-apartment buildings	UD

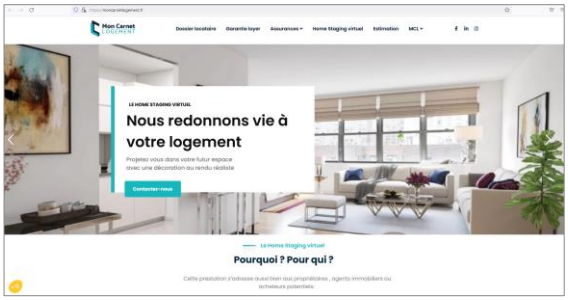
[1] Energy Mangement Information System

	Country/ region	DBL name	Name of organisation/ ministry/ company responsible	Initiative: -mandatory -voluntary	Initiative: -paper -digital	Initiative: -public -private	Type of buildings	Maturity level: UD - under development, IP - in place, D - discontinued
12	FRANCE	**Passeport Efficacité Énergétique (P2E)**	EDF	Voluntary between 2016 and 2018- Mandatory Since 2023	digital	Public and Private since 2018	Individual houses and multi-apartment buildings	IP
13	FRANCE	**PTNB - Plan de Transition Numérique du Bâtiment: Le carnet numérique du logement (digital homebook/ housing logbook)**	Housing ministry	Managed a call of voluntary testor	digital	Public and Private since 2018	Individual houses and multi-apartment buildings	UD
14	FRANCE	**Wiki Habitat**	Novabuilt	Voluntary between 2016 and 2018- Mandatory Since 2023	digital	Public and Private since 2018	Individual houses and multi-apartment buildings	IP
15	GERMANY	**Eigenheim Manager**	Leipziger Eigenheim Manager GmbH	voluntary	digital	private	All types of buildings	IP
16	GERMANY	**Gëbaudepass**	Bundesminister für Verkehr, Bau- und Wohnungswesen	voluntary	digital		Individual houses	IP
17	GERMANY	**Hausakte**	Bundesminister für Verkehr, Bau- und Wohnungswesen	voluntary	digital		Individual houses	IP
18	GERMANY	**ImmoPass**	HypoVereinsbank and Dekra	–	–	private	–	**D**
19	GERMANY	**QDF Hausakte**	Bundesverband Deutscher Fertigbau e.V.	mandatory	paper	–	Individual houses	IP
20	GREECE	**Electronic building identity (HTC)**	Greek Government	mandatory	digital	–	All types of buildings	IP
21	ICELAND	**Property Register**	Registers Iceland	mandatory	digital	–	all types of buildings	IP
22	ITALY	**Fascicolo del Fabbricato**	Regional Government based on national requirement	voluntary	paper		All types of buildings	IP

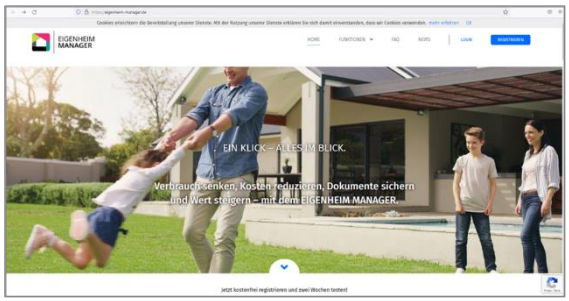
	Country/ region	DBL name	Name of organisation/ ministry/ company responsible	Initiative: -mandatory -voluntary	Initiative: -paper -digital	Initiative: -public -private	Type of buildings	Maturity level: UD - under development, IP - in place, D - discontinued
23	NETHERLANDS	**Madaster**	Madaster Foundation	voluntary	digital	–	All types of buildings	IP
24	NETHERLANDS	**Opleverdossier (Dutch Building File)**	Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (Ministry of Internal Affairs)	voluntary	paper	–	Individual houses and multi-apartment buildings	IP
25	NETHERLANDS	**Platform CB'23 (Circular Construction 2023)**	–	–	digital	–		UD
26	PORTUGAL	**Livro de obra**	Ministry of Environment, Territorial Planning and Regional Development, and Ministry of Public Works, Transportation and Communication	mandatory	paper	–	Individual houses, multi-apartment buildings, office buildings and industrial buildings	IP
27	PORTUGAL	**CasA+**	–	–	–	–	–	–
28	SPAIN	**Libro del Edificio**	Regional Government based on national requirement	mandatory	paper		Individual houses and multi-apartment buildings	IP
29	SPAIN	**PAS-E**	Cíclica, Green Building Council España		digital			UD
30	SWEDEN	**BASTA Loggbok**	BASTA non-profit company	voluntary	digital	private	all types of buildings	IP
31	SWEDEN	**Klimatdekleration**						UD
32	SWEDEN	**MinVilla**	Villaagarnas Riksforbund	voluntary	digital	private	Individual houses	IP
33	SWEDEN	**Produktkolen**	ProduktKollen AB	voluntary	digital		all types of buildings	IP
34	SWITZERLAND	**Federal Register of Buildings and Dwellings**	Federal Statistical Office (FSO)	mandatory	digital		all types of buildings	IP
35	UK	**CIBSE TM31**	Chartered Institution of Building Services Engineers	mandatory	paper		Office buildings, public buildings and industrial buildings	IP
36	UK	**Home Information Pack (HIP)**	–	–	–	–	–	**D**

	Country/ region	DBL name	Name of organisation/ ministry/ company responsible	Initiative: -mandatory -voluntary	Initiative: -paper -digital	Initiative: -public -private	Type of buildings	Maturity level: UD - under development, IP - in place, D - discontinued
37	UK / Scotland	**Home report**	Scottish Government	mandatory	paper	–	individual houses	IP
38	UK	**Spaciable**	–	voluntary	digital	–	–	IP

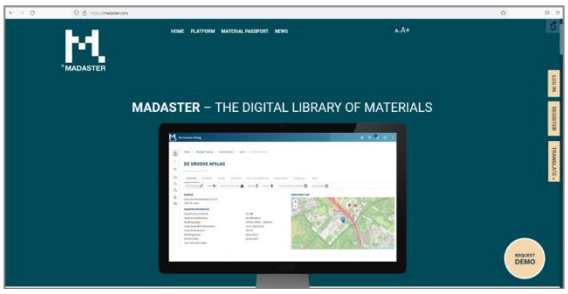
Belgium (Flanders) – Woningpas
https://woningpas.vlaanderen.be/



France - Mon carnet logement
https://moncarnetlogement.fr/

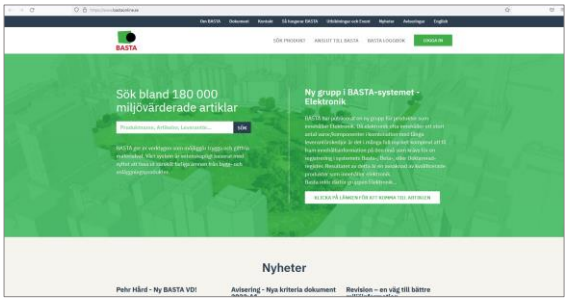


Germany – Eigenheim Manager
https://eigenheim-manager.de/



Netherlands – Madaster
https://madaster.com/

Spain – PAS-E
http://pas-e.es/#/



Sweden – BASTA Loggbok
https://www.bastaonline.se/

Sweden – MinVilla
https://minvilla.villaagarna.se/

Sweden – Produktkolen
https://www.produktkollen.se/

Figure 2: Home pages of fully digitised building logbooks across Europe

Among the listed building logbooks and initiatives there are the following two initiatives primarily used for monitoring and analysing energy and water consumption in buildings:

- Croatia → Informacijski Sustav za Gospodarenje Energijom (Energy Management Information System) (see 1.2.1),
- Estonia → Energiamonitor developed by the Tartu Regional Energy Agency.

Croatia – Energy Management Information System
https://www.isge.hr/login.xhtml

Estonia – Energiamonitor
http://emonitor.trea.ee/login

Figure 3: Two initiatives for monitoring and analysing energy and water consumption in buildings

1.1.1 Estonia - E-construction platform

Within the Announcement Webinar - Expert community on Digital Building Logbooks held online on June 15th, 2022, Mr Jaan Saar, Head of Digital Construction from the Estonia Ministry of Economic Affairs and Communication presented the Estonia E-construction platform. Estonia has been using a kind of building logbook called building registry since 2016. It is used to manage all different kinds of building permits. Mr Saar explained the basic setup of an information system, where one has the database layer at the bottom followed by services provided by the system and the user interfaces. The building registry itself is a logbook of built environment data, but it also manages the process of building permits and approvals. However, there is a movement beyond this narrow scope towards a more holistic approach.

Estonia is developing and has already launched the E-construction platform. In addition, to the building registry services, a lot of new services have been added. For example, they added a database on utility network services, BIM-based building permits, automated BIM checks and a national digital twin.

The main goal of this platform is to enable a lossless exchange of standardised and trustworthy data between all stakeholders throughout the building life-cycle. The Estonian government sees this platform as an enabler for connecting data and services, which in the end it will be used to make better-informed decisions. BIM is an important part of this as it is becoming the default in construction.

1.1.2 Estonia - Energiamonitor

Energiamonitor is a benchmarking tool primarily designed for energy monitoring, analyses, and reduction. It includes the following five application modules:

1. monitoring dashboard (energy data in energy units and in euros),
2. energy labelling (building's calculated energy label),
3. energy performance (testing of different energy saving measures),
4. benchmarking (buildings comparison) and
5. sharing.

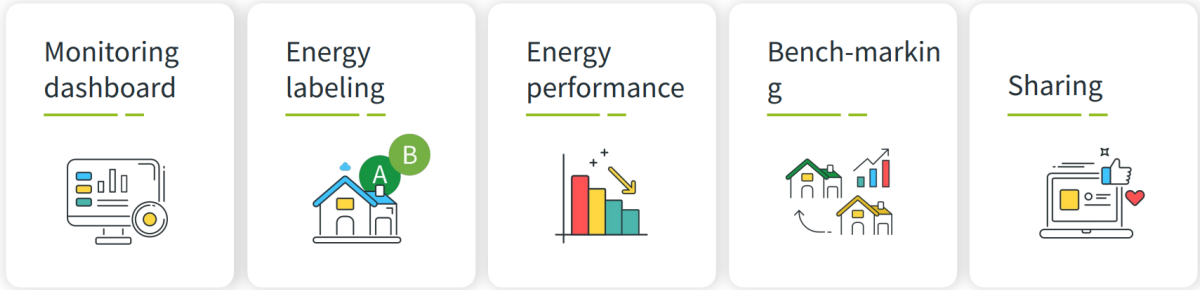


Figure 4: Five application modules of the Energiamonitor

1.1.3 The Netherlands – Madaster

Starting in 2017 the EU-funded the MADASTER SERVICES BV company to lunch the Madaster platform and material passport. **Madaster is the online registry for materials and products.** The aim of the Madaster platform is to promote the transition to a circular economy in the construction industry. Madaster, has developed a disruptive platform that identifies, tracks, and reuses otherwise wasted building materials and can be seen as the first serious step toward the creation of material passport.

Today Madaster is offering the Madaster platform and the material passport service in which the material passport is generated automatically for registered buildings and construction objects out of the building BIM file. Moreover, the Madaster passport use data sources from products and materials to create life cycle assessment or CO_2 data as well as a financial data about the value of materials and provide information about toxicity of the used materials. This link provides an example of the Madaster building material passport and the rating system https://madaster.com/wp-content/uploads/2020/12/Material-Passport-The-Arc-EN.pdf

The Madaster platform register and document all the materials, products and elements used in construction objects. The data is securely stored, intelligently linked, and managed with other databases regarding its CO_2, life cycle values and life cycle cost. The platform thus offers owners and managers of real estate or infrastructure the possibility of always having up-to-date information on the financial and circular value, toxicity and reuse potential of the materials, products and elements used in their real estate. The platform generates a material passport for a building or a portfolio. The property owner is the data owner and can grant internal and external parties access to this data and insights at any time. Access to third-party applications and services, such as Evaluators, accountants, reusable materials marketplaces, and property managers is optional. For property owners, Madaster is offered on a subscription basis. Project developers and consultants get access to the platform via an enterprise license and can create material passports for their customers. The Madaster company is operational in Belgium, Germany, the Netherlands, Norway, and Switzerland.

1.1.4 Portugal – casA+

Some information about the Portuguese portal casA+ are taken from the following document: X-TENDO (2021). *Exploring methodologies and concepts for the implementation of new energy performance certificates features for better data handling logbook*, June 2021 .

https://x-tendo.eu/wp-content/uploads/2020/01/D4.4-Logbook.pdf

Fully digitised Portuguese portal casA+ (https://portalcasamais.pt/) is a one stop shop whose foundation lies on the digital building logbook. This portal facilitates:

- the access of the homeowner to building related information while encouraging energy efficiency home improvements,
- communication between the homeowner, the building expert and companies/service suppliers.

The target audience of Portal casA+ are homeowners and tenants, building experts and energy/water efficiency companies.

Figure 5: Home page of the Portuguese Portal casA+

The portal casA+ is based on the digital building logbook. The required data are uploaded into the portal in three different ways:

1. by the homeowner (when either a building does not have an EPC or required data are not available in the EPC),
2. by the Portuguese EPC Registry Database – SCE (Sistema de Certificação Energética dos Edifícios),
3. by the Portuguese Water Performance Classification Database – AQUA+.

The digital building logbook stores EPC and AQUA+ data, making also available a historic overview of data from expired EPCs or retrofitted building components. The most of data come from the EPC Registry Database.

The building logbook, where all building related data are stored, comprises the following eight categories:

1. BUILDING IDENTIFICATION (EPC code, INSPIRE ID, etc.)
2. BUILDING CHARACTERISATION
3. BUILDING ENVELOPE
4. LIGHTING&APPLIANCES (light bulbs, washing machine, fridge, etc.)

5. TECHNICAL SYSTEMS (heating, cooling, domestic hot water, etc.)
6. ENERGY BALANCE INDICATORS
7. IMPROVEMENT MEASURES
8. ENERGY/WATER CONSUMPTION

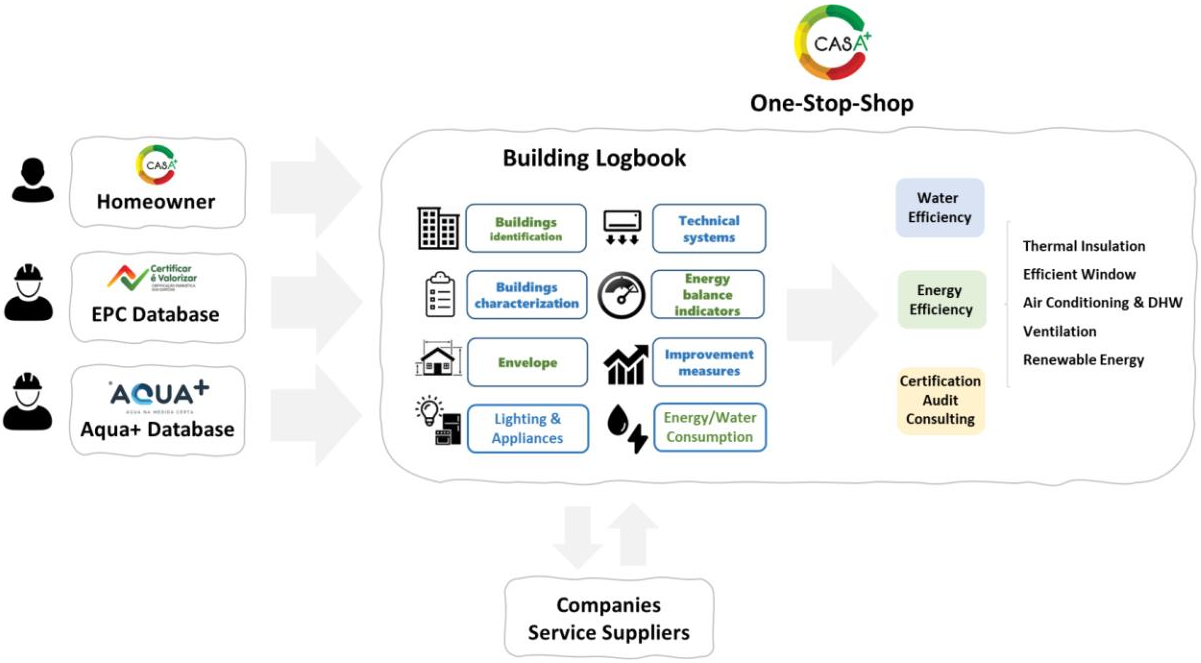


Figure 6: Portuguese building logbook integrated in Portal casA+

According to the source "*Building experts have an important role in the portal, as they are responsible for informing homeowners about the improvement measures recommended in the EPC and AQUA+ or even advise about the advantages of producing a new EPC/AQUA+. Energy and Water efficiency companies will be able to access parts of the logbook data (as for example Envelope or Technical systems) and to propose commercial offers on the execution of the improvement works.*".

1.2 More detailed overview of building logbooks in EUB SuperHub partner countries

The following seven project partner countries are involved in this task: Austria, Croatia, France, Germany, Hungary, Ireland, and Italy.

There are no building logbooks and initiatives registered in Austria and Hungary.

In Croatia there is a national Energy Management Information System in place used for monitoring and analysing energy and water consumption in public buildings.

There are several building logbooks and initiatives either in place or under development in France. Digital building logbook will be mandatory in France from January 2023.

There are four digital building logbooks and initiatives in place in Germany (Eigenheim Manager, Gëbaudepass, Hausakte, and QDF Hausakte), mostly intended for individual houses. ImmoPass is discounted for unknown reasons.

In Italy, there is a voluntary technical document named “Fascicolo del Fabbricato”, which contains all the information related to the usability status of a building, its security, stability, plant engineering and eventually, its maintenance plan.

Table 2: Overview of building logbooks and initiatives across project partner countries involved in this task

Partner countries	DBL name	Name of organisation / ministry / company responsible	Maturity level: UD - under development, IP - in place, D - discontinued
Croatia	Energy Management Information System	Croatian Government Real Estate Agency	IP
France	CLEA	QUALLITEL	IP
	Mon carnet logement	DIGILOGEMENT	UD
	Passeport Efficacité Énergétique (P2E)	EDF	IP
	PTNB - Plan de Transition Numérique du Bâtiment	Housing ministry	UD
	Wiki Habitat	Novabuilt	IP
Germany	Eigenheim Manager	Leipziger Eigenheim Manager GmbH	IP
	Gëbaudepass	Bundesminister für Verkehr, Bau- und Wohnungswesen (BMBBW)	IP
	Hausakte	Bundesminister für Verkehr, Bau- und Wohnungswesen (BMBBW)	IP
	ImmoPass	HypoVereinsbank and Dekra	D
	QDF Hausakte	Bundesverband Deutscher Fertigbau e.V.	IP
Italy	Fascicolo del Fabbricato	Regional Government based on national requirement	IP

1.2.1 Croatia – Energy Management Information System

The public buildings in Croatia have a significant carbon footprint. To reduce energy and water consumption in public buildings, a fully digitised national **Energy Management Information System – EMIS** (Informacijski Sustav za Gospodarenje Energijom – ISGE) for public buildings in Croatia has been developed and donated by UNDP (United Nations Development Programme).

The Croatian Government Real Estate Agency (Agencija za pravni promet i posredovanje nekretninama – APN, https://apn.hr/) is responsible for the administration, development, and use of the Croatian Energy Management Information system.

Figure 7: Home page of the Croatian Energy Management Information System

EMIS is a web application for monitoring and analysing energy and water consumption in public buildings. EMIS provides a transparent overview and control of energy consumption, making itself an inevitable tool for systematic energy management in the public sector.

Login to EMIS is possible from any computer device with internet access (desktop computers, laptops, handheld computers and smartphones) by typing a unique username and password on the system page https://isge.hr/login.xhtml

Data contained in EMIS are used for many energy performance calculations, analysis and continuous oversight and control of energy usage. This enables easier understanding of how and where energy and water are consumed in a particular building, the comparison of individual buildings with other similar buildings, as well as identifying unwanted, excessive, and irrational energy and water usage. EMIS greatly simplifies the process of sustainable energy management in public buildings because it allows easy access to data on energy and water consumption, enables easy graphical and tabular display and print of the data.

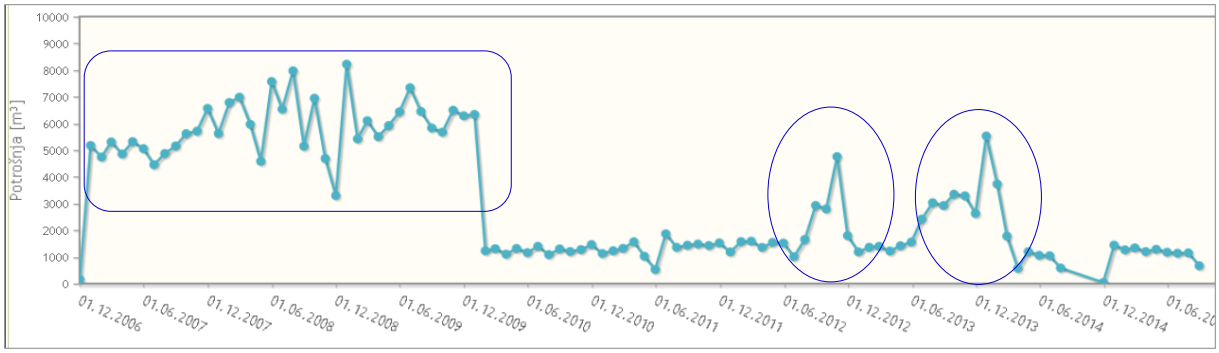


Figure 8: Increased water consumption due to cracked water pipes in the water distribution system outside a public building detected by EMIS

Readings Voda (27964) $

All meters | Readings | Metering point details | Readings upload | Remote reading log | Grid month overview of hourly consumption | Monthly consumption

Refresh Year 2018 Month 1 Display next months 1 Voda [m³]

Metering point: (27964) $ Year:2018 Month:1 Counters:1 Voda [m³]

Hour / Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
0	1.0	1.0	2.0	2.0	2.0	1.0	1.0	1.0	3.0	2.0	2.0	1.0	2.0	3.0	1.0	1.0	2.0	2.0	1.0	1.0	2.0	0.0	0.0	1.0	0.0	1.0	1.0	2.0	1.0	2.0	1.0	
1	1.0	0.0	0.0	2.0	1.0	0.0	0.0	0.0	1.0	1.0	2.0	1.0	1.0	0.0	1.0	0.0	0.0	1.0	1.0	0.0	1.0	1.0	1.0	0.0	1.0	2.0	1.0	1.0	0.0	2.0	0.0	
2	2.0	0.0	1.0	0.0	1.0	0.0	1.0	4.0	1.0	1.0	2.0	0.0	2.0	1.0	3.0	1.0	1.0	0.0	2.0	0.0	1.0	3.0	0.0	1.0	1.0	0.0	0.0	1.0	3.0	2.0	1.0	
3	0.0	1.0	1.0	1.0	1.0	0.0	0.0	1.0	0.0	1.0	3.0	1.0	2.0	1.0	3.0	0.0	1.0	1.0	1.0	0.0	1.0	1.0	0.0	0.0	3.0	1.0	1.0	2.0	0.0	3.0	1.0	
4	1.0	1.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	2.0	2.0	1.0	1.0	2.0	1.0	1.0	1.0	2.0	1.0	0.0	0.0	1.0	1.0	2.0	1.0	1.0	0.0	1.0	0.0	1.0	
5	1.0	0.0	1.0	2.0	1.0	1.0	1.0	2.0	1.0	2.0	3.0	1.0	2.0	1.0	2.0	2.0	1.0	2.0	1.0	2.0	1.0	1.0	0.0	1.0	2.0	1.0	1.0	1.0	2.0	2.0	2.0	
6	1.0	3.0	3.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0	5.0	3.0	2.0	4.0	4.0	4.0	4.0	4.0	3.0	2.0	3.0	3.0	3.0	4.0	4.0	3.0	2.0	3.0	3.0	3.0		
7	2.0	3.0	5.0	5.0	3.0	3.0	3.0	4.0	4.0	6.0	5.0	4.0	3.0	2.0	4.0	4.0	5.0	5.0	4.0	4.0	2.0	4.0	4.0	4.0	4.0	3.0	4.0	2.0	4.0	5.0	4.0	
8	3.0	3.0	5.0	5.0	3.0	3.0	3.0	4.0	5.0	6.0	4.0	4.0	4.0	4.0	4.0	5.0	4.0	4.0	3.0	3.0	3.0	4.0	5.0	4.0	5.0	5.0	4.0	3.0	3.0	3.0	4.0	
9	4.0	4.0	4.0	4.0	4.0	2.0	2.0	5.0	5.0	5.0	3.0	4.0	3.0	2.0	5.0	5.0	4.0	5.0	4.0	3.0	4.0	3.0	4.0	4.0	5.0	6.0	5.0	2.0	5.0	4.0	4.0	
10	3.0	4.0	4.0	4.0	4.0	4.0	3.0	5.0	4.0	5.0	5.0	6.0	3.0	3.0	5.0	6.0	5.0	5.0	4.0	4.0	3.0	4.0	4.0	5.0	5.0	5.0	5.0	3.0	5.0	5.0	4.0	
11	3.0	4.0	3.0	4.0	5.0	2.0	2.0	5.0	5.0	5.0	4.0	5.0	3.0	2.0	5.0	4.0	5.0	3.0	4.0	6.0	3.0	4.0	5.0	3.0	3.0	4.0	2.0	2.0	4.0	3.0	4.0	
12	3.0	2.0	3.0	4.0	4.0	2.0	1.0	5.0	3.0	4.0	3.0	4.0	2.0	3.0	4.0	5.0	4.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.0	2.0	5.0	2.0	4.0	
13	4.0	3.0	4.0	4.0	4.0	2.0	2.0	6.0	4.0	5.0	4.0	4.0	4.0	2.0	5.0	3.0	4.0	4.0	4.0	3.0	3.0	3.0	3.0	4.0	5.0	5.0	3.0	2.0	5.0	4.0	5.0	
14	3.0	4.0	4.0	3.0	4.0	4.0	2.0	5.0	3.0	5.0	5.0	5.0	4.0	2.0	5.0	6.0	5.0	5.0	5.0	3.0	3.0	4.0	5.0	5.0	4.0	3.0	3.0	2.0	5.0	5.0	4.0	
15	4.0	5.0	4.0	4.0	3.0	4.0	2.0	5.0	5.0	5.0	6.0	5.0	4.0	2.0	4.0	6.0	4.0	4.0	5.0	5.0	2.0	5.0	5.0	5.0	4.0	5.0	4.0	3.0	5.0	4.0	4.0	
16	4.0	3.0	3.0	3.0	4.0	2.0	2.0	4.0	3.0	4.0	4.0	5.0	4.0	3.0	5.0	3.0	2.0	3.0	3.0	3.0	2.0	5.0	4.0	4.0	3.0	3.0	2.0	3.0	4.0	4.0	4.0	
17	3.0	4.0	2.0	2.0	3.0	3.0	1.0	4.0	4.0	4.0	5.0	3.0	4.0	2.0	3.0	4.0	4.0	4.0	3.0	3.0	3.0	4.0	4.0	4.0	3.0	3.0	3.0	3.0	4.0	2.0		
18	2.0	2.0	4.0	2.0	2.0	3.0	2.0	2.0	3.0	2.0	3.0	4.0	4.0	2.0	3.0	3.0	3.0	3.0	2.0	2.0	2.0	3.0	3.0	3.0	2.0	3.0	4.0	2.0	4.0	3.0	3.0	
19	2.0	3.0	3.0	2.0	2.0	3.0	1.0	3.0	2.0	2.0	2.0	3.0	3.0	3.0	3.0	5.0	4.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	4.0	2.0	2.0	2.0	3.0	4.0	
20	1.0	2.0	3.0	3.0	3.0	1.0	2.0	3.0	2.0	3.0	3.0	3.0	2.0	2.0	4.0	3.0	3.0	3.0	3.0	2.0	2.0	3.0	3.0	2.0	3.0	3.0	4.0	2.0				
21	1.0	1.0	2.0	3.0	0.0	2.0	2.0	1.0	1.0	2.0	4.0	3.0	1.0	1.0	2.0	3.0	3.0	2.0	2.0	1.0	1.0	1.0	1.0	2.0	2.0	2.0	1.0	2.0	3.0	2.0		
22	1.0	2.0	2.0	1.0	2.0	1.0	2.0	2.0	2.0	1.0	3.0	2.0	2.0	1.0	1.0	3.0	2.0	2.0	2.0	2.0	0.0	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	1.0	2.0	
23	1.0	0.0	1.0	1.0	1.0	2.0	0.0	2.0	1.0	2.0	1.0	2.0	1.0	1.0	2.0	1.0	1.0	2.0	3.0	2.0	1.0	1.0	1.0	2.0	1.0	3.0	3.0	1.0	2.0	1.0	1.0	
All Users	51.0	55.0	64.0	67.0	61.0	49.0	38.0	76.0	65.0	76.0	81.0	77.0	65.0	46.0	78.0	79.0	72.0	70.0	69.0	61.0	49.0	63.0	65.0	67.0	69.0	72.0	61.0	47.0	73.0	72.0	66.0	2004.0

Figure 9: Meter readings graph of water consumption by hour within EMIS

Očitanja Loživo ulje ekstra lako (Plamenik 1)

Sva mjerna mjesta | Očitanja | Tablični mjesečni pregled satne potrošnje

Refresh Year 2022 Month 2 Display next months 1 Ekstra lako loživo ulje [l]

Metering point: (Plamenik 1) Year:2022 Month:2 Counters:1 Ekstra lako loživo ulje [l]

Hour / Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
0	24.0	25.0	24.0	21.0	17.0	23.0	21.0	24.0	22.0	23.0	31.83	31.83	24.0	20.0	24.0	15.0	21.0	13.0	16.0	17.0	23.0	16.0	22.0	40.0	16.0	21.0	0.0	0.0	
1	23.0	14.0	24.0	21.0	17.0	18.0	17.0	19.0	24.0	19.0	31.83	31.83	24.0	16.0	18.0	23.0	22.0	20.0	19.0	20.0	11.0	18.0	23.0	30.0	23.0	16.0	0.0	0.0	
2	16.0	23.0	16.0	13.0	23.0	17.0	17.0	18.0	21.0	24.0	31.83	31.83	13.0	24.0	15.0	20.0	12.0	20.0	15.0	19.0	22.0	24.0	17.0	24.0	11.0	24.0	0.0	0.0	
3	21.0	25.0	20.0	22.0	13.0	23.0	23.0	24.0	17.0	21.0	31.83	31.83	25.0	24.0	23.0	15.0	23.0	15.0	23.0	20.0	18.0	23.0	19.0	18.0	23.0	25.0	0.0	0.0	
4	24.0	25.0	24.0	16.0	22.0	23.0	11.0	25.0	25.0	17.0	31.83	31.83	22.0	16.0	12.0	24.0	19.0	23.0	11.0	20.0	15.0	15.0	24.0	18.0	17.0	19.0	0.0	0.0	
5	31.0	20.0	26.0	19.0	25.0	19.0	24.0	20.0	29.0	25.0	31.83	31.83	19.0	23.0	23.0	23.0	20.0	28.0	22.0	26.0	26.0	24.0	28.0	27.0	19.0	22.0	0.0	0.0	
6	59.0	58.0	55.0	48.0	44.0	52.0	45.0	53.0	65.0	57.0	31.83	31.83	50.0	49.0	44.0	62.0	49.0	52.0	37.0	43.0	37.0	46.0	46.0	48.0	47.0	47.0	0.0	0.0	
7	13.0	51.0	50.0	50.0	36.0	45.0	29.0	49.0	64.0	46.0	31.83	31.83	47.0	28.0	24.0	5.0	6.0	8.0	40.0	42.0	21.0	33.0	42.0	25.0	21.0	47.0	0.0	0.0	
8	86.0	50.0	36.0	59.0	56.0	49.0	73.0	61.0	59.0	61.0	31.83	31.83	49.0	67.0	63.0	80.0	85.0	80.0	46.0	40.0	59.0	69.0	60.0	64.0	70.0	49.0	0.0	65.0	
9	49.0	56.0	66.0	44.0	40.0	46.0	49.0	50.0	59.0	48.0	31.83	31.83	45.0	33.0	46.0	48.0	38.0	43.0	34.0	31.0	48.0	41.0	36.0	48.0	38.0	50.0	0.0	50.0	
10	46.0	48.0	47.0	42.0	34.0	39.0	48.0	46.0	49.0	47.0	31.83	31.83	33.0	68.0	30.0	36.0	43.0	38.0	33.0	39.0	37.0	32.0	33.0	34.0	35.0	42.0	0.0	54.0	
11	22.0	49.0	38.0	47.0	47.0	30.0	45.0	39.0	48.0	20.0	31.83	31.83	31.0	33.0	44.0	45.0	46.0	22.0	40.0	37.0	44.0	37.0	41.0	27.0	41.0	39.0	0.0	40.0	
12	23.0	46.0	23.0	36.0	32.0	51.0	40.0	38.0	27.0	46.0	31.83	35.0	34.0	2.0	39.0	22.0	32.0	0.0	19.0	38.0	15.0	40.0	33.0	39.0	23.0	34.0	0.0	20.0	
13	81.0	31.0	49.0	46.0	44.0	33.0	18.0	50.0	37.0	48.0	31.83	42.0	42.0	88.0	31.0	47.0	42.0	79.0	42.0	35.0	56.0	31.0	33.0	33.0	45.0	49.0	0.0	31.0	
14	37.0	46.0	46.0	44.0	34.0	46.0	58.0	30.0	61.0	31.83	31.83	37.0	26.0	34.0	37.0	7.0	24.0	29.0	36.0	28.0	39.0	32.0	40.0	42.0	37.0	35.0	0.0	74.0	
15	45.0	33.0	35.0	36.0	32.0	33.0	38.0	46.0	32.0	31.83	31.83	32.0	31.0	50.0	46.0	55.0	51.0	32.0	28.0	26.0	36.0	30.0	32.0	29.0	33.0	35.0	0.0	37.0	
16	32.0	34.0	33.0	34.0	38.0	31.0	37.0	33.0	33.0	31.83	31.83	35.0	44.0	47.0	29.0	33.0	29.0	33.0	29.0	25.0	33.0	34.0	31.0	27.0	39.0	45.0	0.0	40.0	
17	47.0	46.0	40.0	42.0	40.0	36.0	41.0	37.0	44.0	31.83	31.83	40.0	35.0	39.0	35.0	38.0	31.0	37.0	32.0	34.0	31.0	38.0	29.0	30.0	37.0	19.0	0.0	41.0	
18	35.0	35.0	32.0	23.0	36.0	43.0	34.0	46.0	34.0	31.83	31.83	34.0	34.0	40.0	43.0	36.0	38.0	41.0	40.0	24.0	30.0	34.0	34.0	43.0	35.0	0.0	0.0	48.0	
19	38.0	38.0	33.0	44.0	36.0	28.0	41.0	35.0	39.0	31.83	31.83	34.0	42.0	29.0	29.0	28.0	33.0	27.0	32.0	40.0	37.0	32.0	36.0	28.0	41.0	0.0	0.0	32.0	
20	41.0	37.0	34.0	34.0	36.0	33.0	34.0	33.0	33.0	31.83	31.83	36.0	31.0	32.0	27.0	30.0	30.0	28.0	26.0	33.0	39.0	33.0	35.0	28.0	30.0	0.0	0.0	0.0	
21	32.0	36.0	33.0	28.0	29.0	32.0	28.0	38.0	27.0	31.83	31.83	34.0	31.0	32.0	27.0	33.0	28.0	25.0	30.0	31.0	29.0	34.0	28.0	27.0	31.0	0.0	0.0	0.0	
22	21.0	24.0	26.0	19.0	21.0	26.0	23.0	24.0	27.0	31.83	31.83	24.0	24.0	26.0	29.0	27.0	17.0	24.0	20.0	21.0	25.0	25.0	20.0	27.0	25.0	0.0	0.0	0.0	
23	24.0	15.0	13.0	22.0	21.0	12.0	23.0	17.0	29.0	31.83	31.83	16.0	25.0	12.0	19.0	14.0	24.0	18.0	21.0	15.0	25.0	15.0	20.0	19.0	26.0	0.0	0.0	0.0	
Total	870.0	865.0	823.0	810.0	773.0	788.0	817.0	855.0	905.0	820.3	763.92	780.96	781.0	832.0	757.0	766.0	763.0	735.0	691.0	704.0	756.0	756.0	762.0	775.0	763.0	618.0	0.0	532.0	20862.18

Figure 10: Meter readings graph of extra-light heating oil consumption by hour within EMIS

Energy and water consumption data are collected:

- manually by entering data from invoices for energy (electricity, gas, district heating) and water or by entering data read from meters and counters,
- automatically by importing data from relevant meters and counters equipped for remote reading.

The EMIS database is already connected with 90 energy and water vendors in Croatia to avoid manually entering data from invoices for energy and water.

EMIS can be connected to the web portal or EE (energy efficiency) panel to raise awareness about public building energy/water consumption and costs.

Thanks to EMIS, significant energy and water savings (excessive energy consumption or water losses) are achieved in public buildings in Croatia. Through EMIS and educations the awareness of energy - and water saving possibilities among public employees is significantly raised. For all public buildings in Croatia actual building consumption data can be taken from the EMIS for the purpose of energy performance certification of buildings.

Alongside the energy and water consumption data, this database collects also:

- technical data (surface area of building, total heated area and volume, electricity supply, technical characteristics of heating system, domestic hot water, air-conditioning systems, lighting system),
- non-technical data (maps and locations of buildings, number of users, working hours, real temperature).

However, the accuracy of technical and non-technical data is sometimes questionable.

The EMIS application is constantly developing and changing. It is planned to connect EMIS database with the national EPC database in Croatia (Informacijski sustav energetskih certifikata - IEC).

(https://eenergetskicertifikat.mgipu.hr/login.html).

Basic functionalities of EMIS:

- Collecting and entering basic building data and controlling energy and water consumption on a monthly, weekly, or daily basis (monthly bills and/or reading of meter status),
- Collecting data on public lighting consumption in the cities and municipalities of the Republic of Croatia,
- Module for entering energy audits, certificates, and other energy efficiency measures on the facility,
- Module for monitoring the Government's program for energy renewal of public sector buildings,
- Easy access to information on the total amount of energy and water consumed, the ways and places where energy is spent and used.
- Calculations and analyses to detect unwanted, excessive, and irrational consumption and identify potential for energy and money savings,
- Monitoring and verification of realized savings,
- Automated warning of critical events and malfunctions in operation,
- User interfaces are adjusted to individual roles in the system,
- Advanced filtering and sorting of the database,

- Reports and different graphical views can be displayed in Excel and PDF format, by object, object group or label,
- Individual editing account groups of individual distributors,
- Individual editing of account items within certain account groups,
- Tabular hourly display of consumption (smart) measuring devices,
- Graphical analysis through absolute and relative consumption, E-T curves and CUSUM curves,
- Daily statistical database processing,
- Internal communication, document storage and alarm systems,
- Developed smartphone application – mISGE. Currently available for Android operating system, application can be find on play.google.com/store/apps/details?id=com.apn.isge&hl=en
- Possibility of application to various workshops and training through the interface at www.isge.hr/seminar ,
- Various guides and instructions for entering and monitoring data within the home page of system and at www.isge.hr/upute ,
- Enabled direct account entry into the database by distributors and suppliers and analytical tracking of the submitted data by the same,
- Monitoring sessions of each individual user as well as user groups.

1.2.2 France – building logbook concepts

The national authorities in France have launched a testing phase of different logbook concepts organised in the framework of PTNB – Plan de Transition Numérique du Bâtiment (Building Digital Transition Plan) launched in December 2014 by the Housing Ministry.

Provided by the law on energy transition of August 2015, this digital booklet aims to help owners and occupants to carry out future energy performance improvement works (ref: https://www.actu-environnement.com/ae/news/rapport-neveu-mise-en-oeuvre-carnet-numerique-suivi-entretien-logements-26635.php4).

EDF, Qualitel, PMB Software, Vilogi, Energies Demain, Intent and EP, Novabuilt designated in 2017 by the Digital Transition Plan for the Building Industry, have experimented the digital housing logbook, which, by targeting housing to be renovated as a priority and by measuring the effects of the renovations, will contribute precisely to the massification of the energy renovation of buildings (ref: https://www.batiactu.com/edito/carnet-numerique-logement-conseil-etat-aurait-emis-58337.php).

In this document we detail 2 notebooks developed by 2 winners: EDF and Qualitel.

In line with the PTNB, the 'Experience P2E' was launched in 2016 by EDF to create a renovation process based on an online 'Passport Efficacité Energétique' (P2E) equivalent to Building Renovation Passport (BRP).

Here is the process:

1. The owner creates an account on the online application and contacts an expert in building renovation.
2. The expert goes on-site, get the owner's project (desired works...) and enters the building properties on the application (on-site building assessment). In the questionnaire, the expert needs to evaluate the state of the 9 technical packages (roof, floor, windows, ventilation system, heating system, domestic hot water system, heating control system and permeability).
3. Selection of the renovation works with the owner (Energy performance combinations, multi-year plan of works).
4. Generation of the renovation Roadmap.

Figure 11: P2E renovation process

The main goal of the P2E application is to generate a renovation roadmap. However, the application act like a small logbook by storing the data that were collected on-site (questionary input saved) as well as the renovation roadmap outputs. The owner can at any time see the collected information with his account.

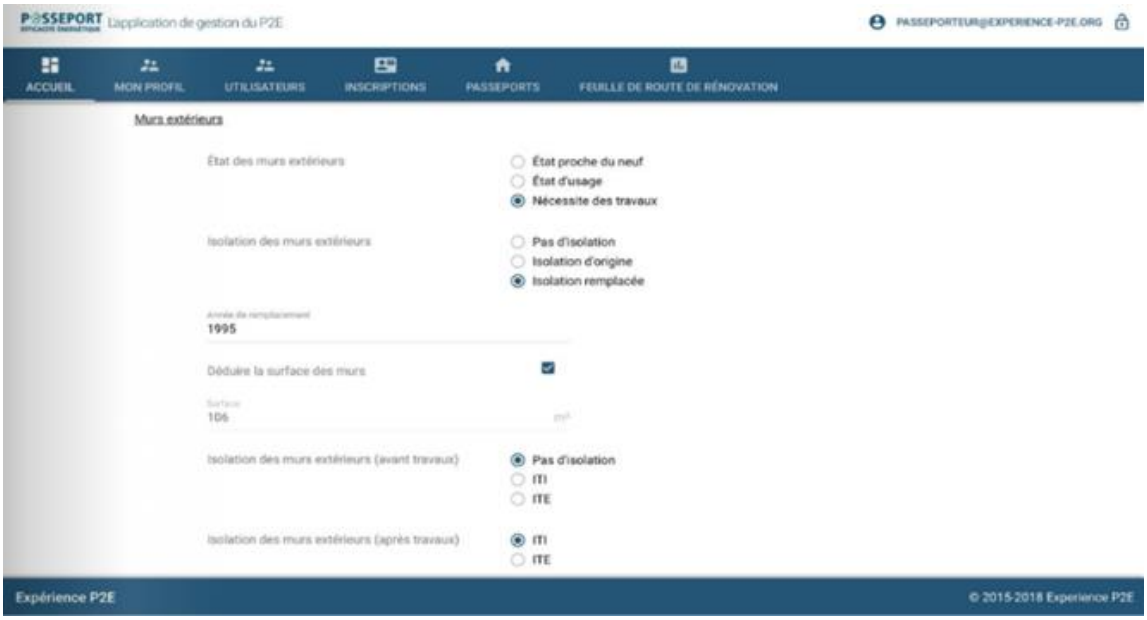


Figure 12: P2E application

Once the owner got his renovation roadmap, he can go further in the renovation process by ordering an energy audit or a price quote.

In line with the PTNB, Qualitel has experimented CLEA

Digital housing booklet - logbook: Results of the experiment (April 2018- ref: https://monimmeuble.com/actualite/carnet-numerique-du-logement-resultats-de-l-experimentation)

11 solutions proposed by the 11 winners and 3040 booklets-logbooks deployed throughout France.

Presented in the form of a digital platform, the digital logbook allows access to documents and data at any time. But it must also be adaptable to all populations, those who have difficulties with computer interfaces and be able to offer complementary solutions supplied by third parties.

This platform is aimed at individuals as well as professionals. It must meet their specific needs over time by guaranteeing continuity of service. This platform must also comply with the specificities of collective housing.

Feedback has shown that for this to work, support is needed with guides, videos, support, meetings to present the tool, etc. It is also necessary to add alert and notification systems linked to daily life.

The digital logbook will be able to provide a service to a variety of actors in the energy renovation chain and more generally in the building sector. Different levels of access have been planned to allow each stakeholder to consult, contribute to and even use the logbook. Several questions arise: the generalisation of standard transmission formats and the confidentiality of data.

Indeed, the issue of personal data protection comes into play in the management of access to the log by third parties and during the transmission of data for Big Data purposes, which must guarantee the anonymisation of these data.

The cost of creating and managing the booklets is considered to be 80 % variable and is estimated at between 2 and 12 euro per booklet and per year, depending on the solutions. This raises the question of whether the booklet should be free of charge for users.

Different economic models are thus envisaged by the winners, in particular:

- Subscription, from one euro per month,
- Licensing, i.e., a one-off payment for the provision of the booklet,
- Freemium, which consists of offering a basic service free of charge and paying for additional features (connection with smart meters or asset management tools, increased storage space, etc.),
- According to the winners, it is envisaged that these costs will be paid by the owner (private or lessor), by the developers/builders in the case of new buildings, or even by the State if possible (according to one of the winners).

The digital housing booklet (“carnet numérique du logement”) has been replaced by the housing information booklet (carnet d’information du logement” -CIL) which will be applicable from 1 January 2023 for French new construction and renovation

(ref:https://www.legifrance.gouv.fr/codes/section_lc/LEGITEXT000006074096/LEGISCTA000043966757/2021-09-09)

"This booklet makes it possible to know the state of the dwelling and the building, when the dwelling is subject to the status of co-ownership, as well as the functioning of their equipment and to accompany the progressive improvement of their environmental performance.

"This logbook allows for the support and monitoring of the improvement of the energy and environmental performance of the building and the dwelling for the entire life of the latter.

"The elements contained in the logbook are for information purposes only.”

"The digital information, monitoring and maintenance booklet is a secure online service that brings together information aimed at improving the information provided to owners, purchasers and occupants of housing. The operator of this service declares it to the administrative authority and ensures the possibility of retrieving the information and the portability of the digital logbook without additional management costs."

"The digital logbook includes the technical diagnostic file mentioned in Article L. 271-4 and, when the dwelling is subject to co-ownership status, the documents mentioned in Article L. 721-2."

(ref: https://www.legifrance.gouv.fr/jorf/article_jo/JORFARTI000037639685)

This implementation of the law and the associated decree is being prepared by a large number of companies the web service developed by the firm DIGILOGEMENT with their housing booklet "mon carnet logement"

The housing information booklet should contain (ref: https://www.legifrance.gouv.fr/dossierlegislatif/JORFDOLE000042137933/?detailType=CONTENU&detailId=1) :

- all the information and documents needed to certify the energy performance of the dwelling, including the Energy Performance Diagnostic (French EPC),
- operating, maintenance and servicing instructions for equipment if it has an impact on energy performance,
- information on the materials used in the construction or work, if these affect the energy performance,
- for new buildings, surface, and sectional plans, as well as plans, diagrams, and descriptions of networks (electricity, gas, ventilation, water).

Smart Building Alliance has formalised the Building Information System (BIS)

In 2022, the SBA published a white paper in France entitled: "BIS and BOS, the tools of building data governance". The SBA (Smart Building Alliance) is a French association gathering the main actors of the building information in France.

In this white paper, we find the definition of BIS, its scope, and its architecture to facilitate the interoperability of the data.

This ARCHITECTURE is essentially based on a convergent digital building infrastructure:

- The convergent of the "physical" infrastructure: the building infrastructure IP network which has been formalised by the R2S (Ready to Service French label delivered by Certivea for tertiary buildings and Bureau Veritas for residential buildings)
- A convergent of the "logical" infrastructure: the building's representative synthesis model, the digital twin, managed by the building's operating system, the BOS (Building Operation System), which constitutes the building's digital foundation and ensures the governance of the data.

FUNCTIONALITY OF THE BIS

From the previous definition, the BIS:

- Provides data management of shared building data:
  - management of shared building data,
  - Security and rights management of shared building data,
  - the single point of data sharing with external building systems,
  - Managing the sharing of building data through APIs,
- Is built around a core platform, the BOS, which ensures:
  - the management of the building's unique repository data,
  - Security and rights management of the building repository data,
  - the capacity for automatic discovery of repository data,
  - Characterisation of all shared data against the repository,
  - Single point of sharing repository data with external building systems,
  - building systems,
  - Management of building data sharing.

The elements of the BIS reference framework

The repository is not a single description, it is composed of a set of sub repositories including:

- Structured/organisational and hierarchical repositories:
  - description of the building: its spaces, its structure, its equipment,
  - representation of the networks in the building,
  - organisations in the building (not compulsory: internal or by delegation);
- Room profiles, building charter,
- User profiles (identifiers),
- Semantic repository:
  - description of BIS components,
  - typologies shared physical or logical entities (measurement, alarm, setpoint,
  - tickets, events, equipment, BIM objects...),
  - shared characteristics (attributes, tags, metadata, naming conventions...),
- Time synchronisation repository:
  - Time,
  - Units,
- Unified and shared units repository.

1.2.3 Germany – building logbook concepts

In 2001 the HypoVereinsbank in cooperation with DEKRA Umwelt, DEKRA ETS and Intep GmbH lunched the "ImmoPass" to the German market. The ImmoPass is essentially a quality assurance system that intended to provide prospective real estate buyers with information about the sustainability performance of the building in transparent manner. The ImmoPass is currently discounted in Germany for unknown reasons. The ImmoPass rated the building performance with a list of 130 criteria, that checked qualitatively and quantitatively the sustainability and energy efficiency performance of the building. Meanwhile, there is a company operating in Belgium and Luxembourg with a similar name, that carries out house auditing and real estate inspection for prospective real estate buyers ahead of buying a property. The connection between both companies cannot be established.

Staring in 2004, the German Federal Ministry of Transport, Building and Housing introduced the Gëbaudepass (building pass) and the Hausakte (house folder) for the construction and owners of single-family houses. The aim was to improve the comparison of quality and prices on the confusing real estate market for builders and buyers and to help the building owners to keep track of the state of their buildings and the changes made.

The Gëbaudepass, which is usually issued by the architect or developer, contains the most important technical and structural data of the house, for example a brief description of the building construction and the technical systems as well as information on energy requirements and sound insulation. This gives owners and prospective buyers a systematic overview about the building condition in its finished state. The uniform and modular nature of the Gëbaudepass intended to enable prospective buyers with means to compare the building with other offers.

The Gëbaudepass represents the first chapter of the more holistic Hausakte. The Hausakte expand on the Gëbaudepass and is intended to help the new owners compile all the important building documents throughout the various phases of the building life cycle from planning, construction to the usage periods of the house. In addition to the planning and execution documents. The Hausakte also includes the documentation of extensions, repairs, and modernizations. It must be noted that the both the Gëbaudepass and the Hausakte are not mandatory but recommended for home builders and owners. A user can download the template pdf file from the following webpage:
https://www.bbsr.bund.de/BBSR/DE/veroeffentlichungen/ministerien/bmvbs/kostenguenstig-qualitaetsbewusst-bauen/downloads/Hausakte.pdf

In 2017 a private company lunched the web application Eigenheim Manager. The Eigenheim Manager is a subscription-based application that runs on all common web browsers, iOS and Android devices. The web application is designed to help existing homeowners save, track, and compare the main operational aspects about their building. After registering to the application, the user enters the essential properties information of their house, selects the energy sources, and completes the annual consumption data. If desired, information on financing and insurance can also be uploaded to the platform. The Eigenheim Manager provide the homeowners with functions to help them record the vital house information about

the water, heating, electrical consumption and running costs in a monthly time intervals. Moreover, the user can schedule appointments, upload building documents, enter information about the insurance and mortgage and provide information about the maintenance status of the property in a digital maintenance booklet. The digital maintenance booklet allows the user to define and manage inspections and maintenance for their home. In the initial registration, the user needs to state the condition of the most important component groups and components of the house and the app will specify the maintenance intervals. The application allows to also remove components that are not applicable or add new components to the house.

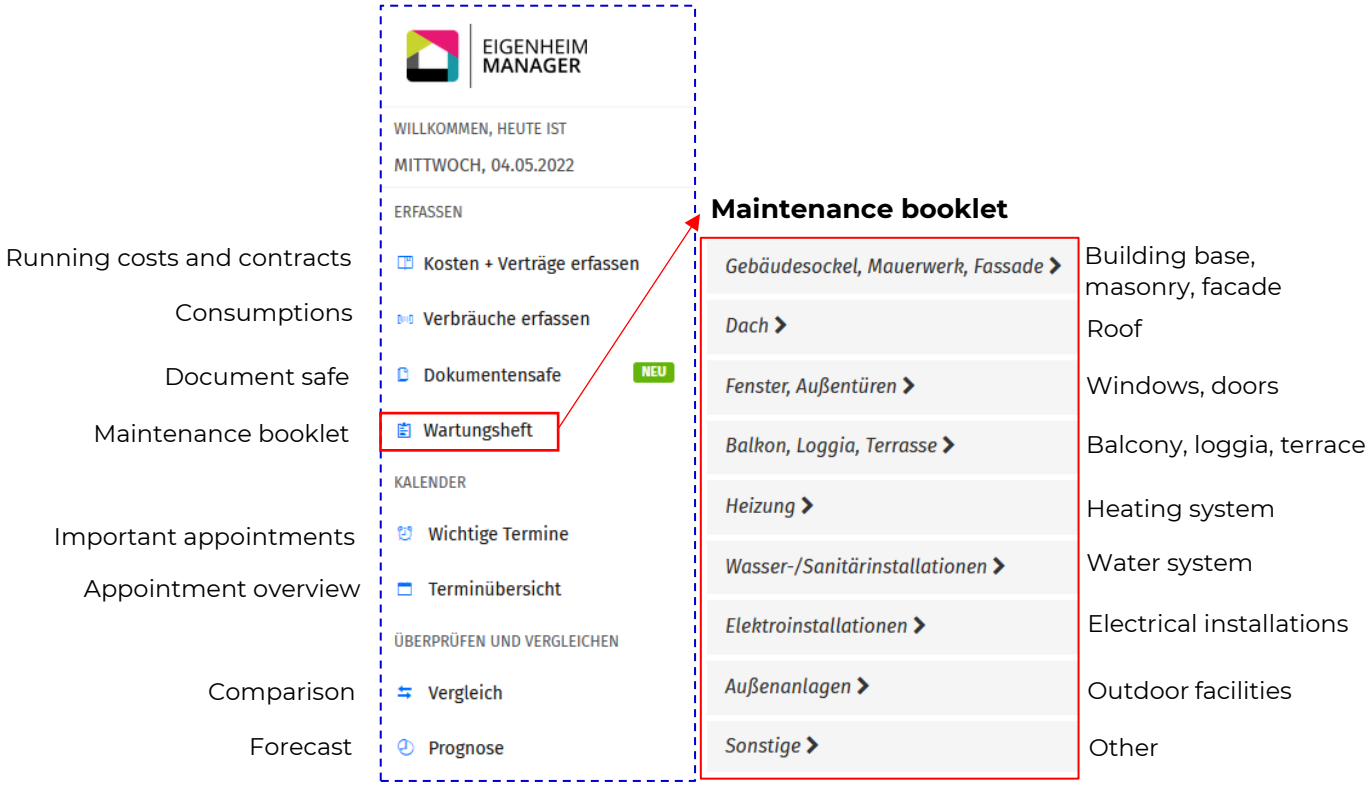


Figure 13: Eigenheim Manger – the main logbook data structure – maintenance book covering different building element

A significant development toward a building logbook in Germany happen in 2016. At that year the German Government required the sellers of prefabricated houses to provide new owners with a building information folder (Hausakte). The Hausakte is individual documentation system for owners. From the start of construction, the most important features of the new wooden prefabricated house are collected in the Hausakte and summarized in a clear and meaningful way. The Hausakte is designed to contain all relevant information about the building, such as statics and architecture specs of the building, the installed services and heating technology, the thermal insulation used as well as the results of the air tightness measurement in the blower door test. In general, the Hausakte contains:

- building application and building permit,
- all construction drawings,
- static calculations,
- the energy certificate,

- the sampling and testing protocols
- as well as care, operating and maintenance instructions.

In this sense, the Hausakte not only serves as a permanent, life cycle building documentation for the owners, but also for third parties for whom the performance characteristics of the house could become interesting over the years. In essence, the Hausakte certifies that a house was built according to the strict specifications of the QDF (Quality association for German prefabricated construction) and illustrates, among other things, all the details that contribute to the good efficiency of the building.

1.2.4 Italy – Fascicolo del Fabbricato

As part of the study on the "Development of a European Union Framework for Digital Building Logbooks", promoted by the European Commission, the definition of the Digital Building Logbook has been given. The work was based on a stakeholders consultation, on interviews with experts and, above all, on the analysis of 40 initiatives existing in Europe on this topic. Within this framework, **for Italy it has been taken into account the "Fascicolo del Fabbricato"**.

The aim with which the "Fascicolo del Fabbricato" has been developed from its very beginning is just one: **make available to the community a compendium that**, like an identity card, **allowed to gather in a single document all the distinctive elements of a dwelling** for the purposes of comprehensive knowledge and consequently, prevention and safety. In summary, it is a digital register of buildings, a common archive for all relevant building data which promotes transparency and greater availability of data for a wide range of market players (property owners, tenants, investors, financial institutions, and public administrations).

The "Fascicolo del Fabbricato" is a technical document, **not mandatory** at the time of writing (June 2022), in which are contained all the information related to the usability status of a building, its security also considering its stability, its plant engineering and eventually, its maintenance plan. Through the "Fascicolo" it is possible to find the property unit of the building, in all respects, being therefore available to **verify the lawfulness construction urban planning**, it is also possible to understand **its state of conservation** and also **to plan, accordingly, all possible renovation interventions** necessary to keep the building, and all its components, efficient. More in depth, the "Fascicolo del Fabbricato" is articulated into the following sections:

Identification of the building property from a technical and administrative point of view:

- Structural typology and its anti-seismic features,
- Plant typology and characteristics,
- Finishing description,
- Conservation state,
- Structural and non-structural interventions modifying the original state,
- Information on the maintenance operations to be carried out,
- Indications on the correct use of the property, with particular reference to safety.

The "Fascicolo del Fabbricato", generally, it shall be **updated at intervals not exceeding 10 years**, and this is the responsibility of the owner or of the administrator of the building. In addition, **it must be updated at each working operation, significant modification or in case of destination use change**. The update must be completed within thirty days from the date of completion of the work.

Charges for drawing up the "Fascicolo del Fabbricato" shall be charged to the owners. The acquisition at the regional offices of the necessary documentation for the preparation of the dossier has no charges for the applicant. It's difficult to define with certainty an indicative price, because it depends on a multitude of factors, as

for example, the dimension of the building, where it is located, the status of the building, etc.

To **the filling out** of the "Fascicolo del Fabbricato" provides a **qualified technician, architect, engineer or surveyor**, on the basis of the technical and administrative documentation provided by the owner or by the building administrator or, if necessary, upon acquisition of additional information, investigations and surveys.

Since the "Fascicolo del Fabbricato" has a strong role in highlighting the security of the building, t's important to underline that, following the recent seismic events in Italy, local authorities and institutions are considering **the possibility of restoring its compulsory nature**. At the national and regional level there were several draft laws who, however, have never completed the process of parliamentary approval. To date, June 2022, the power to establish the "Fascicolo del Fabbricato" is left to the municipalities and depends on the municipal building regulations.

COMUNE DI
ASSESSORATO LAVORI PUBBLICI
MANUTENZIONE URBANA E ATTUAZIONE
DEGLI STRUMENTI URBANISTICI
DIPARTIMENTO IX

FASCICOLO DEL FABBRICATO
PER L'ACCERTAMENTO DELLA CONSISTENZA STATICO-FUNZIONALE
(DELIBERA DEL C.C. n°166 DEL 2 E 4 NOVEMBRE 1999)

DEL FABBRICATO SITO IN , Quartiere/Rione/.....
Circ.ne.....Via/Piazza/[ii].....civ. n°.....cap.....
Estremi identificativi del proprietario, titolare o amministratore pro-tempore del fabbricato:
.....
.....
IN DATA[iii].....
COMPILATO DA[iv] .....
recapito.....Tel.....

Aggiornamento n°.....[v]
☐ In data ..... sono stati aggiornati i quadri .....
☐ La più recente verifica è stata effettuata in data .....

DICHIARAZIONE PRELIMINARE

Lo scrivente....., iscritto all'Albo dei/degli ..... al n° ....., dichiara che i dati che seguiranno saranno desunti dagli elaborati consegnatigli dagli aventi causa e/o reperiti nel corso dello svolgimento dell'incarico.

Dichiara altresì che gli accertamenti saranno svolti sulla base dell'esame documentale e della visione diretta dei luoghi, laddove possibile, e che la stesura del fascicolo avverrà in conformità delle indicazioni contenute nelle note, che costituiscono parte integrante del presente documento.

I documenti[vi] *mancanti ritenuti necessari per il completamento delle indagini conoscitive saranno elencati in calce.*

In fede

Data, (firma e timbro)
.....

PER PRESA VISIONE DELLA DICHIARAZIONE PRELIMINARE:
La Proprietà (Nome, Cognome o Ragione Sociale e qualifica):.....

Quadro "A": identificazione del fabbricato / complesso immobiliare

1. CARATTERISTICHE DEL COMPLESSO IMMOBILIARE
Il fabbricato in oggetto fa parte di un complesso immobiliare? ☐ si ☐ no
In caso di risposta affermativa, indicare il numero di fabbricati .....
Destinazione prevalente .....
ANNO DI COSTRUZIONE (effettivo[vii] o presunto).....

2. IDENTIFICAZIONE DEL FABBRICATO OGGETTO DI ACCERTAMENTO
classificazione storico- tipologica del fabbricato
☐ di epoca non precisabile
☐ romano (fino al V° secolo) ☐ altomedioevale (VI-XI° secolo) ☐ medioevale (XII-XIV° secolo)
☐ 1400 - 1500 ☐ 1501 – 1700 ☐ 1701 - 1800
☐ 1801 – 1907 ☐ 1908 - 1939 ☐ 1939 - 1950
☐ 1951 - 1962 ☐ 1963 – 1971 ☐ dopo il 1971
☐ altro (*specificare*).....
È soggetto a vincoli? ☐ si[viii] ☐ no
Rispetto all'impianto statico / architettonico originario del fabbricato:
Sono presenti ***superfetazioni***? [ix] ☐ si ☐ no ☐ non determinabili ☐ non riconoscibili
descrizione: .....
Sono state fatte nel tempo ***sopraelevazioni***? *☐ si ☐ no ☐ non determinabili ☐ non riconoscibili
descrizione: .....
Sono state apportate altre ***modifiche di rilevanza statica***? ☐ si[x] ☐ no
.....

3. MANUFATTI CONTERMINI
Posizione del fabbricato rispetto a quelli circostanti: ☐ isolato ☐ contiguo
Il fabbricato è staticamente autonomo da altri fabbricati? ☐ si ☐ no ☐ non determinabile ☐ non riconoscibile
Nel caso di risposta negativa, indicare le reciproche influenze: .....
.....

CARATTERISTICHE DEL FABBRICATO E DATI GENERALI
numero di scale:..... cortile interno: ☐ uno ☐ più di uno ☐ no
numero piani fuori terra[xii]: ..... numero piani entro terra[xiii]: .....
Superficie coperta[xiv] (o sedime): mq.....
Superficie scoperta: mq.....
Altezza massima[xv] ml:.....
Altezza minima[xvi] ml:.....
Volume totale del fabbricato fuori terra[xvii] mc:.....
Volume totale del fabbricato entro terra: mc.....
Pertinenze[xviii]:
Sup. coperta: mq.....
Sup. scoperta: mq.....
NOTE:[xix] .....

Figure 14: Fascicolo del Fabbricato

1.3 Overview of digital building logbook developed within EU projects

This overview identified several European projects dealing with digital building logbooks. Table 3 lists the European projects with basic data.

Table 3: List of European projects addressing the structure of a digital building logbook

Project acronym	Project title	Project duration	Project home page	DBL name	Type of buildings addressed
iBRoad	Individual Building Renovation Roadmaps	01/06/2017 - 31/12/2020	https://ibroad-project.eu/	iBRoad-Log	residential buildings (single-family houses)
ALDREN	ALliance for Deep RENovation in buildings	01/11/2017 - 30/09/2020	https://aldren.eu/	ALDREN BuildLog	non-residential buildings (mainly office and hotel buildings)
X-tendo	eXTENDing the energy performance assessment and certification schemes via a mOdular approach	01/09/2019 - 31/08/2022	https://x-tendo.eu/	X-tendo logbook	Private (residential, offices) and public buildings (schools, hospitals, etc.)

Figure 15: European projects dealing with the structure of a digital building logbook

1.3.1 iBRoad – Individual Building Renovation Roadmaps

Along the pathway towards a highly efficient and decarbonised building stock by 2050, the iBRoad EU-funded project worked on eliminating the lack of knowledge about what measures to implement and in which order, by **developing an Individual Building Renovation Roadmap (iBRoad-Plan) for single-family houses**. The Roadmap provides a customised renovation plan over a long-term period (10-20 years) by setting up a home-improvement plan which considers the occupants' needs and specific situations (e.g. age, financial situation, composition and expected evolution of the household, etc.). The **Renovation Roadmap is combined with a building logbook (iBRoad-log), which is a repository where all the building-related information can be stored and continuously updated**. The type of information stored in the logbook and its functionalities can evolve over time and could range from energy production and consumption to equipment maintenance, as well as insurance, property plans and obligations, energy bills, smart meter data and links to available financing options for renovation projects. The **iBRoad Building Renovation Passport can be viewed as an evolution of the Energy Performance Certificate (EPC)**, as it not only indicates the energy performance of a building, but also supports building owners with personalised suggestions on their renovation options.

What is behind the creation of an Individual Building Renovation Roadmap?

Many key issues need to be addressed to allow its development and implementation, for that reason, real-life examples based on four existing initiatives revolving around the concept of individual building roadmaps and passports are used by iBRoad to demonstrate how the different elements can be designed and implemented:

- Denmark (BetterHome),
- Flanders (Woningpas and EPC+),
- France (Passeport Efficacité Énergétique),
- Germany (Individueller Sanierungsfahrplan).

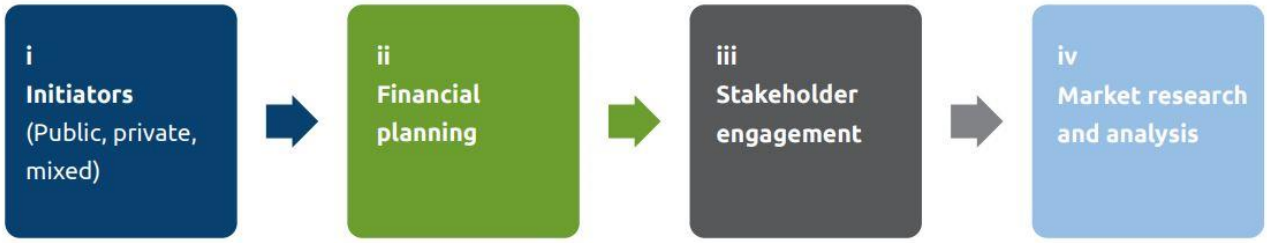
Process	BE-Flanders (EPC+)	France (PEE)	Germany (iSFP)	Denmark (BetterHome)
Definitions (Deep or staged deep renovation and/or alternative definition)	√	√	√	X
Long-term target for the existing building stock (2050)	√	√	√	X
Identified barriers	√	√	√	√
Stakeholders mapping	√	√	√	√
Stakeholders engagement	√	!	√	√
Market analysis	√	√	√	X
Energy Audit – On-site visit	X	√	√	√
Auditors training	X	√	√	√
Tailored solutions (renovation roadmap)	!	√	√	√
CO_2 reductions	√	!	√	√
Logbook/Database	√	!	X	!
Integrated financial support	!	N/A	√	!

√ = Yes ! = Under development/consideration X = No

Figure 16: Four existing initiatives revolving around the concept of individual building roadmaps and passports used by iBRoad

Few suggestions coming from the experience of iBRoad concerning the creation of a renovation roadmap and logbook.

Four key stages for the development of a Building Renovation Passport, according iBRoad approach:



Initiators: Building Renovation Passports can be initiated by different actors (public authorities, private companies and mixed models); depending on local circumstances, the process can be launched by either public or private actors.

Financing: The development and implementation of new instruments require sustainable funding from public or private sources to ensure the necessary funds for the design, testing and implementation of the project are available. This type of funding can take different forms (full public funding, private funding or a combination of the two).

Stakeholder involvement: it is an instrument potentially impacting the whole value chain of the building renovation, so it requires the involvement and support of multiple actors and stakeholders to ensure a proper design and an effective implementation. The engagement with stakeholders is to ensure an effective implementation of the instruments. The stakeholder involvement is generally used for two purposes:

- shape the concept and gain support for the implementation,
- map and find solutions to lift potential legal and administrative barriers. This point also includes the involvement of potential data providers to increase data availability (e.g., renovation costs).

Market research and analysis: it can be performed at different stages of the process, for design, in the pilot phase and for testing purposes.

The Building Renovation Passport is combined with a building logbook (iBRoad-log) and the interaction between the two is perfectly clear: the information from the iBRoad-log will provide better guidance and support evidence to the establishment of a renovation roadmap and this last one will contribute to the update of the logbook with relevant information related to the renovation strategy and with updated data concerning the real implementation of improvement measures.

Figure 17: Interaction between the renovation roadmap and the logbook

The iBRoad-log is made up of three main key elements:

- **Functionalities**: they are developed based on the core elements and information it should provide (energy, envelope, water, daylight, etc.),
- **Data gathering**: mapping the sources is essential for the credibility and reliability of data used by iBRoad-log,
- **Ownership**: data privacy and security are protected by the EU legislation.

iBRoad-Log is categorised in 5 areas of knowledge that accommodates the general information necessary to support the concept of a building renovation passport. These categories, designated "modules", have the goal to facilitate the aggregation of information and the use of the database among different stakeholders, making a clear distinction between the topics related to administrative data on one side, or the EPC and SMART data on the other side.

The 5 modules of the iBRoad-Log are:

A. General and administrative information

B. Building construction information

C. Building Energy Performance

D. Building Operation and Use

E. SMART information

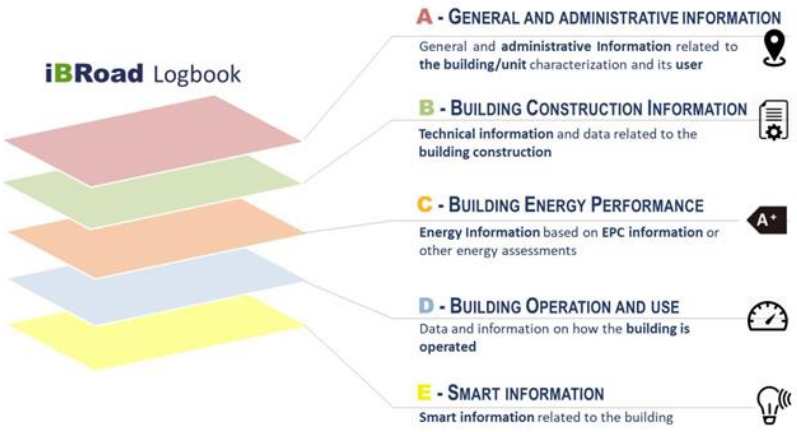


Figure 18: Five modules of iBRoad-Log

The iBRoad-Log data structure is categorised horizontally in a fixed or flexible structure, to accommodate the European and National/Regional levels, respectively, and vertically to accommodate different modules and topics regarding the data structure, as showed in the Portuguese example.

European level National level

Level 0	Level 1	Level 2	Level 3	Level 4	Variable description	Variable code
B - BUILDINGS CONSTRUCTION INFORMATION	1. Envelope	1. Walls	1. Wall Type 1	1. Location of the element	*Exterior*	*B.1.1.1.1*
			2. Contructive Solution	-	*Masonry (after 1960) w/ exterior insulation*	*B.1.1.2*
			3. Surface area information	1. North orientation	-	*B.1.1.3.1*
				2. Northeast orientation	*48,01 m²*	*B.1.1.3.2*
				3. East orientation	-	*B.1.1.3.3*
				4. Southeast orientation	*88,05 m²*	*B.1.1.3.4*
				5. South orientation	-	*B.1.1.3.5*
				6. Southwest orientation	*55,10 m²*	*B.1.1.3.6*
				7. West orientation	-	*B.1.1.3.7*
				8. Northwest orientation	*137,68 m²*	*B.1.1.3.8*
				9. Internal area	-	*B.1.1.3.9*
				10. Total area	*328,84 m²*	*B.1.1.3.10*
			4. Thermal insulation characteristics	1. Type of insulation	*XPS*	*B.1.1.4.1*
				2. Thickness	*0,06 m*	*B.1.1.4.2*
				3. Thermal conductivity	*0,034 W/m.°C*	*B.1.1.4.3*
			5. Thermal transmittance (U-value)	-	*0,42 W/m².°C*	*B.1.1.5*
			6. Date of the refurbishment	-	*2015*	*B.1.1.6*
			7. Cost of refurbishment	-	*11.500 €*	*B.1.1.7*
			8. Contractor	-	*ABEL, Lda.*	*B.1.1.8*
			9. Source of financing	-	*Energy Efficiency Fund*	*B.1.1.9*

A. General and administrative information: the first module is divided in 8 different topics in Level 1 and 18 sub-topics in Level 2

Level 0	Level 1	Level 2	CORE	COMP
A- GENERAL AND ADMINISTRATIVE INFORMATION	1. Building ID	1. National code	✓	
		2. Inspire ID	✓	
		3. Energy suppliers ID	✓	
	2. Address	1. Geo Coordinates	✓	
		2. Address data	✓	
	3. Property ID	1. Legal registration	✓	
		2. Fiscal registration	✓	
	4. Building general features	1. Building	✓	
		2. Building Unit	✓	✓
	5. Licences and Plans	1. Urban Licenses		✓
		2. Design Plans and Designers		✓
	6. Conservation Status	1. Evaluation of the conservation status		✓
	7. Building User	1. Building user information		✓
		2. User profile		✓
	8. Other building information	1. Governmental taxes and incentives		✓
		2. Financial Programs		✓
		3. Real estate information		✓
		4. Energy and Construction market		✓

Building ID – Information that allows for a clear building codification. This information can be originated from European sources allowing for the identification of the building across country boundaries, national cadastres, or utilities.

Address – Building geographic coordinates and postal address.

Property ID – Legal and fiscal identification concerning the building and its legal owners typically used for registration, transactions, cadastre, or other purposes. This information is country dependent.

Building general features – Information related to the building and/or building unit concerning its generic construction features and use.

Licences and Plans – Complementary information corresponding to municipal licensing process which includes the design plans and the designer's identification.

Evaluation of the conservation status – Complementary information which intends to collect data about the building conservation status. Typically, available as a qualitative or quantitative indicator representing how degraded is the building or the building elements.

Building User – Information about the end user (name, address, contacts, etc.) such as preferences in terms of occupancy needs, technical buildings systems or energy sources preference, user behaviour and habits, etc.

Other building information - Governmental taxes and incentives – Financial programs - Real estate Information – Energy and Construction market.

B. Building construction information: it is divided in 2 different topics in Level 1 and 12 sub-topics in Level 2.

Level 0	Level 1	Level 2	CORE	COMP
B - BUILDINGS CONSTRUCTION INFORMATION	1. Envelope	1. Walls	✓	
		2. Roofs	✓	
		3. Floors	✓	
		4. Thermal bridges	✓	
		5. Doors	✓	
		6. Windows	✓	
	2. Technical Building Systems (TBS)	1. Ventilation systems	✓	
		2. Heating systems	✓	
		3. Cooling systems	✓	
		4. DHW systems	✓	
		5. Lighting systems	✓	
		6. Building automation & control (BAC)	✓	

Envelope - Technical information regarding each component from the building envelope identified in the energy audit process. This information can include description of the building element, technical characteristics and performance and complementary information about previous refurbishments, costs and contractor involved or source of financing.

Technical building systems (TBS) - Technical information regarding each TBS identified in the energy audit process. This information can include the description of the system, technical characteristics and performance and complementary information about previous refurbishments, costs and contractor involved or source of financing.

C. Building Energy Performance: it is divided into 4 different topics in Level 1 and 23 sub-topics in Level 2.

Level 0	Level 1	Level 2	CORE	COMP
C- BUILDING ENERGY PERFORMANCE	1. EPC General information	1. Expert name	✓	
		2. Expert ID	✓	
		3. Type of EPC	✓	
		4. EPC Number	✓	
		5. Energy label	✓	
		6. Issue date	✓	
		7. Term date	✓	
		8. Photograph report	✓	
		9. EPC support documentation	✓	
	2. Audit General information	1. Expert name	✓	
		2. Professional order	✓	
		3. Audit date	✓	
		4. Energy label	✓	
		5. Photograph report	✓	
		6. Energy audit support documentation	✓	
	3. Energy and other indicators	1. Energy use	✓	
		2. Delivered energy	✓	
		3. Primary energy	✓	
		4. Environmental and energy indicators	✓	
		5. Other indicators		✓
		6. Comfort level		✓
	4. Recommendations	1. Individual impact	✓	
		2. Collective impact	✓	

EPC general Information – Generic information provided in the energy performance certificate (EPC).

Audit general Information – Generic information provided in the energy performance certificate (EPC).

Energy and other indicators – Energy indicators coming from the EPC evaluation or audit, describing the demand, delivered or primary energy (by use, type of energy, costs with energy, etc), including environmental indicators (e.g. CO2 emissions) or energy produced by renewable energy sources (RES).

D. Building Operation and Use: it is divided into 6 different topics in Level 1 and 11 sub-topics in Level 2.

Level 0	Level 1	Level 2	CORE	COMP
D- BUILDING OPERATION AND USE	1. Energy consumption	1. Energy source	✓	
		2. Metering system information	✓	
	2. Energy generation	1. Renewable energy source	✓	
		2. Metering system information	✓	
	3. Energy suppliers	1. Energy source		✓
		2. Metering system information		✓
	4. Inspections	1. Building element		✓
		2. Inspection information		✓
	5. Maintenance	1. Building element		✓
		2. Maintenance information		✓
	6. Climate data	1. Weather data		✓

Energy consumption – Information related to the energy consumption of the building.

Energy generation – Information related to the renewable energy generated at the building.

Energy suppliers – List of energy suppliers that deliver energy to the building.

Inspections – Historic information of inspections performed in the building concerning its elements (typically technical buildings systems).

Maintenance – Historic information of maintenance performed in the building concerning its elements (envelope or technical buildings systems).

Climate data – Historic data regarding weather parameters at the building location.

E. SMART information: it is divided into 3 different topics in Level 1 and 4 sub-topics in Level 2.

Level 0	Level 1	Level 2	CORE	COMP
E – SMART INFORMATION	1. Smart Indicator	1. SRi – Smart Readiness Indicator		✓
		2. Other smart indicators		✓
	2. E-mobility	1. EV Charging points		✓
	3. Smart district	1. Smart district indicators		✓

Smart indicator – Information related to the building or its surrounding infrastructure through information and communication technologies (ICT) or other technological features to promote a better management of the building and its TBS (e.g., charging points, energy storage systems, demand response, etc.), to ensure an efficient and comfortable building operation.

E-mobility – Specific information related to the electric vehicle (EV) charging point infrastructure available at the building.

Smart district – Information related to the infrastructure available in the building's surrounding (considering the possibility to interact with it) promoting a better management of the building or the infrastructure.

Concerning the **stakeholder's engagement**, for the setting up process of the iBRoad-log, many stakeholders have been involved in that activity, both for the data providing and for the promoting of the concept. This has allowed a more efficient adoption at national or regional level but also to promote a better link with entities or institutions at wider level. Anyway, besides the different typology of stakeholders that can participate in the logbook setting up process, one should bear in mind that the main target of the building renovation passport is the building user.

Concerning integration of data, the iBRoad IT solution receives information and interacts with several data sources. There are three types of data integration:

- initial data load: the solution needs to be loaded with initial information, as for example existing buildings, existing energy certificates, etc. That bulk of the information is inserted into the solution database on a "one shot" basis.
- data coming from human interface: during the life of the process, part of the information is introduced through the Human Interface. This data collection procedure will apply to low volume information, as for example specific information of a particular installation, introduced by the engineer, energy auditors and/or owners. Only authenticated users with an assigned proper profile are allowed to access, insert or change information in the solution.

- data coming from third party applications: some of the information needed to the solution processing, during its life, may also come online from external entities, as for example, information to authenticate users, to validate user profile/role or information related to buildings.

Within this framework, the new **data protection** framework is set to boost the digital economy and generate a greater confidence among European consumers on the electronic commerce with a special focus on the personal data processed by entities able to process personal data. The new General Data Protection Regulation (GDPR - Regulation 2016/679), which all Member States have to (mandatorily) adopt, was published in the Official Journal of the European Union on 4 May 2016 and, as of May 25, 2018, replaces the European Directive (95/46/EC). The regulation creates a single set of rules and levels which guarantees the legal security to companies and establishes the same level of personal data protection in all EU countries.

So, one important remark in the process of setting up a logbook is to have a **Controller or Processor or even by a Data Protection Officer (DPO)**, which is mandatory if the holder of a future database administration is a public organisation or if the core of the logbook involves the treatment of significantly sensitive data, such as personal data.

Table 4: Main categories and subcategories – iBRoad-Log (July 2018)

iBRoad-Log (July 2018)		
Category		Sub-category
A	**GENERAL AND ADMINISTRATIVE INFORMATION**	1. Building ID
		2. Address
		3. Property ID
		4. Building general features
		5. Licences and plans
		6. Conservation status
		7. Building user
		8. Other building information
B	**BUILDING CONSTRUCTION INFORMATION**	1. Envelope
		2. Technical Building Systems (TBS)
C	**BUILDING ENERGY PERFORMANCE**	1. EPC general information
		2. Audit general information
		3. Energy and other indicators
		4. Recommendations
D	**BUILDING OPERATION AND USE**	1. Energy consumption
		2. Energy generation
		3. Energy suppliers
		4. Inspections
		5. Maintenance
		6. Climate data
E	**SMART INFORMATION**	1. Smart indicator
		2. E-mobility
		3. Smart district

1.3.2 ALDREN – ALliance for Deep RENovation in Buildings

The EU funded Horizon 2020 ALDREN research project (ALliance for Deep RENovation in Buildings) ran from November 2017 to April 2020 and gathered eight European partners with the main aim to increase the rate and quality of non-residential building energy renovations (office buildings and hotels). Within this project a harmonized energy performance rating based on the European Voluntary Certification Scheme (EVCS) is offered. Aligning market recognition of high quality with enhanced building value by financial tools and capacity building was offered too. The intention was to encourage investment and accelerate the movement towards a nearly zero energy non-residential building stock across the EU.

To provide information to a potential purchaser, investors, renter, or user of the building a Building passport was introduced, which is composed by two main elements: digital building logbook (ALDREN BuildLog) and renovation roadmap (ALDREN RenoMap). The ALDREN BuildLog is composed of in total six modules:

- Module 1 BUILDING PICTURE
  To collect the main information of the building in terms of geometry data, location, documentation, certification, technical components and general information of ownership. Data can be added without performing any calculations.
- Module 2 ENERGY RATING & TARGET
  To collect detailed data concerning the energy consumption, building envelope, system plant and energy rating. Most of the information can be collected from the EP calculation, the EVC (European Voluntary Certification) ALDREN or the RenoMap (ALDREN ROADMAP).
- Module 3 ENERGY VERIFICATION
  To compare the results from the EP calculation to the measured energy consumption. In terms of energy vector for the whole building and different end-use (space heating, hot water, refrigeration…). The data can be in some cases collected by BMS or other monitoring systems already in place on the existing building. Actual weather data is as well collected.
- Module 4 COMFORT & WELL-BEING
  To collect the main indicators and values necessary to evaluate thermal, acoustic, visual comfort and air quality. The information must be evaluated following the protocol from the ALDREN comfort method (TAIL) by a monitoring campaign or by simulations.
- Module 5 COST VALUE RISK
  To collect information related to financial aspects, market trends and building value.
- Module 6 DOCUMENTATION BIM
  To collect information related to documentation (EPC, energy audit, BIM file …): the availability, the format (digital, paper …), the file name and its location.
  The ALDREN RenoMap is composed of 2 modules. The first is used to identify and evaluate the elementary renovation actions (ERAs). The second allows to organise the ERAs into renovation packages and generate a renovation roadmap.

The data from the Buildlog and the RenoMap are contained in an Excel file, with one sheet per module (Figure 19).

Figure 19: Representation of the ALDREN BRP digital version content

Table 5: Main categories and subcategories – ALDREN BuildLog (April 2019)

	ALDREN BuildLog (April 2019)	
	Category	Sub-category
M1	**BUILDING PICTURE**	1. Building features
		2. Location data
		3. Weather data
		4. Building geometry
		5. Envelope
		6. Technical system
M2	**ENERGY RATING & TARGET** (ENERGY PERFORMANCE)	1. Geometry
		2. Standard building use (for EP assessment)
		3. Climate data (for EP assessment)
		4.
		5. Energy performance - calculated
		6.
		7. ALDREN EVC - rating
		8.
M3	**ENERGY VERIFICATION** (ENERGY MEASURED)	1. Quantity
		2. End use
		3. Weather data actual
M4	**COMFORT & WELL-BEING**	1. Thermal environment
		2. Air quality
		3. Acoustic environment
		4. Visual environment
		5. Others
M5	**COST VALUE RISK**	1. Annual costs and revenues associated with energy
		2. Annual other running costs
		3. Renewal costs
		4. Financial value drivers
		5. Risks
		6. GHG emission costs
		7. Productivity and attractivity for end users
		8. Renovation decision – making indicators
M6	**DOCUMENTATION BIM**	1. Technical document and drawings
		2. Weather data
		3. BIM model

1.3.3 X-tendo – eXTENDing the energy performance assessment and certification schemes via a mOdular approach

The EU funded Horizon 2020 X-tendo research project (eXTENDing the energy performance assessment and certification schemes via a mOdular approach) ran from September 2019 to August 2022 and gathered 12 European partners from 10 EU countries (Austria, Belgium, Denmark, Estonia, Greece, Italy, Poland, Portugal, Romania, the United Kingdom) with the main aim to provide support to the EU market and authorities for the next-generation EPC schemes and usability. Vienna Technical University was a project coordinator.

The X-tendo logbook follows the exact structure defined by European Commission in the *Report 1 of the Study on the development of a European Union Framework for Buildings' Digital Logbook* comprising the following eight main categories (Level 1):

1. ADMINISTRATIVE INFORMATION
2. GENERAL INFORMATION
3. BUILDING DESCRIPTIONS AND CHARCTERISTICS
4. BUILDING OPERATION AND USE
5. BUILDING PERFORMANCE
6. BUILDING MATERIAL INVENOTRY
7. SMART READINESS
8. FINANCE

	European level High level fixed structure: Common data categories		***Member State level*** Flexible and more granular structure: Logbook data structure adapted to local context		
	LEVEL 1 (8 categories)	**LEVEL 2 (216 data fields)**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5…**
	Administrative information	13			
	General information	9			
	Building descriptions and characteristics	118			
	Building operation and use	37			
	Building performance	6			
	Building material inventory	11			
	Smart readiness	9			
	Finance	10			

Figure 20: X-tendo logbook data structure

Table 6: Main categories and subcategories – X-tendo logbook (November 2020)

	X-tendo logbook (November 2020)	
	Category	Sub-category
1	**ADMINISTRATIVE INFORMATION**	Unique building identifier Address Building owner Logbook prepared by When was the logbook last edited Building use Ownership type Tenancy agreement Utility contract Service contract Insurance document Maintenance log Licences
2	**GENERAL INFORMATION**	District heating access Solar potential Soil/terrain Climate data (zone) Altitude Accessibility for people with disabilities Outdoor air quality Safety manual Primary energy conversion factor for energy carrier
3	**BUILDING DESCRIPTIONS AND CHARACTERISTICS**	Design and plans of the building Building information modelling Floor area Heated floor volume Heated floor area Number of floors Orientation Building envelope construction Whole building solar absorption (g.A) g-value Sun protection (shading) Surface area U-value (frame) U-value (glazing) Multiple glazed percentage Windows orientation Yie-value periodic thermal transmittance Frame factor Number of sheltered sides (e.g., two) Factor for ambient on back side Insulation thermal conductivity Insulation thickness Insulation type Layer material (for n layers) Layer thermal conductivity (for n layers) Layer thickness (for n layers) Overall flat thermal bridge U-value Surface area U-value Surface area U-value Surface area U-value Insulation thickness Appliances DHW primary energy demand (not renewable) DHW primary energy demand (renewable) Construction year Expected lifetime DHW service present DHW manual DHW certificate/warranty DHW system efficiency Fuel type Storage

X-tendo logbook (November 2020)	
Category	Sub-category
	Primary pipework insulation present Fuel type Heat emission control Heat generation Heat generator control (for combustion and district heating) Heat supply temperature Heated area Heated gross-volume Heating days Heating energy source Heating system efficiency Indoor temperature Main heat delivery system Net energy for space heating Nominal electrical power Nominal thermal power Norm outdoor temperature Number of units installed Operational thermal efficiency of the space heating system Central heating pump age Date of installation Date of last inspection Certificate/warranty Manual Cooled area Cooled gross-volume Cooling emission control Cooling energy source Cooling system efficiency Energy delivered for space cooling by energy carrier Fuel type Storage Generator control for cooling Percentage from the total heat generation Nominal electrical power Nominal thermal power Number of units installed Date of installation Date of last inspection Certificate/warranty Manual Control system Lamp type Lighting system efficiency Lighting is considered Total power Interaction between TBS and/or BACS Energy delivered for other purposes (excl. non-EPC uses) by energy carrier Mech vent system efficiency Mech vent system present Air flow control at room level Filter type/class Heat recovery efficiency Operational thermal efficiency of the heat recovery unit Temperature of ventilation return air Temperature of ventilation supply air Ventilation air flow rate Ventilation rate Ventilation type Date of installation Date of last inspection Certificate/warranty Manual Equivalent solar area/net heated area ratio Installed capacity Installed capacity Exported energy

	X-tendo logbook (November 2020)	
	Category	Sub-category
		Date of installation Date of latest inspection Annual calculated production Annual measured production Manual Certificate/warranty
4	**BUILDING OPERATION AND USE**	Number of occupants Main function Estimated heating consumption Estimated electricity consumption Estimated hot water consumption Estimated carbon emission use Cooling primary energy demand (not renewable) Cooling primary energy demand (renewable) Global CO_2 emission (heating, cooling, domestic hot water etc.) Global primary energy demand (not renewable) Global primary energy demand (renewable) Heating primary energy demand (not renewable) Heating primary energy demand (renewable) Energy needs for cooling Energy needs for heating Lighting primary energy demand (not renewable) Lighting primary energy demand (renewable) Mechanical ventilation primary energy demand (not renewable) Mechanical ventilation primary energy demand (renewable) Transport primary energy demand (not renewable) Transport primary energy demand (renewable) Transport system efficiency Transport systems are considered/exist Useful electricity demand Useful energy demand for heating Useful energy demand for domestic hot water Useful energy demand for cooling Useful energy demand for lighting Useful energy demand for mechanical ventilation Primary energy conversion factor for energy carrier Dynamic heating consumption Dynamic electricity consumption Renewable energy consumption Particular matter (2.5, 10) Radon Asbestos Behavioural insights
5	**BUILDING PERFORMANCE**	EPC rating Air tightness Building envelope (U-value of different components) Renovation recommendations Tailored renovation recommendations Climate resilience potential
6	**BUILDING MATERIAL INVENTORY**	Material 1 – Type Material 1 – Location Material 1 – Volume Material 1 – Weight Material 1 – Embodied carbon Material 1 – Life span Material 1 – Fire resistance class Material 1 – Waste category Material 1 – Certificate 1 Material 1 – Chemical declaration Material 1 – Global Trade Item Number
7	**SMART READINESS**	SRI result EV charging grid balancing EV charging information and connectivity Storage of locally generated energy Smart grid integration Cooling system storage and shifting of thermal energy Control of domestic hot water storage charging Heating system storage and shifting of thermal energy

	X-tendo logbook (November 2020)	
	Category	Sub-category
		Smart district Demand response potential
8	**FINANCE**	Annual rent/property tax Annual maintenance charges Property value Valuation date Valuation method Valuation conducted by Valuation document 1 Property yield Building costs Annual electricity cost Annual water cost Annual gas cost

1.4 European Commission documents referring to Digital Building Logbooks

In 2020 the European Commission published three valuable reports referring to digital building logbook.

1.4.1 Study on the Development of an EU Framework for Buildings' Digital Logbook by European Commission (July – December 2020)

In the year 2020 the European Commission carried out a study on the "**EU-wide Framework for a Digital Building Logbook (DBL)**" and published the following three reports with the main aim to support the widespread use of digital building logbooks across Europe and to encourage data transparency and increased data availability to a broad range of market players, including property owners, tenants, investors, financial institutions, and public administrations:

- DEFINITION OF THE DIGITAL BUILDING LOGBOOK – **Report 1** of the Study on the development of a European Union Framework for Buildings' Digital Logbook, **July 2020** [3],
- BUILDING LOGBOOK STATE OF PLAY – **Report 2** of the Study on the development of a European Union Framework for Buildings' Digital Logbook, **July 2020** [4],
- Study on the Development of a European Union Framework for Digital Building Logbooks **FINAL REPORT**, December 2020 [5].

Figure 21: Three crucial reports related to digital building logbooks published by the European Commission in the year 2020

The present **Report 1** presented a definition of a DBL, building on a state-of-play analysis and stakeholder input from across Europe. The report outlined the potential role and scope of an EU-supported DBL, including the central features of the instrument, as well as data handling and governance issues.

The present **Report 2** aimed to present the results of the analysis of 40 building logbook initiatives in different countries. The report provided an overview of the initiatives and highlighted key success factors and barriers to the implementation of building logbooks.

The **Final report** identified the list of 15 actions, three priority actions for the European Commission to consider and potentially carry out in support of the widespread use and efficient functioning of digital building logbooks across the EU.

The Study on the "EU-wide Framework for a Digital Building Logbook" carried out the following **four main tasks**:

Task 1: Conceptual definition of DBL

Task 2: State of play and review of national & sectoral initiatives promoting the use of building logbooks

Task 3: Gaps analysis

Task 4: Recommended EU Commission actions

All key findings from those three reports are of utmost importance for this deliverable providing input data and guidelines for the definition of the DBL structure within EUB SuperHub project covering the entire lifecycle of buildings and comprising all relevant building information to a broader range of stakeholders.

1.4.1.1 DEFINITION OF THE DIGITAL BUILDING LOGBOOK – Report 1 of the Study on the development of a European Union Framework for Buildings' Digital Logbook

This report presents: and outlines:

- a definition of a DBL,
- building on a state-of-play analysis and stakeholder input from across Europe,
- the potential role and scope of an EU-supported DBL,
- data handling and governance issues.

The basis for the results and main key findings described in this report are:

- **a thorough review of existing literature**,
- **a semi-structured interviews** with 32 experts from 9 EU countries,
- **an online survey** with 93 respondents from 19 EU countries.

1.4.1.1.1 Interviews findings

There were several questions within the conducted semi-structured interviews.

One of the questions for interviewed participants was what a digital building logbook is. Participants stated that:

- DBL is a "repository for (all relevant) building data",
- DBL could enable a reduction of energy/carbon use and mitigate climate and environmental footprint,
- DBL could support the construction value chain and provide benefits to building owners.

The participants indicated the following functionalities that the DBL should include:

- Providing different data for different actors and purposes,
- Easy storage and access to information,
- Easy to understand, accessible and reliable,
- Systematically log and store existing data and information,

- Contribution to an increased awareness of the building's energy performance, material use over the lifecycle, sustainability performance, indoor environmental quality, potential energy, and cost savings
- Traceability of materials and chemicals over the building's lifecycle,
- Providing services to building owners and storing information
- Comparing energy consumption,
- Finding contractors,
- Integration of BIM/digital twins …

The participants indicated the data that should be collected within the DBL:

- administrative, building characteristics, energy performance data, operational, maintenance, financial data,
- linking DBL with existing policy and market instruments, such as Energy Performance Certificates, the Smart Readiness Indicator, LEVEL(s) and material passports.

A common argument was that the data needs to be up-to-date and reliable to be useful.

1.4.1.1.2 On-line survey findings

The above-mentioned **online survey** gathered stakeholders' views and input regarding the type of information included in the DBL, functionalities, as well as data governance issues. There were in total 93 respondents from 9 EU countries representing different stakeholder groups (e.g., building owners, engineers, architects, finance expert, digital expert, public authority, research, demolition representative, ….,) to gather a wide range of perspectives.

Based on the online survey results the following data should be collected in the DBL (the first six data fields with the highest number of votes considered as very important):

1. Building descriptions and characteristics (81 of 93 votes),
2. Equipment, with description and design (75 of 93 votes),
3. Energy Performance Certificate (71 of 93 votes),
4. Building material inventory (70 of 93 votes),
5. Designs and plans of building interventions (67 of 93 votes),
6. Designs and plans of the building (66 of 93 votes)

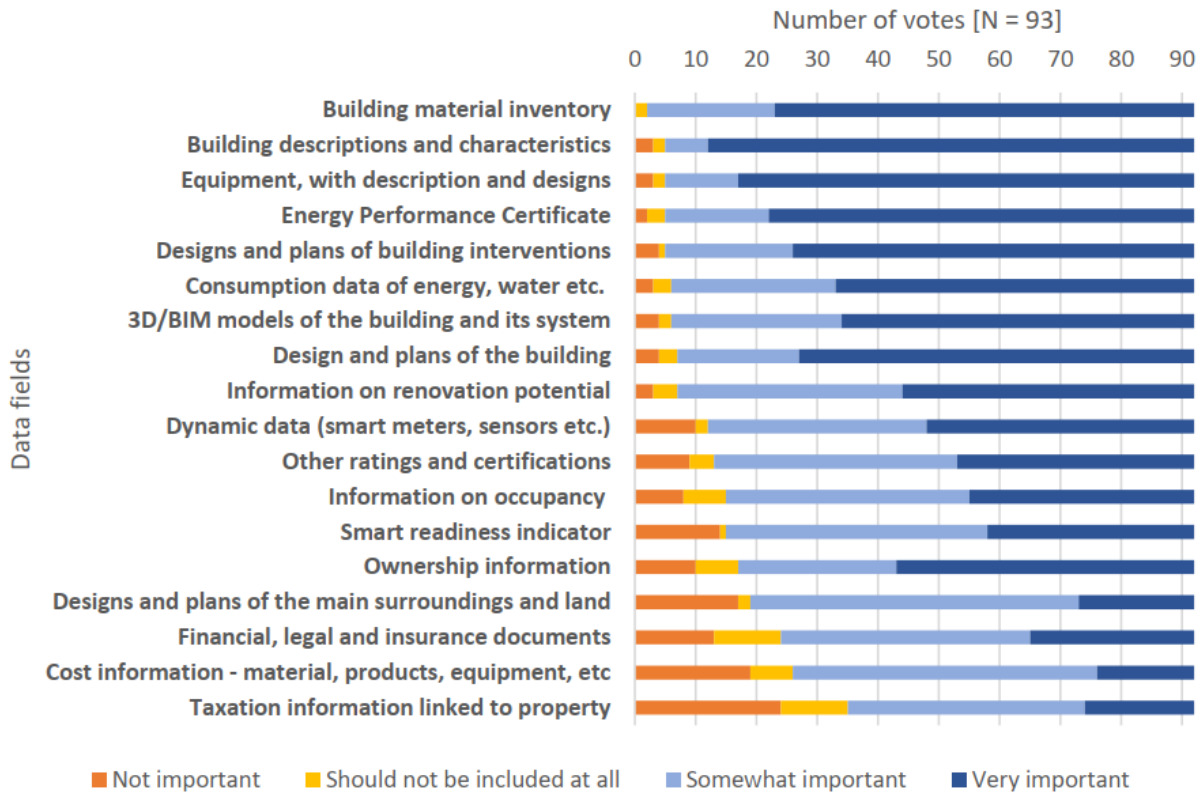


Figure 22: Results of the performed online survey – data fields

One question asked was who should be responsible for data ownership and liability. 59 % (47 out of 79 respondents) suggested the building owner (either alone or together with a public authority), while 34 % suggested the public authorities.

Within this survey respondents were also asked to answer a question on data accessibility for the three main users: building owners, public authorities, and 3rd party actors (actors in the construction value chain, utility companies etc). 75% (65 out of 87 respondents) think that building owners should have full access to the data stored in the DBL about their building.

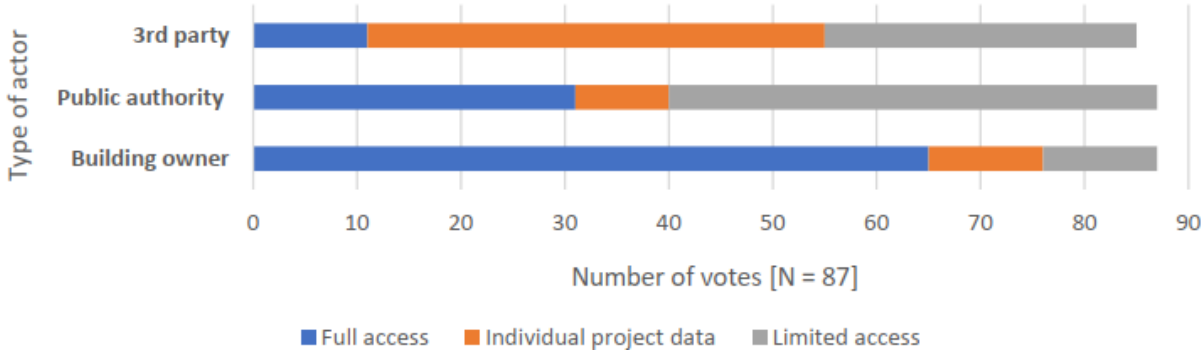


Figure 23: Results of the performed online survey – data access

Most respondents think that DBL should be updated “any time the building undergoes intervention work”.

1.4.1.1.3 Definition of a Digital Building Logbooks

This report gives the following definitions of a DBL:

"*A digital building logbook is a common repository for all relevant building data. It facilitates transparency, trust, informed decision making and information sharing within the construction sector, among building owners and occupants, financial institutions, and public authorities.*"

"*A digital building logbook is a dynamic tool that allows a variety of data, information, and documents to be recorded, accessed, enriched, and organised under specific categories. It represents a record of major events and changes over a building's lifecycle, such as change of ownership, tenure or use, maintenance, refurbishment, and other interventions. As such, it can include administrative documents, plans, description of the land, the building and its surrounding, technical systems, traceability and characteristics of construction materials, performance data such as operational energy use, indoor environmental quality, smart building potential and lifecycle emissions, as well as links to building ratings and certificates. As a result, it also enables circularity in the built environment.*"

1.4.1.1.4 The role of Digital Building Logbooks

The digital building logbook can play a role in relation to the following policy initiatives:

- New Industrial Strategy for Europe - a deeper and more digital single market,
- European Green Deal and the announced 'Renovation Wave' initiative - more resilient and climate-proof buildings,
- Circular Economy Action Plan and Strategy for a Sustainable Built Environment - supporting the construction industry towards climate neutrality and building a more circular economy,
- European Data Strategy - data privacy and security,
- Construction Product Regulation (CPR) review, Sustainable Product Policy and Digital Product Passports.

1.4.1.1.5 Main benefits and concerns of the DBL

To avoid perceiving the DBL as an additional administrative burden, gathering all potential benefits for each stakeholder across the entire construction and built environment value chain is essential. The table below, taken from Annex B of Report 1, gives a detailed overview of the benefits and main concerns to different actors anticipated with the widespread introduction of DBL.

Table 7: Stakeholder mapping – description of main benefits and concerns taken from Annex B – Report 1

Stakeholders	Potential benefits	Main concerns
Landlords / owner-occupiers (including prospective buyers and sellers)	• Increased consumer awareness, knowledge and protection as the end-user generally carries all of the risks of a purchasing decision • Speeds up and eases due diligence processes; provides better security and guarantees during the transaction process • Proper documentation of the building may ensure a lasting and higher value • Reduced sick building syndrome; lingering issues are not overlooked as owners/occupiers/ facility managers can inform themselves on previous cleaning, maintenance, and defects	• Data ownership and privacy; building owners should be the sole owner and data only stored/shared upon consent • The overall interest from building owners might be limited as benefits are perceived as minor or intangible • The unwillingness of data provider to guarantee for data accuracy, e.g. upon transaction • Cost/benefits ratio for small residential owners is only positive if

Stakeholders	Potential benefits	Main concerns
	• Proper documentation can lower insurance premiums • Enables better portfolio management, better-planned maintenance and refurbishment works (renovation roadmap) and maintains the quality of use • Connects to a marketplace of services (e.g. one-stop-shops, tailored financing, turnkey renovation solutions) and aggregation of projects • Visualising future energy/cost saving potentials and smart readiness • Better information about the flexibility, adaptability and circularity of the building and its products	it can bring benefits at "low or no-cost, and a minimum additional burden" • Not all building owners are keen on allowing more transparency of the building's actual quality/performance, as it can influence the value of the building • Lease terms and tenant-landlord relationships (often more adversarial than collaborative) can complicate data sharing and disclosure
Tenants	• Well-documented buildings instil confidence and trust in the quality of the building • Information on indoor environmental quality could be a relevant factor to consider for potential tenants • Potential services related to energy consumption (such as demand response) could enable cost savings	• The extra (administrative/ cost) burden could lead to an increase in the rent. • Data ownership and privacy, especially when it comes to monitoring user behaviour (real energy consumption) • Lease terms and tenant-landlord relationships (often more adversarial than collaborative) can complicate data sharing and disclosure
Designers	• Encourages integrated and collaborative design • The setting of quality targets creates incentives to meet targets in construction projects • Access to comprehensive information in case of renovation/extension • Design information will be better maintained and accessible overtime to support decision-making over the whole lifecycle • Potential for integration with BIM	• Limited incentives to update the DBL after work is finished • May create exposure of design/engineering decisions in case of disputes on building performance
Developers	• Proper documentation and transparency may increase the value of the building, e.g. by providing an audit trail of who did what during the construction phase) • Simplifies the planning process and reduces red tape • Information regarding the flexibility and adaptability potential of the building could also increase the value of the building since it supports multiple uses/functions and extends the useful lifecycle of the asset • The DBL can be used to demonstrate regulatory compliance and provide links to various certifications and ratings	• Need for additional documentation, which entails more work/higher cost
Construction contractors	• In case of renovation/extension, information can be easily accessed about existing building structure/materials • Potential for integration with BIM • Enables end-of-life recycling, while increasing safety for the contractors	• Need to properly document works implies additional efforts
Investors	• More reliable and transparent information on building performance supports transaction due diligence, informed decision-making, risk assessments and certainty, CAPEX planning and tenant recruitment/retention • Accessible data lowers costs of voluntary and regulatory reporting (e.g., energy use/GHG emissions; climate risk etc.) • The material inventory can increase the residual value of the asset and encourage responsible investment practices (e.g. impact investing)	• Tenant buy-in, data access and quality management, which are often outside of the control of landlords and investors
Banks and insurers	• Increased transparency concerning financial instruments	• Any data collection required beyond initial due diligence at the

Stakeholders	Potential benefits	Main concerns
	• Supports lenders with reliable data and may potentially increase the value of energy-efficient and sustainable real estate asset collateral • Enables the 'green' tagging of loans that could be packaged as asset-backed securities and refinanced by green bonds • Tracking the financial performance of energy-efficient/green loans relative to traditional financial products • Potentially lower risk and better capital treatment	time of underwriting creates additional costs • Adapting business processes and loan service agreements to reflect heightened data collection requirements and due diligence • Banks are often too many steps removed from the assets, e.g. tenant buy-in, data access and quality management
Material suppliers	• Enables circularity in construction and buildings through deconstruction, reuse and recycling of materials • Improved traceability of materials and chemical substances • Innovative business models and value definition such as the leasing of construction materials or building elements	• Need to provide additional information on their materials
Facility and building managers	• Helps to monitor and reduce operational energy use and fuel bills • Improved building performance, occupant comfort and indoor environmental quality • Improved maintenance and use of buildings; extended asset life • Monitoring KPIs to support organisational goals	• Need for additional documentation • Needs to be easy to use and aligned with existing practices • Needs to be compatible with smart meters, sensors and intelligent devices in order to support the capturing and integration of big data
Demolition contractors	• Supports circular economy practices by providing information on the type, amount and location of materials used in the building, and their potential for re-use and recycling	
Public authorities and policy makers	• Enables better policymaking and enforcement • Access to reliable building data for monitoring of process towards climate targets • Development of better-tailored support schemes • Provides evidence about the effectiveness of policy measures	
Real estate agents	• Transparency and trust as a sales/marketing argument • Shortens and simplifies transaction processes	• Increased transparency might limit flexibility during the sales/letting process • Upskilling and capacity building to understand and communicate the wide range of data
Research	• Gives access to updated data on large parts of the building stock, significantly increasing the accuracy of building stock models	
Utilities	• Access to a wider scope of data facilitating the understanding of customer profiles and customer services • Facilitates smart energy use and energy demand reduction strategies • New business models, such as energy efficiency services	• Data privacy rules
Certifiers	• Significantly reduces the effort to generate certificates • Potential for semi-automatisation of certificates	• The potential loss of business volume due to automatisation
Valuers	• Significantly reduces the effort to generate valuation reports • Potential for semi-automatisation of reports • Availability of data and information from safe sources in a time and cost-saving way • Improves the accuracy of valuations by taking into account the many factors impacting the overall quality of buildings	• Change of business models and value additions due to extended use of automated valuation models (AVMs)

1.4.1.1.6 The building blocks of a Digital Building Logbook

The main building blocks of the DBL are:

- Data and information,
- Features, functionalities, and benefits
- Data governance.

It is important to stress that a digital building logbook is a repository for all relevant building data within entire building life cycle covering the following stages:

- **Design and planning**,
- **Construction**,
- **Sales/leasing**,
- **Operation and refurbishment**,
- **Repurpose or demolition**.

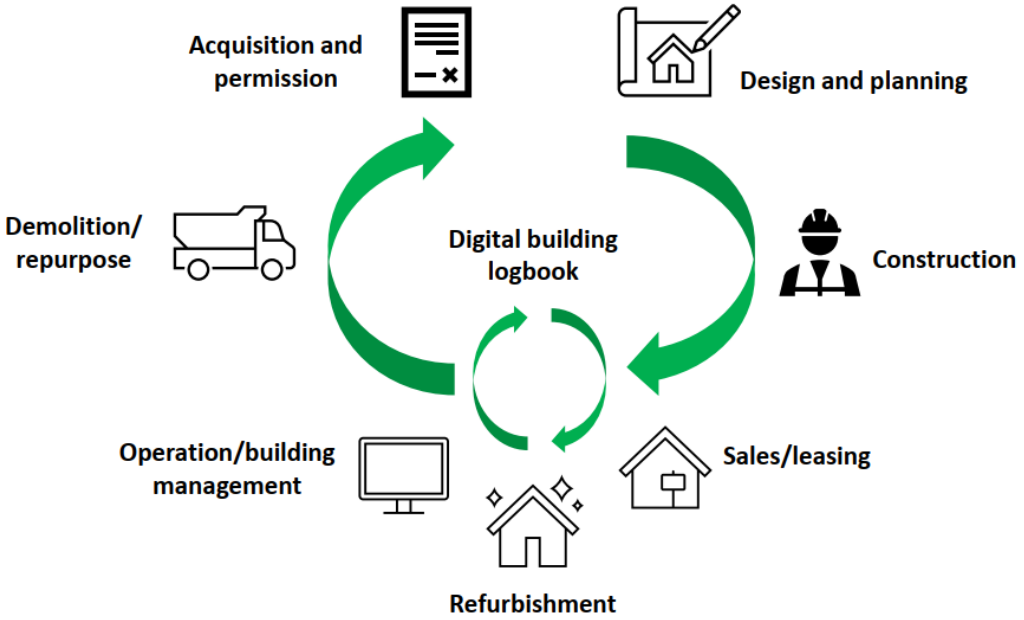


Figure 24: Lifecycle of a building

During each of these phases, large numbers of stakeholders interact with the building requiring different information. They use data in different ways and for different purposes.

This report also suggests that a common DBL for the entire building stock is desirable. "*A separate DBL for different building typologies should not be pursued.*"

There are two types of information stored in the DBL:

- static information – information with little or no change (e.g., address of the building)
- dynamic information – all information changing over time (e.g., resource consumption, renewable energy generation)

This report describes DBL as a living document as the data it contains must continuously be updated to be relevant, useful, and reliable.

Based on the desk research and the mapping of existing initiatives the report suggests the following data fields structured according to the following **eight information categories:**

1. ADMINISTRATIVE INFORMATION
2. GENERAL INFORMATION
3. BUILDING DESCRIPTIONS AND CHARACTERISTICS
4. BUILDING OPERATION AND USE
5. BUILDING PERFORMANCE
6. BUILDING MATERIAL INVENTORY
7. SMART READINESS
8. FINANCE

Table 8: Main categories and subcategories – Study EU DBL (July 2020)

Study EU DBL (July 2020)		
	Category	Sub-category
1	**ADMINISTRATIVE INFORMATION**	Unique building identifier Address Building owner DBL prepared by When was the DBL last edited Ownership type Tenancy agreement Utilities contracts Maintenance service contact Insurance documents Maintenance log Licenses
2	**GENERAL INFORMATION**	District heating access Year built Solar potential Soil/terrain Climate information Physical accessibility Safety manual
3	**BUILDING DESCRIPTIONS AND CHARACTERISTICS**	Design and plans of the building Building information model Floor area Heated floor area Number of floors Façade types Roof type Windows and door types Heating systems and related energy carriers Cooling equipment Lighting systems Ventilation systems Technical building systems Renewable energy systems Domestic water Sewer systems Rainwater drainage Fire Safety Plan (evacuation plans, signalisation, alarms etc). Building surroundings Historical context (blueprint plans or heritage of the building and municipality) Expected lifetime
4	**BUILDING OPERATION AND USE**	Number of occupants Functions Measured heating consumption Measured electricity consumption Measured hot water consumption Dynamic heating consumption Dynamic electricity consumption Renewable energy production Behavioural insights
5	**BUILDING PERFORMANCE**	EPC rating Building envelope (U-value of different components) "Total calculated heating consumption" Total calculated electricity consumption

	Study EU DBL (July 2020)	
	Category	Sub-category
		Tailored renovation recommendations Climate resilience potential
6	**BUILDING MATERIAL INVENTORY**	Material 1 - Type Material 1 - Location Material 1 - Volume Material 1 - Weight Material 1 - Embodied carbon Material 1 - Life span Material 1 - Fire resistance class Material 1 - Waste category Material 1 - Certificate 1 Material 1 - Chemical declaration Material 1 - Global Trade Item Number
7	**SMART READINESS**	SRI result Charging infrastructure for E-mobility Smart district potential Demand response potential
8	**FINANCE**	Annual rent Annual property tax Annual maintenance costs Property value Valuation date Valuation method Valuation conducted by Valuation document 1 Property yield Annual electricity cost Annual water cost Annual heating cost Other costs

The report 1 states that the main purpose of the DBL is to develop a better understanding of the building throughout its full lifecycle by improving transparency and trust and providing the basis for informed decision-making and actions.

It is stresses that "*the DBL should be flexible to make the right information available to the right actor at the right time.*"

The report 1 identified the following **five** most relevant **key features** of the DBL:

1. Digital interface,
2. Interoperability,
3. Data syncing/matching,
4. Storage of data and information and
5. User-friendly navigation and visualisation.

A DBL should be launched in the initial phase with a limited number of essential data fields and functions. Over time the DBL will evolve with additional data fields and related functions.

This report also outlines data handling and governance issues stressing that "*concerns over privacy, confidentiality, and control data can be a limiting factor to the market uptake of DBLs*".

The building owner should be the principal owner of the information in the DBL. Certain information should be made available to third parties with the building/data owner's consent.

The report suggests setting up a **data access layer** to clarify who has access to data and who has the right to amend or delete records.

Within this report, three main approaches are considered as solutions for data storage:

- DBL as a database which physically stores all the information related to the building,
- DBL as a digital gateway to which data and information can be linked via a unique building ID. The advantage of this approach is that information can be collated from various sources (both public and private) and the information is up to date whenever data is being updated 'at source'.
- hybrid versions which are a combination of the above two approaches.

1.4.1.1.7 Next steps as a conclusion

At the end of this report, instead of conclusion, the authors of this report defined the next steps that need to be further taken such as exploration and discussion of barriers, gaps, and recommendation for the DBL.

The authors also stated that the successful implementation of a DBL takes time requiring substantial planning and testing. The DBL must be adapted to the needs of users.

1.4.1.2 BUILDING LOGBOOK STATE OF PLAY – Report 2 of the Study on the development of a European Union Framework for Buildings' Digital Logbook

This report presents and provides:

- presents the **results of the analysis of 40 building logbook initiatives** in different countries,
- provides an **overview of initiatives** and
- highlights **key success factors and barriers to the implementation of building logbooks**.

Based on thorough literature review and desk research the final list of already existing initiatives set up within this report includes 40 initiatives. Thirty-one are from EU countries.

Building logbooks analysed

- Arc platform - USA
- BASTA Loggbok – Sweden
- Bedrebolig – Denmark
- Building Passport GBC – Finland
- CIBSE TM31 - UK
- Dossier d'intervention ultérieure – Belgium
- Electronic building ID – Greece
- Eigenheim Manager – Germany
- Fascicolo del Fabbricato - Italy
- Federal Register – Switzerland
- Gëbaudepass – Germany
- Hausakte – Germany
- Homebook – France
- Home Information Pack – UK
- Home report – Scotland
- Ilmastoviisaat Taloyhtiöt – Finland
- ImmoPass – Germany
- Klimatdeklaration – Sweden
- Le carnet numérique du logement - France
- Libro del Edificio - Spain
- Livro de obra - Portugal
- Madaster – The Netherlands
- Wikihabitat – France
- Min Villa – Sweden
- Mon carnet logement - France
- Opleverdossier – The Netherlands
- PAS-E – Spain
- Passeport Efficacité Énergétique - France
- Platform CB'23 – The Netherlands
- Produktkollen – Sweden
- Property Register – Iceland
- QDF Hausakte – Germany
- Real estate service manual – Finland
- Woningpas – Flanders

- **Relevant H2020 projects**
  - IBroad
  - ALDREN
  - BAMB
  - BIM4EEB
  - DigiPLACE
  - X-tendo

Figure 25: Building logbook initiatives analysed within Report 2

The report 2 analysed each of in total 40 initiatives using an evaluation template (see Annex A), which covered the following aspects:

- description of the initiative,
- data fields and functionalities included,
- public or private, paper or digital, mandatory or voluntary,
- data management approach,
- applicability over different types of buildings and usage by different stakeholders,
- affinity and compatibility with other European initiatives.

1.4.1.2.1 Analysis results of the initiatives

The analysis of the initiatives is described based on five maturity levels: under development (UD), tested (T), in place (IP) and discontinued (D).

At the time of publishing (July 2020) the six digital building logbook initiatives were under development (see Figure 26).

UD1 - Building Passport GBC – Finland
UD2 - Klimatdeklaration – Sweden
UD3 - PAS-E – Spain
UD4 - Platform CB'23 – The Netherlands
UD5 - Ilmastoviisaat Taloyhtiöt – Finland
UD6 - Electronic building ID – Greece

Figure 26: Building logbook initiatives analysed within Report 2 – under development (UD)

The Electronic Building Identity (HTC; translated into Greek as Illektroniki Taftotita Ktiriou - Ηλεκτρονικής Ταυτότητας Κτιρίου) is already in place and mandatory for all the real properties of the Greek territory as of February 1st, 2021. The HTC is defined as

the file that contains the details of the property and a special reference to the Code Number of the National Land Registry (KAEK) of the property. The purpose of the HTC is to capture the current condition of the building and its permits and monitor and control its changes during the property's lifetime. The HTC is issued and associated with the property, not the owner (only one HTC for the property).

The documentation for the Building's Electronic ID filing is the following:

- The body of the building permit of the building, together with its revisions,
- The plans accompanying the building permit,
- The energy performance certificate of the Real Property,
- The construction inspection certificate, if any,
- Declarations pertaining to laws that suspend the imposition of sanctions for arbitrary buildings,
- The structural vulnerability sheet or the static inspection technical report,
- The cadastral number of the Real Property,
- The Certificate of Completeness for Building's Electronic Identity.

At the time of publishing this report two initiatives were under development in Finland, the Building Passport GBC and the Ilmastoviisaat Taloyhtiöt (Climate-Wise Housing Corporation). The building passport aims at extending the information provided by current schemes such as EPC, BREEAM and LEED into a unique building 's performance indicator set. The main goal of the Ilmastoviisaat Taloyhtiöt is to reduce energy consumption and GHG emissions by analysing data collected through IoT sensors.

At the time of publishing this report, five French initiatives were tested, and 21 initiatives were already in place.

T1 - Passeport Efficacité Énergétique – France
T2 - Homebook – France
T3 - Le carnet numérique du logement – France
T4 - Mon carnet logement – France
T5 - Wikihabitat – France

Figure 27: Building logbook initiatives analysed within Report 2 – tested (T)

Annex B of Report 2 briefly describes each initiative in place.

IP1 - Arc platform – USA
IP2 - BASTA Loggbok – Sweden
IP3 - Bedrebolig – Denmark
IP4 - CIBSE TM31 – UK
IP5 - Dossier d'intervention ultérieure – Belgium
IP6 - Eigenheim Manager – Germany
IP7 - Fascicolo del Fabbricato – Italy
IP8 - Federal Register – Switzerland
IP9 - Gëbaudepass – Germany
IP10 - Hausakte – Germany
IP11 - Home report – Scotland
IP12 - Libro del Edificio – Spain
IP13 - Livro de obra – Portugal
IP14 - Madaster – The Netherlands
IP15 - Min Villa – Sweden
IP16 - Opleverdossier – The Netherlands
IP17 - Produktkollen – Sweden
IP18 - Property Register – Iceland
IP19 - QDF Hausakte – Germany
IP20 - Real estate service manual – Finland
IP21 - Woningpas – Flanders (Belgium)

Figure 28: Building logbook initiatives analysed within Report 2 – in place (IP)

Out of the 21 initiatives, 14 are public and 7 are private, with most of the public initiatives (10) being mandatory and most private initiatives being voluntary (6). It is noteworthy that among the initiatives in place at the time, 11 initiatives were paper-based (e.g., BASTA loggbok, Bedrebolig, CIBSE TM31, Dossier d'intervention ultérieure, Fascicolo del Fabbricato, Home report, Libro del Edificio, Livro de obra, Opleverdossier, QDF Hausakte, Real estate service manual) and 10 were digital (e.g., Arc platform, Eigenheim Manager, Federal Register of Buildings and Dwellings, Gëbaudepass, Hausakte, Madaster, Min Villa, Produktkollen, Property Register, Woningpas).

It is interesting to see the map of the data fields included in each building logbook in place. The data mostly present across the building logbooks are related to general administrative information together with building characteristics and information on building operation and use. It is noteworthy that Madaster, Opleverdossier and Arc platform (all voluntary) include the largest number of data fields compared to the others.

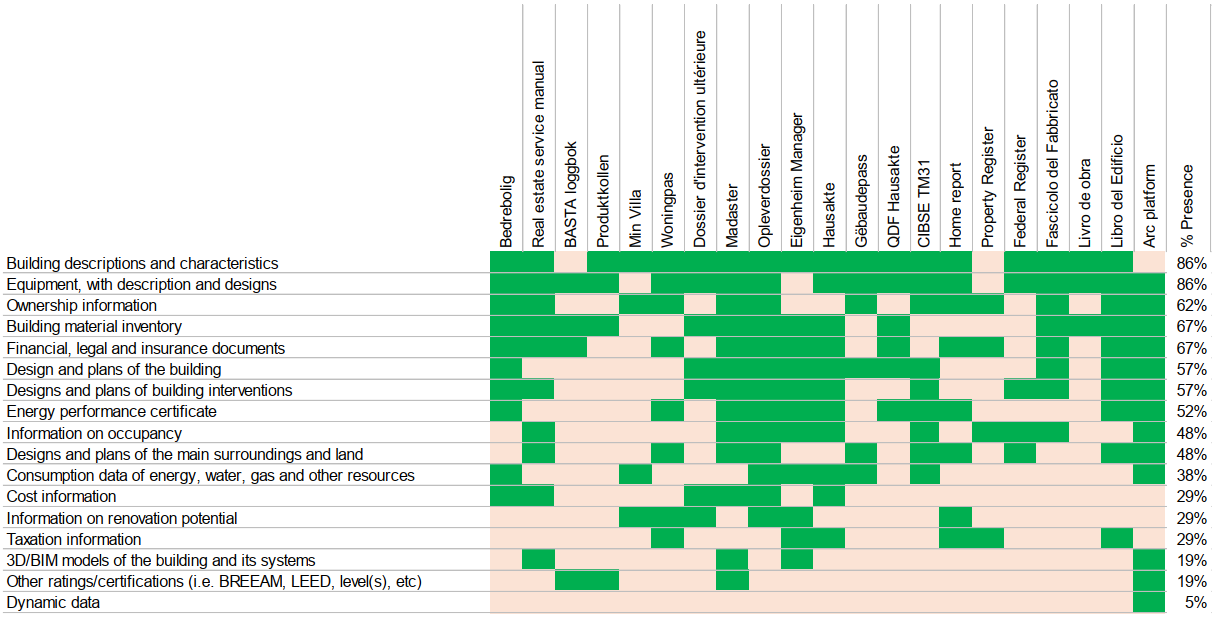


Figure 29: Data fields building logbooks in place

Report 2 also compared functionalities among the building logbooks in place. Authors of Report 2 concluded that building logbooks in place are mainly used as collector of administrative and construction information together with operational maintenance and use. Only some of the more "advanced" functionalities (benchmarking with similar buildings, alerts on performance/condition, environmental impact, or compatibility with 3D/BIM models) listed at the bottom of Figure 30 are available in few voluntary initiatives.

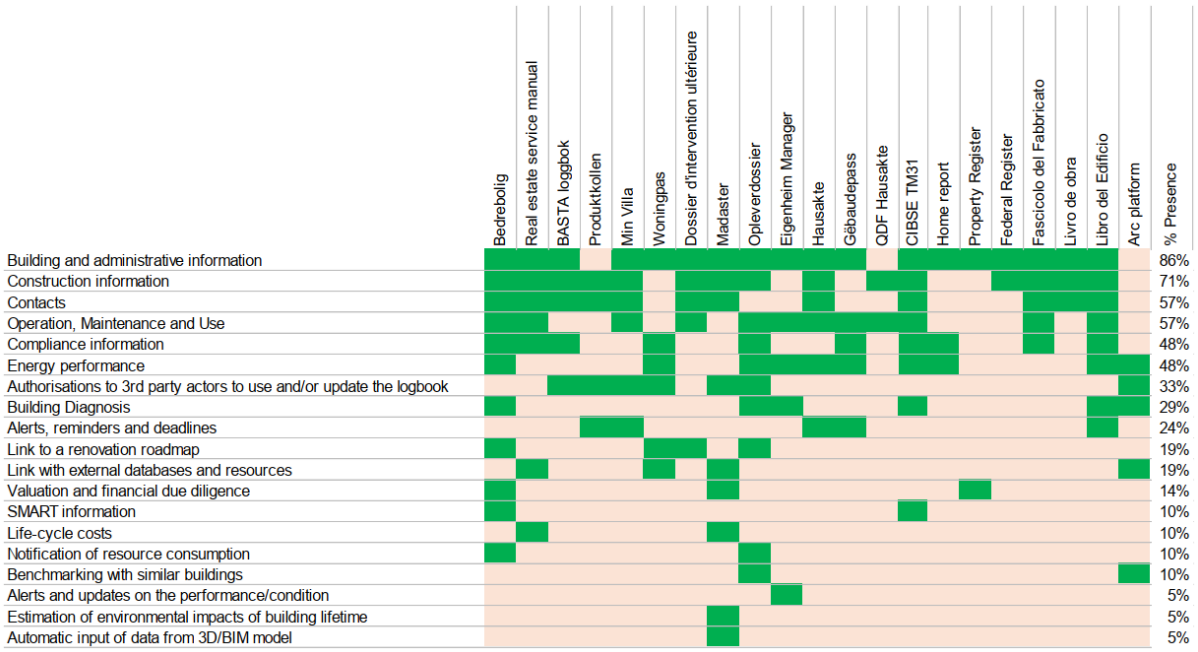


Figure 30: Functionalities building logbooks in place

From the analysed building logbook initiatives, the two of them are discontinued (Home Information Pack in UK, and ImmoPass in Germany).

D1 - Home Information Pack – UK
D2 - ImmoPass – Germany

Figure 31: Building logbook initiatives analysed within Report 2 – discontinued (D)

1.4.1.2.2 Barriers to implementation of building logbooks

Based on the thorough analysis of building logbook initiatives, the authors of this report highlighted different barriers that prevent or slow down the uptake of DBL.

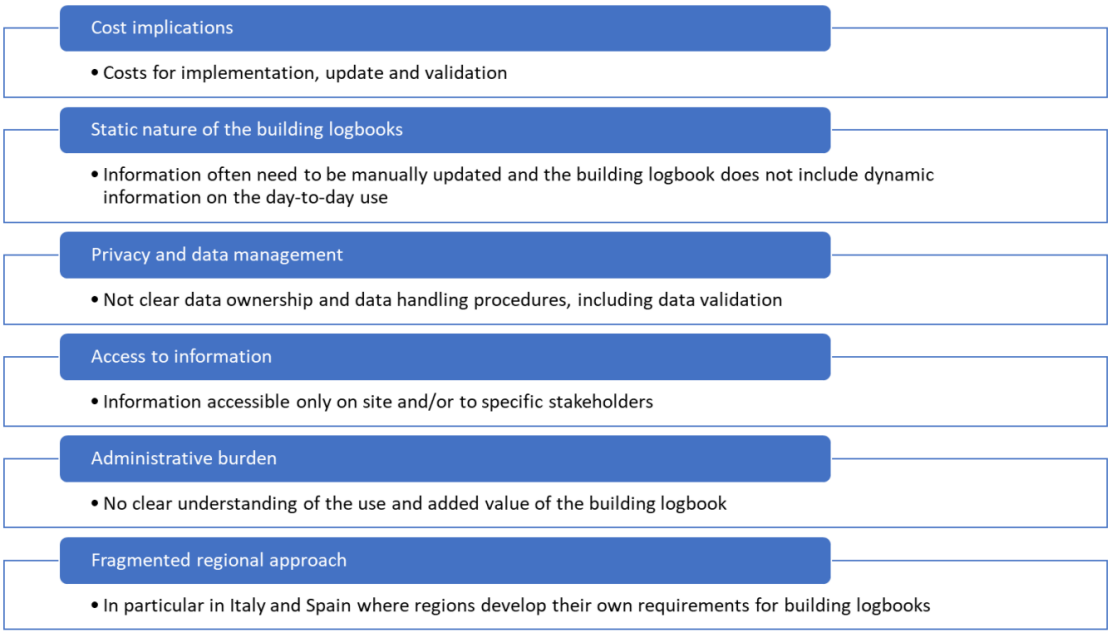
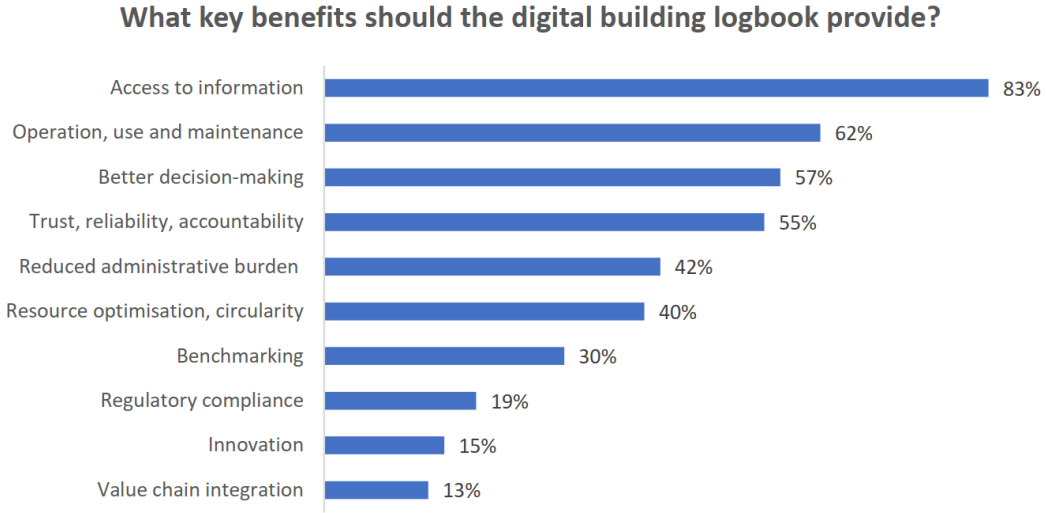
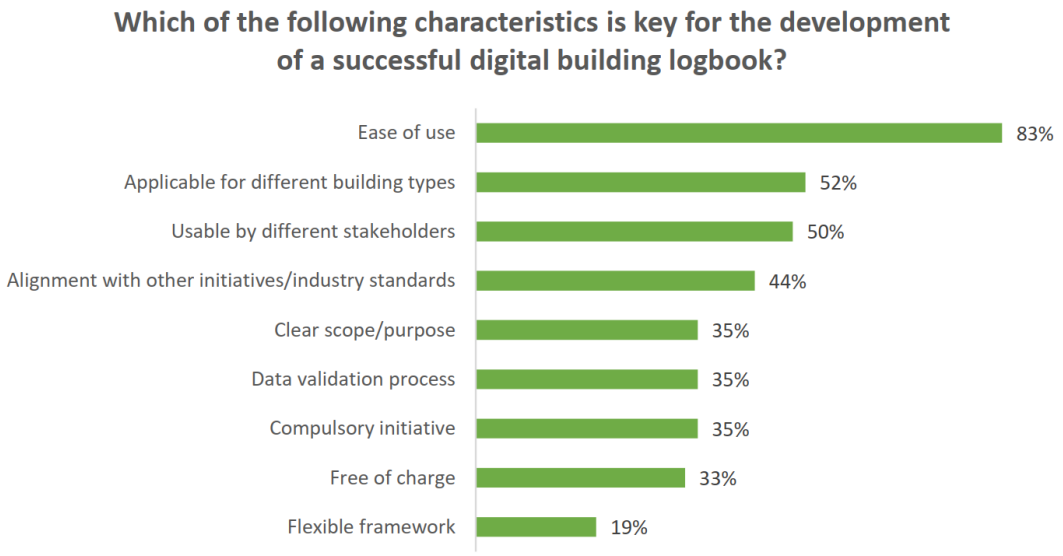


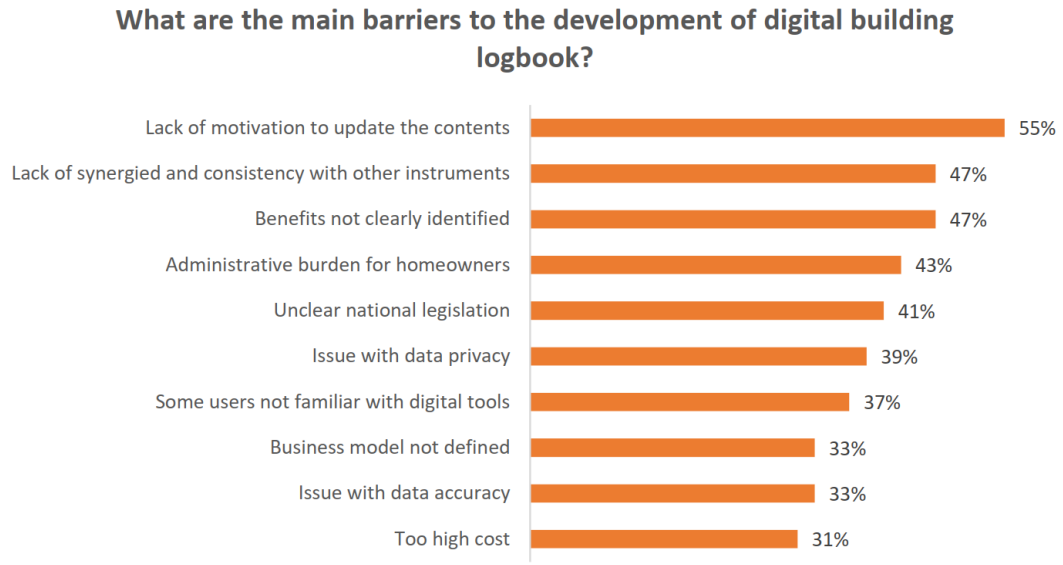
Figure 32: Barriers to the implementation of building logbooks

1.4.1.2.3 Webinar results organised by the B-LOG consortium

The B-LOG consortium organised a webinar with 68 participants of different stakeholders' groups on May 13th, 2020, to share the results of their activities in the project's initial phase. During this webinar, participants answered the following three questions:







From the responses, it is clear that for the participants, the most important:

- key benefit the DBL should provide is **access to information**,
- key characteristic for the development of a successful DBL is **ease of use**,
- barrier to developing a DBL is a **lack of motivation to update the contents**.

1.4.1.2.4 Conclusions

Based on the performed analysis of the state of play of the building logbooks, the authors of this report came to the following conclusions:

- Building logbooks in place are used to collect administrative information, together with building characteristics and operational data.
- Building logbooks can become enabling tools for initiatives such as the renovation roadmaps or for investment decision making and can also be enriched with details that can support circular economy.
- Ease of use is the key element for a successful building logbook.
- Only a clear understanding by the users of the usefulness of the building logbook together with an easy to implement approach would push the uptake.

- The existing digital building logbook named Woningpas (building passport for residential dwellings) developed in Flanders (Belgium) links with existing databases and gets automatically updated (positive example of approaches aimed at simplifying the process of implementation).
- All the issues related with data, including quality assurance, lack of standardisation, privacy, accuracy can influence the utility and utilisation of the building logbook.
- Not validated/updated building logbooks lose their purpose and make the whole process an onerous and time-consuming exercise with very little benefits.
- It is important to clearly define the scope and functionalities to ensure success of DBLs.
- Moving toward a digital building logbook by developing an integrated instrument that provides accurate and up-to-date information and enables analysis, based on different user's needs, on how to manage, maintain and improve the building.

1.4.1.3 Study on the Development of a European Union Framework for Digital Building Logbooks FINAL REPORT

The final report on study on the development of a European Union Framework for Digital Building Logbooks published in December 2020, specified set of actions to address the main gaps in the implementation of DBLs and proposed the three priority actions to spread the use and efficient functioning of DBLs.

1.4.1.3.1 Gaps analysis

Based on the stakeholder consultation, the main DBL implementation gaps were identified.

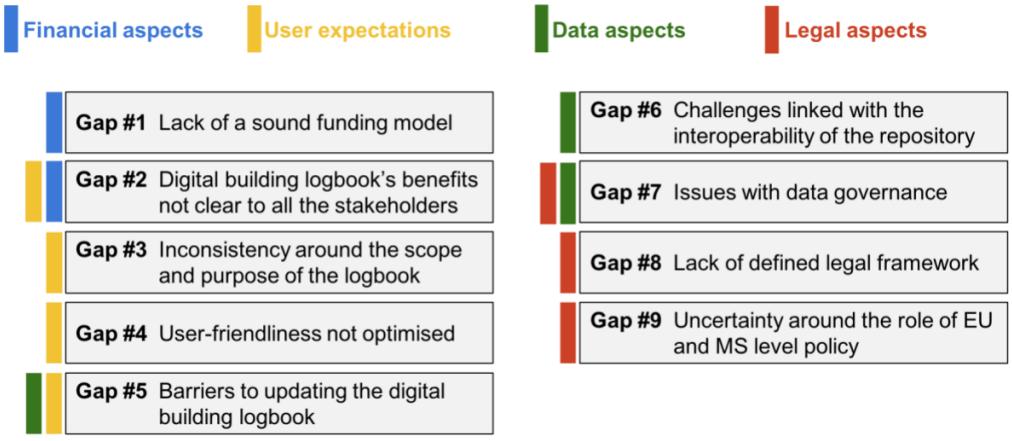


Figure 33: Key gaps in the implementation of DBLs

1.4.1.3.2 Set of actions to address the main gaps in the implementation of DBLs

Within the final report the set of **15 actions to address the main gaps** in the implementation of DBLs were proposed:

Action A. Launch of publicly funded R&I projects to further explore the digital building logbook concept and its implementation

Action B. Cost-benefit analysis and impact assessment

Action C. Identification of different funding models

Action D. Market potential study of specific functionalities

Action E. Communication campaign and awareness-raising activities

Action F. Make digital building logbooks mandatory for public buildings

Action G. Creation of a digital building logbook definition at EU level, including data fields and functionalities

Action H. User experience study

Action I. Development of a standard for data collection, data management and interoperability

Action J. Development of guidelines for linking existing databases

Action K. Training for construction and built environment professionals

Action L. Juridical/legal study about data governance aspects (ownership, privacy)

Action M. Development of a public tool enabling plug-ins from the private sector

Action N. Exploration of potential legislative actions

Action O. Mapping and guidance for the deployment of digital building logbooks

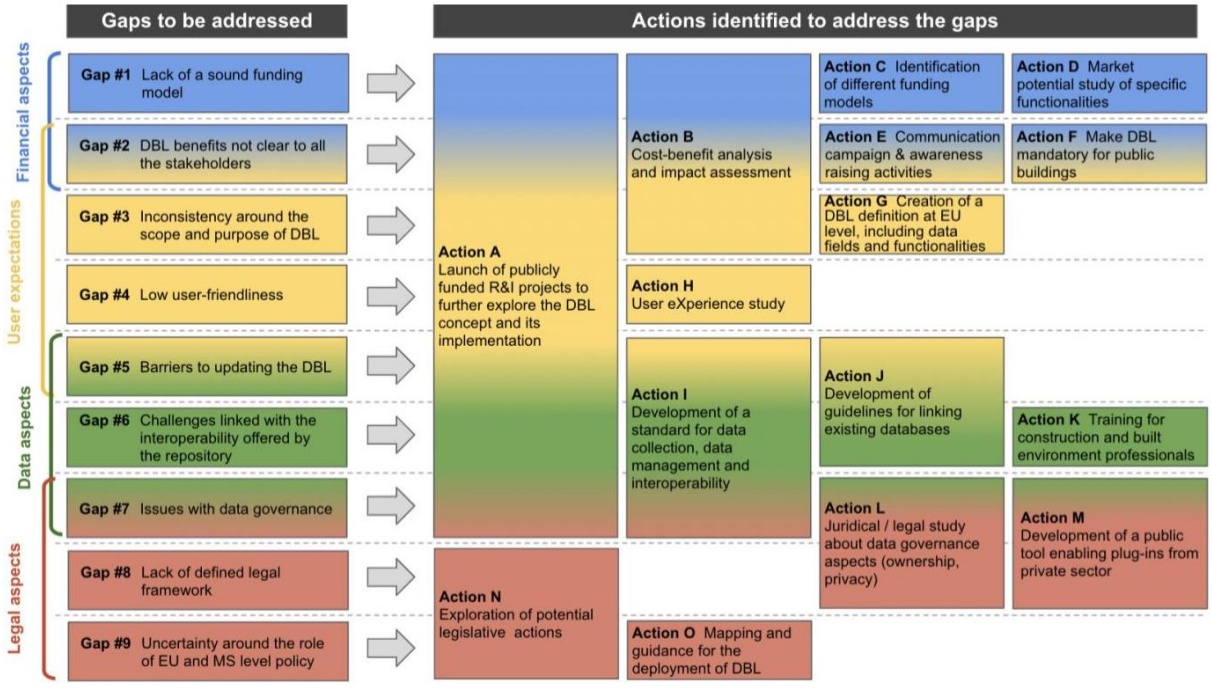


Figure 34: Key gaps and actions to address the gaps

1.4.1.3.3 Three priority actions for the European Commission

This final report proposed the following three priority actions for the European Commission to consider and potentially carry out in support of the widespread use and efficient functioning of digital building logbooks across the EU:

PRIORITY ACTION 1: Development of a standardised approach for data collection, data management and interoperability and its legal framework,

PRIORITY ACTION 2: Development of guidelines for linking existing databases; and
PRIORITY ACTION 3: Launch of public funded R&I projects to further explore the Digital Building Logbook concept and its implementation.

PRIORITY ACTION 1: Development of a standardised approach for data collection, data management and interoperability and its legal framework

A wider uptake of the digital building logbook requires a systematic and more closely aligned capture of information, data gathering, processing, exchange and storage. An EU-wide harmonised set of logbook data protocols would enable interoperability and the inclusion of external databases while bringing together fragmented and scattered data across several organisations.

PRIORITY ACTION 2: Development of guidelines for linking existing databases

Many building information databases exist across the EU (e.g., the EPC database, the database of real estate prices, etc.). The purpose of the digital building logbook is to bring these data sources together and become a common gateway to access data. Connecting all these data sources and users requires common 'languages' – interfaces and protocols – to enable interoperability, data consistency and information exchange. Linking multiple databases might require the existence of identifiers or 'primary keys' (e.g., building id) in each of the databases so the information of interest from multiple sources can be selected in one query.

PRIORITY ACTION 3: Launch of public funded R&I projects to further explore the Digital Building Logbook concept and its implementation.

This priority action explores the launch of publicly funded Research and Innovation (R&I) projects to further explore the digital building logbook concept and its implementation.

1.4.1.3.4 Synergies with existing EU&international initiatives

The implementation potential of DBLs across EU will increase through synergies within a larger framework of EU and international initiatives. The most relevant initiatives are:

- Building renovation passport
- Circular Economy Action Plan
- Digital Europe Programme
- Energy Performance Certificates
- Environmental Product Declarations
- Level(s)
- Product Environmental Footprint
- Renovation Wave
- Smart Readiness Indicator

1.4.1.3.5 Conclusions

The authors of this final report came to the following conclusions:

- In the digitalisation agenda of the construction sector, the digital building logbook plays a pivotal role.
- Digital building logbooks will serve as repositories for data on individual buildings and will facilitate information-sharing within the construction

sector and between building owners and tenants, financial institutions and public authorities.

- The European Commission can foster the widespread use and efficient operation of the digital building logbook by pursuing the following priority actions:
  Development of a standardised approach for data collection, data management and interoperability including its legal framework
  Development of guidelines for linking existing databases
  Launch of publicly funded R&I projects to further explore the digital building logbook concept and its implementation.
- The inclusion of the digital building logbook in the Renovation Wave provides an important push to continue the development of logbooks and the exploration of policy avenues which support their uptake.
- Guidelines on the interoperability of logbooks, the development of a platform linking with databases, and the development of features and functionalities demand significant investment and commitment.
- The implementation potential and chances for success of the priority actions will increase through building synergies within a larger framework of EU and international initiatives.

1.4.2 Directive (EU) 2018/844

Revision of EPBD and EED in 2018 ((EU) 2018/844) introduced some new provisions (transposition deadline of 10 March 2020) relating to:

- Long-term renovation strategy – requiring all Member States to develop long-term building renovation strategies, including a roadmap with measures and progression indicators
- Technical building systems, electromobility and smart readiness indicator (Article 8),
  - New buildings need to be equipped with self-regulating devices for the separate regulation of the temperature in each room,
  - In existing buildings, the installation of such self-regulating devices shall be required when heat generators are replaced,
  - new non-residential buildings and non-residential buildings undergoing major renovation, with more than ten parking spaces need to ensure the installation of at least one recharging point and ducting infrastructure
- Inspection of heating systems (Article 14),
  Non-residential buildings with an effective rated output for heating systems or systems for combined space heating and ventilation of over 290 kW need to be equipped with building automation and control systems by 2025
- Inspection of air-conditioning systems (Article 15),
  Non-residential buildings with an effective rated output for systems for air-conditioning or systems for combined air conditioning and ventilation of over 290 kW need to be equipped with building automation and control systems by 2025.

1.4.3 EU Renovation Wave strategy (October 2020)

In October 2020, the European Commission the EU Renovation wave strategy (COM(2020) 662 final) with the main objective to at least double the annual energy renovation rate of residential and non-residential buildings by 2030 and to foster deep energy renovations. This document also stresses the urgency for the EU to focus on making our buildings more energy-efficient, less carbon-intensive, and more usable and sustainable.

The EU Renovation Wave strategy stresses that deep renovation of a building is not always achievable in one go and it is therefore important to create better conditions for staged renovation. It also states that "***the Commission will introduce Digital Building Logbooks*** *that will integrate all building related data provided by the upcoming Building Renovation Passport, Smart Readiness Indicators, Level(s) and EPCs to ensure compatibility and integration of data throughout the renovation journey*".

The Digital Building Logbooks will serve as repositories for data on individual buildings and facilitate information sharing within the construction sector, and between building owners and tenants, financial institutions, and public authorities.

1.4.4 3rd revision of the Energy Performance of Buildings Directive (December 2021)

In December 2021, the European Commission published the proposal for a directive on the energy performance of buildings (COM(2021) 802 final) aiming to accelerate building renovation rates, reduce GHG emissions and energy consumption, and promote the uptake of renewable energy in buildings.

The main measures in the new proposal are:

- the gradual introduction of minimum energy performance standards to trigger renovation of the worst performing buildings,
- a new standard for new buildings and a more ambitious vision for buildings to be zero-emission,
- enhanced long-term renovation strategies, to be renamed national Building Renovation Plans,
- increased reliability, quality, and digitalisation of Energy Performance Certificates; with energy performance classes to be based on common criteria,
- a definition of deep renovation and the introduction of building renovation passports,
- modernisation of buildings and their systems, and better energy system integration (for heating, cooling, ventilation, charging of electric vehicles, renewable energy).

The proposed revision of the directive is now being considered by the Council and the European Parliament.

The proposed revision mentioned the term Digital Building Logbook twice:

- Article 2 – Definitions,
- Article 19 – Databases for energy performance of buildings.

The proposal gives the following definition of a digital building logbook:

"***digital building logbook*** *means a common repository for all relevant building data, including data related to energy performance such as energy performance certificates, renovation passports and smart readiness indicators, which facilitates informed decision making and information sharing within the construction sector, among building owners and occupants, financial institutions, and public authorities.* "

Renovation passport is defined as a document that provides a tailored roadmap for the renovation of a specific building in several steps that will significantly improve its energy performance.

Article 19 of this EPBD proposal refers to *Database for energy performance of buildings*. The last paragraph of this article states that "*Member States shall ensure that the national database for energy performance of buildings is interoperable and integrated with other administrative databases containing information on buildings, such as the national building cadastre and digital building logbooks*."

This sentence within article 19 paves the way for mandatory linking the national EPC databases to digital building logbooks.

The purpose of the digital building logbook is to bring building related data from different data sources together and become a common gateway to access data.

In the Annex V (*Template for energy performance certificates*) there are the following three lists:

- the list of elements that EPC should display on its front page.
- the list of indicators that EPC may include in addition (e.g., life-cycle Global Warming Potential, metered energy consumption), and
- the list of links with other initiatives that EPC may include (e.g., the value of smart assessment, a yes/no indicator whether a DBL is available for the building).

There is a whole list of provisions referring to **new buildings** that will become obligatory with the final adoption of the recast EPBD:

- as of 1 January 2027, all new buildings occupied or owned by public authorities must be zero emission buildings,
- as of 1 January 2030, all new buildings must be zero emission buildings,
- zero-emission buildings will need to be equipped with measuring and control devices for the monitoring and regulation of indoor air quality,
- as of 1 January 2027, the life-cycle Global Warming Potential (GWP) must be calculated for all new buildings with a useful floor area larger than 2000 m^2,
- as of 1 January 2030, the life-cycle Global Warming Potential (GWP) must be calculated for all new buildings regardless of useful floor area, according to Annex III (Requirements for new and renovated zero emission buildings and calculation of life-cycle global warming potential),
- the following issues need to be addressed for all new buildings:
  - healthy indoor climate conditions,
  - adaptation to climate change,
  - fire safety,
  - risks related to intense seismic activity and
  - accessibility for persons with disabilities.

Zero emission buildings, defined as buildings with very low energy demand fully covered by energy from renewable sources (generated on-site, from a renewable energy community or from district heating and cooling systems), shall not generate carbon emissions on site and therefore represent the vision of the building stock in 2050.

Also, all new and existing non-residential buildings with an effective rated output for heating/cooling systems of over 290 kW must be equipped with building automation and control system (BACS) as of 31 December 2024. This threshold will be lowered to 70 kW as of 1 December 2030.

1.5 Lessons learned from the conducted literature review

There are already many building logbooks and initiatives across Europe at different maturity levels (in place or under development). These logbooks and initiatives differ in terms of:

- **focus or area covering** (e.g., Energy Management Information System in Croatia and Energiamonitor in Estonia are primarily intended to be used for energy monitoring, Madaster in the Netherlands records all materials and products that are incorporated in a real estate, Wohningpas in Flanders (Belgium) features information on energy performance, renovation advice, the housing quality, and data on the environment),
- **types of buildings covering** (e.g., Woningpas in Belgium covers only individual houses and multi apartment buildings, whereas Eigenheim Manager in Germany, Madaster in the Netherlands, Basta Logbook in Sweden, Produktkolen in Sweden cover all types of buildings),
- **initiative type** (voluntary/mandatory, public/private, paper/digital).

Based on the analysed existing DBL data structure and all the suggestions within the Study on the Development of an EU Framework for Buildings' Digital Logbook (Report 1, Report 2, Final report) published by the European Commission and bearing in mind all forthcoming requirements within EU legislation, there is a whole list of requirements (main findings) that need to fulfil when defining and implementing the EUB SuperHub digital building logbook.

The EUB SuperHub digital building logbook needs to:

1. be applicable for the entire building stock (residential and non-residential buildings),
2. collect and monitor all relevant building data within the entire building life cycle,
3. be ease of use (simplicity, user friendly),
4. be easily understandable and usable by different stakeholders who have different information needs, use data in different ways and for different purposes,
5. become a common gateway to access data and bring data from different data sources together by linking with other existing reliable building information databases (e.g., EPC database, Property price /leas register, Energy Management Information system, as well as databases related to the Smart Readiness Indicator, building renovation passports and the Level(s) framework) – Michael Flickenschild : "*DBL is not a self-contained library but links existing databases*", see Meeting report on Announcement Webinar DBL Study [9],
6. use hybrid approach to data storage – only common basic data and data that cannot be found in any other databases are entered and stored physically within a created digital building logbook; for all other building data, that are already stored in some other reliable databases regularly updated and maintained, data and information need to be linked via a unique building ID to DBL – this will ensure that the information is up to date whenever data is being updated at source – only in that case a DBL will become a dynamic tool providing up-to-date and reliable data,

7. comprise at least the following data (elements, indicators) within DBL data structure:
   7.1 **Physical accessibility (design for all)** – according to the new proposal of EPBD directive (December 2021) accessibility for person with disabilities need to be addressed for all new buildings
   7.2 **History about any major renovation or replacement** – based on the task description
   7.3 **Records about materials used (material passport) - Traceability of materials and chemicals over the building's lifecycle** – based on the task description
   7.4 **Energy efficiency classes (EU energy labels)** of source of energy from space heating/domestic hot water/space cooling and built-in light sources – according to the EU's ecodesign directive 15 product groups require an energy label; the most important for DBL are:

   Heaters

   Local space heaters - local space heaters with a nominal heat output of 50 kW or less are sold with energy labels as of 2018; the rating scale ranges from A++ (most efficient, only applicable to solid fuel local space heaters that use pellets) to G (least efficient); Ecodesign requirements for local space heaters are mandatory as of January 2018 for all manufacturers and suppliers wishing to sell their products in the EU; The regulation does not apply to local space heaters using non-woody biomass.

   Space and water heaters - a new space or water heater comes with an energy label showing its energy efficiency class; for individual products, ratings go from G (least efficient) to A++ (most efficient)

   Solid fuel boilers - new solid fuel boilers with a rated heat output of 70 kW or less are labelled on an energy efficiency scale ranging from A+++ (most efficient) to G (least efficient)

   Air heating and cooling products

   Lighting – light sources, such as light bulbs (halogen, compact fluorescent, etc.) od LED modules/lamps; there is a new scale from A (most efficient) to G (least efficient) used for energy labelling of lighting products from 1 September 2021 (Directive (EU) 2019/2015)

   7.5 **BACS efficiency class** (EN 15232-1) – directive (EU) 2018/844 introduced A new provision related to the building automation and control system (BACS); all new and existing non-residential buildings with an effective rated output for heating/cooling systems or systems for combined space heating/cooling and ventilation of over 290 kW need to be equipped with building automation and control system (BACS) as of 31 December 2024; the intention is to lower this threshold from 290 to 70 kW as of 1 December 2030 [7]
   7.6 **Building maintenance history** – based on the task description
   7.7 **Smart Readiness Indicator (SRI)** – rating smart readiness of buildings based on an assessment of the capabilities of a building/building unit to adapt its operation to the needs of the occupant and the grid is becoming nowadays important with the main goal to improve energy efficiency and

overall performance of a building/building unit; new provision introduced by the Directive (EU) 2018/844,

7.8 **E-mobility** – **infrastructure for electric vehicle recharging** - new provision introduced by the Directive (EU) 2018/844,

7.9 **Operational costs** – based on the task description

7.10 **Actual energy performance** of technical building system – based on the task description

7.11 **Life cycle Global Warming Potential (GWP)** – according to the new proposal of EPBD directive (December 2021), the life cycle Global Warming Potential of all new buildings will have to be calculated as of 2030; this obligation will even start earlier as of 2027 for all new buildings with a useful floor area larger than 2.000 m^2

8. to enable an automated generation of the LCA and LCC values of the building,
9. to act as **the digital container** containing all input values to calculate the passport rating in three domains (**EPC, sustainability, and smartness**).

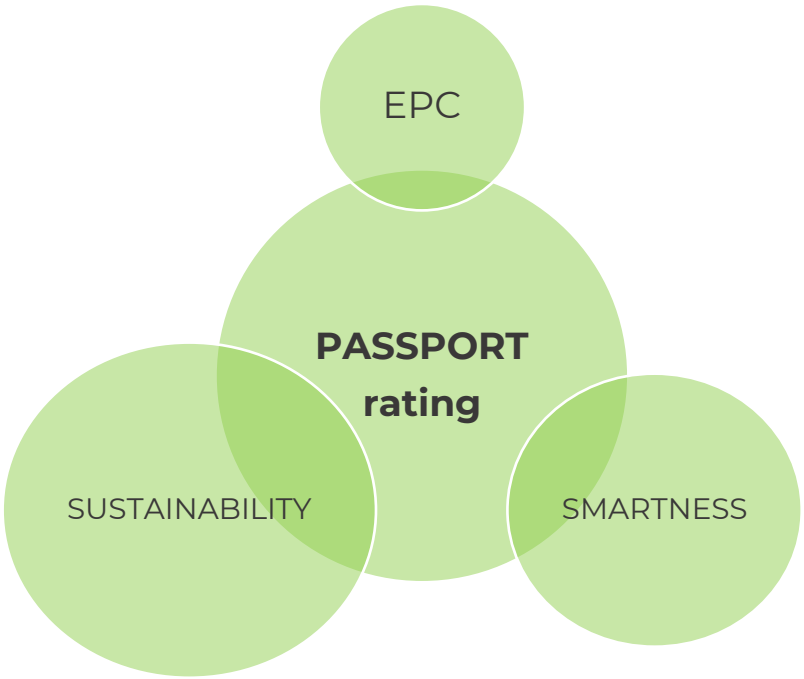


Figure 35: Passport rating in three main domains

2 Elaboration of the digital building logbook data structure

One of the subtasks within Task 2.4 is to elaborate on the digital building logbook data structure.

In the first chapter (Literature review on building logbooks and initiatives across Europe), the following already defined digital building logbook data structures were in detail analysed (see Table 9):

- a DBL data structure named **iBRoad-Log** defined within the iBRoad (Individual Building Renovation Roadmaps) project,
- a DBL data structure named **ALDREN BuildLog** defined within the ALDREN (ALliance for Deep RENovation in Buildings) project,
- a DBL data structure named **Study EU DBL** defined within the Study on the Development of an EU Framework for Buildings' Digital Logbook published by European Commission,
- a DBL data structure named **X-tendo logbook** defined within the X-tendo (eXTENDing the energy performance assessment and certification schemes via a modular approach) project.

Table 9 depicts the main categories of different digital building logbooks.

Table 9: Main categories of different existing digital building logbooks

	iBRoad-Log July 2018	**ALDREN BuildLog** April 2019	**Study EU DBL** July 2020	**X-tendo logbook** November 2020
	Residential buildings (single-family houses)	Non-residential buildings (office and hotel buildings)	All types of buildings	–
1	GENERAL AND ADMINISTRATIVE INFORMATION	BUILDING PICTURE	ADMINISTRATIVE INFORMATION	ADMINISTRATIVE INFORMATION
2	BUILDING CONSTRUCTION INFORMATION	ENERGY RATING & TARGET (Energy performance)	GENERAL INFORMATION	GENERAL INFORMATION
3	BUILDING ENERGY PERFORMANCE	ENERGY VERIFICATION (Energy measured)	BUILDING DESCRIPTIONS AND CHARACTERISTICS	BUILDING DESCRIPTIONS AND CHARACTERISTICS
4	BUILDING OPERATION AND USE	COMFORT & WELL-BEING	BUILDING OPERATION AND USE	BUILDING OPERATION AND USE
5	SMART INFORMATION	COST VALUE RISK	BUILDING PERFORMANCE	BUILDING PERFORMANCE
6	–	DOCUMENTATION BIM	BUILDING MATERIAL INVENTORY	BUILDING MATERIAL INVENTORY
7	–	–	SMART READINESS	SMART READINESS
8	–	–	FINANCE	FINANCE

It is noteworthy that iBRoad Log covers single-family houses, whereas ALDREN BuildLog covers office buildings and hotels. Report 1 of the Study on the development of a European Union Framework for Buildings' Digital Logbook stresses that **a common DBL for the entire building stock is desirable** and would

avoid fragmentation. A separate DBL for different building typologies should not be pursued.

Each analysed DBL structure contains the following same main categories:

- GENERAL AND ADMINISTRATIVE INFORMATION (called Building picture within the ALDREN BuildLog),
- BUILDING PERFORMANCE (called ENERGY RATING & TARGET within the ALDREN BuildLog), and
- BUILDING OPERATION AND USE (called ENERGY VERIFICATION within the ALDREN BuildLog).

Smart readiness as a main category is present in all analysed DBLs except in the ALDREN BuildLog. Finance (or Cost Value Risk within the ALDREN BuildLog) as another important category is present in all analysed DBLs except in the iBRoad-Log.

Documentation is a separate main category within the ALDREN BuildLog, whereas in all other analysed DBLs, different types of documents are part of already defined main categories. There is no separate category used only for storing building documentation.

Based on the analysed existing DBL data structures and all the suggestions within the Study on the Development of an EU Framework for Buildings' Digital Logbook (Report 1, Report 2, FINAL REPORT) published by European Commission the following **EUB SuperHub digital building logbook data structure** is defined containing the following eight main categories (application modules):

1. ADMINISTRATIVE INFORMATION
2. GENERAL BUILDING INFORMATION
3. BUILDING ELEMENT INFORMATION
4. BUILDING OPERATION AND USE
5. BUILDING PERFORMANCE
6. SMART READINESS
7. FINANCE
8. BUILDING DOCUMENTATION BIM

The EUB SuperHub digital building logbook is in line with the main categories defined in the Study on the Development of an EU Framework for Buildings' Digital Logbook, with only one additional category added separately, which is the last eight category, named *8. Building documentation BIM*. Also, within the EUB SuperHub digital building logbook structure there is no separate category called *Building material inventory* because it is part of the category *3. Building element information*.

The first category named *1. ADMINISTRATIVE INFORMATION* provides the data related to building name (if any, building name in case of non-residential buildings), unique building identifier, building type, building address, ownership, building owner, DBL author/s.

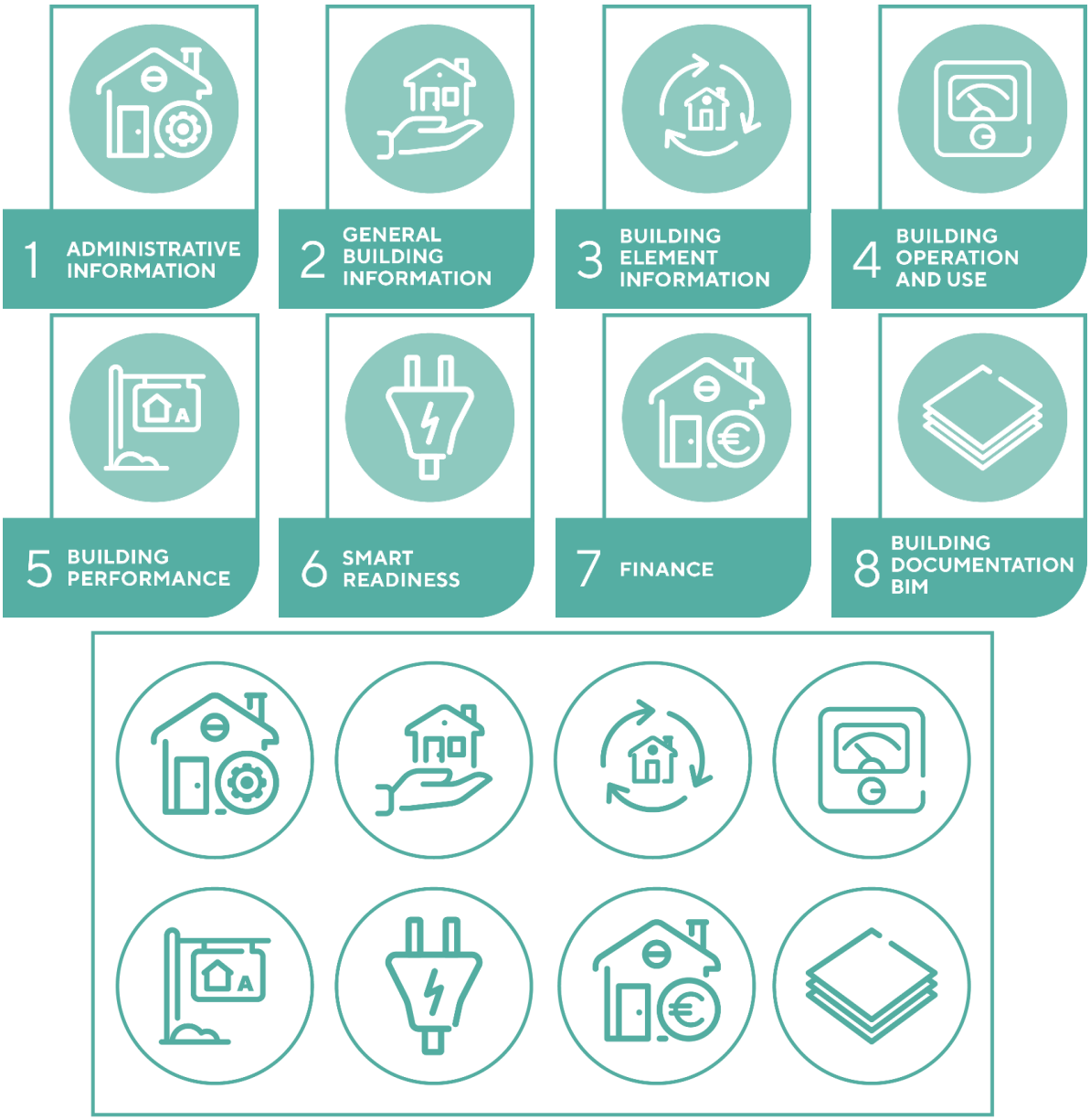


Figure 36: The main categories of EUB SuperHub digital building logbook

The second category named *2. GENERAL BUILDING INFORMATION* specifies basic building data (e.g., year of construction, history about any major renovation or replacement, building pictures, number of floors, historical status, building surroundings, etc.), building geometry (e.g., floor area, building's envelope area, building volume, shape factor, etc.), and geometric characteristics (e.g., type of construction, roof type, façade type).

There is a definition within the EPBD directive (2010/31/EU, Proposal for a directive on the energy performance of buildings published by European Commission in December 2021) stating that '**building element**' means a technical building system or an element of the building envelope. The category named *3. BUILDING ELEMENT INFORMATION* comprises all relevant information about building envelope and technical building system (TBS). Technical building system comprises the broad range of technical equipment used for space heating, space cooling, ventilation, domestic hot water preparation, built-in lighting, building

automation and control, on-site renewable energy generation (e.g., photovoltaic system, solar thermal system) and storage, or a combination thereof, including those systems using energy from renewable sources, of a building or building unit. It is noteworthy that building material inventory is placed within this category within building envelope.

The fourth category 4. BUILDING OPERATION AND USE provides the data related to the following subcategories: Building use, Climate data actual, Metered data, Inspection of heating and air-conditioning data, Building maintenance.

The category named 5. BUILDING PERFORMANCE covers the following three main subcategories:

- Energy Performance Certification (EPBD),
- EUB SuperHub certification,
- Sustainability certification (e.g., DGNB, BREEAM, LEED, Protocollo ITACA),
- Key Performance Indicators (KPI).

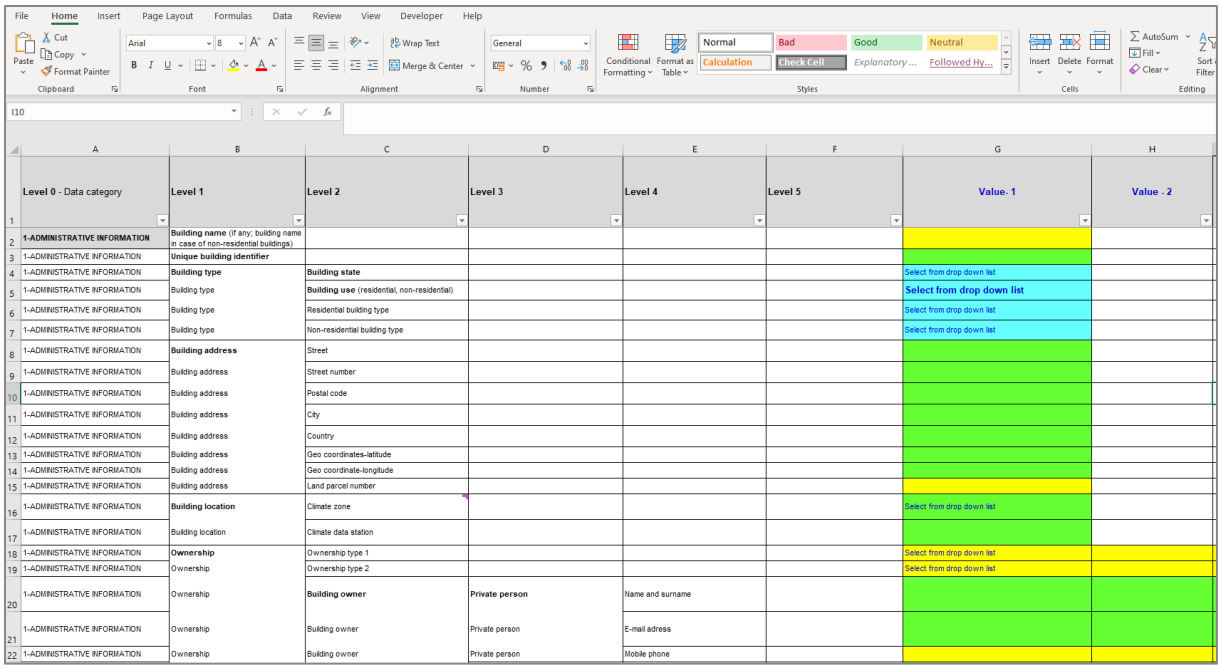
The sixth category 6. SMART READINESS covers smart readiness of the building, and E-mobility, as another important issue since mobility must be CO_2-neutral in the future.

The seventh category 7. FINANCE provides the data related to all types of possible costs related to the building such as: annual rent, annual property tax, market value, property price paid, renewal costs, EPC costs, operational costs, energy revenues. According to the grant agreement the developed EUB SuperHub digital building logbook needs to cover operational costs.

In the last category named 8. BUILDING DOCUMENTATION BIM there are all kind of documents related to the building such as: permits, manuals, design and plans of the building, tenancy agreement, utility contracts, utility bills, documents related to building construction and maintenance, energy performance certificates, sustainability certificates, reports on the inspection of heating and air-conditioning systems, valuation reports, insurance documents, weather files, BIM and building pictures.

The developed structure of the EUB SuperHub digital building logbook represents one layer within Planning and Verification tool (PVT module) and will be tested on case studies (*Task 5.3 Implementation of the case studies across the EU*). The main goal of task 5.3 will be to implement in total 100 case studies across seven project partner countries involved in this project.

Within the first step, the whole EUB SuperHub digital building logbook structure is defined in one Microsoft Excel worksheet. There are in total six levels of information (Level 0, Level 1, Level 2, Level 3, Level 4, and Level 5). Level 0 comprises the eight DBL modules, and Level 1 presents the main subcategories of each module (category).



Level 0 - Data category	Level 1	Level 2	Level 3	Level 4	Level 5	Value- 1	Value - 2
1-ADMINISTRATIVE INFORMATION	**Building name** (if any; building name in case of non-residential buildings)						
1-ADMINISTRATIVE INFORMATION	**Unique building identifier**						
1-ADMINISTRATIVE INFORMATION	**Building type**	**Building state**				Select from drop down list	
1-ADMINISTRATIVE INFORMATION	Building type	**Building use** (residential, non-residential)				**Select from drop down list**	
1-ADMINISTRATIVE INFORMATION	Building type	Residential building type				Select from drop down list	
1-ADMINISTRATIVE INFORMATION	Building type	Non-residential building type				Select from drop down list	
1-ADMINISTRATIVE INFORMATION	**Building address**	Street					
1-ADMINISTRATIVE INFORMATION	Building address	Street number					
1-ADMINISTRATIVE INFORMATION	Building address	Postal code					
1-ADMINISTRATIVE INFORMATION	Building address	City					
1-ADMINISTRATIVE INFORMATION	Building address	Country					
1-ADMINISTRATIVE INFORMATION	Building address	Geo coordinates-latitude					
1-ADMINISTRATIVE INFORMATION	Building address	Geo coordinate-longitude					
1-ADMINISTRATIVE INFORMATION	Building address	Land parcel number					
1-ADMINISTRATIVE INFORMATION	**Building location**	Climate zone				Select from drop down list	
1-ADMINISTRATIVE INFORMATION	Building location	Climate data station					
1-ADMINISTRATIVE INFORMATION	**Ownership**	Ownership type 1				Select from drop down list	
1-ADMINISTRATIVE INFORMATION	Ownership	Ownership type 2				Select from drop down list	
1-ADMINISTRATIVE INFORMATION	Ownership	**Building owner**	**Private person**	Name and surname			
1-ADMINISTRATIVE INFORMATION	Ownership	Building owner	Private person	E-mail adress			
1-ADMINISTRATIVE INFORMATION	Ownership	Building owner	Private person	Mobile phone			

Figure 37: Screenshot of the worksheet containing the EUB SuperHub digital building logbook data structure

It is important to differ data entry fields according to the following legend:

- yellow-coloured cells – INPUT FIELDS – user needs to insert manually value or text, or select from a drop-down list
- blue-coloured cells – INPUT FIELDS – data entry fields required for KPIs calculation entered by user
- green-coloured cells – FIELDS filled automatically and cannot be edited
- orange-coloured cells – FIELDS filled automatically and cannot be edited – link to module 8 – BUILDING DOCUMENTATION BIM

Although it is a common suggestion to keep DBL data structure as simple as possible, a comprehensive digital building logbook data structure containing eight main modules has been developed within the EUB SuperHub project trying to fulfil and take into account different requirements defined within already existing EU legislation and the future ones that will be soon adopted (e.g., proposal for the EPBD recast published in December 2021).

Each project partner country denoted the necessity for each data entry field (one from three possible options: optional, recommended, required). When implementing case studies across the EU (100 case studies in total) and testing the suggested DBL data structure, all data entry fields denoted as “required” by most partners will be collected. There will be no obligation to collect data entry fields denoted as “optional” or “recommended” (voluntary collection).

There are in total 1.052 data entry fields, where 47 % are denoted as required.

Table 10: EUB SuperHub DBL data structure – overview of the number of data entry fields

EUB SuperHub DBL	Total number of data entry fields denoted as			**TOTAL**
Module	REQUIRED	RECOMMENDED	OPTIONAL	
1-ADMINISTRATIVE INFORMATION	29	2	3	34
2-GENERAL BUILDING INFORMATION	37	21	6	64
3-BUILDING ELEMENT INFORMATION	159	282	2	443
4-BUILDING OPERATION AND USE	61	56	4	121
5-BUILDING PERFORMANCE	171	32	29	232
6-SMART READINESS	8	4	2	14
7-FINANCE	5	5	51	61
8-BUILDING DOCUMENTATION BIM	21	36	28	85
TOTAL	**491**	**438**	**125**	**1.054**
Share [%]	*46,58*	*41,56*	*11,86*	*100,00*

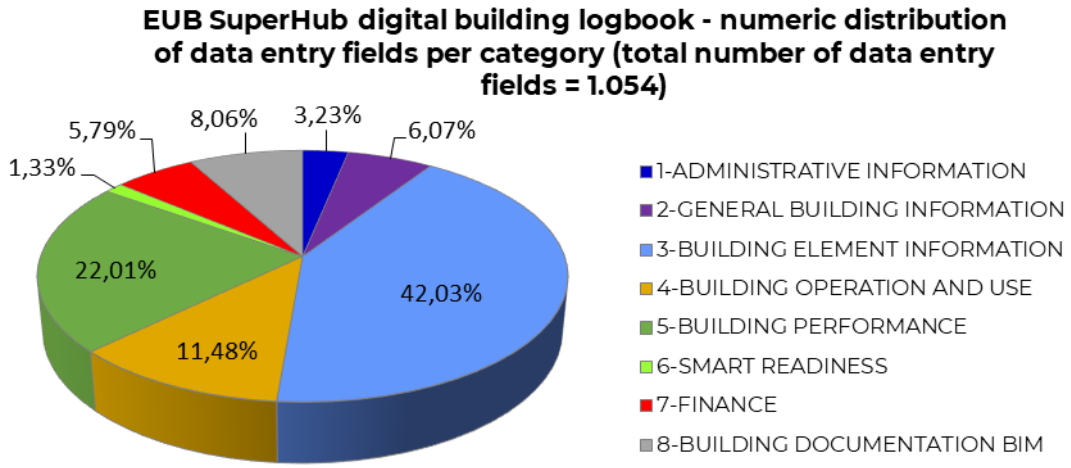


Figure 38: EUB SuperHub digital building logbook data – numeric distribution of data entry fields per category

The third category 3-BUILDING ELEMENT INFORMATION contains the highest number of total data entry fields (42,03 %) followed by the fifth category 5-BUILDING PERFORMANCE (22,01 %).

The following eight chapters give the more detailed description and explanation of each module.

The data to the EUB SuperHub digital building logbook will be fed:

- manually by experts trained by EUB SuperHub training (*Task 5.2 Training the user groups and professionals*),
- automatically through an automated connection to existing databases.

2.1 Module 1: ADMINISTRATIVE INFORMATION

The first module named 1. ADMINISTRATIVE INFORMATION is divided into eight different topics in Level 1 (Figure 39) providing the usual common administrative data like building name, unique building identifier automatically generated by software tool, building type, building address, ownership, building owner, DBL author/s and possible comments added from the side of DBL author/s.

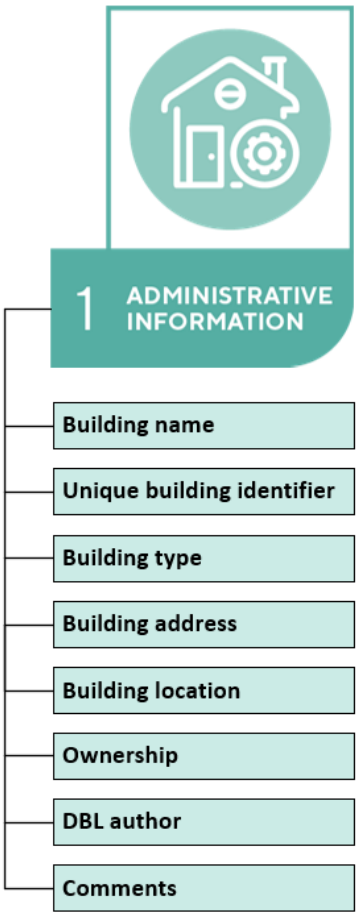


Figure 39: EUB SuperHub digital building logbook – main subcategories of Module 1. ADMINISTRATIVE INFORMATION

Table 11 provides the whole data structure of first module 1 – ADMINISTRATIVE INFORMATION.

The DBL data structure needs to cover buildings in the following three different building life-cycle phases:

- new buildings after construction (new buildings 'as built'),
- existing buildings in the use phase,
- existing buildings after major renovation.

As aforementioned within task 5.3 (*Task 5.3 Implementation of the case studies across the EU*), 100 case studies need to be implemented by testing the proposed DBL data structure.

The proposed EUB SuperHub digital building logbook is intended to be applicable for the entire building stock (residential and non-residential buildings), although there are not so many data entry fields added particularly for the specific building

features (e.g., the number of rooms in a hotel, the category of a hotel, number of offices in an office building, number of beds of health establishment with accommodation, etc.)

All data entry fields referring to building address except land parcel number are green coloured meaning, that those fields will be automatically filled. Those fields will be automatically assigned based on the user claim in the EUB SuperHub platform (see D2.3 *The EUB SuperHub Platform modules: Features and functions*).

Also, some data related to building owner (private person, public institutions/company) and DBL author will be also automatically assigned based on user login data in the EUB SuperHub platform (see D2.3 *The EUB SuperHub Platform modules: Features and functions – Function 1.6.1: The login / register page*). The user of the EUB SuperHub platform must provide their username (E-mail address) and password to enter their account on the platform.

Table 11: The EUB SuperHub digital building logbook data structure – Module 1 – ADMINISTRATIVE INFORMATION

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
1-ADMINISTRATIVE INFORMATION	**Building name** [2]						String	–	REQUIRED
	Unique building identifier						Alfa-numerical code	–	REQUIRED
	Building type	Building state				• New building after construction – new building 'as built' • Existing building in the use phase • Existing building after major renovation	String-drop down list	–	REQUIRED
		Building use (residential, non-residential)				• Residential building • Non-residential building	String-drop down list	–	REQUIRED
		Residential building type				• Single-family house • Multi-family house • Apartment block (Multi-apartment residential building) • Home for elderly and disabled people (e.g., retirement house, nursing home) • Residence for collective use (e.g., dormitory)	String-drop down list	–	REQUIRED
		Non-residential building type				• Office building • Educational building • Hospital • Hotel and restaurant • Sport facility • Wholesale and retail trade services building	String-drop down list	–	REQUIRED
	Building address	Street					String	–	REQUIRED
		Street number					Special-Street number	–	REQUIRED
		Postal code					Special-Postal code	–	REQUIRED
		City					String	–	REQUIRED
		Country					String-drop down list	–	REQUIRED
		Geo coordinates-latitude					Integer	°	REQUIRED
		Geo coordinate-longitude					Integer	°	REQUIRED
		Land parcel number					Alfa-numerical code	–	RECOMMENDED

[2] if any; building name in case of non-residential buildings

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
1-ADMINISTRATIVE INFORMATION	**Building location**	Climate zone				• Northern Europe: Denmark, Finland, Sweden, Norway, Iceland • Western Europe: **Austria**, Belgium, **France**, **Germany**, **Ireland**, Luxembourg, Netherlands, United Kingdom, Liechtenstein, Switzerland • Southern Europe: Greece, **Italy**, Malta, Portugal, Spain, Cyprus • North-Eastern Europe: Czechia, Estonia, Latvia, Lithuania, Poland, Slovakia • South-Eastern Europe: Bulgaria, **Croatia**, **Hungary**, Romania, Slovenia	String-drop down list	–	REQUIRED
		Climate data station					String	–	REQUIRED
	Ownership	Ownership type 1				• Sole (full) ownership • Co-ownership • Collective ownership	String-drop down list	–	REQUIRED
		Ownership type 2				• Private • Local administration • Central administration	String-drop down list	–	REQUIRED
		Building owner	Private person	Name and surname			String	–	REQUIRED
				E-mail address			Special-E-mail address	–	REQUIRED
				Mobile phone			Special-Phone number	–	OPTIONAL
			Public institutions/Company	Name			String	–	REQUIRED
				Address	Street		String	–	REQUIRED
					Street number		Special-Street number	–	REQUIRED
					Postal code		Special-Postal code	–	REQUIRED
					City		String	–	REQUIRED
					Country		String	–	REQUIRED
				Web page			Special-web page	–	OPTIONAL
	DBL author	DBL author	Name and surname				String	–	REQUIRED
			Username				String	–	REQUIRED
			E-mail address				Special-E-mail address	–	REQUIRED
			Mobile phone				Special-Phone number	–	RECOMMENDED
		DBL last update	Date and time				Date&time	–	REQUIRED
	Comments						String-descriptive	–	OPTIONAL

2.2 Module 2: GENERAL BUILDING INFORMATION

The second module named 2. GENERAL BULDING INFORMATION is divided into three different topics in Level 1 (Figure 40) providing basic building data, building geometry and basics of building construction.

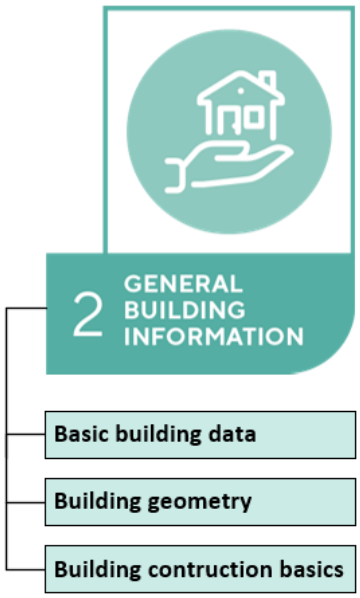


Figure 40: EUB SuperHub digital building logbook – main subcategories of Module 2. GENERAL BUILDING INFORMATION

The first subcategory named **Basic building data** (Figure 42) contains basic building data such as year of construction, building pictures, base height, number of storeys (floors), floor height, building height, topmost floor heated (yes or no), number of heated basement floors. Based on the entered number of storeys and average floor hight, the building height can be calculated.

'Base height' or foundation height (or height above ground) is the distance from the top of the foundation to the surrounding soil.

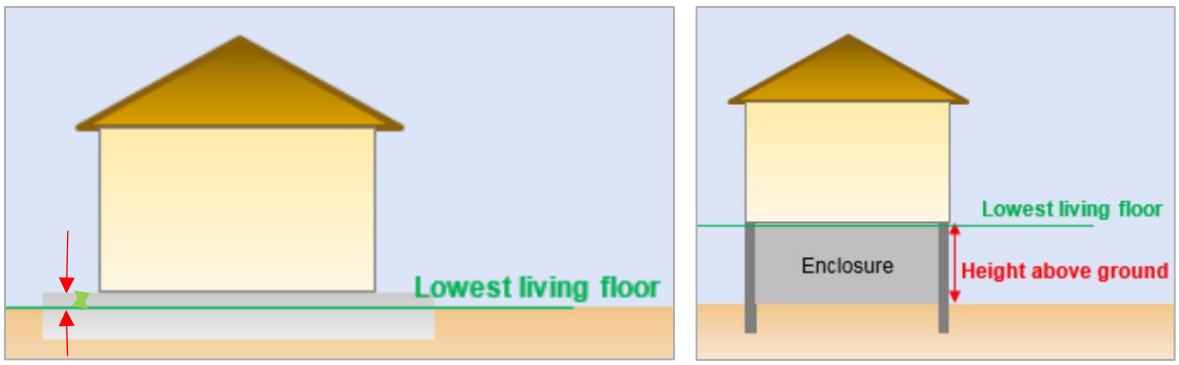


Figure 41: Base height – height above ground for non-elevated and elevated buildings

Source: https://www.macneillgroup.com/flood-foundation-elevation-height-important-getting-private-flood-quote/

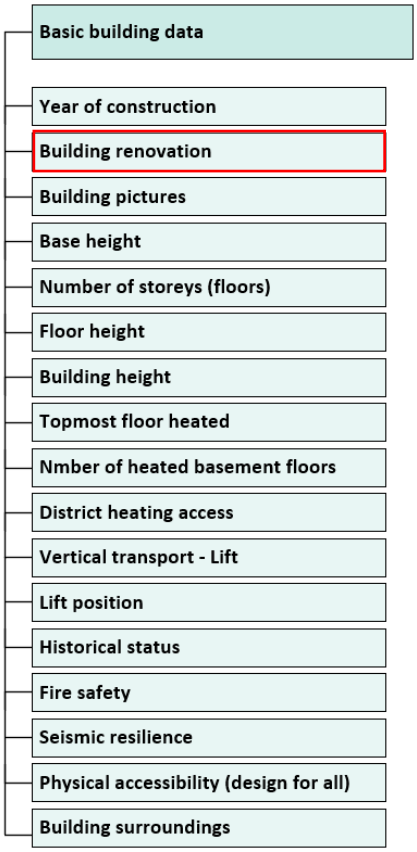


Figure 42: EUB SuperHub digital building logbook – 2. GENERAL BUILDING INFORMATION – subcategory Basic building data

Given the requirements in the grant agreement, the elaborated EUB Superhub digital building logbook also holds data about any major renovation or replacements. The DBL author can choose all the renovated building elements by checking corresponding checkboxes (Figure 43). Each renovated building element is connected to the time by entering the year of renovation.

NOTE: 'Building element' means a technical building system or an element of the building envelope.

			YEAR 1	
Building renovation	Year of renovation			Integer
Building renovation	Renovated building element		Select from drop down list	String-drop down list
Building renovation	**Renovated building envelope**	Walls	☐ Walls	Check box
Building renovation		Floor	☐ Floor	Check box
Building renovation		Roof	☐ Roof	Check box
Building renovation		Windows	☐ Windows	Check box
Building renovation		Skylights	☐ Skylights	Check box
Building renovation		Door/s	☐ Door/s	Check box
Building renovation		Other	☐ Other	Check box
Building renovation	**Renovated Technical Building System (TBS)**	Space heating system	☐ Space heating system	Check box
Building renovation		Domestic Hot Water (DHW) preparation system	☐ Domestic Hot Water (DHW) preparation system	Check box
Building renovation		Space cooling system	☐ Space cooling system	Check box
Building renovation		Ventilation system	☐ Ventilation system	Check box
Building renovation		Lighting system	☐ Lighting system	Check box
Building renovation		Building Automation and Control system (BACS)	☐ Building Automation and Control system (BACS)	Check box
Building renovation		ON-SITE Renewable energy generation and storage	☐ ON-SITE Renewable energy generation and storage	Check box
Building renovation		Other	☐ Other	Check box
Building renovation	Brief description of renovation			String-descriptive

Figure 43: Part of the EUB SuperHub digital building logbook referring to building renovation

One topic requiring string-descriptive answer is named 'District heating access'. The DBL author needs to write here if there is a possible nearby connection to district heating network. E.g., in capital city of Croatia, Zagreb, all buildings in one street are connected to district heating network, and in the next nearby street there is no district heating network because there is gas pipeline installed and all buildings are in a way forced to use natural gas as a source of heat for space heating and domestic hot water preparation. The building owners cannot choose between two possible heat sources.

The DBL author could here write for example: "*There is a possibility to connect this building to the district heating network, which is only 300 meters away*."

Two topics within the first subcategory (Basic building data) are related to lift or elevator. The DBL author denotes if there is/are lift/s in the building. And if the answer is positive, the DBL author denotes the lift position (inside the building, outside the building, next to the staircase).

It is also required to choose the historical status of the building, which can be:

- Building without historic value,
- Listed historic building,
- Historic building (not listed),
- Building in a conservation area.

The EPBD directive EU 2018/844 highlighted that "*Member States shall address the* issues of healthy indoor climate conditions (indoor air quality IAQ), *fire safety and risks related to intense seismic activity*." For that reason, consortium team decided to ask for fire safety report and Seismic resilience report (those two reports, if available, are part of the last category 8-BUILDING DOCUMENTATION BIM).

Physical accessibility or design for all is one of three DGNB minimum requirements for buildings that must be fulfilled as part of the DGNB certification process. It is for sure an important topic and the DBL author just needs to check degree of barrier-free design (e.g., ramp – access routes to the entrance door, access routes to lift, barrier-free WC/s, operating information with at least two senses principles). The DBL author needs to enter the Number of barrier-free bathroom facilities and the Number of car parking spaces for people with disabilities.

The last topic within the first subcategory (Basic building data) refers to Building surroundings requiring descriptive answer. This data entry field as denoted as 'OPTIONAL' by project partners. The DBL author could here briefly describe the surroundings of the building like: "*The office building is not a stand-alone building. It is located between the residential building and another office building, which are both in poor condition requiring building envelope renovation and probably renovation of technical building system*".

The second subcategory refers to **Building geometry** (Figure 44) collecting data related to different type of building areas and shape factor.

'Footprint area' is the outline of the total area of a lot or site that is surrounded by the exterior walls of a building or portion of a building, exclusive of courtyards. In the absence of surrounding exterior walls, the building footprint shall be the area under the horizontal projection of the roof.

The value of a building footprint area is filled automatically by the EUB SuperHub platform after drawing the footprint of a selected building using the polygon tool.

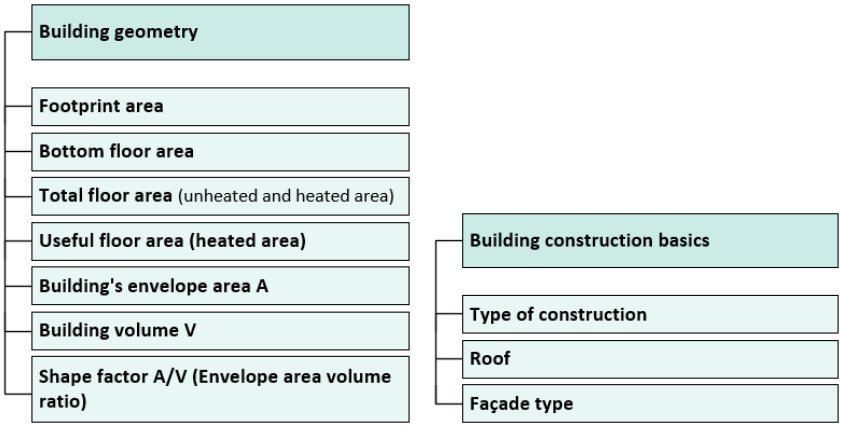


Figure 44: EUB SuperHub digital building logbook – 2. GENERAL BUILDING INFORMATION – subcategories Building geometry and Building construction basics

'Bottom floor area' means the footprint area minus area of the walls. This value is also calculated automatically by the EUB SuperHub platform.

'Total floor area (unheated and heated area)' is the sum of all unheated and heated areas of a building calculated with external dimensions.

'Useful floor area (heated area)' means the heated area of a building calculated with the internal dimensions of a building.

'Building's envelope area *A*' is the sum of areas of external faces of the building (e.g., walls, roofs, terraces).

'Building volume V' (also called building volume gross measured by its external dimensions) is the total volume included between the outer surface of the outer walls measured from the level of the lowest storey to the roof of the building (the outer volume of a building).

'Shape factor *A/V*' (also called Envelope area volume ratio) of a building is the ratio between its envelope area and its volume. Buildings with a higher shape factor have a larger surface area in proportion to their volume, which results in larger heat losses in cold climates.

The third subcategory refers to **building construction basics** (Figure 44), collecting data related to the type of construction, roof, and façade type (Table 12).

There are three common roof types flat, gable and hip roof. The main difference between a hip and gable roof are the slopes on its sides. On a hipped roof, all sides slope downward to the home's walls. Gable roofs only have triangle-shaped slopes that extend from the bottom of the roof's eaves to the peak of its ridge.

Figure 45: Common roof types

Source: https://www.lawnstarter.com/blog/roofing/types-of-roof-styles/

Table 12: The EUB SuperHub digital building logbook data structure – Module 2 – GENERAL BUILDING INFORMATION

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
2-GENERAL BUILDING INFORMATION	Basic building data	Year of construction					Integer	–	REQUIRED
		Building renovation	Year of renovation				Integer	–	REQUIRED
			Renovated building element			• Building envelope • Technical Building System (TBS) • Building element and Technical Building System (TBS)	String-drop down list	–	REQUIRED
			Renovated building envelope	Walls		☐ Walls	Check box	–	REQUIRED
				Floor		☐ Floor	Check box	–	REQUIRED
				Roof		☐ Roof	Check box	–	REQUIRED
				Windows		☐ Windows	Check box	–	REQUIRED
				Skylights		☐ Skylights	Check box	–	REQUIRED
				Door/s		☐ Door/s	Check box	–	REQUIRED
				Other		☐ Other	Check box	–	OPTIONAL
			Renovated Technical Building System (TBS)	Space heating system		☐ Space heating system	Check box	–	REQUIRED
				Domestic Hot Water (DHW) preparation system		☐ Domestic Hot Water (DHW) preparation system	Check box	–	REQUIRED
				Space cooling system		☐ Space cooling system	Check box	–	REQUIRED
				Ventilation system		☐ Ventilation system	Check box	–	REQUIRED
				Lighting system		☐ Lighting system	Check box	–	REQUIRED
				Building Automation and Control system (BACS)		☐ Building Automation and Control system (BACS)	Check box	–	REQUIRED
				ON-SITE Renewable energy generation and storage		☐ ON-SITE Renewable energy generation and storage	Check box	–	REQUIRED
				Other		☐ Other	Check box	–	OPTIONAL
			Brief description of renovation				String-descriptive	–	RECOMMENDED
		Building pictures	North façade				Link to BUILDING DOCUMENTATION	–	RECOMMENDED
			South façade				Link to BUILDING DOCUMENTATION	–	RECOMMENDED
			East façade				Link to BUILDING DOCUMENTATION	–	RECOMMENDED
			West façade				Link to BUILDING DOCUMENTATION	–	RECOMMENDED
			North-East façade				Link to BUILDING DOCUMENTATION	–	RECOMMENDED
			North-West façade				Link to BUILDING DOCUMENTATION	–	RECOMMENDED
	Basic building data		South-East façade				Link to BUILDING DOCUMENTATION	–	RECOMMENDED
			South-West façade				Link to BUILDING DOCUMENTATION	–	RECOMMENDED
			Top view				Link to BUILDING DOCUMENTATION	–	OPTIONAL
			Others				Link to BUILDING DOCUMENTATION	–	OPTIONAL

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
2-GENERAL BUILDING INFORMATION	Basic building data	Base height					Float	m	RECOMMENDED
		Number of storeys (floors)					Integer	–	REQUIRED
		Floor height					Float	m	REQUIRED
		Building height					Float	m	REQUIRED
		Topmost floor heated				• Yes • No	String-drop down list	–	REQUIRED
		Number of heated basement floors					Integer	–	REQUIRED
		District heating access					String-descriptive	–	RECOMMENDED
		Vertical transport - Lift (elevator)				• Yes • No	String-drop down list	–	RECOMMENDED
		Lift position				• Inside the building • Outside the building • Next to the staircase	String-drop down list	–	OPTIONAL
		Historical status				• Building without historic value • Listed historic building • Historic building (not listed) • Building in a conservation area	String-drop down list	–	REQUIRED
		Fire safety	Fire safety report available			• Yes • No	String-drop down list	–	RECOMMENDED
			Fire safety report				Link to BUILDING DOCUMENTATION	–	RECOMMENDED
		Seismic resilience	Seismic resilience report available			• Yes • No	String-drop down list	–	RECOMMENDED
			Seismic resilience report				Link to BUILDING DOCUMENTATION	–	RECOMMENDED
		Physical accessibility (design for all)	Degree of barrier-free design			☐ Ramp - access routes to the entrance door/s	Check box	–	REQUIRED
						☐ Access routes to lift, if installed	Check box	–	REQUIRED
						☐ Barrier-free WC/s	Check box	–	REQUIRED
						☐ Operating information with at least two senses principle	Check box	–	REQUIRED
						☐ Other 1	Check box	–	REQUIRED
						☐ Other 2	Check box	–	REQUIRED
			Number of car parking spaces for people with disabilities				Integer	–	REQUIRED
			Number of barrier-free bathroom facilities				Integer	–	REQUIRED
		Building surroundings					String-descriptive	–	OPTIONAL

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
2-GENERAL BUILDING INFORMATION	**Building geometry**	Footprint area					Float	m^2	REQUIRED
		Bottom floor area					Float	m^2	RECOMMENDED
		Total floor area (unheated and heated area)					Float	m^2	RECOMMENDED
		Useful floor area (heated area)					Float	m^2	REQUIRED
		Building's envelope area A (sum of areas of external faces of the building, e.g., walls, roofs, floors)					Float	m^2	REQUIRED
		Building volume V					Float	m^3	REQUIRED
		Shape factor A/V (Envelope area volume ratio)					Float	m-1	REQUIRED
	Building construction basics	Type of construction				• Timber frame • Solid wood • Masonry • Steel • Reinforced concrete	String-drop down list	–	REQUIRED
		Roof	Roof type			• Flat • Gabled • Hipped	String-drop down list	–	REQUIRED
			Roof inclination				Float	°	RECOMMENDED
		Façade type				• Insulated wall façade system • Glass façade system • Steel façade system • Steel and glass façade system • Panel frame façade system • Clay façade system • Double-skin façade system • Solar shading façade system	String-drop down list	–	RECOMMENDED

2.3 Module 3: BUILDING ELEMENT INFORMATION

The third module named 3. BUILDING ELEMENT INFORMATION is divided into two topics in Level 1 (Figure 46), comprising all relevant information about the building envelope and technical building system (TBS). According to the definition given within the EPBD directive (2010/31/EU, Proposal for a directive on the energy performance of buildings published by European Commission in December 2021), '**building element**' means a technical building system or an element of the building envelope.

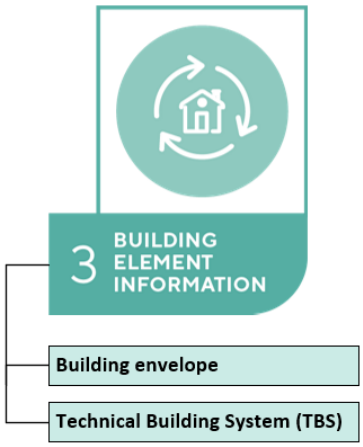


Figure 46: EUB SuperHub digital building logbook – main subcategories of Module 3. BUILDING ELEMENT INFORMATION

According to the grant agreement, the elaborated EUB SuperHub digital building logbook needs to:

- document and store records about materials used (material passport); for that reason, building material inventory is placed within this category within building envelope subcategory,
- hold records of expected end of life of technical building system.

Based on Directive EU 2018/844 on the energy performance of buildings, in the following cases, buildings must be equipped with building automation and control systems by 2025:

- non-residential buildings with an effective rated output for heating systems or systems for combined space heating and ventilation of over 290 kW,
- non-residential buildings with an effective rated output for systems for air-conditioning or systems for combined air-conditioning and ventilation of over 290 kW.

The intention is to lower this threshold from 290 to 70 kW as of 1 December 2030 [7]. Given the current and future requirements of EU legislation, the consortium decided to also consider Building Automation and Control System (BACS). It is already proven that intelligent BACS can reduce the energy consumption of buildings by up to 30 % [20], which contributes substantially to climate and environmental protection.

The first subcategory named **Building envelope** refers to the following integrated elements of a building which separate its interior from the outdoor environment: walls, floor (bottom), roof, windows, and skylights (Figure 47).

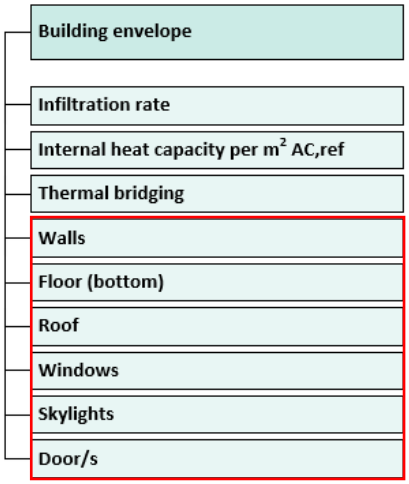


Figure 47: EUB SuperHub digital building logbook – 3. BUILDING ELEMENT INFORMATION – subcategory Building envelope

The elaborated EUB SuperHub digital building logbook collects the following data for each building's construction (walls, floor (bottom), roof) as follows:

- Insulation (insulated/not insulated),
- U value [W/(m^{2}K)],
- Surface area [m^2],
- Data about each layer.

For each layer of a building's construction, the following data are collected representing material passport:

- Material type – name,
- Layer thickness [m],
- Layer thermal conductivity [W/(mK)],
- Layer density [kg/m^3],
- Layer thermal capacity [J/(kgK)],
- Layer vapour permeability [–],
- Material location,
- Material weight (mass of each building element) [kg],
- Material volume (layer volume) [m^3],
- Global Warming Potential (GWP) - embodied carbon [kg CO_2],
- Total Renewable Primary Energy (PERT) [MJ],
- Total non-Renewable Primary Energy (PENRT) [MJ],
- Embodied energy coefficient [MJ/kg],
- Life span (life expectancy) of building material [yr],
- Fire resistance class,
- Waste category,
- Certificate 1,
- Chemical declaration,
- Global Trade Item Number (GTIN).

Material weight in [kg] and **embodied energy coefficient** in [MJ/kg] are required data entry fields needed for calculation of the KPI – 04 - Total use of non-renewable primary energy resources used as raw materials (PENRT) (also called embodied non-renewable primary energy).

Material volume (layer volume) can be calculated automatically based on material weight and density.

Global Warming Potential (GWP) - embodied carbon [kg CO_2], Total Renewable Primary Energy (PERT) [MJ] and Total non-Renewable Primary Energy (PENRT) [MJ] can be retrieved from the ESUCO database (European SUstainable Construction Database).

The product information data can be found in different existing databases such as:

- ESUCO database (European SUstainable Construction Database) with environmental data of construction material,
- Environmental Product Declaration (EPD) – Institut Bauen and Umwelt e.V (IBU) → https://ibu-epd.com/
- Informationsportal Nachhaltiges Bauen – web based database fort the ecological features of building materials → https://www.nachhaltigesbauen.de/, https://www.nachhaltigesbauen.de/en/
- DGNB navigator → https://www.dgnb-navigator.de/

Life span (life expectancy) of building material can be retrieved from https://etoolglobal.com/wp-content/uploads/2015/10/BuildingComponentLifeExpectancy.pdf

Fire resistance class is a class describing how much a construction product is contributing to the development of a fire in an early stage. The European standard EN 13501-1: 2018 (*Fire classification of construction products and building elements - Part 1: Classification using test data from reaction to fire tests*) gives fire classification of construction products excluding roof coverings. Based on the test results the products are divided into seven main classes: A1, A2, B, C, D, E and F for construction products (excluding roof coverings, floorings, and linear pipe thermal insulation products). A1 materials are completely non-combustible while A2 materials have very limited combustibility.

Table 13: Fire classification of construction products according to EN 13501-1:2018

FIRE RESISTANCE CLASS	
Class A1	Non-combustible materials. No contribution to fire.
Class A2	Non-combustible materials. No noticeable contribution to fire.
Class B	Combustible materials. Little or no contribution to fire.
Class C	Combustible materials. Limited contribution to fire.
Class D	Combustible materials. Contributes to fire.
Class E	Combustible materials. Major contribution to fire.
Class F	Combustible materials. Not within classes A1-E.
S1	The material contributes little or insignificantly to the development of smoke.
d0	The material does not create flaming particles or droplets when subjected to fire.

Classification of roof coverings is made according to classification standard EN 13501-5.

Waste category represents waste category according to the latest amendment of the European List of Waste from 2014 [1]. The European List of Waste provides common terminology for classifying waste across the EU. The different types of waste in the list are fully defined by the six-digit code for the waste. Any waste marked with an asterisk (*) in the list of wastes is considered as hazardous waste. There are in total 20 sources of waste on the list. The waste code 17 applies to construction and demolition wastes.

Table 14: European list of waste from 2014 – part of the list with the west code 17

17	**CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)**
17 01	**concrete, bricks, tiles and ceramics**
17 01 01	Concrete
17 01 02	Bricks
17 01 03	tiles and ceramics
17 01 06*	mixtures of, or separate fractions of concrete, bricks, tiles and ceramics containing hazardous substances
17 01 07	mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06
17 02	**wood, glass and plastic**
17 02 01	Wood
17 02 02	Glass
17 02 03	Plastic
17 02 04*	glass, plastic and wood containing or contaminated with hazardous substances
17 03	**bituminous mixtures, coal tar and tarred products**
17 03 01*	bituminous mixtures containing coal tar
17 03 02	bituminous mixtures other than those mentioned in 17 03 01
17 03 03*	coal tar and tarred products
17 04	**metals (including their alloys)**
17 04 01	copper, bronze, brass
17 04 02	Aluminium
17 04 03	Lead
17 04 04	Zinc
17 04 05	iron and steel
17 04 06	Tin
17 04 07	mixed metals
17 04 09*	metal waste contaminated with hazardous substances
17 04 10*	cables containing oil, coal tar and other hazardous substances
17 04 11	cables other than those mentioned in 17 04 10
17 05	**soil (including excavated soil from contaminated sites), stones and dredging spoil**
17 05 03*	soil and stones containing hazardous substances
17 05 04	soil and stones other than those mentioned in 17 05 03
17 05 05*	dredging spoil containing hazardous substances
17 05 06	dredging spoil other than those mentioned in 17 05 05
17 05 07*	track ballast containing hazardous substances
17 05 08	track ballast other than those mentioned in 17 05 07
17 06	**insulation materials and asbestos-containing construction materials**
17 06 01*	insulation materials containing asbestos
17 06 03*	other insulation materials consisting of or containing hazardous substances
17 06 04	insulation materials other than those mentioned in 17 06 01 and 17 06 03
17 06 05*	construction materials containing asbestos
17 08	**gypsum-based construction material**
17 08 01*	gypsum-based construction materials contaminated with hazardous substances
17 08 02	gypsum-based construction materials other than those mentioned in 17 08 01
17 09	other construction and demolition wastes
17 09 01*	construction and demolition wastes containing mercury
17 09 02*	construction and demolition wastes containing PCB (for example PCB-containing sealants, PCB-containing resin-based floorings, PCB-containing sealed glazing units, PCB-containing capacitors)
17 09 03*	other construction and demolition wastes (including mixed wastes) containing hazardous substances
17 09 04	mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03

Certificate 1 refers to certification of construction products. Under the CPR (Construction Products Regulation), CE marking is mandatory for many construction products.

Chemical declaration gives knowledge about hazardous substances and mixtures. The main goal is to be aware of highly dangerous chemicals that should be avoided.

Global Trade Item Number (GTIN) is a unique and internationally recognized identifier for a product. GTINs vary in length depending on the type of product and where the product will be sold. Here are the different GTINs:

- UPC (in North America / GTIN-12): 12-digit number (8-digit UPC-E codes should be converted to 12-digit UPC-A codes),
- EAN (in Europe / GTIN-13): **13-digit number**,
- JAN (in Japan / GTIN-13): 8 or 13-digit number,
- ISBN (for books): 13-digit number (ISBN-10 values should be converted to ISBN-13),
- ITF-14 (for multipacks / GTIN-14): 14-digit number.

Figure 48: GTIN on products sold in Europe or Japan – the 13-digit number below the barcode

In case of windows and skylights some additional data entry fields are also part of the elaborated EUB SuperHub digital building logbook such as:

- Type of windows/skylights,
- Frame material,
- Producer,
- Model number,
- Percentage of frame to glass,
- Area,
- G-value,
- Light transmission factor,
- Type of sun protection,
- Material.

The second subcategory named **Technical Building System (TBS)** comprises the broad range of technical equipment used for space heating, space cooling, ventilation, domestic hot water preparation, built-in lighting, building automation and control, on-site renewable energy generation (e.g., photovoltaic system, solar thermal system) and storage, or a combination thereof, including those systems using energy from renewable sources, of a building or building unit (Figure 49).

The main subcategory is for sure Building automation and control system (BACS), which connect all technical building systems (see chapter 2.3.1).

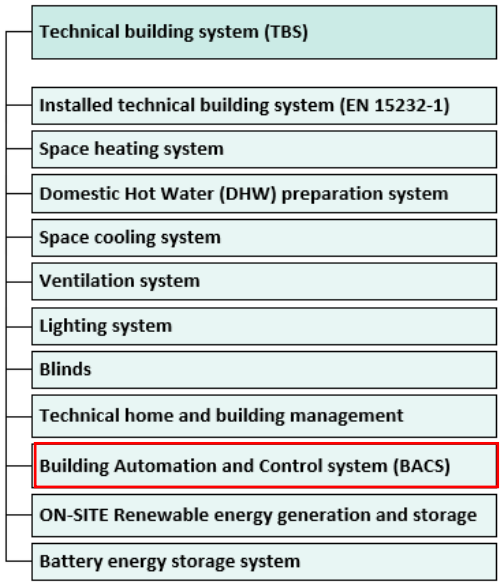


Figure 49: EUB SuperHub digital building logbook – 3. BUILDING ELEMENT INFORMATION – subcategory Technical building system (TBS)

The EUB SuperHub digital building logbook collects similar data for space heating, domestic hot water (DHW) preparation and cooling system:

- Source of energy for space heating/cooling system,
- Type,
- Producer,
- Model,
- Nominal heating/cooling output [kW],
- Electrical efficiency [-] (only for space heating system in cases where direct electric heater or electric heating system boiler is used as a type of space heating system),
- Thermal efficiency [-] (only for space heating system, e.g., boilers),
- Cooling efficiency [-] (only for space cooling system),
- Production year,
- Installation year,
- Life span – max (DIN EN 15459)
- Remaining useful physical life span,
- Energy efficiency class (EU energy label) (see chapter 2.3.2),
- User manual,
- Condition.

The European standard EN 154959-1:2017 (*Energy performance of buildings - Economic evaluation procedure for energy systems in buildings*) gives the minimum and maximum life span in years for all the most important components of technical building systems (e.g., air conditioning units, boilers, air heaters, cooling compressors, heat pumps).

The remaining useful physical life span is an estimate of the number of remaining years that a building component is estimated to be able to function in accordance with its intended purpose before warranting replacement. It determines how long

a building element will remain in usable condition. It can be easily estimated if the production year/installation year and life span are known.

In case of ventilation system, the following common data for each air-handling unit (AHU) separately are collected:

- Ventilation rate [1/h],
- Type,
- Producer,
- Model,
- Nominal air flow rate [m^3/h],
- Sensible heat recovery efficiency [-],
- Moisture recovery efficiency [-], and
- Data related to ventilation and air-conditioning control according to European Standard EN 15232-1:2017 (see chapter 2.3.1).

When it comes to lighting system, the developed EUB SuperHub digital building logbook gathered the following data of all light sources installed within a building:

- Type of electrical lighting sources,
- Energy efficiency class (EU energy label) (see chapter 2.3.2),
- Energy consumption in on-mode [kWh/1000 h] (see chapter 2.3.2),
- Annual energy use for lighting per useful floor area [kWh/(m^2yr),
- Data related to lighting control according to European Standard EN 15232-1:2017 (see chapter 2.3.1), covering two types of control Occupancy and Daylight control.

Energy consumption in on-mode means the electric energy consumption of a light source in full-load with all lighting control parts and non-lighting parts disconnected expressed in kWh/1000 h. This value is a part of every EU energy label of a light source.

Data about blinds and technical home and building management refer to the requirements set within European standard EN 15232-1:2017.

The subcategory named ON-SITE Renewable energy generation and storage covers Photovoltaic (PV) system and solar thermal system.

The last subcategory within this module refers to Battery energy storage system. The data entry fields denoted as 'REQUIRED' by project partners are:

- Battery system available (No or Yes),
- Total battery capacity [kWh] in base battery system is available,
- Production year and
- Installation year.

Production/installation year and life span are used to estimate the reaming useful physical life span of a battery system available on-site.

2.3.1 Building Automation and Control System (BACS)

Building Automation and Control System (BACS) means a system comprising all products, software and engineering services that can support energy efficient, economical and safe operation of technical building systems through automatic controls and by facilitating the manual management of those technical building systems [7].

Based on EN 15232-1:2017 (*Energy performance of buildings – Part 1: Impact of Building Automation, Controls and Building Management),* there are in total four different BACS efficiency classes:

- **A** (highly energy efficient BACS and TBM),
- **B** (advanced BACS and some specific TBM functions),
- **C** (standard BACS) and
- **D** (non-energy efficient BACS; buildings with such systems should be retrofitted; new buildings may no longer be built with such systems).

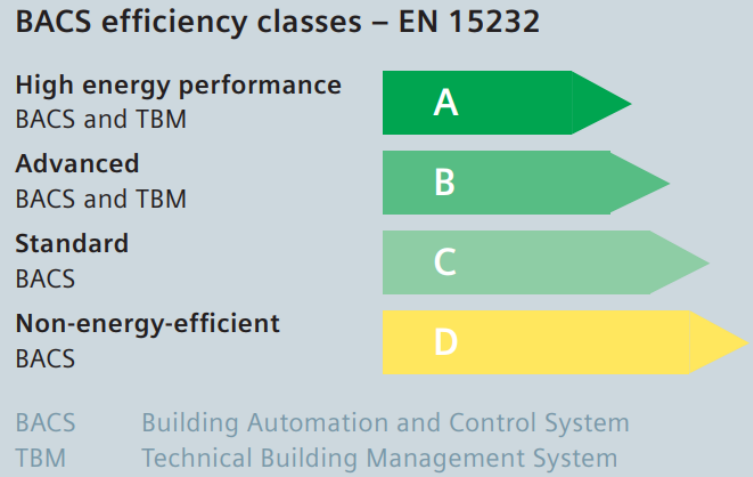


Figure 50: BACS efficiency classes – EN 15232 [20]

The European standard EN 15232-1:2017 describes the method to estimate the efficiency of automation systems for all facilities that supply heating, for the production of domestic hot water, air conditioning, the ventilation and lighting in a building. The most important table within this European standard for estimating the BACS efficiency class is *Table 5 – Function list and assignment to BACS efficiency classes*, which defines a list of control functions for each technology covering the following seven main categories:

1. HEATING CONTROL
2. DOMESTIC HOT WATER SUPPLY CONTROL
3. COOLING CONTROL
4. VENTILATION AND AIR-CONDITIONING CONTROL
5. LIGHTING CONTROL
6. BLIND CONTROL
7. TECHNICAL HOME AND BUILDING MANAGEMENT

There are several subcategories within each main category, as follows for the first two main categories:

1. HEATING CONTROL
1.1 Emission control
1.2 Emission control for TABS (heating mode)
1.3 Control of distribution network hot water temperature (supply or return)
1.4 Control of distribution pumps in network
1.5 Intermittent control of emission and/or distribution
1.6 Heat generator control (combustion and district heating)
1.7 Heat generator control (heat pump)
1.8 Heat generator control (outdoor unit)
1.9 Sequencing of heat generators
1.10 Control of Thermal Energy Storage (TES) operation
2. DOMESTIC HOT WATER SUPPLY CONTROL
2.1 Control of DHW storage charging with direct electric heating or integrated electric heat pump
2.2 Control of DHW storage charging using hot water generation
2.3 Control of DHW storage charging with solar collector and supplementary heat generation
2.4 Control of DHW circulation pump

There is a list of possible controls for each subcategory. Based on the type of a building (residential or non-residential building) and type of control for a specific subcategory, the BACS efficiency class needs to be estimated for each subcategory (see Figure 51) following the Table 5 (EN 15232-1:2017). For example, if radiators are installed as a heat emission system with individual room control in a residential building, then the BACS efficiency class is C.

			Definition of classes							
			Residential building				Non-residential building			
			D	C	B	A	D	C	B	A
Automatic control										
1	HEATING CONTROL									
1.1	Emission control									
	The control function is applied to the heat emitter (radiators, underfloor heating, fan-coil unit, indoor unit) at room level; for type 1 one function can control several rooms									
o	0	No automatic control	X				X			
	1	Central automatic control	X				X			
	2	**Individual room control**	X	X			X	X		
	3	Individual room control with communication	X	X	X	X[a]	X	X	X	X[a]
	4	Individual room control with communication and occupancy detection (not applied to slow reacting heating emission systems, e.g., floor heating)	X	X	X	X	X	X	X	X

[a] In case of slow reacting heat and cool emission systems, e.g. floor heating, wall heating, etc. functions 1.1.3 and 3.1.3 are allocated to BAC class A.

Figure 51: The first part of Table 5 (EN 15232-1:2017)

If for example, one technical building system is not installed in the building, that system doesn't have to be taken into account when determining BACS efficiency class. Also, if the share of energy consumption related to a service controlled by the function is less than approximately 5 % of the total energy consumption of the building, than that service doesn't have to be taken into account when determining BACS efficiency class.

After estimating the BACS efficiency class for each subcategory, the BACS efficiency class of the main category is estimated by choosing the lowest individual achieved for a subcategory. The final BACS efficiency class represents a category's lowest BACS efficiency class.

2.3.2 Energy efficiency class – EU energy label

As of 1 January 2019, suppliers (manufacturers, importers or authorised representatives established in the EU) must register their products in the European Product Registry for Energy Labelling (EPREL), which is at the moment in beta phase. In May 2022, the database was launched for public access and consultation. Link to EPREL:

https://eprel.ec.europa.eu/screen/home

EPREL contains detailed information about energy labelled products and models. It offers the possibility to identify which products have the best cost-efficiency ratio for a specific need.

According to the EU's energy labelling framework regulation the following product groups require an energy label:

1. **Lighting,**
2. **Heaters** (Local space heaters, Space and water heaters, **Solid fuel boilers**, Air heating and cooling products),
3. Refrigeration (Fridges and freezers, Professional refrigerators, Refrigerators with a direct sales function)
4. Vacuum cleaners
5. Washing machines and driers (washing machines, tumble driers)
6. **Air conditioner and fans** (Air conditioners and comfort fans, Industrial fans, Ventilation units, Air heating and cooling products)
7. Electronic displays and TV boxes
8. Kitchen appliances (Cooking appliances, dishwashers)
9. Pumps
10. Transformers and converters
11. Imaging equipment
12. Game consoles
13. Electric motors
14. Tyres
15. Off mode, standby and networked standby
16. Welding equipment

From March 1st, 2021, there is a new EU energy label scale A-G applicable for the following five product groups:

- Household refrigerators and freezers,
- Washing machines and washer-dryers,
- Dishwashers,
- TVs and displays, and
- **Light sources.**

Lighting products include light sources, such as light bulbs (halogen, compact fluorescent, etc.) or LED modules/lamps. Following the rescaling of the EU energy label for light sources from 1 September 2021, the new labels use a scale from A (most efficient) to G (least efficient). The labels for lighting products provide information on the product's energy efficiency class and energy consumption.

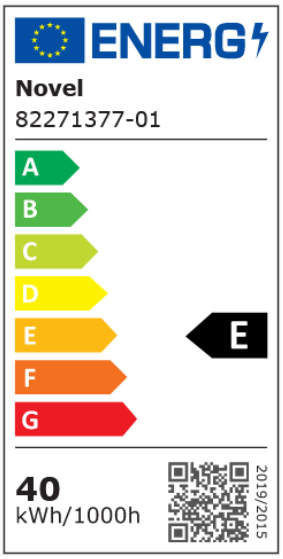


Figure 52: Energy label of a LED module

Local space heaters with a nominal heat output of 50 kW or less are sold with energy labels as of 2018. The rating scale ranges from A++ (most efficient, only applicable to solid fuel local space heaters that use pellets) to G (least efficient).

Solid fuel boilers with a rated heat output of 70 kW or less need to be labelled on an energy efficiency scale ranging from A+++ (most efficient) to G (least efficient). The labels for solid fuel boilers provide information on the product's energy efficiency class (A+++, A++, A+, A, B, C, D, E, F, G) and rated heat output in [kW]. Eco-design requirements for solid fuel boilers with a rated heat output of 500 kW or less are mandatory from 2020 onwards for all manufacturers and suppliers wishing to sell their products in the EU.

Also, all heat pumps designed for installations up to 70 kW must display an energy label.

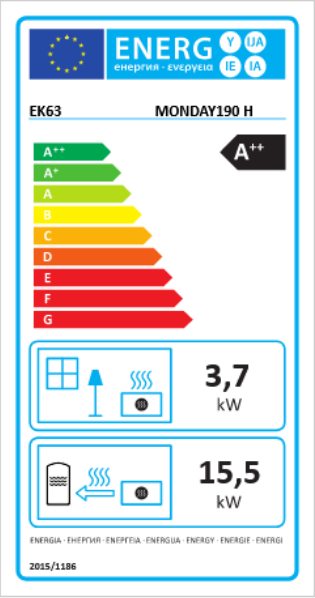


Figure 53: Energy label of a local space heater

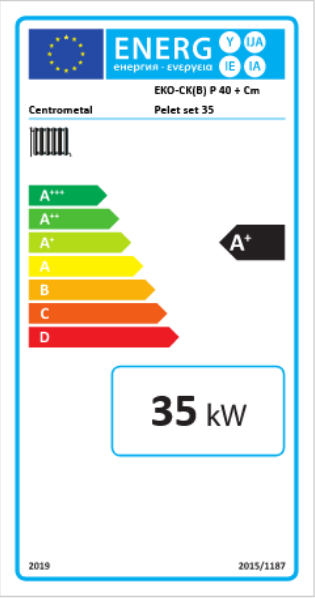


Figure 54: Energy label of a solid fuel boiler

Table 15: The EUB SuperHub digital building logbook data structure – Module 3 –BUILDING ELEMENT INFORMATION

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	Building envelope	Infiltration rate					Float	1/h	REQUIRED
		Internal heat capacity per m^2 AC,ref					Float	Wh/(m^2K)	REQUIRED
		Thermal bridging					Float	W/(m^2K)	REQUIRED
		Walls	Wall insulation	North façade		• Insulated • Not insulated	String-drop down list	–	REQUIRED
				South façade		• Insulated • Not insulated	String-drop down list	–	REQUIRED
				East façade		• Insulated • Not insulated	String-drop down list	–	REQUIRED
				West façade		• Insulated • Not insulated	String-drop down list	–	REQUIRED
				North-East façade		• Insulated • Not insulated	String-drop down list	–	REQUIRED
				North-West façade		• Insulated • Not insulated	String-drop down list	–	REQUIRED
				South-East façade		• Insulated • Not insulated	String-drop down list	–	REQUIRED
				South-West façade		• Insulated • Not insulated	String-drop down list	–	REQUIRED
			U-value wall	North façade			Float	W/(m^2K)	REQUIRED
				South façade			Float	W/(m^2K)	REQUIRED
				East façade			Float	W/(m^2K)	REQUIRED
				West façade			Float	W/(m^2K)	REQUIRED
				North-East façade			Float	W/(m^2K)	REQUIRED
				North-West façade			Float	W/(m^2K)	REQUIRED
				South-East façade			Float	W/(m^2K)	REQUIRED
				South-West façade			Float	W/(m^2K)	REQUIRED
			Surface area	North façade			Float	m^2	REQUIRED
				South façade			Float	m^2	REQUIRED
				East façade			Float	m^2	REQUIRED
				West façade			Float	m^2	REQUIRED
				North-East façade			Float	m^2	REQUIRED
				North-West façade			Float	m^2	REQUIRED
				South-East façade			Float	m^2	REQUIRED
				South-West façade			Float	m^2	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Building envelope**	Walls	Total surface area				Float	m^2	REQUIRED
			Layers	Material type - name			String-descriptive	–	RECOMMENDED
				Layer thickness			Float	m	RECOMMENDED
				Layer thermal conductivity			Float	W/(mK)	RECOMMENDED
				Layer density			Float	kg/m^3	RECOMMENDED
				Layer thermal capacity			Float	J/(kgK)	RECOMMENDED
				Layer vapour permeability			Float	-	RECOMMENDED
				Material location			String	–	RECOMMENDED
				Material weight (mass of each building element)			Float	kg	REQUIRED
				Material volume (layer volume)			Float	m^3	RECOMMENDED
				Global Warming Potential (GWP) - embodied carbon			Float	kg CO_2	REQUIRED
				Total Renewable Primary Energy (PERT)			Float	MJ	RECOMMENDED
				Total non-Renewable Primary Energy (PENRT)			Float	MJ	RECOMMENDED
				Embodied energy coefficient			Float	MJ/kg	REQUIRED
				Life span (life expectancy) of building material			Float	yr	REQUIRED
				Fire resistance class					RECOMMENDED
				Waste category					RECOMMENDED
				Certificate 1					RECOMMENDED
				Chemical declaration					RECOMMENDED
				Global Trade Item Number (GTIN)					RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATIO	Building envelope	Floor (bottom)	Floor insulation			• Insulated • Not insulated	String-drop down list	–	REQUIRED
			U-value floor (bottom)				Float	W/(m²K)	REQUIRED
			Surface area				Float	m²	REQUIRED
			Layers	Material type - name			String-descriptive	–	RECOMMENDED
				Layer thickness			Float	m	RECOMMENDED
				Layer thermal conductivity			Float	W/(mK)	RECOMMENDED
				Layer density			Float	kg/m³	RECOMMENDED
				Layer thermal capacity			Float	J/(kgK)	RECOMMENDED
				Layer vapour permeability			Float	-	RECOMMENDED
				Material location			String	-	RECOMMENDED
				Material weight (mass of each building element)			Float	kg	REQUIRED
				Material volume (layer volume)			Float	m³	RECOMMENDED
				Global Warming Potential (GWP) - embodied carbon			Float	kg CO_2	REQUIRED
				Total Renewable Primary Energy (PERT)			Float	MJ	RECOMMENDED
				Total non-Renewable Primary Energy (PENRT)			Float	MJ	RECOMMENDED
				Embodied energy coefficient			Float	MJ/kg	REQUIRED
				Life span (life expectancy) of building material			Float	yr	REQUIRED
				Fire resistance class					RECOMMENDED
				Waste category					RECOMMENDED
				Certificate 1					RECOMMENDED
				Chemical declaration					RECOMMENDED
				Global Trade Item Number					RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATIO	**Building envelope**	**Roof**	Roof insulation			• Insulated • Not insulated	String-drop down list	–	REQUIRED
			U-value roof				Float	W/(m²K)	REQUIRED
			Surface area				Float	m²	REQUIRED
			Layers	Material type - name			String-descriptive	-	RECOMMENDED
				Layer thickness			Float	m	RECOMMENDED
				Layer thermal conductivity			Float	W/(mK)	RECOMMENDED
				Layer density			Float	kg/m³	RECOMMENDED
				Layer thermal capacity			Float	J/(kgK)	RECOMMENDED
				Layer vapour permeability			Float	-	RECOMMENDED
				Material location			String	-	RECOMMENDED
				Material weight (mass of each building element)			Float	kg	REQUIRED
				Material volume (layer volume)			Float	m³	RECOMMENDED
				Global Warming Potential (GWP) - embodied carbon			Float	kg CO_2	REQUIRED
				Total Renewable Primary Energy (PERT)			Float	MJ	RECOMMENDED
				Total non-Renewable Primary Energy (PENRT)			Float	MJ	RECOMMENDED
				Embodied energy coefficient			Float	MJ/kg	REQUIRED
				Life span (life expectancy) of building material			Float	yr	REQUIRED
				Fire resistance class					RECOMMENDED
				Waste category					RECOMMENDED
				Certificate 1					RECOMMENDED
				Chemical declaration					RECOMMENDED
				Global Trade Item Number					RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Building envelope**	**Windows**	Type of windows	North façade		• Default • Single Glazing (U_g=5,0 W/m²K) • Double Glazing (U_g=2,8 W/m²K) • Triple Glazing (U_g=1,3 W/m²K)	String-drop down list	–	REQUIRED
				South façade		• Default • Single Glazing (U_g=5,0 W/m²K) • Double Glazing (U_g=2,8 W/m²K) • Triple Glazing (U_g=1,3 W/m²K)	String-drop down list	–	REQUIRED
				East façade		• Default • Single Glazing (U_g=5,0 W/m²K) • Double Glazing (U_g=2,8 W/m²K) • Triple Glazing (U_g=1,3 W/m²K)	String-drop down list	–	REQUIRED
				West façade		• Default • Single Glazing (U_g=5,0 W/m²K) • Double Glazing (U_g=2,8 W/m²K) • Triple Glazing (U_g=1,3 W/m²K)	String-drop down list	–	REQUIRED
				North-East façade		• Default • Single Glazing (U_g=5,0 W/m²K) • Double Glazing (U_g=2,8 W/m²K) • Triple Glazing (U_g=1,3 W/m²K)	String-drop down list	–	REQUIRED
				North-West façade		• Default • Single Glazing (U_g=5,0 W/m²K) • Double Glazing (U_g=2,8 W/m²K) • Triple Glazing (U_g=1,3 W/m²K)	String-drop down list	–	REQUIRED
				South-East façade		• Default • Single Glazing (U_g=5,0 W/m²K) • Double Glazing (U_g=2,8 W/m²K) • Triple Glazing (U_g=1,3 W/m²K)	String-drop down list	–	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Building envelope**	**Windows**	Type of windows	South-West façade		• Default • Single Glazing (U_g=5,0 W/m²K) • Double Glazing (U_g=2,8 W/m²K) • Triple Glazing (U_g=1,3 W/m²K)	String-drop down list	–	REQUIRED
			Window frame material	North façade		• Wood • PVC • Aluminium • Fiberglass • Wood-clad • Composite (a combination of wood, metal, and vinyl)	String-drop down list	–	REQUIRED
				South façade		• Wood • PVC • Aluminium • Fiberglass • Wood-clad • Composite (a combination of wood, metal, and vinyl)	String-drop down list	–	REQUIRED
				East façade		• Wood • PVC • Aluminium • Fiberglass • Wood-clad • Composite (a combination of wood, metal, and vinyl)	String-drop down list	–	REQUIRED
				West façade		• Wood • PVC • Aluminium • Fiberglass • Wood-clad • Composite (a combination of wood, metal, and vinyl)	String-drop down list	–	REQUIRED
				North-East façade		• Wood • PVC • Aluminium • Fiberglass • Wood-clad Composite (a combination of wood, metal, and vinyl)	String-drop down list	–	REQUIRED
				North-West façade		• Wood • PVC • Aluminium • Fiberglass • Wood-clad • Composite (a combination of wood, metal, and vinyl)	String-drop down list	–	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	Building envelope	Windows	Window frame material	South-East façade		• Wood • PVC • Aluminium • Fiberglass • Wood-clad • Composite (a combination of wood, metal, and vinyl)	String-drop down list	–	REQUIRED
				South-West façade		• Wood • PVC • Aluminium • Fiberglass • Wood-clad • Composite (a combination of wood, metal, and vinyl)	String-drop down list	–	REQUIRED
			Producer	North façade			String	–	RECOMMENDED
				South façade			String	–	RECOMMENDED
				East façade			String	–	RECOMMENDED
				West façade			String	–	RECOMMENDED
				North-East façade			String	–	RECOMMENDED
				North-West façade			String	–	RECOMMENDED
				South-East façade			String	–	RECOMMENDED
				South-West façade			String	–	RECOMMENDED
			Model number	North façade			String	–	RECOMMENDED
				South façade			String	–	RECOMMENDED
				East façade			String	–	RECOMMENDED
				West façade			String	–	RECOMMENDED
				North-East façade			String	–	RECOMMENDED
				North-West façade			String	–	RECOMMENDED
				South-East façade			String	–	RECOMMENDED
				South-West façade			String	–	RECOMMENDED
			U-value window	North façade			Float	W/(m²K)	REQUIRED
				South façade			Float	W/(m²K)	REQUIRED
				East façade			Float	W/(m²K)	REQUIRED
				West façade			Float	W/(m²K)	REQUIRED
				North-East façade			Float	W/(m²K)	REQUIRED
				North-West façade			Float	W/(m²K)	REQUIRED
				South-East façade			Float	W/(m²K)	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	Building envelope	Windows	U-value window	South-West façade			Float	W/(m²K)	REQUIRED
			Percentage of frame to glass	North façade			Float	%	RECOMMENDED
			Proportion of frame	North façade			Float	%	RECOMMENDED
			Proportion of glass	North façade			Float	%	RECOMMENDED
			Percentage of frame to glass	South façade			Float	%	RECOMMENDED
			Proportion of frame	South façade			Float	%	RECOMMENDED
			Proportion of glass	South façade			Float	%	RECOMMENDED
			Percentage of frame to glass	East façade			Float	%	RECOMMENDED
			Proportion of frame	East façade			Float	%	RECOMMENDED
			Proportion of glass	East façade			Float	%	RECOMMENDED
			Percentage of frame to glass	West façade			Float	%	RECOMMENDED
			Proportion of frame	West façade			Float	%	RECOMMENDED
			Proportion of glass	West façade			Float	%	RECOMMENDED
			Percentage of frame to glass	North-East façade			Float	%	RECOMMENDED
			Proportion of frame	North-East façade			Float	%	RECOMMENDED
			Proportion of glass	North-East façade			Float	%	RECOMMENDED
			Percentage of frame to glass	North-West façade			Float	%	RECOMMENDED
			Proportion of frame	North-West façade			Float	%	RECOMMENDED
			Proportion of glass	North-West façade			Float	%	RECOMMENDED
			Percentage of frame to glass	South-East façade			Float	%	RECOMMENDED
			Proportion of frame	South-East façade			Float	%	RECOMMENDED
			Proportion of glass	South-East façade			Float	%	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	Building envelope	Windows	Percentage of frame to glass	South-West façade			Float	%	RECOMMENDED
			Proportion of frame	South-West façade			Float	%	RECOMMENDED
			Proportion of glass	South-West façade			Float	%	RECOMMENDED
			Window area	North façade			Float	m^2	REQUIRED
				South façade			Float	m^2	REQUIRED
				East façade			Float	m^2	REQUIRED
				West façade			Float	m^2	REQUIRED
				North-East façade			Float	m^2	REQUIRED
				North-West façade			Float	m^2	REQUIRED
				South-East façade			Float	m^2	REQUIRED
				South-West façade			Float	m^2	REQUIRED
				Total area of the window			Float	m^2	REQUIRED
			g-value	North façade			Float	–	RECOMMENDED
				South façade			Float	–	RECOMMENDED
				East façade			Float	–	RECOMMENDED
				West façade			Float	–	RECOMMENDED
				North-East façade			Float	–	RECOMMENDED
				North-West façade			Float	–	RECOMMENDED
				South-East façade			Float	–	RECOMMENDED
				South-West façade			Float	–	RECOMMENDED
			TI of window (light transmission factor)	North façade			Float	–	RECOMMENDED
				South façade			Float	–	RECOMMENDED
				East façade			Float	–	RECOMMENDED
				West façade			Float	–	RECOMMENDED
				North-East façade			Float	–	RECOMMENDED
				North-West façade			Float	–	RECOMMENDED
				South-East façade			Float	–	RECOMMENDED
				South-West façade			Float	–	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Building envelope**	**Windows**	Type of sun protection	North façade		• Default • No shading • External shading • Internal shading • Solar glazing	String-drop down list	–	REQUIRED
				South façade		• Default • No shading • External shading • Internal shading • Solar glazing	String-drop down list	–	REQUIRED
				East façade		• Default • No shading • External shading • Internal shading • Solar glazing	String-drop down list	–	REQUIRED
				West façade		• Default • No shading • External shading • Internal shading • Solar glazing	String-drop down list	–	REQUIRED
				North-East façade		• Default • No shading • External shading • Internal shading • Solar glazing	String-drop down list	–	REQUIRED
				North-West façade		• Default • No shading • External shading • Internal shading • Solar glazing	String-drop down list	–	REQUIRED
				South-East façade		• Default • No shading • External shading • Internal shading • Solar glazing	String-drop down list	–	REQUIRED
				South-West façade		• Default • No shading • External shading • Internal shading • Solar glazing	String-drop down list	–	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Building envelope**	**Windows**	Window material	Blind frame		• Aluminum wing sash profile, powder Coated • Aluminum casement frame section. Thermally separated, powder coated • Aluminum frame section, powder Coated • Window frame PVC-u • Window sash PVC-u • Window frame (spruce) • Aluminium mullion-transom system • Stell mullion-transom system	String-drop down list	–	RECOMMENDED
				Sash frame		• Aluminum wing sash profile, powder Coated • Aluminum casement frame section. Thermally separated, powder coated • Aluminum frame section, powder Coated • Window frame PVC-u • Window sash PVC-u • Window frame (spruce) • Aluminium mullion-transom system • Stell mullion-transom system	String-drop down list	–	RECOMMENDED
				Frame width			Float	cm	RECOMMENDED
				Glazing material		• Glass single page • Insulated glass double pane • Insulated glass triple pane	String-drop down list	–	RECOMMENDED
				Sealing joints		• Joint tape, Polyurethane • Joint tape, Silicone rubber • Joint strips. Butyl • Joint strips. PE/PP foil • Joint strips. polyisobutylene	String-drop down list	–	RECOMMENDED
				Windowsill		• Aluminum die cast • Aluminum profile	String-drop down list	–	RECOMMENDED
				Window soffit		• Aluminum die cast • Aluminum profile	String-drop down list	–	RECOMMENDED
				Window fitting			String-descriptive	–	RECOMMENDED
				Window handles		• Plastic • Aluminum profile • Stainless steel	String-drop down list	–	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	Building envelope	Windows	Window material	Material weight (mass of each building element)			Float	kg	REQUIRED
				Global Warming Potential (GWP) - embodied carbon			Float	kg CO_2	REQUIRED
				Total Renewable Primary Energy (PERT)			Float	MJ	RECOMMENDED
				Total non-Renewable Primary Energy (PENRT)			Float	MJ	RECOMMENDED
				Embodied energy coefficient			Float	MJ/kg	REQUIRED
				Life span (life expectancy) of building material			Float	yr	REQUIRED
				Fire resistance class					RECOMMENDED
				Waste category					RECOMMENDED
				Certificate 1					RECOMMENDED
				Chemical declaration					RECOMMENDED
				Global Trade Item Number (GTIN)					RECOMMENDED
		Skylights	Producer				String	–	RECOMMENDED
			Model number				String	–	RECOMMENDED
			U-value skylight				Float	W/(m^2K)	REQUIRED
			Percentage of frame to glass				Float	%	Float
			Area				Float	m^2	REQUIRED
			g-value				Float	–	RECOMMENDED
			TI of window (light transmission factor)				Float	–	RECOMMENDED
			Type of sun protection			• Default • No shading • External shading • Internal shading • Solar glazing	String-drop down list	–	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Building envelope**	Skylights	Skylight material	Blind frame		• Aluminum wing sash profile, powder Coated • Aluminum casement frame section. Thermally separated, powder coated • Aluminum frame section, powder Coated • Window frame PVC-u • Window sash PVC-u • Window frame (spruce) • Aluminium mullion-transom system • Stell mullion-transom system	Select from drop down list	–	RECOMMENDED
				Sash frame		• Aluminum wing sash profile, powder Coated • Aluminum casement frame section. Thermally separated, powder coated • Aluminum frame section, powder Coated • Window frame PVC-u • Window sash PVC-u • Window frame (spruce) • Aluminium mullion-transom system • Stell mullion-transom system	Select from drop down list	–	RECOMMENDED
				Frame width			Float	cm	RECOMMENDED
				Glazing material		• Glass single page • Insulated glass double pane • Insulated glass triple pane	Select from drop down list	–	RECOMMENDED
				Sealing joints		• Joint tape, Polyurethane • Joint tape, Silicone rubber • Joint strips. Butyl • Joint strips. PE/PP foil • Joint strips. polyisobutylene	Select from drop down list	–	RECOMMENDED
				Windowsill		• Aluminum die cast • Aluminum profile	Select from drop down list	–	RECOMMENDED
				Skylight soffit		• Aluminum die cast • Aluminum profile	Select from drop down list	–	RECOMMENDED
				Skylight fitting			String-descriptive	–	RECOMMENDED
				Skylight handles		• Plastic • Aluminum profile • Stainless steel	Select from drop down list	–	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	Building envelope	Skylights	Skylight material	Material weight (mass of each building element)			Float	kg	REQUIRED
				Global Warming Potential (GWP) - embodied carbon			Float	kg CO_2	REQUIRED
				Total Renewable Primary Energy (PERT)			Float	MJ	RECOMMENDED
				Total non-Renewable Primary Energy (PENRT)			Float	MJ	RECOMMENDED
				Embodied energy coefficient			Float	MJ/kg	REQUIRED
				Life span (life expectancy) of building material			Float	yr	REQUIRED
				Fire resistance class					RECOMMENDED
				Waste category					RECOMMENDED
				Certificate 1					RECOMMENDED
				Chemical declaration					RECOMMENDED
				Global Trade Item Number (GTIN)					RECOMMENDED
		Doors	Entry (exterior) door/s material			• Wood • Glass • PVC • Aluminium • Steel • Fiberglass • Wood-clad • Composite (a combination of wood, metal, and vinyl) • Fiber Reinforced Plastic Door	String-drop down list	–	REQUIRED
			Number of external doors				Integer	–	REQUIRED
			Producer				String	–	RECOMMENDED
			Model number				String	–	RECOMMENDED
			U-value door				Float	W/(m^2K)	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	Building envelope	Doors	Door material	Door frame		• Wood • Steel • Aluminium • PVC	String-drop down list	–	RECOMMENDED
				Door panel		• Wood • Steel • Aluminium • Glass • PVC	String-drop down list	–	RECOMMENDED
				Door fitting			String-descriptive	–	RECOMMENDED
				Door handles		• Plastic • Aluminum profile • Stainless steel	String-drop down list	–	RECOMMENDED
				Door seal		• Tension Seal • Felt • Reinforced Foam • Tape • Rolled or Reinforced Vinyl • Door Sweep • Tubular Rubber and Vinyl	String-drop down list	–	RECOMMENDED
				Material weight (mass of each building element)			Float	kg	REQUIRED
				Global Warming Potential (GWP) - embodied carbon			Float	kg CO_2	REQUIRED
				Total Renewable Primary Energy (PERT)			Float	MJ	RECOMMENDED
				Total non-Renewable Primary Energy (PENRT)			Float	MJ	RECOMMENDED
				Embodied energy coefficient			Float	MJ/kg	REQUIRED
				Life span (life expectancy) of building material			Float	yr	REQUIRED
				Fire resistance class					RECOMMENDED
				Waste category					RECOMMENDED
				Certificate 1					RECOMMENDED
				Chemical declaration					RECOMMENDED
				Global Trade Item Number (GTIN)					RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Technical Building System (TBS)**	Installed technical building system (EN 15232-1)	1-Space heating system			• Installed • installed but energy consumption of this system is less than 5 % of the buildings total energy use • not installed	String-drop down list	–	REQUIRED
			2-Domestic Hot Water (DHW) preparation system			• Installed • installed but energy consumption of this system is less than 5 % of the buildings total energy use • not installed	String-drop down list	–	REQUIRED
			3-Space cooling system			• Installed • installed but energy consumption of this system is less than 5 % of the buildings total energy use • not installed	String-drop down list	–	REQUIRED
			4-Ventilation system			• Installed • installed but energy consumption of this system is less than 5 % of the buildings total energy use • not installed	String-drop down list	–	REQUIRED
			5-Lighting system			• Installed • installed but energy consumption of this system is less than 5 % of the buildings total energy use • not installed	String-drop down list	–	REQUIRED
			6-Blinds			• Installed • installed but energy consumption of this system is less than 5 % of the buildings total energy use • not installed	String-drop down list	–	REQUIRED
			7-Technical home and building management system			• Installed • installed but energy consumption of this system is less than 5 % of the buildings total energy use • not installed	String-drop down list	–	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Technical Building System (TBS)**	Space heating system	Source of energy for space heating system			• Natural gas • Fuel oil • Liquified Natural Gas (LNG) • Wood logs • Wood chips • Wood pellets • Biogas • Waste heat • Electricity • District heating system (medium-hot water) • District heating system (medium-steam)	String-drop down list	–	REQUIRED
			Type			• Default • open fire (decentralized heating system) • wood burning stove (decentralized heating system) • wood pellets stove (decentralized heating system) • natural gas stove (decentralized heating system) • gas-fired space heater (decentralized heating system) • electric direct heater (decentralized heating system) • fossil fuel boiler, non-condensing • fossil fuel boiler, condensing • wood-logs boiler • wood-chips boiler • wood-pellets boiler, non-condensing • wood-pellets boiler, condensing • combined boiler for firing wood-pellets and wood-logs • electric heating system boiler • absorption heat pump • compression heat pump, heat source outdoor air, air to air	String-drop down list	–	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Technical Building System (TBS)**	Space heating system	Type			• compression heat pump, heat source outdoor air, air to water • compression heat pump, heat source ground • compression heat pump, heat source water (surface water, ground water, sea water) • compression heat pump, heat source waste heat • solar thermal collector • district heating transfer substation • combined heat and power (CHP)-cogeneration	String-drop down list	–	REQUIRED
			Producer				String	–	RECOMMENDED
			Model				String	–	RECOMMENDED
			Nominal heating output (rated heat output)				Float	kW	REQUIRED
			Electrical efficiency				Float	–	REQUIRED
			Thermal efficiency				Float	–	REQUIRED
			Production year				Integer	–	REQUIRED
			Installation year				Integer	–	REQUIRED
			Life span - max (DIN EN 15459)				Integer	years	RECOMMENDED
			Remaining useful physical life span				Integer	years	RECOMMENDED
			Energy efficiency class (EU energy label) - Class of seasonal energy heating efficiency - Energy class heating			• A+++ • A++ • A+ • A • B • C • D • E • F • G • Not available	String-drop down list	–	RECOMMENDED
			User manual				Link to BUILDING DOCUMENTATION	–	OPTIONAL

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Technical Building System (TBS)**	Space heating system	Condition			• in good working condition • require maintenance • require replacement	String-drop down list	–	RECOMMENDED
			Share of metered energy used for space heating system				Float	%	REQUIRED
			Thermal losses from the space heating DISTRIBUTION subsystem				Float	%	RECOMMENDED
			Thermal losses from the space heating STORAGE vessel				Float	%	RECOMMENDED
			1. Heating control	1.1-Emission control	Type	• Not installed • No automatic control • Central automatic control • Individual room control • Individual room control with communication • Individual room control with communication (slow reacting heat emission systems, e.g., floor heating, wall heating) • Individual room control with communication and occupancy detection (not applied to slow reacting heating emission systems, e.g. floor heating)	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				1.2-Emission control for TABS (heating mode)	Type	• TABS not installed • No automatic control • Central automatic control • Advanced central automatic control • Advanced central automatic control with intermittent operation and/or room temperature feedback control	String-drop down list	–	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Technical Building System (TBS)**	Space heating system	1. Heating control		Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				1.3-Control of distribution network hot water temperature (supply or return)	Type	• Not installed • No automatic control • Outside temperature compensated control • Demand based control	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				1.4-Control of distribution pumps in network	Type	• Not installed • No automatic control • On off control • Multi-Stage control • Variable speed pump control: constant or variable Δp based on pump system assessments (internal) • Variable speed pump control: variable Δp due to an external demand signal, e.g. hydraulic requirement, ΔT, energy optimization	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				1.5-Intermittent control of emission and/or distribution	Type	• Not installed • No automatic control • Automatic control with fixed time program • Automatic control with optimum start/stop • Automatic control with demand evaluation	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				1.6-Heat generator control (combustion and district heating)	Type	• Boiler/district heating substation not installed • Constant temperature control • Variable temperature control depending on outside temperature • Variable temperature control depending on the load	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Technical Building System (TBS)**	Space heating system	1. Heating control	1.7-Heat generator control (heat pump)	Type	• Heat pump not installed • Constant temperature unit • Variable temperature control depending on outside temperature • Variable temperature control depending on the load	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				1.8-Heat generator control (outdoor unit)	Type	• Outdoor unit not installed • On/Off-control of heat generator • Multi-stage control of heat generator • Variable control of heat generator	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				1.9-Sequencing of heat generators	Type	• Only one heat generator - no sequencing • Priorities based on fixed priority list • Priorities only based on loads • Priorities dynamically based on generator efficiency and characteristics • Load prediction based sequencing (various parameters)	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				1.10-Control of Thermal Energy Storage (TES) operation	Type	• Thermal Energy Storage (TES) not installed • Continuous storage operation • 2-sensor charging of storage • Load prediction based storage operation	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
					Total efficiency class - HEATING CONTROL (EN 15232-1) (the lowest individual achieved)		String	–	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Technical Building System (TBS)**	Domestic Hot Water (DHW) preparation system	Source of energy for DHW system			• Natural gas • Fuel oil • Liquified Natural Gas (LNG) • Wood logs • Wood chips • Wood pellets • Biogas • Waste heat • Electricity • District heating system (medium-hot water) • District heating system (medium-steam)	String-drop down list	–	REQUIRED
			Type			• Default • direct gas-fired instantaneous water heater • direct gas-fired storage water heater • electric immersion heater • electric instantaneous water heater • electric storage water heater • compact (integrated) air-source heat pump water heater • fossil fuel boiler, non-condensing • fossil fuel boiler, condensing • wood-logs boiler • wood-chips boiler • wood-pellets boiler, non-condensing • wood-pellets boiler, condensing • combined boiler for firing wood-pellets and wood-logs • electric heating system boiler • absorption heat pump • compression heat pump, heat source outdoor air, air to air • compression heat pump, heat source outdoor air, air to water • compression heat pump, heat source ground • compression heat pump, heat source water (surface water, ground water, sea water)	String-drop down list	–	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Technical Building System (TBS)**	Domestic Hot Water (DHW) preparation system	Type			• compression heat pump, heat source waste heat • compression heat pump, heat source exhaust air • solar thermal collector • district heating transfer substation • combined heat and power (CHP)-cogeneration	String-drop down list	–	REQUIRED
			Producer				String	–	RECOMMENDED
			Model				String	–	RECOMMENDED
			Electrical efficiency				Float	–	REQUIRED
			Thermal efficiency				Float	–	REQUIRED
			Production year				Integer	–	REQUIRED
			Installation year				Integer	–	REQUIRED
			Life span - max (DIN EN 15459)				Integer	years	RECOMMENDED
			Remaining useful physical life span				Integer	years	RECOMMENDED
			Energy efficiency class (EU energy label) - Energy class hot water			• A • B • C • D • E • D • G • Not available	String-drop down list	–	RECOMMENDED
			Condition			• in good working condition • require maintenance • require replacement	String-drop down list	–	RECOMMENDED
			Share of metered energy used for DHW preparation system				Float	%	REQUIRED
			Annual energy need for domestic hot water (DHW) per useful floor area				Float	kWh/(m²yr)	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Technical Building System (TBS)**	Domestic Hot Water (DHW) preparation system	Thermal losses from the domestic hot water DISTRIBUTION subsystem				Float	%	RECOMMENDED
			Thermal losses from the domestic hot water STORAGE vessel				Float	%	RECOMMENDED
			2. Domestic hot water supply control	2.1-Control of DHW storage charging with direct electric heating or intergrated electric heat pump	Type	• Not installed • Automatic on/off-control • Automatic on/off-control and scheduled charging enable • Automatic on/off-control and scheduled charging enable and multi-sensor storage management	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				2.2-Control of DHW storage charging using hot water generation	Type	• Not installed • Automatic on/off-control • Automatic on/off-control and scheduled charging enable • Automatic on/off-control, scheduled charging enable and demand-based supply temperature control or multi-sensor storage management	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				2.3-Control of DHW storage charging with solar collector and supplementary heat generation	Type	• Not installed • Manual control • Automatic control of solar storage charge (Prio. 1) and supplementary storage charge (Prio. 2) • Automatic control of solar storage charge (Prio. 1) and supplementary storage charge (Prio. 2) plus demand based supply temperature control or multi-sensor storage management	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Technical Building System (TBS)**	Domestic Hot Water (DHW) preparation system		2.4-Control of DHW circulation pump	Type	• Not installed • No control, continuous operation • With time program	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
					Total efficiency class - DHW SUPPLY CONTROL (EN 15232-1) (the lowest individual achieved)		String	–	RECOMMENDED
		Space cooling system	Share of cooling area				String-drop down list	–	REQUIRED
			Source of energy for space cooling system			• Electricity (compression chiller) • District cooling system • Natural gas (absorption chiller) • Liquified natural gas (absorption chiller) • Biogas (absorption chiller) • Waste heat (absorption chiller)	String-drop down list	–	REQUIRED
			Type			• Default • no cooling system • split/multisplit compression air conditioners • VRV (Variable Refrigerant Volume) system • air-cooled compression chiller • water-cooled compression chiller • direct fired absorption chiller • direct one-stage steam-fired absorption chiller • direct two-stage steam-fired absorption chiller • direct three-stage steam-fired absorption chiller • medium pressure hot water driven absorption chiller • high pressure hot water driven absorption chiller • ultra low temperature hot water driven absorption chiller •	String-drop down list	–	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Technical Building System (TBS)**	**Space cooling system**	Type			• solar driven absorption chiller • multi-energy driven absorption chiller • local district cooling system • district cooling system			
			Producer				Integer	–	RECOMMENDED
			Model				Integer	–	RECOMMENDED
			Nominal cooling output (rated cold output) - cooling capacity				Float	kW	REQUIRED
			Cooling efficiency				Float	–	REQUIRED
			Production year				Integer	–	REQUIRED
			Installation year				Integer	–	REQUIRED
			Life span - max (DIN EN 15459)				Integer	years	RECOMMENDED
			Remaining useful physical life span				Integer	years	RECOMMENDED
			Energy efficiency class (EU energy label) - Energy class hot water				String-drop down list	–	RECOMMENDED
			User manual				Link to BUILDING DOCUMENTATION	–	OPTIONAL
			Condition			• in good working condition • require maintenance • require replacement	String-drop down list	–	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Technical Building System (TBS**	**Space cooling system**	3. Cooling control	3.1-Emission control	Type	• Not installed • No automatic control • Central automatic control • Individual room control • Individual room control with communication • Individual room control with communication (slow reacting cold emission systems, e.g., wall cooling) • Individual room control with communication and occupancy detection not applied to slow reacting cooling emission systems, e.g. floor cooling)	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				3.2-Emission control for TABS	Type	• TABS not installed • No automatic control • Central automatic control • Advanced central automatic control • Advanced central automatic control with intermittent operation and and/or room temperature feedback control	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				3.3-Control of distribution network chilled water temperature (supply or return)	Type	• Not installed • Constant temperature control • Outside temperature compensated control • Demand based control	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				3.4-Control of distribution pumps in networks	Type	• Not installed • No automatic control • On off control • Multi-Stage control • Variable speed pump control (pumpu nit (internal) estimations) • Variable speed pump control (external demand signal)	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Technical Building System (TBS**	**Space cooling system**	3. Cooling control	3.5-Intermittent control of emission and/or distribution	Type	• Not installed • No automatic control • Automatic control with fixed time program • Automatic control with optimum start/stop • Automatic control with demand evaluation	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				3.6-Interlock between heating and cooling control of emission and/or distribution	Type	• Not installed • No interlock • Partial interlock (dependent on the HVAC system) • Total interlock	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				3.7-Generator control for cooling	Type	• Not installed • Constant temperature control • Variable temperature control depending on outside temperature • Variable temperature control depending on the load	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				3.8-Sequencing of generators for chilled water	Type	• Only one cold generator - no sequencing • Priorities only based on running times • Priorities only based on loads • Priorities based on generator efficiency and characteristics • Load prediction based sequencing	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				3.9-Control of Thermal Energy Storage (TES) operation	Type	• Thermal Energy Storage (TES) not installed • Continuous storage operation • Time-scheduled storage operation • Load prediction based storage operation	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	Technical Building System (TBS)	**Space cooling system**	3. Cooling control		Total efficiency class - COOLING CONTROL (EN 15232-1) (the lowest individual achieved)		String	–	RECOMMENDED
		Ventilation system	Ventilation rate				Float	1/h	REQUIRED
			Type			• Default • no mechanical ventilation system • exhaust air mechanical ventilation system • mechanical ventilation system without heat recovery system • mechanical ventilation system with heat recovery system • hybrid ventilation system	String-drop down list	–	REQUIRED
			Producer				String	–	RECOMMENDED
			Model				String	–	RECOMMENDED
			Nominal air volume flow				Float	m^3/h	REQUIRED
			Sensible heat recovery efficiency				Float	–	REQUIRED
			Moisture recovery efficiency				Float	–	REQUIRED
			4. Ventilation and air-conditioning control	4.1-Supply air flow control at the room level	Type	• No automatic control • Time control • Occupancy detection	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				4.2-Room air temp. control (all-air systems)	Type	• On-off control • Variable control • Demand control	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				4.3-Room air temp.control (combined air-water system)	Type	• No coordination • Coordination	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Technical Building System (TBS)**	**Ventilation system**		4.4-Outside air (OA) flow control	Type	• Fixed OA ratio/OA flow • Staged (low/high) OA ratio/OA flow (time schedule) • Staged (low/high) OA ratio/OA flow (occupancy) • Variable control	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				4.5-Air flow or pressure control at the air handler level	Type	• No automatic control • On off time control • Multi-stage control • Automatic flow or pressure control (without reset) • Automatic flow or pressure control (with reset)	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				4.6-Heat recovery control: icing protecton	Type	• Without icing protection • With icing protection	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				4.7-Heat recovery control: prevention of overheating	Type	• Without overheating control • With overheating control	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				4.8-Free mechanical cooling	Type	• No automatic control • Night cooling • Free cooling • H,x – directed control	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				4.9-Supply air temperature control	Type	• No automatic control • Constant setpoint • Variable setpoint with outside temperature compensation • Variable setpoint with load dependant compensation	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				4.10-Humidity control	Type	• No automatic control • Dew point control • Direct humidity control	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	Technical Building System (TBS)	**Ventilation system**			Total efficiency class - VENTILATION AND AIR-CONDITIONING CONTROL (EN 15232-1) (the lowest individual achieved)		String	–	RECOMMENDED
		Lighting system	Type of electrical lighting sources			• Default • bulb lamps • energy saving lamps • CFL (compact fluorescent lamp) • fluorescent light tubes • LED (Light-Emitting Diode)	String-drop down list	–	REQUIRED
			Energy efficiency class (EU energy label)			• A • B • C • D • E • F • G • Not available	String-drop down list	–	REQUIRED
			Energy consumption in on-mode				Integer	kWh/1000 h	RECOMMENDED
			Annual energy use for lighting per useful floor area				Foat	kWh/(m²yr)	REQUIRED
			5. Lighting control	5.1-Occupancy control	Type	• Manual on/off switch • Manual on/off switch + additional sweeping extinction signal • Automatic detection (auto on) • Automatic detection (manual on)	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				5.2-Daylight control	Type	• No daylight control • Manual (central) • Manual (per room/zone) • Automatic switching • Automatic dimming	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Technical Building System (TBS)**	Lighting system	5. Lighting control		Total efficiency class - LIGHTING CONTROL (EN 15232-1) (the lowest individual achieved)		String	–	RECOMMENDED
		Blinds	6. Blind control		Type	• Not installed • Manual operation • Motorized operation with manual control • Motorized operation with automatic control • Combined light/blind/HVAC control	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
		Technical home and building management		7.1-Setpoint management	Type	• No setpoint management • Manual setting room by room individually • Adaptation from distributed/decentralized plant rooms only • Adaptation from a central room • Adaptation from a central room with frequent set back of user inputs	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				7.2-Runtime management	Type	• No runtime managament • Manual setting (plant enabling) • Individual setting following a predifined time schedule including fixed preconditioning phases • Individual setting following a predifined time schedule; adaptation from a central room; variable preconditioning phases	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	**Technical Building System (TBS)**	Technical home and building management		7.3-Detecting faults of technical building systems and providing support to the diagnosis of these faults	Type	• No detecting faults of technical building systems • No central indications of detected faults and alarms • With central indications of detected faults and alarms • With central indications of detected faults and alarms/diagnosing functions	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				7.4-Reporting information regarding energy consumption, indoor conditions	Type	• No reporting information • Indication of actual values only (e.g. temperatures, meter values) • Trending functions and consumption determination • Analysing, performance evaluation, benchmarking	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				7.5-Local energy production and renewable energies	Type	• Local energy production not installed • Uncontrolled generation depending on the fluctuating avaibility of RES an or run time of CHP; overproduction will be fed into the grid • Coordination of local RES and CHP with regard to local energy demand profile including enertgy storage management; Optimization of own consumption	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
				7.6-Waste heat recovery and heat shifting	Type	• Waste heat recovery and heat shifting not installed • Instantaneous use of waste hest or heat shifting • Managed use of waste heat or heat shifting (including charging/discharging TES)	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	Technical Building System (TBS)	Technical home and building management		7.7-Smart grid integration	Type	• No smart grid integration • No harmonization between grid and building energy systems; building is operated independently from the grid load • Building energy system are managed and operated depending on grid load; demand side management is used for load shifting	String-drop down list	–	RECOMMENDED
					Efficiency class (EN 15232-1)		String	–	RECOMMENDED
					Total efficiency class - TECHNICAL HOME AND BUILDING MANAGEMENT (EN 15232-1) (the lowest individual achieved)		String	–	RECOMMENDED
		Building Automation and Control system (BACS)	BACS efficiency class (EN 15232-1)				String	–	RECOMMENDED
		ON-SITE Renewable energy generation and storage	Photovoltaic (PV) system	Type		• Grid connected PV system without battery • Grid connected PV system with battery • Stand-alone system (off-grid solar system) • Hybrid system	String-drop down list	–	REQUIRED
				Producer			String	–	RECOMMENDED
				Model			String	–	RECOMMENDED
				Panel area			Float	m^2	REQUIRED
				Power rating			Float	kW	REQUIRED
				PV efficiency			Float	–	REQUIRED
				Production year			Integer	–	REQUIRED
				Installation year			Integer	–	REQUIRED
				Life span - max (DIN EN 15459)			Integer	years	RECOMMENDED
				Remaining useful physical life span			Integer	years	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
3-BUILDING ELEMENT INFORMATION	Technical Building System (TBS)	**ON-SITE Renewable energy generation and storage**	Solar Thermal System	Type		• Unglazed solar collectors • Flat plate solar collectors • Evacuated tube solar collectors • Solar thermal air collectors • Solar thermal bowl collectors	String-drop down list	–	REQUIRED
				Producer			String	–	RECOMMENDED
				Model			String	–	RECOMMENDED
				Panel area			Float	m^2	REQUIRED
				Efficiency			Float	–	REQUIRED
				Production year			Integer	–	REQUIRED
				Installation year			Integer	–	REQUIRED
				Life span - max (DIN EN 15459)			Integer	years	RECOMMENDED
				Remaining useful physical life span			Integer	years	RECOMMENDED
		Battery energy storage system	Battery system available			• No • Yes	String-drop down list	–	REQUIRED
			Battery chemistry			• Lead acid • Lithium ion • Flow • Nickel cadmimum	String-drop down list	–	RECOMMENDED
			Total battery capacity				Float	kWh	REQUIRED
			Battery power output (CONTINOUS)				Float	kW	RECOMMENDED
			Battery power output (PEAK)				Float	kW	RECOMMENDED
			Production year				Integer	–	REQUIRED
			Installation year				Integer	–	REQUIRED
			Life span - max (DIN EN 15459)				Integer	years	RECOMMENDED
			Remaining useful physical life span				Integer	years	RECOMMENDED

2.4 Module 4: BUILDING OPERATION AND USE

The fourth module corresponds to BUILDING OPERATION AND USE and is divided into five different topics:

- Building use,
- Climate data actual,
- Metered data,
- Inspection of heating and air-conditioning systems (EPBD) and
- Building element maintenance.

According to the grant agreement, the elaborated EUB SuperHub digital building logbook needs to hold records about maintenance history.

This module is focused on actual use of building, actual climate data and metered data (energy consumption, water consumption).

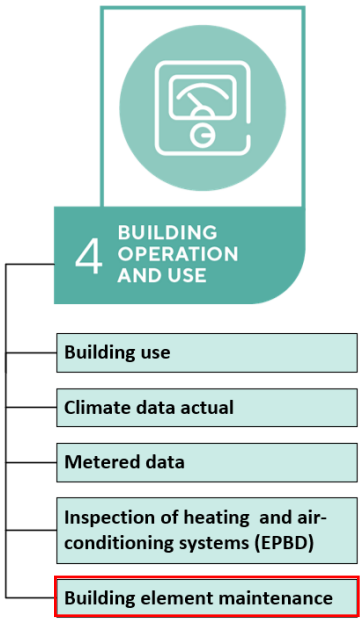


Figure 55: EUB SuperHub digital building logbook – main subcategories of Module 4. BUILDING OPERATION AND USE

The first subcategory named **Building use** (Figure 56) collects the data about the number of occupants, daily usage time and annual usage time of a building, but also daily HVAC system operating hours and setting room temperatures (for heating and cooling period), which could vary over time.

Under the subcategory User behaviour, the DBL author needs to denote the usage intensity for space heating, space cooling, domestic hot water (DHW) and electricity. There are three possible choices under the drop-down list default, low, medium, high. In an office building with only sanitary facilities consuming domestic hot water (without showers, without kitchen), the domestic hot water usage intensity can be for sure denoted as low. The domestic hot water usage intensity could be high in a sports facility delivering all kinds of training. In contrast, space heating usage intensity in a sports facility is usually low due to lower setting point temperature for heating.

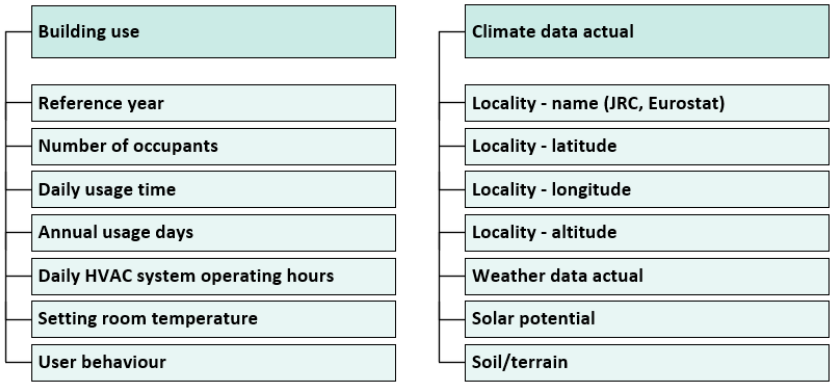


Figure 56: EUB SuperHub digital building logbook – 4. BUILDING OPERATION AND USE – subcategories Building use and Climate data actual

The second subcategory named **Climate data actual** (Figure 56) collects the data about the locality of a building (e.g., latitude, longitude, altitude), actual weather data (outside air temperature, solar radiation, wind speed, heating degree days, cooling degree days), solar potential and soil/terrain.

Solar potential and Soil/terrain are denoted as 'RECOMMENDED' data entry fields by project partners requiring descriptive answers. The type of soil, on which a building is built, is important for building foundations. Also, unstable terrains could cause landslides.

A DBL author can write here for example: "*The building is built on gravely soil on a plain terrain.*" or "*The building is built on rocky soil on hilly terrain.*"

Soil is mainly divided into the following three types according to soil structure:

- Coarse-grained soils (e.g., sand, gravel) – loose of granular soils,
- Fine-grained soils (e.g., silt, clay, loam),
- Rocky soils (e.g., limestones, dolomites, and magmatic rocks).

Sand and gravel have large particles which allow this soil to drain water quickly (which is good for buildings). Retaining less water means less risk for the building to shift around and form structural and non-structural cracks. Compacted sand and gravel offer even more stability and are a great option to build a foundation on. Silt is poor soil option for building a foundation due to its prolonged ability to retain water. Clay is not an ideal soil for buildings due to its tendency to shift around as it dries or moistens. Loam is the best soil type for construction due to its ideal combination of silt, sand, and clay. It combines the best of all their qualities into the ideal balance for supporting a foundation. Loam generally does not shift, expand, or shrink drastically and handles the presence of water very well. There are many types of rock (sandstone, limestone, etc.) and they are all excellent options due to their high bearing capacity (making this type of foundation ideal for larger buildings). Bedrock is a layer of rock underneath a surface layer of soil. (Source: https://uretek-gulfcoast.com/types-soil-for-building-foundation-dirt/)

There are several terrain classifications divided based on the slope of the land surface: flat or plain (slope < 2%), flat to undulating (slope 3-7%), undulating or rolling (slope 8-13%), undulating to hilly (slope 14-20%), hilly (slope 21-55%), and steep mountains (slope > 55%).

The third of utmost importance subcategory named **Metered data** (Figure 57) comprises all metered data related to energy consumption, renewable energy generated on-site, water consumption and domestic hot water consumption within a selected building.

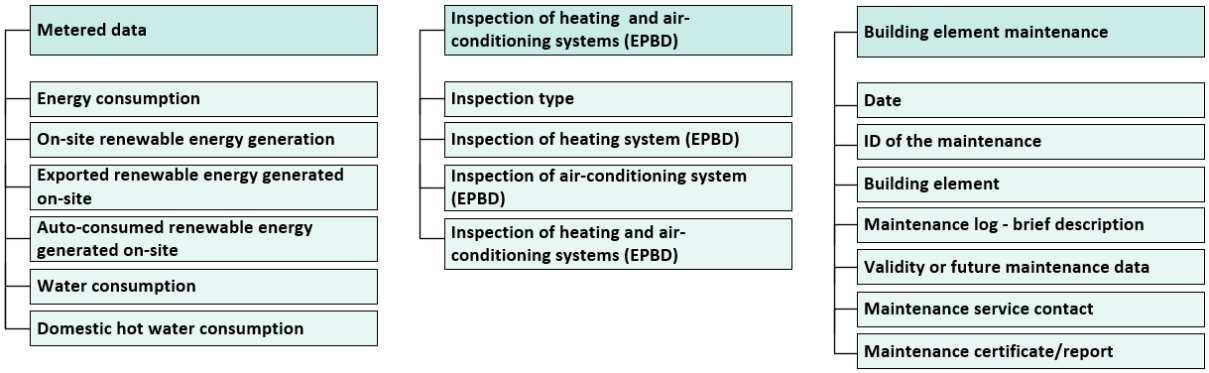


Figure 57: EUB SuperHub digital building logbook – 4. BUILDING OPERATION AND USE – subcategories Metered data, Inspection of heating and air-conditioning systems (EPBD) and Building maintenance

The fourth subcategory relates to the regular **Inspection of heating and air-conditioning systems (EPBD)** according to the requirements of EPBD directive (Figure 57) gathering the main data related to regular inspections such as Date, ID of the inspection, validity data or future inspection data, tailored renovation recommendations, inspection service contact data and reports, which are also part of the last module 8-BUILDING DOCUMENTATION BIM.

Based on Directive EU 2018/844 on the energy performance of buildings the following technical building systems require inspection at regular intervals:

- Heating systems or combined heating and ventilation systems with an effective rating over 70 kW (Article 14 Inspection of heating systems),
- Air-conditioning systems or combined air-conditioning and ventilation systems with an effective rating over 70 kW (Article 15 Inspection of air-conditioning systems).

The last fifth subcategory within this module refers to the **maintenance of building elements** having in mind the maintenance of building envelope and maintenance of technical building system (TBS). This part of DBL collects basic data: ID of the maintenance, which building element is maintained and when and by whom, brief description of performed maintenance. If possible, it would be good to upload also maintenance reports/certificates.

Table 16: The EUB SuperHub digital building logbook data structure – Module 4 – BUILDING OPERATION AND USE

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
4-BUILDING OPERATION AND USE	**Building use**	Reference year					Integer	–	REQUIRED
		Number of occupants					Integer	–	REQUIRED
		Daily usage time					Float	hr/day	REQUIRED
		Annual usage days					Integer	days/yr	REQUIRED
		Daily HVAC system operating hours					Float	hr/day	REQUIRED
		Setting room temperature	Setpoint Room Temperature Heating Period				Float	°C	REQUIRED
			Setpoint Room Temperature Cooling Period				Float	°C	REQUIRED
		User behaviour	Heating usage intensity			• Default • Low • Medium • High	String-drop down list	–	RECOMMENDED
			Cooling usage intensity			• Default • Low • Medium High	String-drop down list	–	RECOMMENDED
			Domestic hot water (DHW) usage intensity			• Default • Low • Medium • High	String-drop down list	–	RECOMMENDED
			Electricity usage intensity			• Default • Low • Medium • High	String-drop down list	–	RECOMMENDED
	Climate data actual	Locality - name (JRC, Eurostat)					String		RECOMMENDED
		Locality - latitude					Float	°	RECOMMENDED
		Locality - longitude					Float	°	RECOMMENDED
		Locality - altitude					Float	m	RECOMMENDED
		Weather data actual	Annual average outside air temperature				Float	°C	RECOMMENDED
			Annual average solar radiation				Float	W/m²	RECOMMENDED
			Annual average wind speed				Float	m/s	RECOMMENDED
			Heating degree days (HDD)				Float	K.day	RECOMMENDED
			Cooling degree days (CDD)				Float	K.day	RECOMMENDED
		Solar potential					String-descriptive	–	RECOMMENDED
		Soil/terrain					String-descriptive	–	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
4-BUILDING OPERATION AND USE	**Metered data**	Energy consumption	Name of supplier for each energy carrier (cr) (e.g., electricity, natural gas, district heating system, ...)				String	–	REQUIRED
			Type of electiricity meter			• Standard meter • Dial meter • Digital meter • Variable-rate meter • Prepayment meter • Smart meter	String-drop down list	–	REQUIRED
			Type of gas flow meter			• Diaphragm gas flow meter • Ultrasonic gas flow meter • Rotary gas flow meter • Turbine gas flow meter	String-drop down list	–	REQUIRED
			Metered annual delivered energy for each energy carrier (cr) (e.g., electricity, natural gas, district heating system, ...)				Float	kWh/yr	REQUIRED
			Metered annual delivered energy for each energy carrier (cr) (e.g., electricity, natural gas, district heating system, ...) per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Metered total delivered annual final energy demand				Float	kWh/yr	REQUIRED
			Metered total delivered annual final energy demand per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Calculated non-renewable annual primary energy demand				Float	kWh/yr	REQUIRED
			Calculated non-renewable annual primary energy demand per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Calculated renewable annual primary energy demand				Float	kWh/yr	REQUIRED
			Calculated renewable annual primary energy demand per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Total annual primary energy demand (based on measured delivered energy)				Float	kWh/yr	REQUIRED
			Total annual primary energy demand (based on measured delivered energy) per useful floor area				Float	kWh/(m²yr)	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
4-BUILDING OPERATION AND USE	Metered data	On-site renewable energy generation	Electricity generation - by photovoltaics (PV) panels				Float	kWh/yr	REQUIRED
			Electricity generation - by photovoltaics (PV) panels per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Electricity generation - by photovoltaics (PV) panels	Type of meter		• Standard meter • Dial meter • Digital meter • Variable-rate meter • Prepayment meter • Smart meter	String-drop down list	–	REQUIRED
			Electricity generation - by small wind turbines				Float	kWh/yr	REQUIRED
			Electricity generation - by small wind turbines per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Electricity generation - by small wind turbines	Type of meter		• Standard meter • Dial meter • Digital meter • Variable-rate meter • Prepayment meter • Smart meter	String-drop down list	–	REQUIRED
			Thermal energy generation - by solar thermal system				Float	kWh/yr	REQUIRED
			Thermal energy generation - by solar thermal system per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Thermal energy generation - by solar thermal system	Type of meter			String-drop down list	–	REQUIRED
			Thermal energy generation - by biomass				Float	kWh/yr	REQUIRED
			Thermal energy generation - by biomass per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Thermal energy generation - heat pump				Float	kWh/yr	REQUIRED
			Thermal energy generation - heat pump per useful floor area				Float	kWh/(m²yr)	REQUIRED
		Exported renewable energy generated on-site	Electricity generation - by photovoltaics (PV) panels				Float	kWh/yr	REQUIRED
			Electricity generation - by photovoltaics (PV) panels per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Electricity generation - by photovoltaics (PV) panels	Type of meter		• Standard meter • Dial meter • Digital meter • Variable-rate meter • Prepayment meter • Smart meter	String-drop down list	–	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
4-BUILDING OPERATION AND USE	Metered data	Exported renewable energy generated on-site	Electricity generation - by small wind turbines				Float	kWh/yr	REQUIRED
			Electricity generation - by small wind turbines per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Electricity generation - by small wind turbines	Type of meter		• Standard meter • Dial meter • Digital meter • Variable-rate meter • Prepayment meter • Smart meter	String-drop down list	–	REQUIRED
			Thermal energy generation - by solar thermal system				Float	kWh/yr	REQUIRED
			Thermal energy generation - by solar thermal system per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Thermal energy generation - by solar thermal system	Type of meter			String-drop down list	–	REQUIRED
			Thermal energy generation - by biomass				Float	kWh/yr	REQUIRED
			Thermal energy generation - by biomass per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Thermal energy generation - heat pump				Float	kWh/yr	REQUIRED
			Thermal energy generation - heat pump per useful floor area				Float	kWh/(m²yr)	REQUIRED
		Auto-consumed renewable energy generated on-site	Electricity generation - by photovoltaics (PV) panels				Float	kWh/yr	REQUIRED
			Electricity generation - by photovoltaics (PV) panels per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Electricity generation - by photovoltaics (PV) panels	Type of meter			String-drop down list	–	REQUIRED
			Electricity generation - by small wind turbines				Float	kWh/yr	REQUIRED
			Electricity generation - by small wind turbines per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Electricity generation - by small wind turbines	Type of meter			String-drop down list	–	REQUIRED
			Thermal energy generation - by solar thermal system				Float	kWh/yr	REQUIRED
			Thermal energy generation - by solar thermal system per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Thermal energy generation - by solar thermal system	Type of meter			String-drop down list	–	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
4-BUILDING OPERATION AND USE	Metered data	Auto-consumed renewable energy generated on-site	Thermal energy generation - by biomass				Float	kWh/yr	REQUIRED
			Thermal energy generation - by biomass per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Thermal energy generation - heat pump				Float	kWh/yr	REQUIRED
			Thermal energy generation - heat pump per useful floor area				Float	kWh/(m²yr)	REQUIRED
		Water consumption	Water - name of supplier				String	–	RECOMMENDED
			Water meter type			• Displacement water meter • Velocity water meter • Electromagnetic water meter • Electromagnetic SMART water meter • Ultrasonic water meter • Ultrasonic SMART water meter	String-drop down list	–	RECOMMENDED
			Metered annual WATER consumption from water bills				Float	m³/yr	REQUIRED
		Domestic hot water consumption	Volume of DHW delivered per year at specified temperature				Float	m³/yr	RECOMMENDED
			DHW meter type			• Displacement water meter • Velocity water meter • Electromagnetic water meter • Electromagnetic SMART water meter • Ultrasonic water meter • Ultrasonic SMART water meter	String-drop down list	–	RECOMMENDED
			DHW delivery temperature				Float	°C	REQUIRED
			Cold water supply temperature				Float	°C	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
4-BUILDING OPERATION AND USE	**Inspection of heating and air-conditioning systems (EPBD)**	Inspection type				☐ Inspection of heating system (EPBD)	Check box	–	RECOMMENDED
						☐ Inspection of air-conditioning system (EPBD)	Check box	–	RECOMMENDED
						☐ Inspection of heating and air-conditioning systems (EPBD)	Check box	–	RECOMMENDED
		Inspection of heating system (EPBD)	Date				Date	–	RECOMMENDED
			ID of the inspection				Alfa-numerical code	–	RECOMMENDED
			Validity or future inspection data				Date	–	RECOMMENDED
			Tailored renovation recommendations	Heating system			String-descriptive	–	RECOMMENDED
			Inspection service contact	Name and surname of expert or entity that performed the inspection			String	–	RECOMMENDED
				Company name (if any)			String	–	RECOMMENDED
				E-mail address			Special-E-mail address	–	RECOMMENDED
				Mobile phone			Special-Phone number	–	OPTIONAL
			Report on the inspection of heating system				Link to BUILDING DOCUMENTATION	–	RECOMMENDED
		Inspection of air-conditioning system (EPBD)	Date				Date	–	RECOMMENDED
			ID of the inspection				Alfa-numerical code	–	RECOMMENDED
			Validity or future inspection data				Date	–	RECOMMENDED
			Tailored renovation recommendations	Air-conditioning system			String-descriptive	–	RECOMMENDED
			Inspection service contact	Name and surname of expert or entity that performed the inspection			String	–	RECOMMENDED
				Company name (if any)			String	–	RECOMMENDED
				E-mail address			Special-E-mail address	–	RECOMMENDED
				Mobile phone			Special-Phone number	–	OPTIONAL

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
4-BUILDING OPERATION AND USE	**Inspection of heating and air-conditioning systems (EPBD)**		Report on the inspection of air-conditioning system				Link to BUILDING DOCUMENTATION	–	RECOMMENDED
		Inspection of heating and air-conditioning systems (EPBD)	Date				Date	–	RECOMMENDED
			ID of the inspection				Alfa-numerical code	–	RECOMMENDED
			Validity or future inspection data				Date	–	RECOMMENDED
			Tailored renovation recommendations	Heating and air-conditioning system			String-descriptive	–	RECOMMENDED
			Inspection service contact	Name and surname of expert or entity that performed the inspection			String	–	RECOMMENDED
				Company name (if any)			String	–	RECOMMENDED
				E-mail address			Special-E-mail address	–	RECOMMENDED
				Mobile phone			Special-Phone number	–	OPTIONAL
			Report on the inspection of heating and air-conditioning system				Link to BUILDING DOCUMENTATION	–	RECOMMENDED
	Building element maintenance	Date					Date	–	RECOMMENDED
		ID of the maintenance					Alfa-numerical code	–	RECOMMENDED
		Building element	Building envelope				String-descriptive	–	RECOMMENDED
		Building element	Technical Building System (TBS)				String-descriptive	–	RECOMMENDED
		Maintenance log - brief description					String-descriptive	–	RECOMMENDED
		Validity or future maintenance data					Date	–	RECOMMENDED
		Maintenance service contact	Name and surname of expert or entity that performed the maintenance				String	–	RECOMMENDED
		Maintenance service contact	E-mail address				Special-E-mail address	–	RECOMMENDED
		Maintenance service contact	Mobile phone				Special-Phone number	–	OPTIONAL
		Maintenance certificate/report					Link to BUILDING DOCUMENTATION	–	RECOMMENDED

2.5 Module 5: BUILDING PERFORMANCE

The fifth module corresponds to BUILDING PERFORMANCE and covers the following four subcategories:

- Energy Performance Certification (EPBD),
- EUB SuperHub certification,
- Sustainability certification,
- Key Performance Indicators (KPIs).

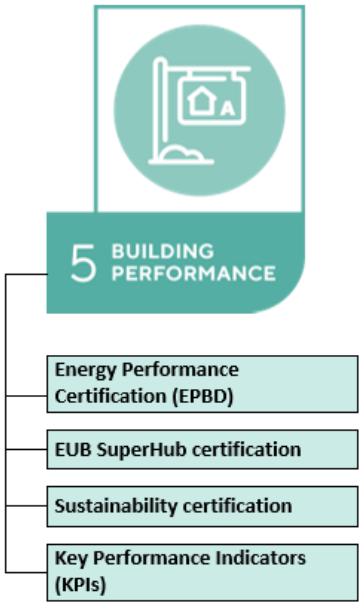


Figure 58: EUB SuperHub digital building logbook – main subcategories of Module 5. BUILDING PERFORMANCE

According to the grant agreement, the elaborated EUB Superhub digital building logbook needs to hold records of all EPCs and sustainability certificates (if available). Many data entry fields related to EPCs and sustainability certificates are donated as 'REQUIRED' by project partners.

The first subcategory within this module named **Energy Performance Certification (EPBD)** (see Figure 59) contains common data visible in every EPC such as EPC number, issue date, validity date and EPC rating (energy performance class displayed on every EPC's front page). All those common data should be automatically fed into the EUB SuperHub digital building logbook from national EPC databases.

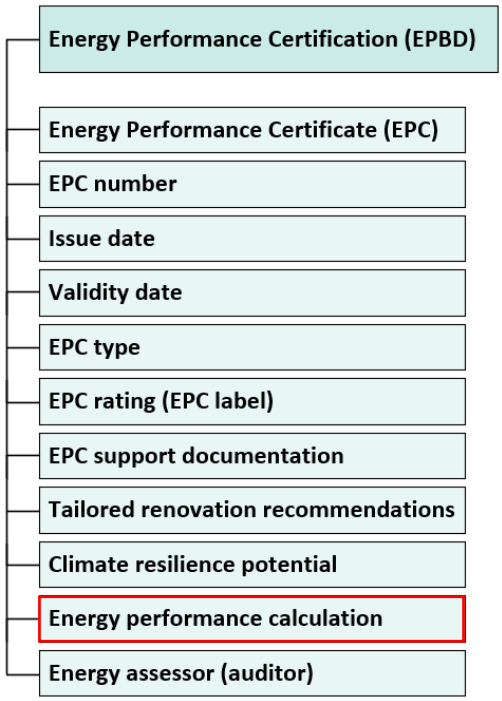


Figure 59: EUB SuperHub digital building logbook – 5. BUILDING PERFORMANCE – subcategory Energy Performance Certification (EPBD)

In some EU countries, an energy assessor must also prepare an energy audit report when issuing an EPC for a building or building unit. For example, it is possible to issue an EPC in Croatia only with an accompanying energy audit report. The energy audit report represents EPC support documentation. Also, files from software for energy performance calculation could be EPC support documentation. EPC support documentation is documentation prepared by the energy assessor that issued the EPC containing relevant information as energy audit report, files from software for energy performance calculation etc.

Tailored renovation recommendations, demonstrating the energy efficiency potential of a building/building unit and proposing the detailed renovation measures, represent one 'REQUIRED' data entry field.

In regard to the **climate resilience potential**, the DBL author needs to write here if the climate change hazards and impacts that are relevant to the location of the buildings, such as being in an area that is at risk of floods, avalanches or landslides, strong wind, drought, etc. and to describe if climate change adaptation interventions are made that reduces the building vulnerability to this climate change risks. Moreover, the DBL author can describe and rate if the adaptation measures are sufficient or require enchantments.

One important topic within the subcategory Energy Performance Certification (EPBD) is for sure Energy performance calculation. Alongside the commercial software name used for EP calculation, standard building use and climate data, a set of calculated energy data need to be entered here.

First, data related to energy needs are 'REQUIRED':

- Calculated annual energy need for space heating per useful floor area in [kWh/(m^{2}yr)],
- Calculated annual energy need for space cooling per useful floor area in [kWh/(m^{2}yr)],
- Calculated annual energy need for DHW preparation per useful floor area in [kWh/(m^{2}yr)].

Energy needs mean energy to be delivered during one year disregarding any technical building system inefficiencies.

One required data is also calculated annual energy used for lighting per useful floor area.

Then, the whole set of numerical data related to delivered (also called energy use) and primary energy follows expressed in [kWh/yr] and [kWh/(m^{2}yr)]:

- Calculated annual delivered energy used for EPB services for each energy carrier (*cr*),
- Calculated total delivered annual final energy demand,
- Calculated non-renewable annual primary energy demand,
- Calculated renewable annual primary energy demand,
- Calculated total annual primary energy demand (used to satisfy the energy performance of buildings services or to produce the exported energy).

Some EU countries haven't defined renewable primary energy factors, so it will not be possible to calculate renewable primary energy demand and total annual primary energy demand.

'Energy performance of buildings (EPB) services' means the services, such as heating, cooling, ventilation, domestic hot water and lighting and others for which the energy use is taken into account in the energy performance of buildings.

'Energy use' means energy input to a technical building system providing an EPB service intended to satisfy an energy need.

Given the set vision for achieving a zero-emission building stock by 2050, it is clear that our new future buildings should not generate carbon emissions on-site anymore and should fully cover the required energy from renewable sources. need to generate as much as possible. Renewable energy can be generated on-site (if possible) or can be brought to the site either from the energy community or from a district heating and cooling. In case renewable energy is produced on-site, it is important to track (if possible) the following three numerical values related to renewable energy generated on-site:

- Calculated annual ON-SITE RENEWABLE ENERGY GENERATION per useful floor area,
- Calculated annual AUTO-CONSUMED RENEWABLE ENERGY generated on-site per useful floor area,
- Calculated annual EXPORTED RENEWABLE ENERGY generated on-site per useful floor area.

AUTO-CONSUMED RENEWABLE ENERGY (also called self-used renewable energy) means part of on-site produced renewable energy used by onsite technical systems for EPB services.

The last topic within the subcategory Energy Performance Certification (EPBD) refers to the contact data of an energy assessor who issued the EPC (name and surname, company name if any, E-mail address, mobile phone).

The second subcategory named **EUB SuperHub certification** refers to the EUB SuperHub certificate, that needs to be elaborated within this project (see *Task 2.5 The EUB SuperHub Transnational framework and passport*).

The third subcategory named **Sustainability certification** collects common data related to sustainability certificates (e.g., certificate, rating, issue date, validity date, and contact data of consultant/auditor).

The last subcategory within this module refers to all the **KPIs** selected and defined within *Task 2.2 Definition of common transnational indicators and assessment metrics for the E-Passport*. The consortium team selected in total 21 KPIs. Within this part of the digital building logbook, the numerical value of each KPI (if available) is 'REQUIRED' accompanied by auditor contact data (name and surname, company name if any. E-mail address and mobile phone).

Table 17: The EUB SuperHub digital building logbook data structure – Module 5 – BUILDING PERFORMANCE

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
5-BUILDING PERFORMANCE	**Energy Performance Certification (EPBD)**	Energy Performance Certificate (EPC)					Link to BUILDING DOCUMENTATION	–	REQUIRED
		EPC number					Alfa-numerical code	–	REQUIRED
		Issue date					Date	–	REQUIRED
		Validity date					Date	–	REQUIRED
		EPC type				• New building • Existing building • Major renovation • Minor renovation • Advertising • Buy or sell • Rent • Access to fiscal benefits • Access to financial instruments • Update after implementation of recommendations • Voluntary • Ruined building	String-drop down list	–	REQUIRED
		EPC rating (EPC label)	EPC rating				String	–	REQUIRED
			Main indicator name used for determination of EPC rating				String-descriptive	–	REQUIRED
			Main indicator value				Float	–	REQUIRED
			Main indicator unit					–	REQUIRED
			Reference (Minimum requirement for new buildings) for main indicator				Float	Main indicator unit	REQUIRED
		EPC support documentation	EPC support documentation			• Yes • No	String-drop down list	–	RECOMMENDED
			The name of EPC support documentation				String-descriptive	–	RECOMMENDED
			EPC support documentation (e.g., energy audit report, files from software for EP calculation)				Link to BUILDING DOCUMENTATION	–	RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
5-BUILDING PERFORMANCE	**Energy Performance Certification (EPBD)**	Tailored renovation recommendations					String-descriptive	–	REQUIRED
		Climate resilience potential					String-descriptive	–	REQUIRED
		Energy performance calculation	Commercial software name used for EP calculation				String-descriptive	–	REQUIRED
			Standard building use	Daily usage time			Float	hr/day	REQUIRED
				Annual usage days			Integer	days/yr	REQUIRED
				Daily HVAC system operating hours			Float	hr/day	REQUIRED
				Setpoint Room Temperature Heating Period			Float	°C	REQUIRED
				Setpoint Room Temperature Cooling Period			Float	°C	REQUIRED
			Climate data	Reference year - Locality - name (JRC)			String	–	REQUIRED
				Reference year - Locality - latitude			Integer	°	REQUIRED
				Reference year - Locality - longitude			Integer	°	REQUIRED
				Reference year - Locality - altitude			Integer	m	REQUIRED
				Reference year - Heating degree days (HDD)			Float	K.days	REQUIRED
				Reference year - Cooling degree days (CDD)			Float	K.days	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
5-BUILDING PERFORMANCE	**Energy Performance Certification (EPBD)**	Energy performance calculation	Calculated annual energy need for space heating per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Calculated annual energy need for space cooling per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Calculated annual energy need for DHW preparation per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Calculated annual energy used for lighting per useful floor area (calculated total annual ELECTRICITY consumption used for lighting per useful floor area)				Float	kWh/(m²yr)	REQUIRED
			Calculated total annual HEATING consumption (delivered annual final energy consumption for space heating and DHW per useful floor area)				Float	kWh/(m²yr)	REQUIRED
			Calculated annual delivered energy used for EPB services for each energy carrier (cr)				Float	kWh/yr	REQUIRED
			Calculated annual delivered energy used for EPB services for each energy carrier (cr) per useful floor area				Float	kWh/(m²yr)	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
5-BUILDING PERFORMANCE	**Energy Performance Certification (EPBD)**	Energy performance calculation	Calculated total delivered annual final energy demand				Float	kWh/yr	REQUIRED
			Calculated total delivered annual final energy demand per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Calculated non-renewable annual primary energy demand				Float	kWh/yr	REQUIRED
			Calculated non-renewable annual primary energy demand per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Calculated renewable annual primary energy demand				Float	kWh/yr	REQUIRED
			Calculated renewable annual primary energy demand per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Calculated total annual primary energy demand (used to satisfy the energy performance of buildings services or to produce the exported energy)				Float	kWh/yr	REQUIRED
			Calculated total annual primary energy demand (used to satisfy the energy performance of buildings services or to produce the exported energy) per useful floor area				Float	kWh/(m²yr)	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
5-BUILDING PERFORMANCE	**Energy Performance Certification (EPBD)**	Energy performance calculation	Calculated annual ON-SITE RENEWABLE ENERGY GENERATION per useful floor area	Electricity generation - by photovoltaics (PV) panels			Float	kWh/(m²yr)	REQUIRED
				Electricity generation - by small wind turbines			Float	kWh/(m²yr)	REQUIRED
				Thermal energy generation - by solar thermal system			Float	kWh/(m²yr)	REQUIRED
				Thermal energy generation - by biomass			Float	kWh/(m²yr)	REQUIRED
				Thermal energy generation - heat pump			Float	kWh/(m²yr)	REQUIRED
			Calculated annual AUTO CONSUMED RENEWABLE ENERGY generated on-site per useful floor area	Electricity generation - by photovoltaics (PV) panels			Float	kWh/(m²yr)	REQUIRED
				Electricity generation - by small wind turbines			Float	kWh/(m²yr)	REQUIRED
				Thermal energy generation - by solar thermal system			Float	kWh/(m²yr)	REQUIRED
				Thermal energy generation - by biomass			Float	kWh/(m²yr)	REQUIRED
				Thermal energy generation - heat pump			Float	kWh/(m²yr)	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
5-BUILDING PERFORMANCE	**Energy Performance Certification (EPBD)**	Energy performance calculation	Calculated annual EXPORTED RENEWABLE ENERGY generated on-site per useful floor area	Electricity generation - by photovoltaics (PV) panels			Float	kWh/(m²yr)	REQUIRED
				Electricity generation - by small wind turbines			Float	kWh/(m²yr)	REQUIRED
				Thermal energy generation - by solar thermal system			Float	kWh/(m²yr)	REQUIRED
				Thermal energy generation - by biomass			Float	kWh/(m²yr)	REQUIRED
				Thermal energy generation - heat pump			Float	kWh/(m²yr)	REQUIRED
			Exported annual primary energy demand per useful floor area				Float	kWh/(m²yr)	REQUIRED
			Net annual primary energy demand per useful floor area (excluding any exported renewable primary energy - including only non-renewable and renewable energy to satisfy EPB services)				Float	kWh/(m²yr)	REQUIRED
			Total annual primary energy demand per useful floor area (net primary energy demand + exported primary energy demand)				Float	kWh/(m²yr)	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
5-BUILDING PERFORMANCE	**Energy Performance Certification (EPBD)**	Energy assessor (auditor)	Name and surname				String	–	REQUIRED
			Company name (if any)				String	–	REQUIRED
			E-mail address				Special-E-mail address	–	RECOMMENDED
			Mobile phone				Special-Phone number	–	OPTIONAL
	EUB SuperHub certification	EUB SuperHub Certificate					Link to BUILDING DOCUMENTATION	–	REQUIRED
		EUB SuperHub Certificate number					Alfa-numerical code	–	REQUIRED
		Issue date					Date	–	REQUIRED
		EUB SuperHub rating					String	–	REQUIRED
		Main indicator name used for determination of EPC rating					String-descriptive	–	REQUIRED
		Main indicator value					Float	–	REQUIRED
		Main indicator unit						–	REQUIRED
		Assessor (auditor)	Name and surname				String	–	REQUIRED
			Company name (if any)				String	–	REQUIRED
			E-mail address				Special-E-mail address	–	RECOMMENDED
			Mobile phone				Special-Phone number	–	OPTIONAL
	Sustainability certification	DGNB (Deutsche Gessellschaft für Nachhaltiges Bauen) certification system	DGNB certificate				Link to BUILDING DOCUMENTATION	–	REQUIRED
			DGNB rating			• Bronze • Silver • Gold • Platinum	String-drop down list	–	REQUIRED
			Total performance index				Float	%	REQUIRED
			Issue data				Date	–	REQUIRED
			Validity date				Date	–	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
5-BUILDING PERFORMANCE			DGNB certificate type			• DGNB pre-certificate for new construction • DGNB certificate for new construction • DGNB pre-certificate for district • DGNB certificate for district • DGNB certificate for existing building • DGNB certificate for renovated building • DGNB certificate for dismantling	String-drop down list	–	REQUIRED
			DGNB consultant / auditor	Name and surname			String	–	REQUIRED
				Company name (if any)			String	–	REQUIRED
				E-mail address			Special-E-mail address	–	RECOMMENDED
				Mobile phone			Special-Phone number	–	OPTIONAL
	Sustainability certification	BREEAM (Building Research Establishment Environmental Assessment Methodology) certification system	BREEAM certificate				Link to BUILDING DOCUMENTATION	–	REQUIRED
			BREEAM rating			• Unclassified • Pass • Good • Very good • Excellent • Outstanding	String-drop down list	–	REQUIRED
			Final performance rating determined by the sum of the weighted category scores - BREEAM score in %				Float	%	REQUIRED
			Issue data				Date	–	REQUIRED
			Validity date				Date	–	REQUIRED
			BREEAM auditor	Name and surname			String	–	REQUIRED
				Company name (if any)			String	–	REQUIRED
				E-mail address			Special-E-mail address	–	RECOMMENDED
				Mobile phone			Special-Phone number	–	OPTIONAL

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
5-BUILDING PERFORMANCE	**Sustainability certification**	LEED (Leadership in Energy and Environmental Design) certification system	LEED certificate				Link to BUILDING DOCUMENTATION	–	REQUIRED
			LEED rating			• Certified • Silver • Gold • Platinum	String-drop down list	–	REQUIRED
			Total number of points earned				Float	points	REQUIRED
			Issue data				Date	–	REQUIRED
			Validity date				Date	–	REQUIRED
			LEED auditor	Name and surname			String	–	REQUIRED
				Company name (if any)			String	–	REQUIRED
				E-mail address			Special-E-mail address	–	RECOMMENDED
				Mobile phone			Special-Phone number	–	OPTIONAL
		Protocollo ITACA certification system	Protocollo ITACA certificate				Link to BUILDING DOCUMENTATION	–	REQUIRED
			Name of Protocollo ITACA applied				String	–	REQUIRED
			Protocollo ITACA rating			• Sufficient • Discreet • Pass • Good • Very good • Excellent	String-drop down list	–	REQUIRED
			Protocollo ITACA score				Float	–	REQUIRED
			Issue date				Date	–	REQUIRED
			Protocollo ITACA consultant	Name and surname			String	–	REQUIRED
				Company name (if any)			String	–	REQUIRED
				E-mail address			Special-E-mail address	–	RECOMMENDED
				Mobile phone			Special-Phone number	–	OPTIONAL
			Protocollo ITACA auditor	Name and surname			String	–	REQUIRED
				Company name (if any)			String	–	REQUIRED
				E-mail address			Special-E-mail address	–	RECOMMENDED
				Mobile phone			Special-Phone number	–	OPTIONAL
5 - B		... X sustainability certification system	X certificate				Link to BUILDING DOCUMENTATION	–	REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
	Sustainability certification		X rating				String	–	REQUIRED
			Main indicator name used for determination of X rating				String	–	REQUIRED
			Main indicator value				Float	–	REQUIRED
			Main indicator unit					–	REQUIRED
			Issue data				Date	–	REQUIRED
			Validity date				Date	–	REQUIRED
			X auditor	Name and surname			String	–	REQUIRED
				Company name (if any)			String	–	REQUIRED
				E-mail address			Special-E-mail address	–	RECOMMENDED
				Mobile phone			Special-Phone number	–	OPTIONAL
	Key Performance Indicators (KPIs)	Energy consumption	Use stage energy performance	**01-Total annual primary energy demand per useful floor area**			Float	**kWh/(m²yr)**	REQUIRED
				Total annual primary energy demand per useful floor area	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
5-BUILDING PERFORMANCE	**Key Performance Indicators** (KPIs)	Energy consumption	Use stage energy performance	**02-Delivered annual final energy demand per useful floor area**			Float	**kWh/(m²yr)**	REQUIRED
				Delivered annual final energy demand per useful floor area	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL
		Energy consumption	Use stage energy performance	**03-Non-renewable annual primary energy demand per useful floor area**			Float	**kWh/(m²yr)**	REQUIRED
				Non-renewable annual primary energy demand per useful floor area	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
5-BUILDING PERFORMANCE	**Key Performance Indicators** (KPIs)	Energy consumption	Embodied non-renewable primary energy	**04**-Total use of non-renewable primary energy resources used as raw materials (**PENRT**) (also called embodied non-renewable primary energy)			Float	**MJ**	REQUIRED
				Total use of non-renewable primary energy resources used as raw materials (PENRT) (also called embodied non-renewable primary energy)	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL
		Renewable Energy	Use stage energy performance	**05-Renewable annual primary energy demand per useful floor area**			Float	**kWh/(m²yr)**	REQUIRED
				Renewable annual primary energy demand per useful floor area	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
5-BUILDING PERFORMANCE	**Key Performance Indicators** (KPIs)	Renewable Energy	Energy from renewable sources in total primary energy consumption	**06-Renewable energy ratio** (on-site, nearby)			Float	**%**	REQUIRED
				Renewable energy ratio (on-site, nearby)	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL
		Greenhouse Gas Emissions (in use stage)	Total GHG Emissions from primary energy used in building operations	**07-Total GHG emissions** from primary energy used in building operations (expressed in CO2 equivalent emissions per useful internal floor area per year of use stage)			Float	**kg CO_2eq./(m^2yr))**	REQUIRED
				Total GHG emissions from primary energy used in building operations (expressed in CO_2 equivalent emissions per useful internal floor area per year of use stage)	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
5-BUILDING PERFORMANCE	**Key Performance Indicators** (KPIs)	Life cycle Global Warming Potential	GHG emissions from energy embodied in construction materials	**08-Life Cycle Global Warming Potential (GWP)**			Float	kg CO_2eq./m^2 useful floor area, for a reference study period (RSP) of 50 years	REQUIRED
				Life Cycle Global Warming Potential (GWP)	Auditor name and surname		String	–	Float
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL
		Thermal comfort	Time outside of thermal comfort range	**09-Time outside of thermal comfort range**			Float	% of time in which the indoor temperature is out of a range of 18°C to 27°C during the heating and cooling seasons with and without building services	REQUIRED
				Time outside of thermal comfort range	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
5-BUILDING PERFORMANCE	**Key Performance Indicators** (KPIs)	Indoor air quality (IAQ)	Indoor air quality conditions	**10-Ventilation rate**			Float	**L/s**	REQUIRED
				Ventilation rate	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL
		Indoor air quality (IAQ)	Indoor air quality conditions	**11-CO_2 concentration**			Float	**ppm**	REQUIRED
				CO_2 concentration	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL
		Indoor air quality (IAQ)	Indoor air quality conditions	**12-Relative Humidity**			Float	**%**	REQUIRED
				Relative Humidity	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
5-BUILDING PERFORMANCE	**Key Performance Indicators** (KPIs)	Indoor air quality (IAQ)	Target pollutants indoor sources	**13-Total VOCs** (Volatile Organic Compounds)			Float	**µg/m³**	REQUIRED
				Total VOCs (Volatile Organic Compounds)	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL
		Indoor air quality (IAQ)	Target pollutants indoor sources	**14-CMR VOCs** concentration			Float	**µg/m³**	REQUIRED
				CMR VOCs concentration (Carcinogenic, mutagenic, reprotoxic volatile organic compounds)	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL
		Indoor air quality (IAQ)	Target pollutants indoor sources	**15-R value**			Float	**Decimal ratio**	REQUIRED
				R value	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
5-BUILDING PERFORMANCE	**Key Performance Indicators** (KPIs)	Indoor air quality (IAQ)	Target pollutants indoor sources	**16-Formaldehyde concentration**			Float	**µg/m³**	REQUIRED
				Formaldehyde concentration	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL
		Life-cycle cost	Operational energy costs	**17-Operational energy costs**			Float	**€/(m²yr)**	REQUIRED
				Operational energy costs	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL
		Smart Readiness Indicator	Smart Readiness Indicator	**18-Smart Readiness Indicator**			Float	**%**	REQUIRED
				Smart Readiness Indicator	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
5-BUILDING PERFORMANCE	**Key Performance Indicators** (KPIs)	Climate change and resiliance	Resilience	**19-Summer thermal discomfort in 2030 and 2050**			Float	**%** of time in which the indoor temperature exceeds 27 °C during the cooling season (summer months)	REQUIRED
				Summer thermal discomfort in 2030 and 2050	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL
		E-mobility	E-mobility	**20-Percentage of recharging points** and installed pre-cabling in relation to the number of parking spaces			Float	**%**	REQUIRED
				Percentage of recharging points and installed pre-cabling in relation to the number of parking spaces	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
5-BUILDING PERFORMANCE	**Key Performance Indicators** (KPIs)	Daylight sufficiency	Daylight sufficiency	**21-Daylight Provision**			Float	**%**	REQUIRED
				Daylight Provision	Auditor name and surname		String	–	REQUIRED
					Auditor company name (if any)		String	–	REQUIRED
					Auditor E-mail address		Special-E-mail address	–	RECOMMENDED
					Auditor mobile phone		Special-Phone number	–	OPTIONAL

2.6 Module 6: SMART READINESS

The sixth module corresponds to SMART READINESS and is divided into three different topics:

- Smart readiness,
- E-mobility and
- Potential.

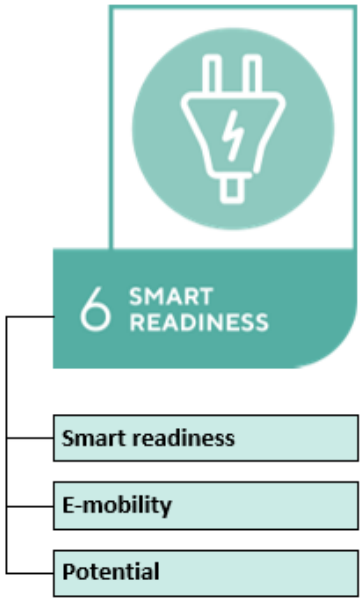


Figure 60: EUB SuperHub digital building logbook – main subcategories of Module 6. SMART READINESS

Within smart readiness topic **smart readiness indicator (SRI)** needs to be calculated in %.

According to the proposal for the 3rd revision of the Energy Performance of Buildings Directive (December 2021) the smart readiness indicator "should be used to measure the capacity of buildings to use information and communication technologies and electronic systems to adapt the operation of buildings to the needs of the occupants and the grid and to improve the energy efficiency and overall performance of buildings".

The smart readiness indicator is particularly beneficial for large buildings with high energy demand. According to Article 13 of the proposal mentioned above, SRI needs to be calculated for non-residential buildings with an effective rated output for the heating systems, or systems for combined space heating and ventilation over 290 kW as of 2026.

At the moment SRI can be calculated following the excel calculation sheet for SR assessment version 4.4 prepared by the European Commission (https://ec.europa.eu/eusurvey/runner/SRI-assessment-package - request for the SRI assessment package). More information about SRI can be found on the SRI website (https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/smart-readiness-indicator_en).

Alongside the already familiar EPCs, there will also be **smart readiness indicator certificates** which will indicate the smart readiness of a building or building unit.

Databases for energy performance of buildings, set up by each Member State at the national level, will need to gather data related not only to EPCs and regular inspections heating and air-conditioning systems, but also to the smart readiness indicator, the building renovation passport and the calculated or metered energy consumption of the buildings in the near future.

The smart readiness indicator represents an important indicator within the digital building logbook.

Another important and fast-developing area is for sure **E-mobility**. To promote electric vehicles each Member State needs to establish requirements for the installation of a minimum number of recharging points for non-residential buildings with more than 20 parking spaces, which are to apply from 2025 (see Directive EU 2018/844 on the energy performance of buildings).

Within the topic E-mobility there are also the following three parameters:

- Total number of available parking spaces N_{tot} [–],
- Number of purpose-built electrical recharging spaces (Number of E-parking spaces) N_1 [–],
- Number of pre-cabled recharging stations N_2 [–],

needed to calculate the KPI 20 - Percentage of recharging points and installed pre-cabling in relation to the number of parking spaces.

The third topic within this module refers to the **potential**. There are two potentials:

- Smart district potential, and
- Demand response potential

which need to be described (data type is string-descriptive). The project partners denoted those two potentials as optional.

There are several definitions of smart cities and smart districts. The definition of a smart city by the Smart Cities Marketplace (https://commission.europa.eu/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en) is as follows:

“A smart city is a place where traditional networks and services are made more efficient with the use of digital solutions for the benefit of its inhabitants and business. “

Definition of a smart district (https://cityinnovatorsforum.com/innovation-district-vs-smart-district-whats-the-difference/):

“A 'smart district' is defined as “a geographic area in which the city accelerates innovation through the use of rapid testing and trialling of solutions in order to solve city challenges.”

A smart city goes beyond the use of digital technologies for better resource use and less emissions. The main aims of smart districts are to achieve sustainability and to improve the quality of citizen’s life by including technical, institutional, economic and social concepts in interactions with existing infrastructure. A key factor for developing smart districts and cities lies in efficient and reliable information and communication technologies (ICT).

The examples of smart cities/districts, what does it mean, when saying that some city district is smart? A 'smart district' has a primary focus on addressing urban challenges through the use of engagement and technology solutions such as:

- use of new information and communication technologies (ICT),
- urban water infrastructure - upgraded water supply, wastewater treatment plants,
- recycling water (use it more than once) - as much as 75 % of domestic water can be reused as greywater, e.g. for plans watering,
- reuse of black water (wastewater from bathrooms and toilets that contains faecal matter and urine), e.g., for irrigating green spaces and food crops in a district,
- using sewage water to recover excess heat for heating or for cooling buildings using different types of heat pumps,
- upgraded waste disposal facilities,
- more efficient ways to light and heat buildings,
- smarter urban transport networks, sustainable transport (e.g., maximizing the use of public transport compared to private vehicles, high-speed train connections)
- more interactive and responsive city administration,
- safer public spaces,
- meeting the needs of an ageing population,
- preventing soli sealing,
- ensuring biodiversity in a district
- analysing existing energy potential (waste heat, renewable energies),
- use of the roof surfaces for energy generation,
- designing of passive building concepts,
- using industrial waste heat for building heating or cooling by absorption cooling systems.

Smart district potential gives information related to the infrastructure available in the building's surrounding (considering the possibility to interact with it) promoting a better management of the building or the infrastructure.

Demand response is a change in electricity consumption by consumers (such as commercial and industrial businesses) to help keep the supply and demand of electricity in balance.

We are now part of the green revolution moving toward the electrical vehicles and installing more heat pumps in almost every new home to achieve nZEB standard. The ongoing electrification leads to a large increase in the demand of electricity, and since the new electricity supply from wind and solar is highly intermittent and not available constantly, the demand response is gaining importance. Demand response (or the adaptation of electricity consumption to generation) needs to adjust the balance between supply and demand.

The main goal of demand response is to lower the demand for electricity during peak periods (on the coldest or hottest days of the year) instead of increasing the supply of electricity by turning on peaking power plants which mostly use fossil fuel sources.

"*Customers participate in demand response because of the economic benefits. Customers who sign up to participate in demand response get paid to both be willing to lower their energy use during peak periods as well as reduce their energy usage during these times of stress on the grid.* " (https://enode.com/blog/demand-response)

There are many ways a customer can participate in demand response during peak periods such as:

- raising the set point on the air conditioner,
- changing operation schedules (e.g., delaying the use of a washing machine),
- slowing or stopping the charge of electrical vehicles,
- battery storage for storing for example energy generated by PVs,
- connected thermostats controlled by thermostat API for reducing energy consumption automatically in a home by adjusting the set point,
- slowing production lines (commercial and industrial customers only) …

Whereas energy efficiency aims at using less energy while still providing the same level of comfort, demand response aims to shift energy consumption to a different point in time [19].

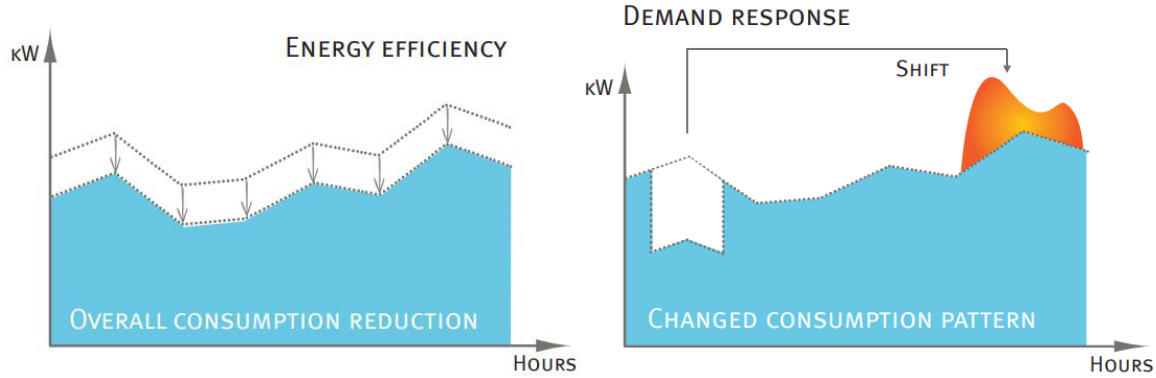


Figure 61: Comparison of principle of energy efficiency and demand response

Table 18: The EUB SuperHub digital building logbook data structure – Module 6 – SMART READINESS

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
6-SMART READINESS	**Smart readiness**	Smart Readiness Indicator (SRI)					Float	%	REQUIRED
	E-mobility	Charging infrastructure for E-mobility				• No • Yes	String-drop down list	–	REQUIRED
		Total number of available parking spaces					Integer	–	REQUIRED
		Number of purpose built electrical recharging spaces (Number of E-parking spaces)					Integer	–	REQUIRED
		Number of pre-cabled recharging stations					Integer	–	REQUIRED
		Electrical Vehicle (EV) charging station types				• Private charging station (access only to residents/employees that use the building) • Public charging station (access to public)	String-drop down list	–	RECOMMENDED
		Electrical Vehicle (EV) charging types				• EV charging – GRID • EV charging - NON-GRID • EV charging - MARKET	String-drop down list	–	RECOMMENDED
		Electrical Vehicle (EV) charging capacity				• not present • ducting (or simple power plug) available (pre-cabled recharging stations) • 0-9% of parking spaces have recharging points • 10-50% or parking spaces has recharging point • >50% of parking spaces have recharging point	String-drop down list	–	REQUIRED
		Total charging capacity					Float	kW	RECOMMENDED
		Maximum charging capacity per E-parking space (when charging one car only)					Float	kW	RECOMMENDED
		Electrical Vehicle (EV) grid balancing				• Not present (uncontrolled charging) • 1-way controlled charging (e.g. including desired departure time and grid signals for optimization) • 2-way (bidirectional) controlled charging (e.g. including desired departure time and grid signals for optimization)	String-drop down list	–	REQUIRED
		Electrical Vehicle (EV) charging information and connectivity				• No information available • Reporting information on EV charging status to occupant • Reporting information on EV charging status to occupant and automatic identification and authorizition of the driver to the charging station (ISO 15118 compliant)	String-drop down list	–	REQUIRED
	Potential	Smart district potential					String-descriptive	–	OPTIONAL
		Demand response potential					String-descriptive	–	OPTIONAL

2.7 Module 7: FINANCE

The seventh module corresponds to FINANCE and comprises all imaginable possible topics related to currency (€) (see Figure 62, Table 19). If required, the list can be extended.

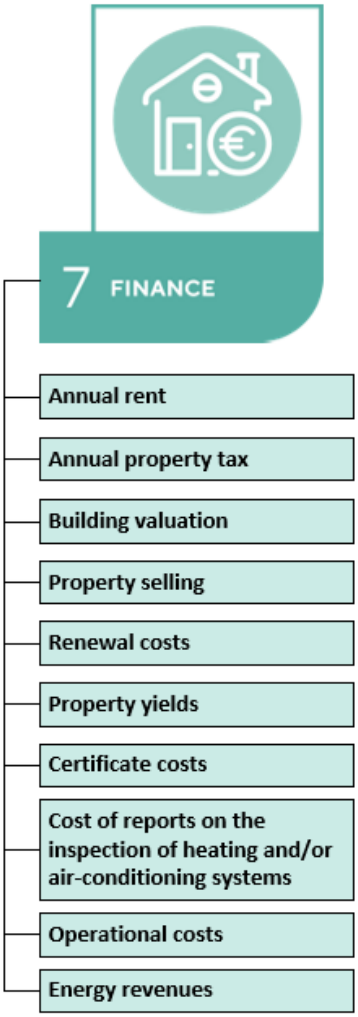


Figure 62: EUB SuperHub digital building logbook – main subcategories of Module 7. FINANCE

The most important topic for this project is the subcategory named **Operational costs**. According to the grant agreement, the developed EUB SuperHub digital building logbook needs to cover operational costs.

Within this category the following data entry fields related to operational costs of energy are denoted as 'REQUIRED' and need to be collected:

- Annual energy costs for each energy carrier (*cr*) (e.g., electricity, natural gas, district heating system…) [€/yr],
- Annual energy costs for each energy carrier (*cr*) (e.g., electricity, natural gas, district heating system…) per useful floor area [€/(m²yr)],
- Energy price with VAT included for each energy carrier (*cr*) (e.g., electricity, natural gas, district heating system…) [€/kWh],
- TOTAL annual ENERGY costs [€/yr],

- TOTAL annual ENERGY costs per useful floor area [€/(m²yr)].

Only water costs and renewal costs are denoted as 'RECOMMENDED' by project partners, whereas all other data entry fields are denoted as 'OPTIONAL'.

The last subcategory on the list is **Energy revenues**. If a building owner has installed PVs on the surface roof producing more solar electricity than required for the building's needs, the excess of produced renewable energy can be fed to the grid making additional energy revenues or incomes. Those energy revenues are expressed in [€/yr] or [€/(m²yr)].

Table 19: The EUB SuperHub digital building logbook data structure – Module 7 – FINANCE

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
7-FINANCE	**Annual rent**	Annual rent					Currency	€/yr	OPTIONAL
		Annual rent per useful floor area					Float	€/(m²yr)	OPTIONAL
	Annual property tax	Annual property tax					Currency	€/yr	OPTIONAL
		Annual property tax per useful floor area					Float	€/(m²yr)	OPTIONAL
	Building valuation	Market value	Market value				Currency	€	OPTIONAL
			Market value per useful floor area				Float	€/m²	OPTIONAL
		Rent value	Rent value				Currency	€	OPTIONAL
			Rent value per useful floor area				Float	€/m²	OPTIONAL
		Valuation date					Date	–	OPTIONAL
		Real estate valuer	Name and surname				String	–	OPTIONAL
			E-mail address				Special-E-mail address	–	OPTIONAL
			Mobile phone				Special-Phone number	–	OPTIONAL
		Valuation approach				• Market approach • Income approach • Cost approach	String-drop down list		OPTIONAL
		Valuation purpose				• mortgage loan • other banking use • sale • purchase • taxation • renovation • extension	String-drop down list		OPTIONAL
		Valuation cost					Currency	€	OPTIONAL
		Valuation cost per useful floor area					Float	€/m²	OPTIONAL
	Property selling	Property price paid					Currency	€	OPTIONAL
		Property price paid per useful floor area					Float	€/m²	OPTIONAL
	Renewal cost	Renewal costs					Currency	€	RECOMMENDED
		Renewal costs per useful floor area					Float	€/m²	RECOMMENDED
		Brief description of renewal					String-descriptive	–	RECOMMENDED
		Total renewal cost - LIFE CYCLE COSTS					Currency	€	OPTIONAL
		Total renewal cost - LIFE CYCLE COSTS per useful floor area					Float	€/m²	OPTIONAL

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
7-FINANCE	**Property yield**						Float	%	OPTIONAL
	Certificate costs	Energy Performance Certification (EPBD)	EPC cost				Currency	€	OPTIONAL
			EPC cost per useful floor area				Float	€/m²	OPTIONAL
		DGNB (Deutsche Gessellschaft für Nachhaltiges Bauen) certification system	DGNB certificate cost				Currency	€	OPTIONAL
			DGNB certificate cost per useful floor area				Float	€/m²	OPTIONAL
		BREEAM (Building Research Establishment Environmental Assessment Methodology) certification system	BREEAM certificate cost				Currency	€	OPTIONAL
			BREEAM certificate per useful floor area				Float	€/m²	OPTIONAL
		LEED (Leadership in Energy and Environmental Design) certification system	LEED certificate cost				Currency	€	OPTIONAL
			LEED certificate cost per useful floor area				Float	€/m²	OPTIONAL
		Protocollo ITACA certification system	Protocollo ITACA certificate cost				Currency	€	OPTIONAL
			Protocollo ITACA certificate cost per useful floor area				Float	€/m²	OPTIONAL
		... X certification system	X certificate cost				Currency	€	OPTIONAL
			X certificate cost per useful floor area				Float	€/m²	OPTIONAL
	Cost of reports on the inspection of heating and/or air-conditioning systems	Cost of report on the inspection of heating system					Currency	€	OPTIONAL
		Cost of report on the inspection of heating system per useful floor area					Float	€/m²	OPTIONAL
		Cost of report on the inspection of air-conditioning system					Currency	€	OPTIONAL
		Cost of report on the inspection of air-conditioning system per useful floor area					Float	€/m²	OPTIONAL
		Cost of reports on the inspection of heating and/or air-conditioning systems					Currency	€	OPTIONAL
		Cost of reports on the inspection of heating and/or air-conditioning systems per useful floor area					Float	€/m²	OPTIONAL

0	Level 1	Level 2	Level 3	Level 4	Level 5	Content of drop-down list	Data type	Unit	Necessity
7-FINANCE	Operational costs	Annual energy costs for each energy carrier (cr) (e.g., electricity, natural gas, district heating system…)					Currency	€/yr	REQUIRED
		Annual energy costs for each energy carrier (cr) (e.g., electricity, natural gas, district heating system…) per useful floor area					Float	€/(m²yr)	REQUIRED
		Energy price with VAT included for each energy carrier (cr) (e.g., electricity, natural gas, district heating system…)					Float	€/kWh	REQUIRED
		TOTAL annual ENERGY costs					Currency	€/yr	REQUIRED
		TOTAL annual ENERGY costs per useful floor area					Float	€/(m2yr)	REQUIRED
		Annual water costs					Currency	€/yr	RECOMMENDED
		Annual water costs per useful floor area					Float	€/(m²yr)	RECOMMENDED
		Annual maintenance costs for Technical Building System					Currency	€/yr	OPTIONAL
		Annual maintenance costs for Technical Building System (TBS) per useful floor area					Float	€/(m²yr)	OPTIONAL
		Other annual maintenance costs					Currency	€/yr	OPTIONAL
		Other annual maintenance costs per useful floor area					Float	€/(m²yr)	OPTIONAL
		Annual building insurance costs					Currency	€/yr	OPTIONAL
		Annual building insurance costs per useful floor area					Float	€/(m²yr)	OPTIONAL
		Other annual running costs					Currency	€/yr	OPTIONAL
		Other annual running costs per useful floor area					Float	€/(m²yr)	OPTIONAL
		Sum of all annual running costs					Currency	€/yr	OPTIONAL
		Sum of all annual running costs per useful floor area					Float	€/(m²yr)	OPTIONAL
	Energy revenues	Annual energy revenues					Currency	€/yr	OPTIONAL
		Annual energy revenues per useful floor area					Float	€/(m²yr)	OPTIONAL

2.8 Module 8: BUILDING DOCUMENTATION BIM

The last module within EUB SuperHub digital building logbook data structure refers to BUILDING DOCUMENTATION BIM. The project partners decided to have a separate module (main category) only for building documentation as it is in the ALDREN BuildLog considering that very convenient solution also for later extension with other building documentations.

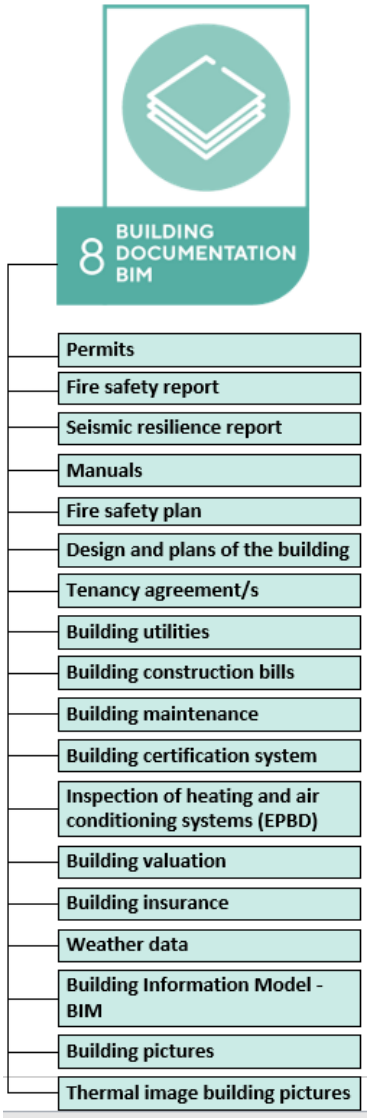


Figure 63: EUB SuperHub digital building logbook – main subcategories of Module 8. BUILDING DOCUMENTATION BIM

The most important subcategory within this module is for sure subcategory named **Building certification system** containing the following topics:

- Energy Performance Certification (EPBD) → Energy Performance Certificate (EPC),
- EUB SuperHub certification → EUB SuperHub Certificate,
- Sustainability certification → DGNB pre-certificate/certificate, BREEAM certificate, LEED certificate, Protocollo ITACA certificate, any other sustainability certificate.

According to the grant agreement, the elaborated EUB Superhub digital building logbook needs to hold records of all EPCs and sustainability certificates (if available). As visible in Table 20 all those data entry fields referring to either to EPCs or any other sustainability certificate (e.g., DGNB, BREEAM, LEED, Protocollo ITACA certificate) are denoted as 'REQUIRED' by project partners.

To be able to calculate **KPI-19 Summer thermal discomfort in 2030 and 2050** the following two future weather files are required:

- Weather file for the year 2030, and
- Weather file for the year 2050.

There are several types of weather file formats that have been developed for the purpose of building energy simulation. Those weather files provide 8.760 hourly values for weather variables including temperature, humidity, wind speed, and solar irradiance.

Also, all building permits are denoted as 'REQUIRED'. That means links need to be established to the national databases containing permits.

Table 20: The EUB SuperHub digital building logbook data structure – Module 8 – BUILDING DOCUMENTATION BIM

0	Level 1	Level 2	Level 3	Level 4	Level 5	Checklist	Data type	File name	Necessity
8-BUILDING DOCUMENTATION BIM	**Permits**	Location (planning) permit					Digital file		REQUIRED
		Building permit					Digital file		REQUIRED
		Construction permit					Digital file		REQUIRED
		Use permit					Digital file		REQUIRED
	Fire safety report						Digital file		OPTIONAL
	Seismic resilience report						Digital file		OPTIONAL
	Manuals	Safety manual					Digital file		OPTIONAL
		User manual	Heat source	Heat source 1			Digital file		OPTIONAL
				Heat source 2			Digital file		OPTIONAL
				Heat source 3			Digital file		OPTIONAL
				Hea source n			Digital file		OPTIONAL
			Cold source	Cold source 1			Digital file		OPTIONAL
				Cold source 2			Digital file		OPTIONAL
				Cold source 3			Digital file		OPTIONAL
				Cold source n			Digital file		OPTIONAL
	Fire safety plan (evacuation plan, signalisation, alarms)						Digital file		OPTIONAL
	Design and plans of the building	Architectural plans					Digital file		RECOMMENDED
		3D model					Digital file		RECOMMENDED
		Technical Building System (TBS) plan 1					Digital file		RECOMMENDED
		Technical Building System (TBS) plan 2					Digital file		RECOMMENDED
		Technical Building System (TBS) plan 3					Digital file		RECOMMENDED
		Technical Building System (TBS) plan 4					Digital file		RECOMMENDED
		Technical Building System (TBS) plan x					Digital file		RECOMMENDED
		As built plans					Digital file		RECOMMENDED
	Tenancy agreement/s						Digital file		OPTIONAL

0	Level 1	Level 2	Level 3	Level 4	Level 5	Checklist	Data type	File name	Necessity
8-BUILDING DOCUMENTATION BIM	**Building utilities**	Utility contracts	Electricity				Digital file		RECOMMENDED
			Water				Digital file		RECOMMENDED
			Thermal energy	Natural gas			Digital file		RECOMMENDED
				District heating system			Digital file		RECOMMENDED
				X			Digital file		RECOMMENDED
		Utility bills	Electricity				Digital file		RECOMMENDED
			Water				Digital file		RECOMMENDED
			Thermal energy	Natural gas			Digital file		RECOMMENDED
				District heating system			Digital file		RECOMMENDED
				X			Digital file		RECOMMENDED
	Building construction bills						Digital file		RECOMMENDED
	Building maintenance	Maintenance service contract					Digital file		RECOMMENDED
		Maintenance bills					Digital file		RECOMMENDED
		Maintenance certificate/report					Digital file		RECOMMENDED
	Building certification system	Energy Performance Certification (EPBD)	**Energy Performance Certificate (EPC)**				Digital file		**REQUIRED**
			Energy audit report				Digital file		REQUIRED
			Files from software for EP calculation				Digital file		RECOMMENDED
		EUB SuperHub certification	**EUB SuperHub Certificate**				Digital file		**REQUIRED**
		Sustainability certification	DGNB (Deutsche Gessellschaft für Nachhaltiges Bauen) certification system	DGNB pre-certificate for new construction			Digital file		REQUIRED
				DGNB certificate for new construction			Digital file		REQUIRED
				DGNB pre-certificate for district			Digital file		REQUIRED
				DGNB certificate for district			Digital file		REQUIRED
				DGNB certificate for existing building			Digital file		REQUIRED
				DGNB certificate for renovated building			Digital file		REQUIRED
				DGNB certificate for dismantling			Digital file		REQUIRED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Checklist	Data type	File name	Necessity
8-BUILDING DOCUMENTATION BIM			BREEAM (Building Research Establishment Environmental Assessment Methodology) certification system	BREEAM certificate			Digital file		REQUIRED
			LEED (Leadership in Energy and Environmental Design) certification system	LEED certificate			Digital file		REQUIRED
			Protocollo ITACA certification system	Protocollo ITACA certificate			Digital file		REQUIRED
			… X sustainability certification system	X certificate			Digital file		REQUIRED
	Inspection of heating and air conditioning systems (EPBD)	Report on the inspection of heating system					Digital file		RECOMMENDED
		Report on the inspection of air-conditioning system					Digital file		RECOMMENDED
		Report on the inspection of heating and air-conditioning systems					Digital file		RECOMMENDED
	Building valuation	Valuation report					Digital file		OPTIONAL
	Building insurance	Insurance document					Digital file		OPTIONAL
	Weather data	Weather file					Digital file		REQUIRED
		Weather file for year 2030 (required for KPI-19-Summer thermal discomfort in 2030)					Digital file		REQUIRED
		Weather file for year 2050 (required for KPI-19-Summer thermal discomfort in 2050)					Digital file		REQUIRED
	Building Information Model - BIM						Digital file		RECOMMENDED

0	Level 1	Level 2	Level 3	Level 4	Level 5	Checklist	Data type	File name	Necessity
8-BUILDING DOCUMENTATION BIM	Building pictures						Digital file		RECOMMENDED
		North façade					Digital file		RECOMMENDED
		South façade					Digital file		RECOMMENDED
		East façade					Digital file		RECOMMENDED
		West façade					Digital file		RECOMMENDED
		North-East façade					Digital file		RECOMMENDED
		North-West façade					Digital file		RECOMMENDED
		South-East façade					Digital file		RECOMMENDED
		South-West façade					Digital file		RECOMMENDED
		Top view					Digital file		OPTIONAL
		Others					Digital file		OPTIONAL
	Thermal image building pictures						Digital file		OPTIONAL
		North façade					Digital file		OPTIONAL
		South façade					Digital file		OPTIONAL
		East façade					Digital file		OPTIONAL
		West façade					Digital file		OPTIONAL
		North-East façade					Digital file		OPTIONAL
		North-West façade					Digital file		OPTIONAL
		South-East façade					Digital file		OPTIONAL
		South-West façade					Digital file		OPTIONAL
		Top view					Digital file		OPTIONAL
		Others					Digital file		OPTIONAL

3 Key performance indicators – identification of input parameters and data extraction

This chapter is devoted to Key Performance Indicators (KPIs), which have already been selected and described using a prescribed description template within Task 2.2 (*Definition of common transnational indicators and assessment metrics*).

Table 21 provides a brief overview of selected KPIs within this project covering the following thematic area: Energy consumption, Renewable energy, GHG emissions, Thermal comfort, Indoor Air Quality (IAQ), Costs, Smartness, Resilience, E-mobility and Daylight sufficiency. For each selected KPI, a reference framework is visible.

In total seven KPIs were selected by project partners within the thematic area named Indoor Air Quality, referring to the health and comfort of building occupants.

This chapter provides:

1. Identification of all input parameters for each KPI defined within Task 2.2 (*Task 2.2 Definition of common transnational indicators and assessment metrics*),
2. Data extraction for each KPI,
3. Elaboration of mechanisms for the integration of data originating from national databases,
4. Interaction between the gathered data values and the digital building logbook.

Data extraction is the process of getting data from a source for further data processing, storage, or analysis elsewhere.

The elaborated EUB SuperHub digital building logbook covers the following three building states:

- **New buildings after construction – new building 'as built'** means a building without long-term use data (a new building less than three years old),
- **Existing building in the use phase** means a building with long-term use data of at least three years (a building more than three years old),
- **Existing building after major renovation** means an existing building after major renovation without long-term use data (a building less than three years old after a major renovation).

Given the three possible aforementioned building states that evaluated EUB SuperHub DBL data structure needs to cover, Table 22 provides a brief overview of the applicability of selected KPIs depending on those three possible building states taken into consideration within this project. D2.2 (*Definition of common transnational indicators and assessment metrics*) provides detailed description of 21 selected KPIs.

Many KPIs can be only estimated by performing measurements (e.g., KPIs referring to Indoor Air Quality), whereas for existing buildings in the use phase, some KPIs can be calculated and measured (e.g., KPIs which refer to energy consumption and renewable energy).

Table 21: List of KPIs selected within the EUB SuperHub project (see D2.2)

Thematic area	Criterion	Key Performance Indicator (KPI)		Unit	Reference framework
Energy Consumption	Use stage energy performance	1	Total annual primary energy demand per useful floor area	[kWh/(m²yr)]	1.1 Level(s)
		2	Delivered annual final energy demand per useful floor area	[kWh/(m²yr)]	1.1 Level(s)
		3	Non-renewable primary energy demand per useful floor area	[kWh/(m²yr)]	1.1 Level(s)
	Embodied non-renewable primary energy	4	Total use of non-renewable primary energy resources used as raw materials (PENRT)	[MJ]	EN 15978[3]
Renewable Energy	Use stage energy performance	5	Renewable annual primary energy demand per useful floor area	[kWh/(m²yr)]	1.1 Level(s)
		6	Renewable energy ratio (on-site, nearby)	[%]	B1.4 CESBA MED
GHG Emissions	Use stage	7	Use stage energy-related Global Warming Potential (GWP)	[kg CO_2 /(m²yr)]	C1.3 CESBA MED
	Life cycle	8	Life Cycle Global Warming Potential (GWP)	[kg CO_2/m² for a reference study period of 50 years]	1.2 Level(s)
Thermal comfort	Time outside of thermal comfort range	9	Time outside of thermal comfort range	[% of time in which the indoor temperature is out of a range of 18°C to 27°C during the heating and cooling seasons with and without building services]	4.2 Level(s)

[3] EN 15978 Sustainability of construction works - Assessment of environmental performance of buildings – Calculation method (November 2011)

Thematic area	Criterion	Key Performance Indicator (KPI)		Unit	Reference framework
Indoor Air Quality (IAQ)	Indoor air quality conditions	10	Ventilation rate	[L/s]	4.1 Level(s)
		11	CO_2 concentration	[ppm]	
		12	Relative humidity	[%]	
	Target pollutants indoor sources	13	Total VOCs (Volatile Organic Compounds)	[µg/m³]	
		14	CMR VOCs concentration (Carcinogenic, Mutagenic, Reprotoxic volatile organic compounds)	[µg/m³]	
		15	R value	Decimal ratio	
		16	Formaldehyde concentration	[µg/m³]	
Costs	Operational Energy Costs	17	Operational Energy Costs	[€/(m²yr)]	10.1 NewTREND
Smart buildings	Smart readiness indicator	18	Smart Readiness Indicator (SRI)	[%]	SRI
Resilience	Resilience	19	Summer thermal discomfort in 2030 and 2050	[% of time in which the indoor temperature exceeds 27 °C during the cooling season (summer months)]	5.1 Level(s)
E-mobility	E-mobility	20	Percentage of recharging points and installed pre-cabling in relation to the number of parking spaces	[%]	EPBD recast (art.12)
Daylight sufficiency	Daylight sufficiency	21	Daylight Provision	[%]	EN 17037[4]

[4] EN 17037 Daylighting in buildings

Table 22: Applicability of selected KPIs

Key Performance Indicator (KPI)		New buildings after construction – new buildings 'as built'	Existing buildings in the use phase	Existing buildings after major renovation
1	Total annual primary energy demand per useful floor area	CALCULATED METHOD	CALCULATED METHOD MEASURED METHOD	CALCULATED METHOD
2	Delivered annual final energy demand per useful floor area	CALCULATED METHOD	CALCULATED METHOD MEASURED METHOD	CALCULATED METHOD
3	Non-renewable primary energy demand per useful floor area	CALCULATED METHOD	CALCULATED METHOD MEASURED METHOD	CALCULATED METHOD
4	Total use of non-renewable primary energy resources used as raw materials (PENRT)	CALCULATED METHOD	This indicator is NOT APPLICABLE because the existing data for older materials used for the building construction, components and transport are unreliable, and there is often a lack of information on the actual embodied material.	CALCULATED METHOD considering only the materials used for its renovation
5	Renewable annual primary energy demand per useful floor area	CALCULATED METHOD	CALCULATED METHOD MEASURED METHOD	CALCULATED METHOD
6	Renewable energy ratio (on-site, nearby)	CALCULATED METHOD	CALCULATED METHOD[5] MEASURED METHOD[6]	CALCULATED METHOD
7	Use stage energy-related Global Warming Potential (GWP)	CALCULATED METHOD	CALCULATED METHOD MEASURED METHOD	CALCULATED METHOD
8	Life Cycle Global Warming Potential (GWP)	CALCULATED METHOD	CALCULATED METHOD MEASURED METHOD	CALCULATED METHOD without the original production and construction stages
9	Time outside of thermal comfort range	CALCULATED METHOD	CALCULATED METHOD	CALCULATED METHOD
10	Ventilation rate	CALCULATED METHOD according to EN 16798-1[7]	CALCULATED METHOD according to EN 16798-1[7] MEASURED METHOD according to EN 12599[8]	CALCULATED METHOD according to EN 16798-1[7]

[5] Calculated method based on calculated data
[6] Calculated method based on measured data
[7] EN 16798-1: 2019 Energy performance of buildings - Ventilation for buildings
[8] EN 12599: 2012 - Ventilation for buildings - Test procedures and measurement methods to hand over air conditioning and ventilation systems

Key Performance Indicator (KPI)		New buildings after construction – new buildings 'as built'	Existing buildings in the use phase	Existing buildings after major renovation
11	CO_2 concentration	This indicator is NOT APPLICABLE!	MEASURED METHOD according to EN 15251[9] and EN 16798[7]	This indicator is NOT APPLICABLE!
12	Relative humidity	MEASURED METHOD	MEASURED METHOD according to EN 15251[10] and EN 16798[7]	MEASURED METHOD
13	Total VOCs (Volatile Organic Compounds)	MEASURED METHOD	MEASURED METHOD according to EN 16516[11] and ISO 16000-6:2021[12]	MEASURED METHOD
14	CMR VOCs concentration (Carcinogenic, Mutagenic, Reprotoxic volatile organic compounds)	MEASURED METHOD	MEASURED METHOD according to EN 16516[11] and ISO 16000-6:2021[12]	MEASURED METHOD
15	R value	MEASURED METHOD	MEASURED METHOD according to EN 16516[11] and ISO 16000-6:2021[12]	MEASURED METHOD
16	Formaldehyde concentration	MEASURED METHOD	MEASURED METHOD according to EN 16516[11] and ISO 16000-6:2021[12]	MEASURED METHOD
17	Operational Energy Costs	CALCULATED METHOD	MEASURED METHOD	CALCULATED METHOD
18	Smart Readiness Indicator (SRI)	CALCULATED METHOD	CALCULATED METHOD	CALCULATED METHOD
19	Summer thermal discomfort in 2030 and 2050	CALCULATED METHOD dynamic energy simulation	CALCULATED METHOD dynamic energy simulation	CALCULATED METHOD dynamic energy simulation
20	Percentage of recharging points and installed pre-cabling in relation to the number of parking spaces	CALCULATED METHOD based on the building permit	CALCULATED METHOD based on the based on the existing on-site parking situation	CALCULATED METHOD based on the construction permit
21	Daylight Provision	CALCULATED METHOD according to EN 17037[13]	MEASURED METHOD according to EN 17037[13]	CALCULATED (ASSET) METHOD according to EN 17037[13]

[9] EN 15251: 2007 Indoor Environmental Criteria

[10] EN 15251: 2007 Indoor Environmental Criteria

[11] EN 16516 Construction products: Assessment of release of dangerous substances -- Determination of emissions of into indoor air

[12] ISO 16000-6:2021 Indoor air — Part 6: Determination of organic compounds (VVOC, VOC, SVOC) in indoor and test chamber air by active sampling on sorbent tubes, thermal desorption and gas chromatography using MS or MS FID

[13] EN 17037 Daylighting in buildings

3.1 Identification of all input parameters for each KPI

Based on D2.2 (*Definition of common transnational indicators and assessment metrics*) all input parameters, required to determine all selected KPIs within this project, are detected. It is noteworthy that all those input parameters are part of the elaborated EUB SuperHub digital building logbook.

For some KPIs there is no need for additional input parameters (e.g., CO_2 concentration, relative humidity, total VOCs), while for some there are several input parameters required to calculate the corresponding KPI.

For example, in case of KPI 20 - Percentage of recharging points and installed pre-cabling in relation to the number of parking spaces, the following three input parameters are required to calculate the value of that KPI:

- Total number of available parking spaces N_{tot} [–],
- Number of purpose-built electrical recharging spaces (Number of E-parking spaces) N_1 [–],
- Number of pre-cabled recharging stations N_2 [–].

according to the following formula:

$$= \left[\frac{N_1 + 0{,}5 \cdot N_2}{N_{tot}}\right] \cdot 100\ \%$$

All those three input parameters are placed within the sixth module SMART READINESS (topic E-mobility).

Chapter 3.1.1 and chapter 3.1.2 give the primary energy and CO_2 emission factors for seven project partner countries involved in this project (Austria, Croatia, France, Germany, Hungary, Ireland, and Italy).

Energy prices for each energy carrier in [€/kWh] in all project partner countries involved are also required for the calculation of KPI 17 – Operational energy costs expressed in [€/(m²yr)]. Since energy prices can differ around the nation and vary significantly during the time, the energy prices will be considered during the task 5.3. (*Implementation of the case studies across the EU*).

Table 23: Identification of all input parameters for each KPI

KPI / Input parameter name		Unit	Symbol	Formula
1	**Total annual primary energy demand per useful floor area**	**[kWh/(m²yr)]**	$\boldsymbol{E_{Ptot}}$	$E_{Ptot} = E_{Pnren} + E_{Pren}$
1.1	Non-renewable primary energy demand per useful floor area	[kWh/(m²yr)]	E_{Pnren}	
1.2	Renewable annual primary energy demand per useful floor area	[kWh/(m²yr)]	E_{Pren}	
2	**Delivered annual final energy demand per useful floor area**	[kWh/(m²yr)]	$\boldsymbol{E_{del}}$	$E_{del,calc} = \frac{\sum E_{del,calc,cr}}{A_{use}}$ $E_{del,meas} = \frac{\sum E_{del,meas,cr}}{A_{use}}$
2.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	$E_{del,calc,cr}$	
2.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	$E_{del,meas,cr}$	
2.2	Useful floor area	[m²]	A_{use}	
3	**Non-renewable primary energy demand per useful floor area**	**[kWh/(m²yr)]**	$\boldsymbol{E_{Pnren}}$	$E_{Pnren,calc} = \frac{\sum(E_{del,calc,cr} \cdot f_{Pnren,cr})}{A_{use}}$ $E_{Pnren,meas} = \frac{\sum(E_{del,meas,cr} \cdot f_{Pnren,cr})}{A_{use}}$
3.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	$E_{del,calc,cr}$	
3.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	$E_{del,meas,cr}$	
3.2	Non-renewable primary energy factor for energy carrier (*cr*) (e.g., electricity, natural gas, …)	[–]	$f_{Pnren,cr}$	
3.3	Useful floor area	[m²]	A_{use}	
4	**Total use of non-renewable primary energy resources used as raw materials (PENRT)**	**[MJ]**	$\boldsymbol{PENRT}$	$PENRT = m \cdot C$
4.1	Mass of each building element	[kg]	m	
4.2	Embodied energy coefficient	[MJ/kg]	C	
5	**Renewable annual primary energy demand per useful floor area**	[kWh/(m²yr)]	$\boldsymbol{E_{Pren}}$	$E_{Pren,calc} = \frac{\sum(E_{del,calc,cr} \cdot f_{Pren,cr})}{A_{use}}$ $E_{Pren,meas} = \frac{\sum(E_{del,meas,cr} \cdot f_{Pren,cr})}{A_{use}}$
5.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	$E_{del,calc,cr}$	
5.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	$E_{del,meas,cr}$	
5.2	Renewable primary energy factor for energy carrier (*cr*) (e.g., electricity, natural gas, …)	[–]	$f_{Pren,cr}$	

	KPI / Input parameter name	Unit	Symbol	Formula
5.3	Useful floor area	[m²]	A_{use}	
6	**Renewable energy ratio (on-site, nearby)**	[%]	$\boldsymbol{RER_{onst,nrby}}$	$\boldsymbol{RER_{onst,nrby} = \frac{E_{Pren,RER}}{E_{Ptot}} \cdot 100}$ $E_{Pren,RER} = E_{Pren,onst} + E_{Pren,nrby}$ $E_{Pren,onst} = \frac{\sum(E_{del,cr,onst} \cdot f_{Pren,cr})}{A_{use}}$ $E_{Pren,nrby} = \frac{\sum(E_{del,cr,nrby} \cdot f_{Pren,cr})}{A_{use}}$
6.1	Renewable annual primary energy demand per useful floor area	[kWh/(m²yr)]	E_{Pren}	
6.1.1	Annual on-site delivered energy for energy carrier (*cr*)	[kWh/(m²yr)]	$E_{del,cr,onst}$	
6.1.2	Annual nearby delivered energy for energy carrier (*cr*)	[kWh/(m²yr)]	$E_{del,cr,nrby}$	
6.1.3	Renewable primary energy factor for energy carrier (*cr*)	[–]	$f_{Pren,cr}$	
6.2	Total primary energy demand per useful internal floor area	[kWh/(m²yr)]	E_{Ptot}	
7	**Use stage energy-related Global Warming Potential (GWP)**	**[kg CO_2 /(m²yr)]**	**CO_2**	$CO_{2,calc} = \frac{\sum(E_{del,calc,cr} \cdot f_{CO2,cr})}{A_{use}}$ $CO_{2,meas} = \frac{\sum(E_{del,meas,cr} \cdot f_{CO2,cr})}{A_{use}}$
7.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	$E_{del,calc,cr}$	
7.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	$E_{del,meas,cr}$	
7.2	CO_2 emission factor for energy carrier (*cr*)	[–]	$f_{CO2,cr}$	
7.3	Useful floor area	[m²]	A_{use}	
8	**Life Cycle Global Warming Potential (GWP)**	[kg CO_2/m²]	**CO_2**	Result of calculation (see D2.2)
9	**Time outside of thermal comfort range**	[% of time in which the indoor temperature is out of a range of 18°C to 27°C during the heating and cooling seasons with and without building services]		Result of calculation
10	**Ventilation rate**	[L/s]		Result of measurement for existing buildings in the use phase according to EN 12599 (*Ventilation for buildings - Test procedures and measurement methods to hand over air conditioning and ventilation systems*)

	KPI / Input parameter name	Unit	Symbol	Formula
				Result of calculations for all types of buildings as described in the EN 16798-1
11	**CO_2 concentration**	[ppm]		Result of measurement for existing buildings in the use phase according to EN 15251 (*Indoor Environmental Criteria*) and EN 16798-1 (*Energy performance of buildings - Ventilation for buildings*)
12	**Relative humidity**	[%]		Result of measurement
13	**Total VOCs (Volatile Organic Compounds)**	[µg/m³]		Result of measurement
14	**CMR VOCs concentration (Carcinogenic, Mutagenic, Reprotoxic volatile organic compounds)**	[µg/m³]		Result of measurement
15	**R value**	Decimal ratio		Result of measurement
16	**Formaldehyde concentration**	[µg/m³]		Result of measurement
17	**Operational Energy Costs**	**[€/(m²yr)]**	***OEC***	$OEC_{\text{calc}} = \frac{\sum(E_{\text{del,calc},cr} \cdot EP_{cr})}{A_{\text{use}}}$ $OEC_{\text{meas}} = \frac{\sum(E_{\text{del,meas},cr} \cdot EP_{cr})}{A_{\text{use}}}$
17.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	$E_{\text{del,calc},cr}$	
17.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	$E_{\text{del,meas},cr}$	
17.2	Energy price with VAT included for each energy carrier (*cr*) (e.g., electricity, natural gas, district heating system…)	[€/kWh]	EP_{cr}	
17.3	Useful floor area	[m²]	A_{use}	
18	**Smart Readiness Indicator (SRI)**	**[%]**	***SRI***	Result of calculation
19	**Summer thermal discomfort in 2030 and 2050**	[% of time in which the indoor temperature exceeds 27 °C during the cooling season (summer months)]		Result of dynamic energy simulation
20	**Percentage of recharging points and installed pre-cabling in relation to the number of parking spaces**	[%]		$= \frac{N_1 + N_2}{N_{\text{tot}}} \cdot 100\ \%$
20.1	Total number of available parking spaces	[–]	N_{tot}	

	KPI / Input parameter name	Unit	Symbol	Formula
20.2	Number of purpose built electrical recharging spaces (Number of E-parking spaces)	[–]	N_1	
20.3	Number of pre-cabled recharging stations	[–]	N_2	
21	**Daylight Provision**	[%]		Result of calculations for new buildings 'as built' and existing buildings after major renovation accordingly to EN 17037 (*Daylighting in buildings*) Result of on-site measurements for existing buildings in the use phase accordingly to EN 17037 (*Daylighting in buildings*)

3.1.1 Primary energy factors

The latest valid primary energy factors in all project partner countries involved in this project need to be known to calculate KPI 3 (Non-renewable primary energy demand per useful floor area) and KPI 5 (Renewable annual primary energy demand per useful floor area) expressed in [kWh/(m²yr)].

Primary energy, defined as energy that has not been subjected to any conversion or transformation process, includes non-renewable energy and renewable energy. If both are taken into account, it can be called total primary energy. Hence, total primary energy factor is sum of non-renewable and renewable primary energy factors for a given energy carrier:

$$f_{\mathrm{Ptot}} = f_{\mathrm{Pnren}} + f_{\mathrm{Pren}}$$

In some project partner countries (e.g., Croatia, Hungary, Ireland) renewable primary energy factors f_{Pren} are not defined, so it will not be possible to calculate the following KPIs when implementing case studies (*Task 5.3 Implementation of the case studies across the EU*):

- KPI 1 – Total annual primary energy demand per useful floor area [kWh/(m²yr)],
- KPI 5 – Renewable annual primary energy demand per useful floor area [kWh/(m²yr)], and
- KPI 6 – Renewable energy ratio (on-site, nearby) [%].

In April 2022, on the web page of the Ministry of physical planning, construction, and state assets, a new list of primary energy factors (containing non-renewable, renewable and total primary energy factors) was published.

(https://mpgi.gov.hr/UserDocsImages/dokumenti/EnergetskaUcinkovitost/meteoroloski_podaci/Tablice_faktori_prim.en-1.4.2022..pdf). However, the defined factors aren't still in use.

Table 24 provides the sources of legislation for primary energy factors in all project partner countries involved in this project.

Table 24: Sources of legislation for primary energy factors

Project partner country	Primary energy factors – source of legislation
Austria	OIB-Richtlinie 6 2019 (OIB-330.6-026/19; available: https://www.oib.or.at/sites/default/files/richtlinie_6_12.04.19_1.pdf) and Erläuternde Bestimmungen OIB-Richtlinie 6 2019 (OIB-330.6-027/19; available: https://www.oib.or.at/sites/default/files/erlaeuternde_bemerkungen_richtlinie_6_12.04.19_0.pdf)
Croatia	Ministry of physical planning, construction, and state assets https://mpgi.gov.hr/UserDocsImages/dokumenti/EnergetskaUcinkovitost/meteoroloski_podaci/FAKTORI_primarne_energije.pdf
France	n/a
Germany	Gebäudeenergiegesetz - GEG) Anlage 4 - Stand: 2021 / DIN V 18599-1:2018-09
Hungary	n/a
Ireland	National Oil Reserves Agency Act 2007 (Returns and Biofuel Levy) Regulations 2010; Air Pollution Act 1987 (Solid Fuels) Regulations 2022 (S.I. No. 529 of 2022); District Heating Steering Group was formed under the Climate Action Plan 2021; Climate Action and Low Carbon Development Act 2021; Electricity Regulation Act, 1999; Enduring Connection Policy Stage 2 Decision Paper (ECP-2) (CRU/20/060); Climate Action Plan 2021; Directive (EU) 2018/844
Italy	ENEA (https://www.enea.it/it) National Agency for New Technologies, Energy and Sustainable Economic Development. GSE (gse.it) Energy Service Manager

Table 25: Primary energy factors in project partner countries

Primary energy factors			Non-renewable primary energy factor f_{Pnren} [-]							Renewable primary energy factor f_{Pren} [-]							Total primary energy factor f_{Ptot} [-]						
Project partner country			Austria	Croatia	France	Germany	Hungary	Ireland	Italy	Austria	Croatia	France	Germany	Hungary	Ireland	Italy	Austria	Croatia	France	Germany	Hungary	Ireland	Italy
Energy carrier delivered from distant			**AT**	**HR**	**FR**	**DE**	**HU**	**IE**	**IT**	**AT**	**HR**	**FR**	**DE**	**HU**	**IE**	**IT**	**AT**	**HR**	**FR**	**DE**	**HU**	**IE**	**IT**
FOSSIL FULES	Solid	Hard coal	1,46	1,0381		1,10	1,00	1,10	1,10	0,00			0,00			0,00	1,46			1,10			1,10
		Brown coal		1,054		1,20	1,00		1,10				0,00			0,00				1,20			1,10
		Lignite		1,0814			1,00																
		Peat						1,10															
		Manifactured ovoids						1,20															
	Liquid	Petroleum		1,033				1,10															
		Light heating oil		1,138		1,10							0,00							1,10			
		Fuel oil	1,20	1,13		1,10	1,00		1,07	0,00			0,00			0,00	1,20			1,10			1,07
		Liquefied Natural Gas (LNG)		1,16		1,10			1,05				0,00			0,00				1,10			1,05
		Liquefied Petroleum Gas (LPG)				1,10		1,10					0,00							1,10			
		Aviation fuels						1,10															
		Gasoil						1,10															
		Light, medium & heavy fuel oils						1,10															
		Kerosene						1,10															
	Gaseous	Natural gas	1,10	1,095		1,10	1,00		1,05	0,00			0,00			0,00	1,10			1,10			1,05
		Chamber gas																					
		Smelter gas																					
BIOFUELS	Solid	Wood logs		1,00			0,60	1,10															
		Wood coal		1,00			0,60																
		Wood briquettes		1,00			0,60	1,10															
		Wood chips		0,154		0,20	0,60	1,10	0,20				1,00			0,80				1,20			1,00
		Wood pellets	0,234	0,123		0,20	0,60	1,10	0,20	1,022			1,00			0,80	1,256			1,20			1,00
		Solid Biofuels	0,10							1,03							1,13						
	Liquid	Ethanol						1,10															
		Biodiesel						1,10	1,07							0,00							1,07
		Biooil				1,10																	
		Liquid Biofuels	0,50							1,03							1,53						
	Gaseous	Landfill gas						1,00	0,40							0,60							1,00
		Biogas						1,00	0,40							0,60							1,00
		Gaseous Biofuels	0,40							1,00							1,40						
Electricity			1,02	1,614		1,80	2,50	1,952	1,95	0,61						0,47	1,63			2,80			2,42

Energy carrier delivered from nearby		**AT**	**HR**	**FR**	**DE**	**HU**	**IE**	**IT**	**AT**	**HR**	**FR**	**DE**	**HU**	**IE**	**IT**	**AT**	**HR**	**FR**	**DE**	**HU**	**IE**	**IT**
District heating (country average)			1,494			1,12	1,10	1,50							0,00							1,50
District heating from Heating Plant (renewable)		0,28							1,32							1,60						
District heating from Heating Plant (non-renewable)		1,37							0,14							1,51						
District heating from highly efficient CHP		0,00							0,88							0,88						
District cooling (country average)								0,50							0,00							0,50
Energy carrier delivered on-site		**AT**	**HR**	**FR**	**DE**	**HU**	**IE**	**IT**	**AT**	**HR**	**FR**	**DE**	**HU**	**IE**	**IT**	**AT**	**HR**	**FR**	**DE**	**HU**	**IE**	**IT**
Solar	PV electricity		0,00		0,00	0,00		0,00				1,00			1,00				1,00			1,00
	Thermal		0,00		0,00	0,00	1,00	0,00				1,00			1,00				1,00			1,00
Wind						0,00		0,00							1,00							1,00
Environ-ment	Geothermal		0,00		0,00	0,00						1,00							1,00			
	Aerothermal				0,00	0,00						1,00							1,00			
	Hydrothermal				0,00	0,00						1,00							1,00			
Waste heat		1,00			0,00				0,00							1,00			1,00			
Energy carrier exported		**AT**	**HR**	**FR**	**DE**	**HU**	**IE**	**IT**	**AT**	**HR**	**FR**	**DE**	**HU**	**IE**	**IT**	**AT**	**HR**	**FR**	**DE**	**HU**	**IE**	**IT**
Electricity	To the grid							1,95							0,47							2,42
	To non-EPB uses																					

3.1.2 CO_2 emission factors

The latest valid CO_2 emissions factors in all project partner countries involved in this project need to be known to calculate KPI 7 Use stage energy related Global Warming Potential (GWP) expressed in [kg $CO_2/(m^2yr)$]. KPI 7 is associated with energy consumption of the technical building systems during use and operation of the building.

Table 26: The latest CO_2 emission factors in project partner countries

CO_2 emission factors			**CO_2 emission factor [kg CO_2/MWh]**						
Project partner country			Austria	Croatia	France	Germany	Hungary	Ireland	Italy
Energy carrier delivered from distant			**AT**	**HR**	**FR**	**DE**	**HU**	**IE**	**IT**
Fossil fuels	Solid	Hard coal	375,00	343,78		400,00	345,96	340,60	899,90
		Brown coal		353,14		430,00	363,60		899,90
		Lignite		378,48			396,00		
		Milled peat						430,50	
		Sod peat						374,40	
		Peat briquettes						355,90	
	Liquid	Petroleum		264,73		264,00		251,90	
		Light heating oil		299,57		266,00	278,64		
		Fuel oil	310,00	310,31		310,00	266,76	273,60	564,60
		Liquefied Natural Gas (LNG)		260,88		270,00			1.624,80
		Liquefied Petroleum Gas (LPG)				270,00			
		Kerosene						257,00	
		Jet kerosene						257,00	
		Gasoil/Diesel						263,90	
		Naphta						264,00	
		Petroleum coke						338,70	
	Gaseous	Natural gas	247,00	220,20		240,00	201,96	202,90	365,00
		Chamber gas					159,84		
		Smelter gas					936,00		
Biofuels	Solid	Wood logs		29,09		27,00			
		Wood coal		26,17					
		Wood briquettes		32,76					
		Wood chips		42,35		40,00			144,00
		Wood pellets	40,00	34,40		36,00			144,00
		Solid Biofuels	17,00						
	Liquid	Ethanol				43,00			
		Biodiesel				190,00			
		Liquid Biofuels	70,00						
	Gaseous	Landfill gas							
		Biogas				120,00	196,56		
		Gaseous Biofuels	100,00						
Electricity			227,00	234,81		550,00	350,00	347,80	488,90

Energy carrier delivered from nearby		**AT**	**HR**	**FR**	**DE**	**HU**	**IE**	**IT**
District heating (country average)			362,49			273,00		
District heating from Heating Plant (renewable)		59,00						
District heating from Heating Plant (non-renewable)		310,00						
District heating from highly efficient CHP		75,00						
District cooling (country average)								
Energy carrier delivered on-site		**AT**	**HR**	**FR**	**DE**	**HU**	**IE**	**IT**
Solar	PV electricity		0,00		0,00	0,00	0,00	
	Thermal		0,00		0,00	0,00	0,00	
Wind			0,00			0,00	0,00	
Environ-ment	Geothermal		0,00		0,00	0,00	0,00	
	Aerothermal		0,00		0,00	0,00	0,00	
	Hydrothermal		0,00		0,00	0,00	0,00	
Waste heat		22,00						
Energy carrier exported		**AT**	**HR**	**FR**	**DE**	**HU**	**IE**	**IT**
Electri-city	To the grid							
	to non-EPB uses							
CO_2 emission factors		**CO_2 emission factor [kg CO_2/m^3]**						
Water		**AT**	**HR**	**FR**	**DE**	**HU**	**IE**	**IT**
Water			224,24				346,06	

Table 27 provides the sources of legislation for CO_2 emission factors in all project partner countries involved in this project.

Table 27: Sources of legislation for CO_2 emission factors

Project partner country	CO_2 emission factors – source of legislation
Austria	OIB-Richtlinie 6 2019 (OIB-330.6-026/19; available: https://www.oib.or.at/sites/default/files/richtlinie_6_12.04.19_1.pdf)
Croatia	Ministry of physical planning, construction, and state assets https://mpgi.gov.hr/UserDocsImages/dokumenti/EnergetskaUcinkovitost/meteoroloski_podaci/FAKTORI_primarne_energije.pdf
France	n/a
Germany	Informationsblatt CO_2-Faktoren Bundesförderung für Energie-und Ressourceneffizienz in der Wirtschaft -Zuschuss / DIN V 18599-1:2018-09
Hungary	n/a
Ireland	Climate Action and Low Carbon (Amendment) Act 2021; Directive 2010/31/EU on the energy performance of buildings
Italy	ISPRA (https://www.isprambiente.gov.it/it) Institute for Environmental Protection and Research https://www.isprambiente.gov.it/files2017/pubblicazioni/rapporto/R_257_17.pdf

3.2 Data extraction for each KPI

Table 28 provides an overview of national databases in each project partner country involved in the EUB SuperHub, which could be possible data sources for the elaborated digital building logbook.

Data from the national EPC database in Croatia are partly publicly available. The following data are publicly available:

- EPC number,
- Name of company/energy assessor who issued EPC,
- Building type,
- Building name,
- Building unit name,
- Building address (city, street, street number),
- The first EPC rating (EPC label) based on the calculated annual energy need for heating per useful floor area for the reference climatic data $Q_{H,nd}$ [kWh/(m^{2}yr)],
- Calculated annual energy need for heating per useful floor area for the reference climatic data $Q_{H,nd}$ [kWh/(m^{2}yr)],
- The second EPC rating (EPC label) based on the calculated annual primary energy per useful floor area for the reference climatic data E_{prim} [kWh/(m^{2}yr)],
- Calculated annual primary energy per useful floor area for the reference climatic data E_{prim} [kWh/(m^{2}yr)],
- EPC issue date,
- EPC validity date,
- Year of building construction,
- Useful floor area [m^2],
- Total floor area [m^2],
- Specific annual CO_2 emission [kg/[m^{2}yr]].

Izvadak iz Registra izdanih energetskih certifikata, stanje na dan 12.1.2023.

Izvadak iz izdanih energetskih certifikata odnosi se samo na energetske certifikate izdane od 1. listopada 2017. godine putem Informacijskog sustava za izdavanje energetskih certifikata (IEC)

RBR.	OZNAKA ENERGETSKOG CERTIFIKATA	OVLAŠTENA OSOBA KOJA JE IZRADILA ENERGETSKI CERTIFIKAT	VRSTA ZGRADE PREMA PRAVILNIKU O ENERGETSKOM PREGLEDU ZGRADE I ENERGETSKOM CERTIFICIRANJU	NAZIV ZGRADE	NAZIV SAMOSTALNE UPORABNE CJELINE	MJESTO
1	P_944_2015_10000_SZ1	GFKconsulting j.d.o.o.	Obiteljske kuće	Obiteljska stambena zgrada	Obiteljska kuća	Bistrinci
2	F_557_2014_10000_SZ2	Grgić Zoran	Višestambene zgrade	Stambena zgrada	Stan u stambenoj zgradi na trećem katu	Zagreb
3	F_1272_2016_10000_SZ2	Radonić Dalibor	Višestambene zgrade	Višestambena zgrada	Stan Šare, prizemlje	Zagreb
4	F_1285_2017_10000_SZ2	Jantol Danijel	Višestambene zgrade	Višestambena zgrada	Stan 10	Zagreb
5	F_937_2014_10000_SZ2	Đukić Josip	Višestambene zgrade	Stambena zgrada	Stan ST-26 (E-38), II. kat	Zaprešić
6	F_1262_2016_10000_SZ2	Jelić Hrvoje	Višestambene zgrade	Stambena zgrada	Stan Gajski 1 kat	Velika Gorica

ULICA I KUĆNI BROJ	ENERGETSKI RAZRED ODREĐEN TEMELJEM SPECIFIČNE GODIŠNJE POTREBNE TOPLINE ENERGIJE ZA GRIJANJE		ENERGETSKI RAZRED ODREĐEN TEMELJEM SPECIFIČNE GODIŠNJE PRIMARNE ENERGIJE		DATUM IZDAVANJA CERTIFIKATA	ROK VAŽENJA CERTIFIKATA	GODINA ZAVRŠETKA IZGRADNJE	PLOŠTINA KORISNE POVRŠINE GRIJANOG DIJELA ZGRADE (m2)	GRAĐEVINSKA (BRUTO) POVRŠINA ZGRADE (m2)	SPECIFIČNA GODIŠNJA EMISIJA CO2
Ivana Gorana Kovačića 40	C	96,71	C	140,08	4.10.2017.	4.10.2027.	2012	91,61	104,37	25,51
Srednjaci 26 / 8.kat	C	77,52	C	137,97	11.10.2017.	11.10.2027.	1970	50,16	41,55	1557,84
Srebrnjak 40	C	78,19	A	90,35	6.10.2017.	6.10.2027.	1937	19,17	26,28	381,00
Ulica Josipa Eugena Tomića 9	C	94,72	B	106,75	8.10.2017.	8.10.2027.	1892	38,08	56,10	21,13
Ljudevita Gaja 34	D	143,60	C	252,35	7.10.2017.	7.10.2027.	1986	27,64	35,51	48,43
Ulica kralja Dmitra Zvonimira 21	C	68,95	D	349,98	6.10.2017.	6.10.2027.	1980	35,44	42,50	29,14

Figure 64: Publicly available data from the national EPC database in Croatia

Although the vast majority of national EPC databases are not publicly available at the moment or are partly publicly available (e.g., Croatia), according to Article 19 of the 3rd proposed revision of the Energy Performance of Buildings Directive (December 2021), Member States shall ensure that the national EPC databases are interoperable and integrated with other administrative information on buildings, such as the national building cadastre and digital building logbooks. So, in the future, the availability status of current national EPC databases will change for sure.

Table 29 – Table 34 provide data extraction for each KPI in all project partner countries involved in this project (Austria, Croatia, France, Germany, Hungary, Ireland, and Italy).

In **Austria**, almost all input parameters and KPIs need to be manually entered.

Croatia has two national databases: the EPC database and the EMIS (Energy Management Information System), to which the elaborated EUB SuperHub digital building logbook could link. The national database in Croatia contains a lot of useful data related to building envelope, technical building systems and EPC calculations. However, the whole set of KPIs related to Indoor Air Quality (IAQ), which require measurements, cannot be found in any database in Croatia. There is no obligation in Croatia to measure those KPIs. Since renewable primary energy factors are still not in use in Croatia, it is not possible to calculate KPI 1 (Total annual primary energy demand per useful floor area), KPI 5 (Renewable annual primary energy demand per useful floor area) and KPI 6 (Renewable energy ratio).

The EPC database (GEG-Registrierstelle) in **Germany** is not publicly available, so many input parameters and KPIs can be at the moment entered manually based on issued EPCs. The whole set of KPIs related to Indoor Air Quality (IAQ) can be taken from the *Report of indoor air measurement* (in German language *Bericht zur Raumluftmessung*).

Renewable energy factors for energy carriers (see Table 25) are also not defined in **Hungary**, meaning that there is also not possible to calculate KPI 1 (Total annual primary energy demand per useful floor area), KPI 5 (Renewable annual primary energy demand per useful floor area) and KPI 6 (Renewable energy ratio). Like in Croatia, there is also no obligation in Hungary to measure KPIs related to Indoor Air Quality (IAQ).

The two national EPC databases in **Ireland** (data from the national Building Energy Rating Certificate (BER) scheme, data from the Display Energy Certificate (DEC)) are also not publicly available.

There are many national databases in place in **Italy** meaning that Italy has many possible sources of data for the elaborated EUB SuperHub digital building logbook. The national database called SIAPE (*Information System on Energy Performance Certificates*) for the collection of EPCs of buildings and property units, is a source of data for many input parameters and KPIs.

Table 28: National databases as possible sources of data for digital building logbook in each of the countries involved in the EUB SuperHub

Country	National database name in English language	*National database name in original language*	National database name - abbreviation	Name of organisation / ministry / company responsible for data source in English language	*Name of organisation / ministry / company responsible for data source in original language*	National database home page	Brief description of the national database	Publicly accessible (Yes/No/ Partly])
Austria	Energy Performance Certificate Database (EPCDB)	*Energieausweis-datenbank (EADB)*	**Energieausweisdatenbank (EADB)**	Statistics Austria	*Statistik Austria*	https://www.statistik.at/datenbanken/adress-gebaeude-und-wohnungsregister/energieausweisdatenbank-eadb	EADB is a central Energy Performance Certificate Database set up by Statistics Austria. It is up to the federal provinces to decide whether the registration by the issuers of energy performance certificates has to be carried out directly in the central energy performance certificate database (EADB) or in a separate federal province database.	n/a
	EAWZ - Energy certificate centre	*Energieausweis-Zentrale Vorarlberg*	**EAWZ Die Energieausweis-Zentrale**	Country Vorarlberg	*Land Vorarlberg*	https://www.eawz.at/	The EAWZ is used to generate legally valid energy certificates (as PDF files) for Vorarlberg by authorized natural or legal persons. In addition, the EAWZ enables a wide variety of interested parties to obtain information about energy certificates and related topics.	Partly
	ZEUS	*Zentrale Energieausweis Umgebung Steiermark (ZEUS)*	**ZEUS**	–	–	https://www.energieausweise.net/	ZEUS used for the organisation and management of energy performance certificates according to the EPBD directive in the following five of nine Austrian provinces: • Burgenland (Land Burgenland), • Carinthia (Land Kärnten), • Lower Austria (Niederösterreich), • Salzburg (Land Salzburg), • Styria (das Land Steiermark).	n/a
	Baubook	*Baubook*	**Baubook**	–	–	https://www.baubook.info	The web portal BAUBOOK is a platform for building products, components and tools that simplifies ecological and healthy building. It facilitates verification in the context of ecological tenders, building certifications and funding systems and provides validated and structured building material data for the calculation of energy and ecological indicators.	No

Country	National database name in English language	*National database name in original language*	National database name - abbreviation	Name of organisation / ministry / company responsible for data source in English language	*Name of organisation / ministry / company responsible for data source in original language*	National database home page	Brief description of the national database	Publicly accessible (Yes/No/ Partly])
Croatia	Energy Performance Certificate (EPC) Information System	*Informacijski sustav Energetskih Certifikata (IEC)*	**EPC database**	Ministry of Physical Planning, Construction and State Assets	*Ministarstvo prostornoga uređenja, graditeljstva i državne imovine*	https://eenergetskicertifikat.mgipu.hr	The database is used for issuing EPCs, and reports on the regular inspection of heating and air-conditioning systems.	Partly (only certain data are publicly available)
	Energy Management Information System (EMIS)	*Informacijski Sustav za Gospodarenje Energijom (ISGE)*	**EMIS**	Agency for legal market and real estate procurement	*Agencija za pravni promet i posredovanje nekretninama (APN)*	https://www.isge.hr	The database is used for collecting and monitoring data on actual energy and water consumption in public buildings.	No
	Real estate information system 'eNekretnine'	*Informacijski sustav 'eNekretnine'*	**eNekretnine**	Ministry of Physical Planning, Construction and State Assets	*Ministarstvo prostornoga uređenja, graditeljstva i državne imovine*	https://nekretnine.mgipu.hr	This database contains data on the number of transactions for each area, on the types of real estate and data on real estate that was the subject of the transaction - apartment, single-family house, office premises, agricultural, construction, forest land, prices achieved, etc. The property market information system allows certified court valuers, agents in property transactions and local and regional self-government units to access the data on property transactions.	No
	Physical Planning Information System	*Informacijski Sustav Prostornog Uređenja (ISPU)*	**ISPU**	Ministry of Physical Planning, Construction and State Assets	*Ministarstvo prostornoga uređenja, graditeljstva i državne imovine*	https://ispu.mgipu.hr/#/	This system merges into one unit the Geoportal, Cadastre and spatial plans, enabling end-users, i.e., every citizen simple access to information on rules of space use, on plans under construction and reports on public debates.	Yes
Germany	GEG-registration centre	*GEG-Registrierstelle*	**GEG-Registrierstelle**	German Institute for Building Technology	*Deutsches Institut für Bautechnik*	https://www.dibt.de/de/wir-bieten/geg-registrierstelle	The database is responsible for the registration of all energy certificates and inspection reports for air conditioning and it executes random EPC validity checks that are carried out exclusively electronically	No
	ÖKOBAUDAT	*ÖKOBAUDAT-Datenbank*	**ÖKOBAUDAT**	Federal Ministry for Housing, Urban Development and Building	*Bundesministerium für Wohnen, Stadtentwicklung und Bauwesen*	https://www.oekobaudat.de/no_cache/datenbank/suche.html	The database contains all the life cycle information about the construction products. The use of the database is mandatory for conducting a life cycle analysis in the national sustainable building assessment system (BNB). The available data sets for the relevant	Yes

Country	National database name in English language	*National database name in original language*	National database name - abbreviation	Name of organisation / ministry / company responsible for data source in English language	*Name of organisation / ministry / company responsible for data source in original language*	National database home page	Brief description of the national database	Publicly accessible (Yes/No/ Partly])
							construction products are provided in accordance with DIN EN 15804.	
Hungary	Energy Performance Certificate (EPC) Information System	*e-tanúsítás*	**EPC database**	Ministry of Construction and Investment	*Építési és Beruházási Minisztérium*	https://www.e-epites.hu/e-tanusitas	The database is used for issuing EPCs.	
	Energy statistics	*Energia statisztika*	**Energy statistics**	Hungarian Energy and Utilities Regulatory Office	*Magyar Energetikai és Közmű-szabályozási Hivatal*	http://mekh.hu/index	The Hungarian Energy and Public Utilities Regulatory Office publishes data on domestic coal and petroleum products as well as electricity and natural gas supply on a monthly basis.	
Ireland			**EPC database**	Sustainable Energy Authority of Ireland (SEAI)	*Sustainable Energy Authority of Ireland (SEAI)*	https://www.seai.ie/	The SEAI administers the national EPC database for Ireland. For homeowners and private dwellings, data from the national Building Energy Rating Certificate (BER) scheme [https://www.seai.ie/home-energy/building-energy-rating-ber/] is stored but is not publically accessible. For business and public building owners, data from the Display Energy Certificate (DEC) scheme is stored but again, it is not publically available [https://www.seai.ie/business-and-public-sector/display-energy-certificate/].	No
Italy	SIAPE - Information System on Energy Performance Certificates	*SIAPE - Sistema Informativo sugli Attestati di Prestazione Energetica*	**SIAPE database**	ENEA (https://www.enea.it/it) National Agency for New Technologies, Energy and Sustainable Economic Development	*ENEA (https://www.enea.it/it) Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile*	https://siape.enea.it/	The SIAPE is the national database for the collection of the Energy Performance Certificates of buildings and property units	Partly. Aggregated data can be visualised without having access credentials. To have full access to the data it is necessary to request credentials to ENEA through a

Country	National database name in English language	*National database name in original language*	National database name - abbreviation	Name of organisation / ministry / company responsible for data source in English language	*Name of organisation / ministry / company responsible for data source in original language*	National database home page	Brief description of the national database	Publicly accessible (Yes/No/ Partly])
								certified e-mail address and wait for the authorizatio n.
	Fascicolo del Fabbricato (Building Dossier)	*Fascicolo del Fabbricato*	**Fascicolo del Fabbricato**	Municipal Building Regulations	*Regolamenti edilizi comunali*	https://www.studiomadera.it/images/PDF/Fascicolo_del_Fabbricato.pdf	The Italian "Fascicolo del Fabbricato" is a technical document which contains all the information related to the state of usability and safety of a building, in terms of stability, plant engineering and maintenance. It is a digital register of buildings, a common archive for all relevant building data, which promotes transparency and greater availability of data for a wide range of market players	No
Italy	Fascicolo Casa (Home Dossier)	*Fascicolo Casa*	**Fascicolo Casa**	Reliable third-party adjuster companies (bank, insurance, etc.)	*Società peritali terze autorevoli (banche, assicurazioni, ecc.)*	https://anyflip.com/qkzg/hohx	Fascicolo Casa is a set of certified documents that contain information about the property. The Fascicolo Casa allows to verify the regularity of the documents, the title deeds, the Energy Performance Certificate (APE). Furthermore, the Fascicolo Casa includes the analysis and the commercial estimate of the property, drawn up using the same parameters used in the banking system for the granting of a loan.	No
	Building Energy Performance Information System (SIPEE)	*Sistema Informativo per la Prestazione Energetica degli Edifici (SIPEE)*	**SIPEE Piedmont Region**	Piedmont Region (IT)	*Regione Piemonte (IT)*	https://servizi.regione.piemonte.it/catalogo/sistema-informativo-per-prestazione-energetica-degli-edifici-sipee	The SIPEE is the regional online service for Piedmont Region addressed to certifiers, citizens, notaries and training institutions which offers different functionalities in relation to the stakeholder involved, for example, it allows the EPC assessor to fill in the EPC and transmit it, to register in the regional list of certifiers, to pay the annual enrolment fee, etc.	Partly. The section related to the list of EPC certifiers is freely available. The access to the content of the EPCs is reserved for certifiers.

Country	National database name in English language	*National database name in original language*	National database name - abbreviation	Name of organisation / ministry / company responsible for data source in English language	*Name of organisation / ministry / company responsible for data source in original language*	National database home page	Brief description of the national database	Publicly accessible (Yes/No/ Partly])
Italy	CIT - Cadastre of Thermal Installations	*CIT - Catasto Impianti Termici*	**CIT Piedmont Region**	Piedmont Region (IT)	*Regione Piemonte (IT)*	https://servizi.regione.piemonte.it/catalogo/catasto-impianti-termici	The CIT hosts and organizes in a unitary way the data relating to thermal systems throughout the regional territory, allowing maintainers to fulfil administrative obligations	Partly. The access is free only for companies accredited by the CIT.
	EPC data	*Dati degli APE (Attestati di Prestazione Energetica)*	**ENEA**	ENEA (https://www.enea.it/it) National Agency for New Technologies, Energy and Sustainable Economic Development	*ENEA (https://www.enea.it/it) Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile*	https://siape.enea.it/	ENEA, the National Agency for New Technologies, Energy and Sustainable Economic Development, has developed the SIAPE, the Information System on Energy Performance Certificates and collects regional data about EPCs the 31st March of each year	Partly. Aggregated data can be visualised without having access credentials. To have full access to the data it is necessary to request credentials to ENEA through a certified e-mail address and wait for the authorizatio n.
	GSE - Energy Services Manager	*GSE - Gestore Servizi Energetici*	**GSE**	Italian corporation, wholly owned by the Italian Ministry of Economy and Finance	*Società per azioni italiana interamente partecipata dal Ministero dell'economia e delle finanze*	https://www.gse.it/	GSE provides services to citizens, businesses and public administrations, supports institutions by carrying out sector studies and monitoring activities energy-related	Yes. It is necessary to register through the e-mail address.
	ISPRA - Higher institute for the protection and environmental research	*ISPRA - istituto Superiore per la Protezione e la Ricerca Ambientale*	**ISPRA**	Public research institute, supervised by the Minister of Ecological Transition (Mite)	*Ente pubblico di ricerca, sottoposto alla vigilanza del Ministro della Transizione Ecologica (Mite)*	https://www.isprambiente.gov.it/it	ISPRA provides institutional consultancy and technical-scientific support for the Ministry of Environment and Land Protection	Yes
	TERNA - National Electricity Network	*TERNA - Rete Elettrica Nazionale*	**TERNA**	Italian company operating electricity transmission networks	*Società italiana operatrice delle reti di trasmissione dell'energia elettrica*	https://www.terna.it/it	Italian company operating electricity transmission networks, it provides several information on emission data, energy consumption, energy production, etc.	Yes. It is necessary to register through the e-mail address.

Country	National database name in English language	*National database name in original language*	National database name - abbreviation	Name of organisation / ministry / company responsible for data source in English language	*Name of organisation / ministry / company responsible for data source in original language*	National database home page	Brief description of the national database	Publicly accessible (Yes/No/ Partly])
	CTI - Italian Thermo-technical Committee	*CTI - Comitato Termotecnico Italiano*	**CTI**	Non-profit association, carrying out regulatory activity in the sectors of thermotechnics and the production and use of thermal energy, and the related environmental implications. The CTI is a body federated with UNI, the Italian national unification body	*Associazione senza fine di lucro, svolge l'attività normativa nei settori della termotecnica e della produzione e utilizzazione di energia termica, e delle relative implicazioni ambientali. Il CTI è un ente federato all'UNI, Ente nazionale italiano di unificazione*	https://www.cti2000.it/	The CTI collaborates with the CEN and ISO standardization bodies by participating, on behalf of UNI, in the activities of numerous technical committees (TC) and related working groups (WG) focused on the production and use of thermal energy, and the related environmental implications	Yes
	LAW 10/91	*Legge 10/91*	**LAW 10/91**	Italian Government - National law	*Stato Italiano - Legge Nazionale*	https://www.bosettiegatti.eu/info/norme/statali/1991_0010.htm	Law 10/91 is a technical detailed report capable of demonstrating that the newly constructed building, or involved in extraordinary maintenance, renovation or expansion, complies with the minimum required parameters regarding the energy characteristics	The text of the Law is freely available. The Law 10/91 prepraed for buildings is not freely available.
	Cadastral Cartographic Geoportal	*Geoportale Cartografico Catastale*	**Cartographic Geoportal**	Revenue Agency - regulates the national financial administration and accounting	*Agenzia delle Entrate - regola l'amministrazione finanziaria e la contabilità nazionale*	https://geoportale.cartografia.agenziaentrate.gov.it/age-inspire/srv/ita/catalog.search#/home	The Cadastral Cartographic Geoportal allows all citizens free access to consult the cadastral cartography, through the search and dynamic visualization of the parcels present in the cadastral cartography, kept constantly updated, in automatic mode, through the technical documents prepared and transmitted electronically by the licensed professionals.	Yes
	Database of real estate quotations	*Banca dati delle quotazioni immobiliari*	**Real estate quotations**	Revenue Agency - regulates the national financial administration and accounting	*Agenzia delle Entrate - regola l'amministrazione finanziaria e la contabilità nazionale*	https://www1.agenziaentrate.gov.it/servizi/Consultazione/ricerca.htm	From January 2004, the Revenue Agency of the Italian Ministry of Economy and Finance, made available the Database of the real estate prices. It provides an estimate of the transaction value of the properties (indicating a minimum/maximum range of price) based on a set of parameters (location of the building, type of property, state of conservation, etc.).	Partly. Most of the content is freely accessible but there are also a reserved area within the website, accessible

Country	National database name in English language	*National database name in original language*	National database name - abbreviation	Name of organisation / ministry / company responsible for data source in English language	*Name of organisation / ministry / company responsible for data source in original language*	National database home page	Brief description of the national database	Publicly accessible (Yes/No/ Partly])
							The database is updated every six months	only after registration.
Italy	OMI - Real estate Market observatory	*OMI - Osservatorio Mercato Immobiliare*	**OMI**	Revenue Agency - regulates the national financial administration and accounting	*Agenzia delle Entrate - regola l'amministrazione finanziaria e la contabilità nazionale*	https://www.agenziaentrate.gov.it/portale/web/guest/schede/fabbricatiterreni/omi/banche-dati/quotazioni-immobiliari	OMI is the Italian Real estate Market observatory, containing real estate prices	Partly
	Regulatory Authority for Energy, Networks and Environment (ARERA)	*Autorità di regolazione per Energia, Reti e Ambiente (ARERA)*	**ARERA**	A President and four other members, all appointed by of the President of the Republic on a proposal from the Italian Government	*un Presidente e altri quattro membri, tutti nominati con decreto del Presidente della Repubblica su proposta del governo*	https://www.arera.it/it/index.htm#	ARERA deals with the protection of consumers, promoting competition and efficiency in the electricity and gas sectors	Most of the content is freely accessible but there is also a reserved area within the website, accessible only after registration.

3.2.1 Austria

Table 29: Data extraction for each KPI – Austria

AUSTRIA **KPI** / Input parameter name		Unit	**CALCULATED METHOD**			**MEASURED METHOD**		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
1	**Total annual primary energy demand per useful floor area**	**[kWh/(m²yr)]**	**Manually entered data**	**Manually entered data**	**Manually entered data**	**NOT APPLICABLE**	**Manually entered data**	**NOT APPLICABLE**
1.1	Non-renewable primary energy demand per useful floor area	[kWh/(m²yr)]	Manually entered data	Manually entered data	Manually entered data	NOT APPLICABLE	Manually entered data	NOT APPLICABLE
1.2	Renewable annual primary energy demand per useful floor area	[kWh/(m²yr)]	Manually entered data	Manually entered data	Manually entered data	NOT APPLICABLE	Manually entered data	NOT APPLICABLE
2	**Delivered annual final energy demand per useful floor area**	[kWh/(m²yr)]	**Manually entered data**	**Manually entered data**	**Manually entered data**	**NOT APPLICABLE**	**Manually entered data**	**NOT APPLICABLE**
2.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Manually entered data	Manually entered data	Manually entered data	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
2.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	Manually entered data	NOT APPLICABLE
2.2	Useful floor area	[m²]	Manually entered data based on EPC	Manually entered data based on EPC	Manually entered data based on EPC	NOT APPLICABLE	Manually entered data based on EPC	NOT APPLICABLE
3	**Non-renewable primary energy demand per useful floor area**	**[kWh/(m²yr)]**	**Manually entered data**	**Manually entered data**	**Manually entered data**	**NOT APPLICABLE**	**Manually entered data**	**NOT APPLICABLE**
3.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Manually entered data	Manually entered data	Manually entered data	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
3.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	Manually entered data	NOT APPLICABLE
3.2	Non-renewable primary energy factor for energy carrier (*cr*) (e.g., electricity, natural gas, …)	[-]	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE
3.3	Useful floor area	[m²]	Manually entered data based on EPC	Manually entered data based on EPC	Manually entered data based on EPC	NOT APPLICABLE	Manually entered data based on EPC	NOT APPLICABLE
4	**Total use of non-renewable primary energy resources used as raw materials (PENRT)**	**[MJ]**	**Manually entered data**	**NOT APPLICABLE**	**Manually entered data**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**

AUSTRIA **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
5	**Renewable annual primary energy demand per useful floor area**	[kWh/(m²yr)]	**Manually entered data**	**Manually entered data**	**Manually entered data**	**NOT APPLICABLE**	**Manually entered data**	**NOT APPLICABLE**
5.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Manually entered data	Manually entered data	Manually entered data	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
5.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	Manually entered data	NOT APPLICABLE
5.2	Renewable primary energy factor for energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[-]	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE
5.3	Useful floor area	[m²]	Manually entered data based on EPC	Manually entered data based on EPC	Manually entered data based on EPC	NOT APPLICABLE	Manually entered data based on EPC	NOT APPLICABLE
6	**Renewable energy ratio (on-site, nearby)**	[%]	**Manually entered data**	**Manually entered data**	**Manually entered data**	**NOT APPLICABLE**	**Manually entered data**	**NOT APPLICABLE**
6.1	Renewable annual primary energy demand per useful floor area	[kWh/(m²yr)]	Manually entered data	Manually entered data	Manually entered data	NOT APPLICABLE	Manually entered data	NOT APPLICABLE
6.1.1	Annual on-site delivered energy for energy carrier (*cr*)	[kWh/(m²yr)]				NOT APPLICABLE		NOT APPLICABLE
6.1.2	Annual nearby delivered energy for energy carrier (*cr*)	[kWh/(m²yr)]				NOT APPLICABLE		NOT APPLICABLE
6.1.3	Renewable primary energy factor for energy carrier (*cr*)	[-]	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE
6.2	Total primary energy demand per useful internal floor area	[kWh/(m²yr)]	Manually entered data	Manually entered data	Manually entered data	NOT APPLICABLE	Manually entered data	NOT APPLICABLE
7	**Use stage energy-related Global Warming Potential (GWP)**	**[kg CO_2 /(m²yr)]**	**Manually entered data**	**Manually entered data**	**Manually entered data**	**NOT APPLICABLE**	**Manually entered data**	**NOT APPLICABLE**
7.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Manually entered data	Manually entered data	Manually entered data	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
7.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	Manually entered data	NOT APPLICABLE
7.2	CO_2 emission factor for energy carrier (*cr*)	[-]	Table 26: The latest CO2 emission factors in	Table 26: The latest CO2 emission factors	Table 26: The latest CO2 emission factors in project partner countries	NOT APPLICABLE	Table 26: The latest CO2 emission factors	NOT APPLICABLE

AUSTRIA **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
			project partner countries	in project partner countries			in project partner countries	
7.3	Useful floor area	[m^2]	Manually entered data based on EPC	Manually entered data based on EPC	Manually entered data based on EPC	NOT APPLICABLE	Manually entered data based on EPC	NOT APPLICABLE
8	**Life Cycle Global Warming Potential (GWP)**	[kg CO_2/m^2]	**Manually entered data**	**Manually entered data**	**Manually entered data**	**NOT APPLICABLE**	**Manually entered data**	**NOT APPLICABLE**
9	**Time outside of thermal comfort range**	[% of time in which the indoor temperature is out of a range of 18°C to 27°C during the heating and cooling seasons with and without building services]	**Manually entered data**	**Manually entered data**	**Manually entered data**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
10	**Ventilation rate**	[L/s]	**Manually entered data**	**Manually entered data**	**Manually entered data**	**NOT APPLICABLE**	**Manually entered data**	**NOT APPLICABLE**
11	**CO_2 concentration**	[ppm]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data**	**NOT APPLICABLE**
12	**Relative humidity**	[%]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	–	**Manually entered data**	–
13	**Total VOCs (Volatile Organic Compounds)**	[µg/m^3]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	–	–	–
14	**CMR VOCs concentration (Carcinogenic, Mutagenic, Reprotoxic volatile organic compounds)**	[µg/m^3]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	–	**Manually entered data**	–
15	**R value**	Decimal ratio	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	–	**Manually entered data**	–
16	**Formaldehyde concentration**	[µg/m^3]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	–	**Manually entered data**	–
17	**Operational Energy Costs**	**[€/(m^2yr)]**	**Calculated automatically based on the CALCULATED delivered energy**	**Calculated automatically based on the CALCULATED delivered energy**	**Calculated automatically based on the CALCULATED delivered energy**	**NOT APPLICABLE**	**Calculated automatically based on the MEASURED delivered energy**	**NOT APPLICABLE**

AUSTRIA **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
17.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Manually entered data	Manually entered data	Manually entered data	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
17.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	Manually entered data	NOT APPLICABLE
17.2	Energy price with VAT included for each energy carrier (*cr*) (e.g., electricity, natural gas, district heating system...)	[€/kWh]	Latest energy price	Latest energy price	Latest energy price	NOT APPLICABLE	Latest energy price	NOT APPLICABLE
17.3	Useful floor area	[m^2]	Manually entered data based on EPC	Manually entered data based on EPC	Manually entered data based on EPC	NOT APPLICABLE	Manually entered data based on EPC	NOT APPLICABLE
18	**Smart Readiness Indicator (SRI)**	**[%]**	**Calculated using SRI assessment package-v4_4**	**Calculated using SRI assessment package-v4_4**	**Calculated using SRI assessment package-v4_4**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
19	**Summer thermal discomfort in 2030 and 2050**	[% of time in which the indoor temperature exceeds 27 °C during the cooling season (summer months)]	**Manually entered data**	**Manually entered data**	**Manually entered data**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
20	**Percentage of recharging points and installed pre-cabling in relation to the number of parking spaces**	[%]	**Calculated automatically based on the input parameters**	**Calculated automatically based on the input parameters**	**Calculated automatically based on the input parameters**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
20.1	Total number of available parking spaces	[-]	Manually entered data based on the building permit	Manually entered data based on the existing parking situation	Manually entered data based on the construction permit	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
20.2	Number of purpose built electrical recharging spaces (Number of E-parking spaces)	[-]	Manually entered data based on the building permit	Manually entered data based on the existing parking situation	Manually entered data based on the construction permit	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
20.3	Number of pre-cabled recharging stations	[-]	Manually entered data based on the building permit	Manually entered data based on the existing parking situation	Manually entered data based on the construction permit	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
21	**Daylight Provision**	[%]	**Manually entered data**	**Manually entered data**	**Manually entered data**	**NOT APPLICABLE**	**Manually entered data**	**NOT APPLICABLE**

3.2.2 Croatia

Table 30: Data extraction for each KPI – Croatia

CROATIA **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
1	**Total annual primary energy demand per useful floor area**	**[kWh/(m²yr)]**	**–[14]**	**–[14]**	**–[14]**	**NOT APPLICABLE**	**–[14]**	**NOT APPLICABLE**
1.1	Non-renewable primary energy demand per useful floor area	[kWh/(m²yr)]	EPC database	EPC database	EPC database	NOT APPLICABLE	Calculated automatically based on the MEASURED delivered energy	NOT APPLICABLE
1.2	Renewable annual primary energy demand per useful floor area	[kWh/(m²yr)]	–[14]	–[14]	–[14]	NOT APPLICABLE	–[14]	NOT APPLICABLE
2	**Delivered annual final energy demand per useful floor area**	[kWh/(m²yr)]	**EPC database**	**EPC database**	**EPC database**	**NOT APPLICABLE**	**EMIS[15]**	**NOT APPLICABLE**
2.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Files from software for EPB calculation	Files from software for EPB calculation	Files from software for EPB calculation	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
2.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	EMIS[15]	NOT APPLICABLE
2.2	Useful floor area	[m²]	EPC database	EPC database	EPC database	NOT APPLICABLE	EPC database	NOT APPLICABLE
3	**Non-renewable primary energy demand per useful floor area**	**[kWh/(m²yr)]**	**EPC database**	**EPC database**	**EPC database**	**NOT APPLICABLE**	**Calculated automatically based on the MEASURED delivered energy**	**NOT APPLICABLE**
3.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Files from software for EPB calculation	Files from software for EPB calculation	Files from software for EPB calculation	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
3.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	EMIS[15]	NOT APPLICABLE
3.2	Non-renewable primary energy factor for energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[-]	See Table 25: Primary energy factors in	See Table 25: Primary energy	See Table 25: Primary energy	NOT APPLICABLE	See Table 25: Primary energy	NOT APPLICABLE

[14] Value is not available because renewable primary energy factors are still not in use in Croatia.

[15] EMIS – Energy Management Information System – database for collecting and monitoring data on actual energy and water consumption in public buildings.

CROATIA **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
			project partner countries	factors in project partner countries	factors in project partner countries		factors in project partner countries	
3.3	Useful floor area	[m²]	EPC database	EPC database	EPC database	NOT APPLICABLE	EPC database	NOT APPLICABLE
4	**Total use of non-renewable primary energy resources used as raw materials (PENRT)**	**[MJ]**	–	**NOT APPLICABLE**	–	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
5	**Renewable annual primary energy demand per useful floor area**	[kWh/(m²yr)]	**–[14]**	**–[14]**	**–[14]**	**NOT APPLICABLE**	**–[14]**	**NOT APPLICABLE**
5.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Files from software for EPB calculation	Files from software for EPB calculation	Files from software for EPB calculation	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
5.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	EMIS[15]	NOT APPLICABLE
5.2	Renewable primary energy factor for energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[-]	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE
5.3	Useful floor area	[m²]	EPC database	EPC database	EPC database	NOT APPLICABLE	EPC database	NOT APPLICABLE
6	**Renewable energy ratio (on-site, nearby)**	[%]	**–[14]**	**–[14]**	**–[14]**	**NOT APPLICABLE**	**–[14]**	**NOT APPLICABLE**
6.1	Renewable annual primary energy demand per useful floor area	[kWh/(m²yr)]	–[14]	–[14]	–[14]	NOT APPLICABLE	–[14]	NOT APPLICABLE
6.1.1	Annual on-site delivered energy for energy carrier (*cr*)	[kWh/(m²yr)]	Files from software for EPB calculation	Files from software for EPB calculation	Files from software for EPB calculation	NOT APPLICABLE		NOT APPLICABLE
6.1.2	Annual nearby delivered energy for energy carrier (*cr*)	[kWh/(m²yr)]	Files from software for EPB calculation	Files from software for EPB calculation	Files from software for EPB calculation	NOT APPLICABLE		NOT APPLICABLE
6.1.3	Renewable primary energy factor for energy carrier (*cr*)	[-]	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE
6.2	Total primary energy demand per useful internal floor area	[kWh/(m²yr)]	–[14]	–[14]	–[14]	NOT APPLICABLE	–[14]	NOT APPLICABLE
7	**Use stage energy-related Global Warming Potential (GWP)**	**[kg CO_2 /(m²yr)]**	**EPC database**	**EPC database**	**EPC database**	**NOT APPLICABLE**	Calculated automatically	**NOT APPLICABLE**

CROATIA **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
							based on the MEASURED delivered energy	
7.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Files from software for EPB calculation	Files from software for EPB calculation	Files from software for EPB calculation	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
7.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	EMIS[15]	NOT APPLICABLE
7.2	CO_2 emission factor for energy carrier (*cr*)	[-]	Table 26: The latest CO2 emission factors in project partner countries	Table 26: The latest CO2 emission factors in project partner countries	Table 26: The latest CO2 emission factors in project partner countries	NOT APPLICABLE	Table 26: The latest CO2 emission factors in project partner countries	NOT APPLICABLE
7.3	Useful floor area	[m^2]	EPC database	EPC database	EPC database	NOT APPLICABLE	EPC database	NOT APPLICABLE
8	**Life Cycle Global Warming Potential (GWP)**	[kg CO_2/m^2]	–	–	–	**NOT APPLICABLE**	–	**NOT APPLICABLE**
9	**Time outside of thermal comfort range**	[% of time in which the indoor temperature is out of a range of 18°C to 27°C during the heating and cooling seasons with and without building services]	**Manually entered data based on calculation**	**Manually entered data based on calculation**	**Manually entered data based on calculation**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
10	**Ventilation rate**	[L/s]	1. Files from software for EPB calculation 2. Manually enetered data	1. Files from software for EPB calculation 2. Manually enetered data	1. Files from software for EPB calculation 2. Manually enetered data	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**NOT APPLICABLE**
11	**CO_2 concentration**	[ppm]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**NOT APPLICABLE**
12	**Relative humidity**	[%]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**Manually entered data**	**Manually entered data based on the measurements**

CROATIA **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
							based on the measurements	
13	**Total VOCs (Volatile Organic Compounds)**	[µg/m³]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**
14	**CMR VOCs concentration (Carcinogenic, Mutagenic, Reprotoxic volatile organic compounds)**	[µg/m³]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**
15	**R value**	Decimal ratio	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**
16	**Formaldehyde concentration**	[µg/m³]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**
17	**Operational Energy Costs**	**[€/(m²yr)]**	**Calculated automatically based on the CALCULATED delivered energy**	**Calculated automatically based on the CALCULATED delivered energy**	**Calculated automatically based on the CALCULATED delivered energy**	**NOT APPLICABLE**	**Calculated automatically based on the MEASURED delivered energy**	**NOT APPLICABLE**
17.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Files from software for EPB calculation	Files from software for EPB calculation	Files from software for EPB calculation	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
17.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	EMIS[15]	NOT APPLICABLE
17.2	Energy price with VAT included for each energy carrier (*cr*) (e.g., electricity, natural gas, district heating system...)	[€/kWh]	Latest energy price	Latest energy price	Latest energy price	NOT APPLICABLE	Latest energy price	NOT APPLICABLE
17.3	Useful floor area	[m²]	EPC database	EPC database	EPC database	NOT APPLICABLE	EPC database	NOT APPLICABLE
18	**Smart Readiness Indicator (SRI)**	**[%]**	**Calculated using SRI assessment package-v4_4**	**Calculated using SRI assessment package-v4_4**	**Calculated using SRI assessment package-v4_4**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
19	**Summer thermal discomfort in 2030 and 2050**	[% of time in which the indoor temperature exceeds 27 °C during the	**Manually entered data based on calculation**	**Manually entered data based on calculation**	**Manually entered data based on calculation**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**

CROATIA **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
		cooling season (summer months)]						
20	**Percentage of recharging points and installed pre-cabling in relation to the number of parking spaces**	[%]	**Calculated automatically based on the input parameters**	**Calculated automatically based on the input parameters**	**Calculated automatically based on the input parameters**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
20.1	Total number of available parking spaces	[-]	Manually entered data based on the building permit	Manually entered data based on the existing parking situation	Manually entered data based on the construction permit	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
20.2	Number of purpose built electrical recharging spaces (Number of E-parking spaces)	[-]	Manually entered data based on the building permit	Manually entered data based on the existing parking situation	Manually entered data based on the construction permit	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
20.3	Number of pre-cabled recharging stations	[-]	Manually entered data based on the building permit	Manually entered data based on the existing parking situation	Manually entered data based on the construction permit	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
21	**Daylight Provision**	[%]	**Manually entered data based on calculation**	**Manually entered data based on calculation**	**Manually entered data based on calculation**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**NOT APPLICABLE**

3.2.3 Germany

Table 31: Data extraction for each KPI – Germany

GERMANY **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
1	**Total annual primary energy demand per useful floor area**	**[kWh/(m²yr)]**	**Manually entered data based on issued EPC**	**Manually entered data based on issued EPC**	**Manually entered data based on issued EPC**	**NOT APPLICABLE**	**Manually entered data based on issued EPC**	**NOT APPLICABLE**
1.1	Non-renewable primary energy demand per useful floor area	[kWh/(m²yr)]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE	Manually entered data based on issued EPC	NOT APPLICABLE
1.2	Renewable annual primary energy demand per useful floor area	[kWh/(m²yr)]	EUB SuperHub platform	EUB SuperHub platform	EUB SuperHub platform	NOT APPLICABLE	EUB SuperHub platform	NOT APPLICABLE
2	**Delivered annual final energy demand per useful floor area**	[kWh/(m²yr)]	**Manually entered data based on issued EPC**	**Manually entered data based on issued EPC**	**Manually entered data based on issued EPC**	**NOT APPLICABLE**	**Manually entered data based on issued EPC**	**NOT APPLICABLE**
2.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
2.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	Calculated automatically based on measured data	NOT APPLICABLE
2.2	Useful floor area	[m²]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE	Manually entered data based on issued EPC	NOT APPLICABLE
3	**Non-renewable primary energy demand per useful floor area**	**[kWh/(m²yr)]**	**Manually entered data based on issued EPC**	**Manually entered data based on issued EPC**	**Manually entered data based on issued EPC**	**NOT APPLICABLE**	**Manually entered data based on issued EPC**	**NOT APPLICABLE**
3.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
3.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	Calculated automatically based on measured data	NOT APPLICABLE

GERMANY **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
3.2	Non-renewable primary energy factor for energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[-]	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE
3.3	Useful floor area	[m^2]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE	Manually entered data based on issued EPC	NOT APPLICABLE
4	**Total use of non-renewable primary energy resources used as raw materials (PENRT)**	**[MJ]**	**EUB SuperHub platform**	**NOT APPLICABLE**	**EUB SuperHub platform**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
5	**Renewable annual primary energy demand per useful floor area**	[kWh/(m^2yr)]	**EUB SuperHub platform**	**EUB SuperHub platform**	**EUB SuperHub platform**	**NOT APPLICABLE**	**EUB SuperHub platform**	**NOT APPLICABLE**
5.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
5.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	Calculated automatically based on measured data	NOT APPLICABLE
5.2	Renewable primary energy factor for energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[-]	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE
5.3	Useful floor area	[m^2]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE	Manually entered data based on issued EPC	NOT APPLICABLE
6	**Renewable energy ratio (on-site, nearby)**	[%]	**EUB SuperHub platform**	**EUB SuperHub platform**	**EUB SuperHub platform**	**NOT APPLICABLE**	**EUB SuperHub platform**	**NOT APPLICABLE**
6.1	Renewable annual primary energy demand per useful floor area	[kWh/(m^2yr)]	EUB SuperHub platform	EUB SuperHub platform	EUB SuperHub platform	NOT APPLICABLE	EUB SuperHub platform	NOT APPLICABLE
6.1.1	Annual on-site delivered energy for energy carrier (*cr*)	[kWh/(m^2yr)]				NOT APPLICABLE		NOT APPLICABLE
6.1.2	Annual nearby delivered energy for energy carrier (*cr*)	[kWh/(m^2yr)]				NOT APPLICABLE		NOT APPLICABLE
6.1.3	Renewable primary energy factor for energy carrier (*cr*)	[-]	See Table 25: Primary energy factors in	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE

GERMANY **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
			project partner countries					
6.2	Total primary energy demand per useful internal floor area	[kWh/(m²yr)]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE	Manually entered data based on issued EPC	NOT APPLICABLE
7	**Use stage energy-related Global Warming Potential (GWP)**	**[kg CO_2 /(m²yr)]**	**Manually entered data based on issued EPC**	**Manually entered data based on issued EPC**	**Manually entered data based on issued EPC**	**NOT APPLICABLE**	**Manually entered data based on issued EPC**	**NOT APPLICABLE**
7.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
7.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	Calculated automatically based on measured data	NOT APPLICABLE
7.2	CO_2 emission factor for energy carrier (*cr*)	[-]	Table 26: The latest CO2 emission factors in project partner countries	Table 26: The latest CO2 emission factors in project partner countries	Table 26: The latest CO2 emission factors in project partner countries	NOT APPLICABLE	Table 26: The latest CO2 emission factors in project partner countries	NOT APPLICABLE
7.3	Useful floor area	[m²]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE	Manually entered data based on issued EPC	NOT APPLICABLE
8	**Life Cycle Global Warming Potential (GWP)**	[kg CO_2/m²]	**1. File from software for LCA calculation 2. Manually entered data**	**–**	**1. File from software for LCA calculation 2. Manually entered data**	**NOT APPLICABLE**	**1. File from software for LCA calculation 2. Manually entered data**	**NOT APPLICABLE**
9	**Time outside of thermal comfort range**	[% of time in which the indoor temperature is out of a range of 18°C to 27°C during the heating and cooling seasons with and without	**Manually entered data based on calculation**	**Manually entered data based on calculation**	**Manually entered data based on calculation**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**

GERMANY **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
		building services]						
10	**Ventilation rate**	[L/s]	**Manually entered data**	**Manually entered data**	**Manually entered data**	**NOT APPLICABLE**	**Manually entered data**	**NOT APPLICABLE**
11	**CO_2 concentration**	[ppm]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Report of indoor air measurement**	**NOT APPLICABLE**
12	**Relative humidity**	[%]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	–	**Manually entered data**	–
13	**Total VOCs (Volatile Organic Compounds)**	[µg/m³]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Report of indoor air measurement**	–	**Report of indoor air measurement**
14	**CMR VOCs concentration (Carcinogenic, Mutagenic, Reprotoxic volatile organic compounds)**	[µg/m³]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Report of indoor air measurement**	–	**Report of indoor air measurement**
15	**R value**	Decimal ratio	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Report of indoor air measurement**	**Manually entered data**	**Report of indoor air measurement**
16	**Formaldehyde concentration**	[µg/m³]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Report of indoor air measurement**	**Manually entered data**	**Report of indoor air measurement**
17	**Operational Energy Costs**	**[€/(m²yr)]**	**Calculated automatically based on the CALCULATED delivered energy**	**Calculated automatically based on the CALCULATED delivered energy**	**Calculated automatically based on the CALCULATED delivered energy**	**NOT APPLICABLE**	**Calculated automatically based on the MEASURED delivered energy**	**NOT APPLICABLE**
17.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
17.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	Calculated automatically based on measured data	NOT APPLICABLE
17.2	Energy price with VAT included for each energy carrier (*cr*) (e.g., electricity, natural gas, district heating system…)	[€/kWh]	Latest energy price	Latest energy price	Latest energy price	NOT APPLICABLE	Latest energy price	NOT APPLICABLE
17.3	Useful floor area	[m²]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE	Manually entered data based on issued EPC	NOT APPLICABLE
18	**Smart Readiness Indicator (SRI)**	**[%]**	**Calculated using SRI**	**Calculated using SRI**	**Calculated using SRI assessment package-v4_4**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**

GERMANY **KPI** / Input parameter name		Unit	**CALCULATED METHOD**			**MEASURED METHOD**		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
			assessment package-v4_4	**assessment package-v4_4**				
19	**Summer thermal discomfort in 2030 and 2050**	[% of time in which the indoor temperature exceeds 27 °C during the cooling season (summer months)]	**Manually entered data**	**Manually entered data**	**Manually entered data**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
20	**Percentage of recharging points and installed pre-cabling in relation to the number of parking spaces**	[%]	**Calculated automatically based on the input parameters**	**Calculated automatically based on the input parameters**	**Calculated automatically based on the input parameters**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
20.1	Total number of available parking spaces	[-]	Manually entered data based on the building permit	Manually entered data based on the existing parking situation	Manually entered data based on the construction permit	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
20.2	Number of purpose built electrical recharging spaces (Number of E-parking spaces)	[-]	Manually entered data based on the building permit	Manually entered data based on the existing parking situation	Manually entered data based on the construction permit	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
20.3	Number of pre-cabled recharging stations	[-]	Manually entered data based on the building permit	Manually entered data based on the existing parking situation	Manually entered data based on the construction permit	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
21	**Daylight Provision**	[%]	**–**	**–**	**–**	**NOT APPLICABLE**	**–**	**NOT APPLICABLE**

3.2.4 Hungary

Table 32: Data extraction for each KPI – Hungary

HUNGARY **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
1	**Total annual primary energy demand per useful floor area**	**[kWh/(m²yr)]**	**–[16]**	**–[16]**	**–[16]**	**NOT APPLICABLE**	**–[16]**	**NOT APPLICABLE**
1.1	Non-renewable primary energy demand per useful floor area	[kWh/(m²yr)]	EPC database	EPC database	EPC database	NOT APPLICABLE	–	NOT APPLICABLE
1.2	Renewable annual primary energy demand per useful floor area	[kWh/(m²yr)]	–[16]	–[16]	–[16]	NOT APPLICABLE	–[16]	NOT APPLICABLE
2	**Delivered annual final energy demand per useful floor area**	[kWh/(m²yr)]	**EPC database**	**EPC database**	**EPC database**	**NOT APPLICABLE**		**NOT APPLICABLE**
2.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Files from software for EPB calculation	Files from software for EPB calculation	Files from software for EPB calculation	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
2.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	–	NOT APPLICABLE
2.2	Useful floor area	[m²]	EPC database	EPC database	EPC database	NOT APPLICABLE	EPC database	NOT APPLICABLE
3	**Non-renewable primary energy demand per useful floor area**	**[kWh/(m²yr)]**	**EPC database**	**EPC database**	**EPC database**	**NOT APPLICABLE**	**–**	**NOT APPLICABLE**
3.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Files from software for EPB calculation	Files from software for EPB calculation	Files from software for EPB calculation	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
3.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	–	NOT APPLICABLE
3.2	Non-renewable primary energy factor for energy carrier (*cr*) (e.g., electricity, natural gas, …)	[-]	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE
3.3	Useful floor area	[m²]	EPC database	EPC database	EPC database	NOT APPLICABLE	EPC database	NOT APPLICABLE

[16] Value is not available because renewable primary energy factors are still not in use in Hungary.

HUNGARY **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
4	**Total use of non-renewable primary energy resources used as raw materials (PENRT)**	**[MJ]**	**–**	**NOT APPLICABLE**	**–**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
5	**Renewable annual primary energy demand per useful floor area**	[kWh/(m²yr)]	**–[16]**	**–[16]**	**–[16]**	**NOT APPLICABLE**	**–[16]**	**NOT APPLICABLE**
5.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Files from software for EPB calculation	Files from software for EPB calculation	Files from software for EPB calculation	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
5.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	–	NOT APPLICABLE
5.2	Renewable primary energy factor for energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[-]	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE
5.3	Useful floor area	[m²]	EPC database	EPC database	EPC database	NOT APPLICABLE	EPC database	NOT APPLICABLE
6	**Renewable energy ratio (on-site, nearby)**	[%]	**–[16]**	**–[16]**	**–[16]**	**NOT APPLICABLE**	**–[16]**	**NOT APPLICABLE**
6.1	Renewable annual primary energy demand per useful floor area	[kWh/(m²yr)]	–[16]	–[16]	–[16]	NOT APPLICABLE	–[16]	NOT APPLICABLE
6.1.1	Annual on-site delivered energy for energy carrier (*cr*)	[kWh/(m²yr)]	–	–	–	NOT APPLICABLE	–	NOT APPLICABLE
6.1.2	Annual nearby delivered energy for energy carrier (*cr*)	[kWh/(m²yr)]	–	–	–	NOT APPLICABLE	–	NOT APPLICABLE
6.1.3	Renewable primary energy factor for energy carrier (*cr*)	[-]	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE
6.2	Total primary energy demand per useful internal floor area	[kWh/(m²yr)]	–[16]	–[16]	–[16]	NOT APPLICABLE	–[16]	NOT APPLICABLE
7	**Use stage energy-related Global Warming Potential (GWP)**	**[kg CO_2 /(m²yr)]**	**EPC database**	**EPC database**	**EPC database**	**NOT APPLICABLE**		**NOT APPLICABLE**
7.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Files from software for EPB calculation	Files from software for EPB calculation	Files from software for EPB calculation	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
7.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	–	NOT APPLICABLE

HUNGARY **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
7.2	CO_2 emission factor for energy carrier (*cr*)	[-]	Table 26: The latest CO2 emission factors in project partner countries	Table 26: The latest CO2 emission factors in project partner countries	Table 26: The latest CO2 emission factors in project partner countries	NOT APPLICABLE	Table 26: The latest CO2 emission factors in project partner countries	NOT APPLICABLE
7.3	Useful floor area	[m^2]	EPC database	EPC database	EPC database	NOT APPLICABLE	EPC database	NOT APPLICABLE
8	**Life Cycle Global Warming Potential (GWP)**	[kg CO_2/m^2]	–	–	–	**NOT APPLICABLE**	–	**NOT APPLICABLE**
9	**Time outside of thermal comfort range**	[% of time in which the indoor temperature is out of a range of 18°C to 27°C during the heating and cooling seasons with and without building services]	–	–	–	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
10	**Ventilation rate**	[L/s]	–	–	–	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**NOT APPLICABLE**
11	**CO_2 concentration**	[ppm]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**NOT APPLICABLE**
12	**Relative humidity**	[%]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**
13	**Total VOCs (Volatile Organic Compounds)**	[µg/m^3]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**
14	**CMR VOCs concentration (Carcinogenic, Mutagenic, Reprotoxic volatile organic compounds)**	[µg/m^3]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**
15	**R value**	Decimal ratio	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**Manually entered data**	**Manually entered data based on the measurements**

HUNGARY **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
							based on the measurements	
16	**Formaldehyde concentration**	[µg/m³]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**
17	**Operational Energy Costs**	**[€/(m²yr)]**	**Calculated automatically based on the CALCULATED delivered energy**	**Calculated automatically based on the CALCULATED delivered energy**	**Calculated automatically based on the CALCULATED delivered energy**	**NOT APPLICABLE**	–	**NOT APPLICABLE**
17.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Files from software for EPB calculation	Files from software for EPB calculation	Files from software for EPB calculation	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
17.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	–	NOT APPLICABLE
17.2	Energy price with VAT included for each energy carrier (*cr*) (e.g., electricity, natural gas, district heating system…)	[€/kWh]	Latest energy price	Latest energy price	Latest energy price	NOT APPLICABLE	Latest energy price	NOT APPLICABLE
17.3	Useful floor area	[m²]	EPC database	EPC database	EPC database	NOT APPLICABLE	EPC database	NOT APPLICABLE
18	**Smart Readiness Indicator (SRI)**	**[%]**	**Calculated using SRI assessment package-v4_4**	**Calculated using SRI assessment package-v4_4**	**Calculated using SRI assessment package-v4_4**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
19	**Summer thermal discomfort in 2030 and 2050**	[% of time in which the indoor temperature exceeds 27 °C during the cooling season (summer months)]	–	–	–	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
20	**Percentage of recharging points and installed pre-cabling in relation to the number of parking spaces**	[%]	**Calculated automatically based on the input parameters**	**Calculated automatically based on the input parameters**	**Calculated automatically based on the input parameters**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
20.1	Total number of available parking spaces	[-]	Manually entered data based on the	Manually entered data based on the	Manually entered data based on the construction permit	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE

HUNGARY **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
			building permit	existing parking situation				
20.2	Number of purpose built electrical recharging spaces (Number of E-parking spaces)	[-]	Manually entered data based on the building permit	Manually entered data based on the existing parking situation	Manually entered data based on the construction permit	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
20.3	Number of pre-cabled recharging stations	[-]	Manually entered data based on the building permit	Manually entered data based on the existing parking situation	Manually entered data based on the construction permit	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
21	**Daylight Provision**	[%]	**–**	**–**	**–**	**NOT APPLICABLE**	**–**	**NOT APPLICABLE**

3.2.5 Ireland

Table 33: Data extraction for each KPI – Ireland

IRELAND **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
1	**Total annual primary energy demand per useful floor area**	**[kWh/(m²yr)]**	**Manually entered data based on issued EPC**	**Manually entered data based on issued EPC**	**Manually entered data based on issued EPC**	**NOT APPLICABLE**		**NOT APPLICABLE**
1.1	Non-renewable primary energy demand per useful floor area	[kWh/(m²yr)]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE		NOT APPLICABLE
1.2	Renewable annual primary energy demand per useful floor area	[kWh/(m²yr)]	EUB SuperHub platform	EUB SuperHub platform	EUB SuperHub platform	NOT APPLICABLE		NOT APPLICABLE
2	**Delivered annual final energy demand per useful floor area**	[kWh/(m²yr)]	**Manually entered data based on issued EPC**	**Manually entered data based on issued EPC**	**Manually entered data based on issued EPC**	**NOT APPLICABLE**		**NOT APPLICABLE**
2.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
2.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE		NOT APPLICABLE
2.2	Useful floor area	[m²]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE		NOT APPLICABLE
3	**Non-renewable primary energy demand per useful floor area**	**[kWh/(m²yr)]**				**NOT APPLICABLE**		**NOT APPLICABLE**
3.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
3.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE		NOT APPLICABLE
3.2	Non-renewable primary energy factor for energy carrier (*cr*) (e.g., electricity, natural gas, …)	[-]	See Table 25: Primary energy factors in	See Table 25: Primary energy	See Table 25: Primary energy	NOT APPLICABLE	See Table 25: Primary energy	NOT APPLICABLE

IRELAND **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
			project partner countries	factors in project partner countries	factors in project partner countries		factors in project partner countries	
3.3	Useful floor area	[m²]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE		NOT APPLICABLE
4	**Total use of non-renewable primary energy resources used as raw materials (PENRT)**	**[MJ]**	**EUB SuperHub platform**	**NOT APPLICABLE**	**EUB SuperHub platform**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
5	**Renewable annual primary energy demand per useful floor area**	[kWh/(m²yr)]	**EUB SuperHub platform**	**EUB SuperHub platform**	**EUB SuperHub platform**	**NOT APPLICABLE**		**NOT APPLICABLE**
5.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
5.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE		NOT APPLICABLE
5.2	Renewable primary energy factor for energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[-]	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE
5.3	Useful floor area	[m²]	Manually entered data based on issued EPC	Manually entered data based on issued EPC	Manually entered data based on issued EPC	NOT APPLICABLE		NOT APPLICABLE
6	**Renewable energy ratio (on-site, nearby)**	[%]	**EUB SuperHub platform**	**EUB SuperHub platform**	**EUB SuperHub platform**	**NOT APPLICABLE**		**NOT APPLICABLE**
6.1	Renewable annual primary energy demand per useful floor area	[kWh/(m²yr)]	EUB SuperHub platform	EUB SuperHub platform	EUB SuperHub platform	NOT APPLICABLE		NOT APPLICABLE
6.1.1	Annual on-site delivered energy for energy carrier (*cr*)	[kWh/(m²yr)]	Manually entered data	Manually entered data	Manually entered data	NOT APPLICABLE		NOT APPLICABLE
6.1.2	Annual nearby delivered energy for energy carrier (*cr*)	[kWh/(m²yr)]	Manually entered data	Manually entered data	Manually entered data	NOT APPLICABLE		NOT APPLICABLE
6.1.3	Renewable primary energy factor for energy carrier (*cr*)	[-]	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE
6.2	Total primary energy demand per useful internal floor area	[kWh/(m²yr)]	Manually entered data	Manually entered data	Manually entered data	NOT APPLICABLE		NOT APPLICABLE

IRELAND **KPI** / Input parameter name		Unit	**CALCULATED METHOD**			**MEASURED METHOD**		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
7	**Use stage energy-related Global Warming Potential (GWP)**	**[kg CO_2 /(m^2yr)]**	**Manually entered data**	**Manually entered data**	**Manually entered data**	**NOT APPLICABLE**	**Manually entered data**	**NOT APPLICABLE**
7.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Manually entered data	Manually entered data	Manually entered data	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
7.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	Manually entered data	NOT APPLICABLE
7.2	CO_2 emission factor for energy carrier (*cr*)	[-]	Table 26: The latest CO2 emission factors in project partner countries	Table 26: The latest CO2 emission factors in project partner countries	Table 26: The latest CO2 emission factors in project partner countries	NOT APPLICABLE	Table 26: The latest CO2 emission factors in project partner countries	NOT APPLICABLE
7.3	Useful floor area	[m^2]	Manually entered data based on EPC	Manually entered data based on EPC	Manually entered data based on EPC	NOT APPLICABLE	Manually entered data based on EPC	NOT APPLICABLE
8	**Life Cycle Global Warming Potential (GWP)**	[kg CO_2/m^2]	**Manually entered data**	**Manually entered data**	**Manually entered data**	**NOT APPLICABLE**	**Manually entered data**	**NOT APPLICABLE**
9	**Time outside of thermal comfort range**	[% of time in which the indoor temperature is out of a range of 18°C to 27°C during the heating and cooling seasons with and without building services]	**Manually entered data based on calculation**	**Manually entered data based on calculation**	**Manually entered data based on calculation**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
10	**Ventilation rate**	[L/s]	**Manually entered data**	**Manually entered data**	**Manually entered data**	**NOT APPLICABLE**	**Manually entered data**	**NOT APPLICABLE**
11	**CO_2 concentration**	[ppm]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data**	**NOT APPLICABLE**
12	**Relative humidity**	[%]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**		**Manually entered data**	
13	**Total VOCs (Volatile Organic Compounds)**	[µg/m^3]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**			
14	**CMR VOCs concentration (Carcinogenic, Mutagenic, Reprotoxic volatile organic compounds)**	[µg/m^3]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**		**Manually entered data**	

IRELAND **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
15	**R value**	Decimal ratio	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**		**Manually entered data**	
16	**Formaldehyde concentration**	[µg/m^3]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**		**Manually entered data**	
17	**Operational Energy Costs**	**[€/(m^{2}yr)]**	**Calculated automatically based on the CALCULATED delivered energy**	**Calculated automatically based on the CALCULATED delivered energy**	**Calculated automatically based on the CALCULATED delivered energy**	**NOT APPLICABLE**	**Calculated automatically based on the MEASURED delivered energy**	**NOT APPLICABLE**
17.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	Manually entered data	Manually entered data	Manually entered data	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
17.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	Manually entered data	NOT APPLICABLE
17.2	Energy price with VAT included for each energy carrier (*cr*) (e.g., electricity, natural gas, district heating system...)	[€/kWh]	Latest energy price	Latest energy price	Latest energy price	NOT APPLICABLE	Latest energy price	NOT APPLICABLE
17.3	Useful floor area	[m^2]	Manually entered data based on EPC	Manually entered data based on EPC	Manually entered data based on EPC	NOT APPLICABLE	Manually entered data based on EPC	NOT APPLICABLE
18	**Smart Readiness Indicator (SRI)**	**[%]**	**Calculated using SRI assessment package-v4_4**	**Calculated using SRI assessment package-v4_4**	**Calculated using SRI assessment package-v4_4**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
19	**Summer thermal discomfort in 2030 and 2050**	[% of time in which the indoor temperature exceeds 27 °C during the cooling season (summer months)]	**Manually entered data**	**Manually entered data**	**Manually entered data**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
20	**Percentage of recharging points and installed pre-cabling in relation to the number of parking spaces**	[%]	**Calculated automatically based on the input parameters**	**Calculated automatically based on the input parameters**	**Calculated automatically based on the input parameters**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
20.1	Total number of available parking spaces	[-]	Manually entered data based on the building permit	Manually entered data based on the existing parking situation	Manually entered data based on the construction permit	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE

IRELAND **KPI** / Input parameter name		Unit	**CALCULATED METHOD**			**MEASURED METHOD**		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
20.2	Number of purpose built electrical recharging spaces (Number of E-parking spaces)	[-]	Manually entered data based on the building permit	Manually entered data based on the existing parking situation	Manually entered data based on the construction permit	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
20.3	Number of pre-cabled recharging stations	[-]	Manually entered data based on the building permit	Manually entered data based on the existing parking situation	Manually entered data based on the construction permit	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
21	**Daylight Provision**	[%]	**Manually entered data**	**Manually entered data**	**Manually entered data**	**NOT APPLICABLE**	**Manually entered data**	**NOT APPLICABLE**

3.2.6 Italy

Table 34: Data extraction for each KPI – Italy

ITALY **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
1	**Total annual primary energy demand per useful floor area**	**[kWh/(m²yr)]**	**SIAPE database**	**SIAPE database**	**SIAPE database**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**NOT APPLICABLE**
1.1	Non-renewable primary energy demand per useful floor area	[kWh/(m²yr)]	SIAPE database	SIAPE database	SIAPE database	NOT APPLICABLE	Manually entered data based on the measurements	NOT APPLICABLE
1.2	Renewable annual primary energy demand per useful floor area	[kWh/(m²yr)]	SIAPE database	SIAPE database	SIAPE database	NOT APPLICABLE	Manually entered data based on the measurements	NOT APPLICABLE
2	**Delivered annual final energy demand per useful floor area**	[kWh/(m²yr)]	**SIAPE database**	**SIAPE database**	**SIAPE database**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**NOT APPLICABLE**
2.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	1. File from software for EPB calculation 2. Manually entered data	1. File from software for EPB calculation 2. Manually entered data	1. File from software for EPB calculation 2. Manually entered data	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
2.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	Calculated automatically based on measured data	NOT APPLICABLE
2.2	Useful floor area	[m²]	SIAPE database	SIAPE database	SIAPE database	NOT APPLICABLE	SIAPE database	NOT APPLICABLE
3	**Non-renewable primary energy demand per useful floor area**	**[kWh/(m²yr)]**	**SIAPE database**	**SIAPE database**	**SIAPE database**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**NOT APPLICABLE**
3.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	1. File from software for EPB calculation 2. Manually entered data	1. File from software for EPB calculation 2. Manually entered data	1. File from software for EPB calculation 2. Manually entered data	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE

ITALY **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
3.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	Calculated automatically based on measured data	NOT APPLICABLE
3.2	Non-renewable primary energy factor for energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[-]	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE
3.3	Useful floor area	[m^2]	SIAPE database	SIAPE database	SIAPE database	NOT APPLICABLE	SIAPE database	NOT APPLICABLE
4	**Total use of non-renewable primary energy resources used as raw materials (PENRT)**	**[MJ]**	**SIAPE database**	**NOT APPLICABLE**	**SIAPE database**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
5	**Renewable annual primary energy demand per useful floor area**	[kWh/(m^2yr)]	**SIAPE database**	**SIAPE database**	**SIAPE database**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**NOT APPLICABLE**
5.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	1. File from software for EPB calculation 2. Manually entered data	1. File from software for EPB calculation 2. Manually entered data	1. File from software for EPB calculation 2. Manually entered data	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
5.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	Calculated automatically based on measured data	NOT APPLICABLE
5.2	Renewable primary energy factor for energy carrier (*cr*) (e.g., electricity, natural gas, ...)	[-]	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE
5.3	Useful floor area	[m^2]	SIAPE database	SIAPE database	SIAPE database	NOT APPLICABLE	SIAPE database	NOT APPLICABLE
6	**Renewable energy ratio (on-site, nearby)**	[%]	**SIAPE database**	**SIAPE database**	**SIAPE database**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**NOT APPLICABLE**
6.1	Renewable annual primary energy demand per useful floor area	[kWh/(m^2yr)]				NOT APPLICABLE		NOT APPLICABLE
6.1.1	Annual on-site delivered energy for energy carrier (*cr*)	[kWh/(m^2yr)]				NOT APPLICABLE		NOT APPLICABLE

ITALY **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
6.1.2	Annual nearby delivered energy for energy carrier (*cr*)	[kWh/(m²yr)]				NOT APPLICABLE		NOT APPLICABLE
6.1.3	Renewable primary energy factor for energy carrier (*cr*)	[-]	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE	See Table 25: Primary energy factors in project partner countries	NOT APPLICABLE
6.2	Total primary energy demand per useful internal floor area	[kWh/(m²yr)]	SIAPE database	SIAPE database	SIAPE database	NOT APPLICABLE	Manually entered data based on the measurements	NOT APPLICABLE
7	**Use stage energy-related Global Warming Potential (GWP)**	**[kg CO_2 /(m²yr)]**	**SIAPE database**	**SIAPE database**	**SIAPE database**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**NOT APPLICABLE**
7.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	1. File from software for EPB calculation 2. Manually entered data	1. File from software for EPB calculation 2. Manually entered data	1. File from software for EPB calculation 2. Manually entered data	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
7.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	Calculated automatically based on measured data	NOT APPLICABLE
7.2	CO_2 emission factor for energy carrier (*cr*)	[-]	Table 26: The latest CO2 emission factors in project partner countries	Table 26: The latest CO2 emission factors in project partner countries	Table 26: The latest CO2 emission factors in project partner countries	NOT APPLICABLE	Table 26: The latest CO2 emission factors in project partner countries	NOT APPLICABLE
7.3	Useful floor area	[m²]	SIAPE database	SIAPE database	SIAPE database	NOT APPLICABLE	SIAPE database	NOT APPLICABLE
8	**Life Cycle Global Warming Potential (GWP)**	[kg CO_2/m²]	**SIAPE database**	**SIAPE database**	**SIAPE database**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**NOT APPLICABLE**
9	**Time outside of thermal comfort range**	[% of time in which the indoor temperature is out of a range of 18°C to 27°C during the heating and	**1. File from software for EPB calculation** (TERMOLOG or similar) **2. Manually entered data**	**1. File from software for EPB calculation** (TERMOLOG or similar) **2. Manually entered data**	**1. File from software for EPB calculation** (TERMOLOG or similar) **2. Manually entered data**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**

ITALY **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
		cooling seasons with and without building services]						
10	**Ventilation rate**	[L/s]	**1. File from software for EPB calculation** (TERMOLOG or similar) **2. Manually entered data**	**1. File from software for EPB calculation** (TERMOLOG or similar) **2. Manually entered data**	**1. File from software for EPB calculation** (TERMOLOG or similar) **2. Manually entered data**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**NOT APPLICABLE**
11	**CO_2 concentration**	[ppm]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**NOT APPLICABLE**
12	**Relative humidity**	[%]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**
13	**Total VOCs (Volatile Organic Compounds)**	[µg/m³]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**
14	**CMR VOCs concentration (Carcinogenic, Mutagenic, Reprotoxic volatile organic compounds)**	[µg/m³]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**
15	**R value**	Decimal ratio	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**
16	**Formaldehyde concentration**	[µg/m³]	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**	**Manually entered data based on the measurements**
17	**Operational Energy Costs**	**[€/(m²yr)]**	**Calculated automatically based on the CALCULATED delivered energy**	**Calculated automatically based on the CALCULATED delivered energy**	**Calculated automatically based on the CALCULATED delivered energy**	**NOT APPLICABLE**	**Calculated automatically based on the MEASURED delivered energy**	**NOT APPLICABLE**
17.1a	Calculated annual delivered energy used for EPB services for each energy carrier (*cr*)	[kWh/yr)]	1. File from software for	1. File from software for EPB calculation	1. File from software for EPB calculation	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE

ITALY **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
			EPB calculation 2. Manually entered data	2. Manually entered data	2. Manually entered data			
17.1b	Measured annual delivered final energy demand for each energy carrier (*cr*) (e.g., electricity, natural gas, …)	[kWh/yr)]	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	Calculated automatically based on measured data	NOT APPLICABLE
17.2	Energy price with VAT included for each energy carrier (*cr*) (e.g., electricity, natural gas, district heating system…)	[€/kWh]	Latest energy price	Latest energy price	Latest energy price	NOT APPLICABLE	Latest energy price	NOT APPLICABLE
17.3	Useful floor area	[m^2]	SIAPE database	SIAPE database	SIAPE database	NOT APPLICABLE	SIAPE database	NOT APPLICABLE
18	**Smart Readiness Indicator (SRI)**	**[%]**	**Calculated using SRI assessment package-v4_4**	**Calculated using SRI assessment package-v4_4**	**Calculated using SRI assessment package-v4_4**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
19	**Summer thermal discomfort in 2030 and 2050**	[% of time in which the indoor temperature exceeds 27 °C during the cooling season (summer months)]	–	–	–	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
20	**Percentage of recharging points and installed pre-cabling in relation to the number of parking spaces**	[%]	**Calculated automatically based on the input parameters**	**Calculated automatically based on the input parameters**	**Calculated automatically based on the input parameters**	**NOT APPLICABLE**	**NOT APPLICABLE**	**NOT APPLICABLE**
20.1	Total number of available parking spaces	[-]	Manually entered data based on the building permit	Manually entered data based on the existing parking situation	Manually entered data based on the construction permit	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
20.2	Number of purpose built electrical recharging spaces (Number of E-parking spaces)	[-]	Manually entered data based on the building permit	Manually entered data based on the existing parking situation	Manually entered data based on the construction permit	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
20.3	Number of pre-cabled recharging stations	[-]	Manually entered data based on the building permit	Manually entered data based on the existing parking situation	Manually entered data based on the construction permit	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE

ITALY **KPI** / Input parameter name		Unit	CALCULATED METHOD			MEASURED METHOD		
			New building 'as built'	Existing building in the use phase	Existing building after major renovation	New building 'as built'	Existing building in the use phase	Existing building after major renovation
21	**Daylight Provision**	[%]	**1. File from software for EPB calculation** (TERMOLOG or similar) **2. Manually entered data**	**1. File from software for EPB calculation** (TERMOLOG or similar) **2. Manually entered data**	**1. File from software for EPB calculation** (TERMOLOG or similar) **2. Manually entered data**	**NOT APPLICABLE**	**Manually entered data based on the measurements**	**NOT APPLICABLE**

3.3 Elaboration of mechanisms for the integration of data originating from EPC databases

There are five key elements needed for the correct operation of the EUB SuperHub platform to ensure the reliability and trust in EPC scores and the passport assessment values:

1. Data availability,
2. Data accessibility,
3. Data quality,
4. Data interoperability,
5. Data transparency.

There is a massive world of available data that needs to be turn into accessible data. Not all available data are accessible due to different reasons (e.g., host server failure, data quality, storage failure, slow data transfers, data compatibility)

Data availability is the process of ensuring that data is available to end-users and applications, when and where they need it.

Data accessibility is a key component that defines the degree or extent to which data is readily usable along with the necessary IT and management procedures, tools, and technologies required to enable, manage and continue to make data available.

Data quality - Data that is redundant, inconsistent, or incomplete can be useless to IT operations. Outdated data can become unusable.

Interoperability is the real-time data exchange between different systems (databases) that speak directly to one another in the same language, instantly interpreting incoming data and presenting it as it was received while preserving its original context. A software intermediary that allows the communication between two different databases is called **Application Programming Interface (API)**. To be able to communicate, those two different databases need to work with compatible data interchange formats (e.g., XML, CSV).

Task 3.3. (*Third-party software connections via API*) deals with the definition and development of Application Programming Interfaces (APIs) to be able to make connection of elaborated EUB SuperHub platform with different databases (national EPC databases, GIS, etc.).

Data transparency means utilizing data with integrity so that individuals know what data is being collected, who has access to it, and how they're able to interact with it.

The elaborated EUB SuperHub digital building logbook, acting as the digital container containing all building-related data, needs to be a dynamic tool automatically updated that allows a variety of data, information, and documents to be recorded, accessed, enriched, and organised under eight main categories.

The main advantage of a DBL architecture based on APIs is, that DBL is being permanently updated as long as the data sources are updated too.

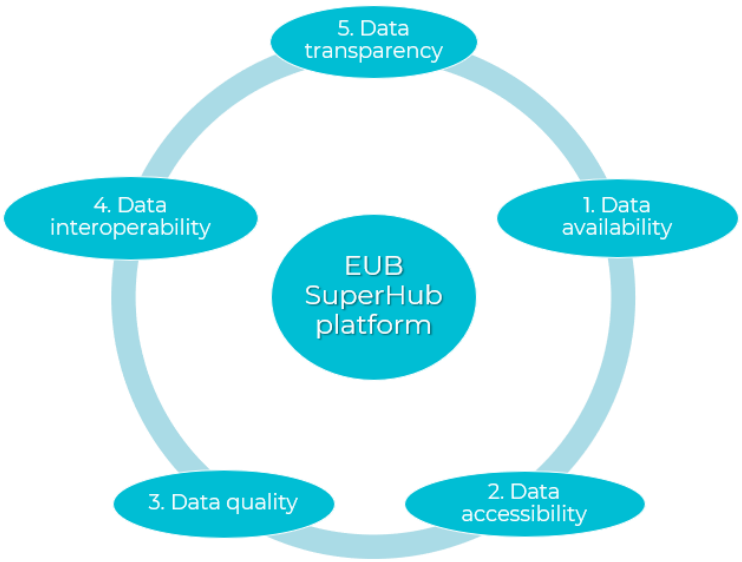


Figure 65: Five key elements needed for the correct operation of the EUB SuperHub platform

When it comes to data storage within the elaborated DBL, there are three main approaches [3]:

- DBL as a database which physically stores all the information related to the building,
- DBL as a digital gateway to which data and information can be linked via a unique building ID,
- Hybrid versions, which are a combination of the above two approaches.

The EUB SuperHub team decided to follow the last so-called **hybrid approach**. The elaborated EUB SuperHub DBL will act as a gateway linked to existing national databases using APIs, whenever it is possible (whenever national databases contain interoperable data). The interoperability of existing national databases needs to be checked. If it is not possible to find an interoperable data source for some data entry fields within the DBL, the information will be manually entered by DBL authors and physically stored in the DBL. For example, building owners will provide specific data and documentation that will be manually entered and uploaded.

It is noteworthy that approach used depends largely on the availability of data sources in each project partner country involved in this project.

For the elaborated EUB SuperHub digital building logbook data structure, national/regional EPC databases could constitute important data sources for the DBL.

All project partner countries have national EPC databases in place, except Austria and Italy.

Austria and Italy have regional EPC databases in place, meaning that each region has its own regional EPC database. Austria has in total nine provinces (Länder). One Austrian project partner EIV (Energie Institut Vorarlberg) is coming from Vorarlberg. Italy has in total 20 regions. Three Italian project partners are coming from Piedmont Region (iiSBE Italia), Lombardy Region (UNI) and Calabria Region (Calabria Regione). In case of Italy there is also in place a national EPC database named SIAPE (Information System on Energy Performance Certificates,

https://siape.enea.it/) for the collection of the Energy Performance Certificates of buildings and property units.

Table 35 provides national and regional EPC database overview for project partner countries involved in this project.

Table 35: National and regional EPC database overview

Project partner country	EPC database existence (Yes/No)	Regional / National / Regional and national	National EPC database name in English language	National EPC database name in original language	National EPC database ownership	Region name	Regional EPC database name in English language	Regional EPC database name in original language	Regional EPC database ownership	Publicly accessible (Yes/No/ Partly)
Austria	Yes	Regional and national	Energy Performance Certificate Database (EPCDB)	Energieausweis-datenbank (EADB)	Statistics Austria	Burgenland	ZEUS	n/a	n/a	n/a
						Carinthia	ZEUS	n/a	n/a	n/a
						Lower Austria	ZEUS	n/a	n/a	n/a
						Upper Austria	n/a	n/a	n/a	n/a
						Salzburg	ZEUS	n/a	n/a	n/a
						Styria	ZEUS - central energy certificate environment Styria	Zentrale Energieausweis Umgebung Steiermark	Energy Agency Styria	n/a
						Tyrol	n/a	n/a	n/a	n/a
						Vorarlberg	EAWZ [17] - Energy certificate centre	Energieausweis-Zentrale Vorarlberg	Country Vorarlberg	Partly
						Vienna	WUKSEA[18]	WUKSEA – Wiener Unabhängiges Kontrollsystem für Energieausweise	Stadt Wien	Partly
Croatia	Yes	National	Energy Performance Certificate (EPC) Information System	Informacijski sustav Energetskih Certifikata (IEC)	Ministry of Physical Planning, Construction and State Assets	–	–	–	–	Partly
Germany	Yes	National	GEG-registration centre	GEG-Registrierstelle	German Institute for Building Technology	–	–	–	–	No
Hungary	Yes	National	Energy Performance Certificate (EPC) Information System	e-tanúsítás	Ministry of Construction and Investment	–	–	–	–	–
Ireland	Yes	National	EPC database	EPC database	Sustainable Energy Authority of Ireland (SEAI)	–	–	–	–	No

[17] https://www.eawz.at/
[18] https://www.wien.gv.at/wukseagis/public/

Project partner country	EPC database existence (Yes/No)	Regional / National / Regional and national	National EPC database name in English language	National EPC database name in original language	National EPC database ownership	Region name	Regional EPC database name in English language	Regional EPC database name in original language	Regional EPC database ownership	Publicly accessible (Yes/No/ Partly)
Italy	Yes	Regional and national	SIAPE - Information System on Energy Performance Certificates	*SIAPE - Sistema Informativo sugli Attestati di Prestazione Energetica*	ENEA National Agency for New Technologies, Energy and Sustainable Economic Development	Piedmont (Turin)	SIPEE - Building Energy Performance Information System[19]	Sistema Informativo per la Prestazione Energetica degli Edifici (SIPEE)	Piedmont Region (IT)	Partly. The section related to the list of EPC certifiers is freely available. The access to the content of the EPCs is reserved for certifiers.
						Lombardy (Milan)	CENED- Energy Certification for Buildings[20]	Certificazione ENergetica degli EDifici	Lombardy Region (IT)	Partly
						Calabria (Catanzaro)	APE Calabria[21]	Sistema Informativo APE Calabria	Calabria Region (IT)	Partly

19 https://servizi.regione.piemonte.it/catalogo/sistema-informativo-per-prestazione-energetica-degli-edifici-sipee
20 https://www.cened.it/home
21 https://www.apecalabria.enea.it/

3.3.1 Austria

Given the nine Austrian provinces (Länder), the implementation of building regulations in Austria is under the jurisdiction of the provinces. The Austrian Institute of Construction Engineering (OiB - Österreichisches Institut für Bautechnik) was assigned to manage the harmonising process of the implementation of the EPBD in the provinces in 2006. The outcome is the OIB Guideline 6 – OIB-RICHTLINIE 6 (Energy conservation and thermal protection – Energieeinsparung und Wärmeschutz, April 2019, https://www.oib.or.at/sites/default/files/richtlinie_6_12.04.19_1.pdf), whose contents, defining the requirements for energy efficiency of buildings, are implemented in each respective province's building regulations. The format and content of an EPC (Energieausweis – EA) is defined by the OIB Guideline 6.

In Vorarlberg, authorized natural or legal persons are using web-based application named Energieausweis-Zentrale Vorarlberg (**EAWZ**, https://www.eawz.at/) to generate legally valid energy certificates (as PDF files) for Vorarlberg. In addition, the EAWZ enables a wide variety of interested parties to obtain information about energy certificates and related topics.

An online database named ZEUS (in German „Zentrale Energieausweis Umgebung Steiermark", https://www.energieausweise.net/) has been used for the organisation and management of energy performance certificates according to the EPBD directive in the following five of nine Austrian provinces:

- Burgenland (Land Burgenland),
- Carinthia (Land Kärnten),
- Lower Austria (Niederösterreich),
- Salzburg (Land Salzburg),
- Styria (das Land Steiermark).

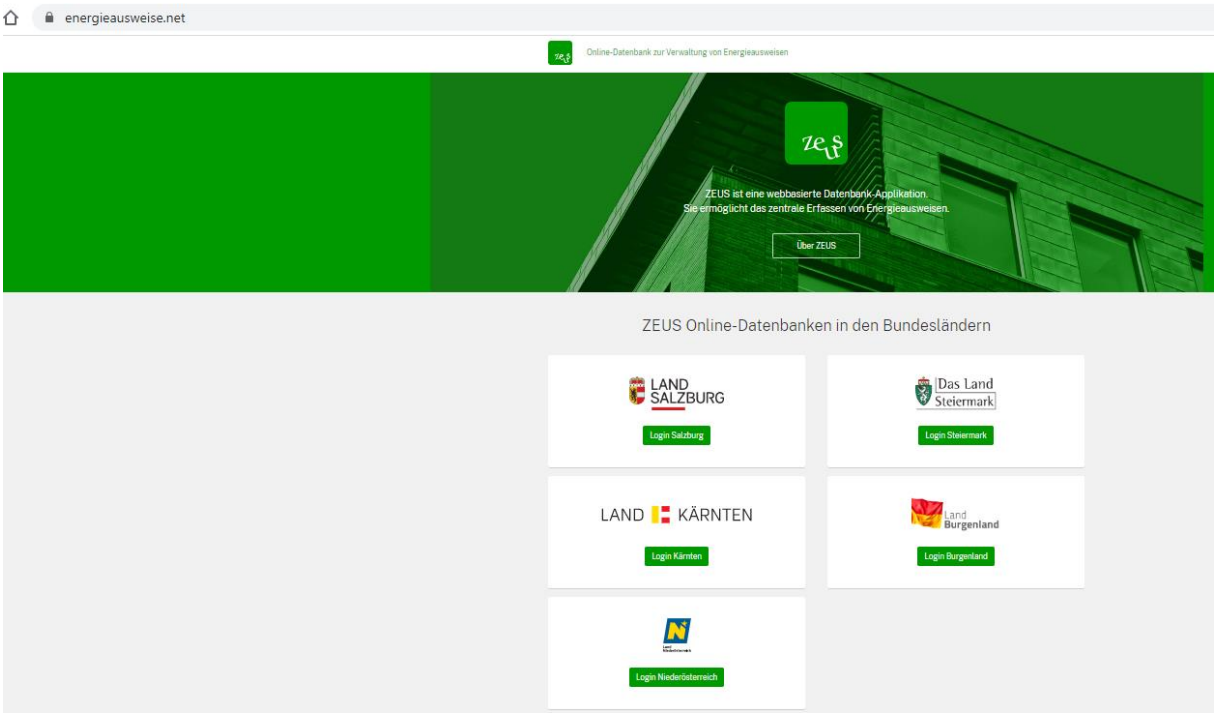


Figure 66: Online EPC database ZEUS home page

The database ZEUS stores and administrates the energy certificates and the calculation files, is able to interchange data with the central buildings and apartment register of "Statistik Austria" enables federal authorities and funding agencies to access necessary energy certificates, if needed for building permissions, funding administration, etc., and provides the possibility of creating statistical evaluations.

Statistics Austria set up a separate **central Energy Performance Certificate Database** in Austria (Energieausweis-datenbank – EADB) as part of the Buildings and Dwellings Register for the electronic registration of energy performance certificates. It is up to the federal provinces to decide whether the registration by the issuers of energy performance certificates has to be carried out directly in the central energy performance certificate database (EADB) or in a separate federal province database. If the regulations of the federals states require a registration and data recording to the federal province database, it must be ensured that this information is also transmitted to the central energy performance certificate database. The data stored in the EADB can be used for statistical purposes as well as for evaluations relevant to environmental or energy policy. They thereby make a considerable contribution to the evaluation of energy sustainability and climate protection. To use the EADB, it is necessary to have a role and access rights.

3.3.2 Italy

There are 20 regions in Italy, plus two independent city-states, San Marino and the Vatican, that remain independent. Each region in Italy has its own regional EPC database. Since 2015 a national database (interoperable with the regional ones) has been set up, called SIAPE (Information System on Energy Performance Certificates, https://siape.enea.it/) for the collection of the Energy Performance Certificates of buildings and property units. Data from three regions (Sardinia, Campania and Basilicata) are still not interoperable with SIAPE and the database for Tuscany Region is in update.

Within the SIAPE database, updated on 31 January 2022, there are 2.915.669 EPCs stored.

APE (Attestato di Prestazione Energetica = Energy Performance Certificate) is an Italian EPC.

Figure 67: National EPC database in Italy named SIAPE

Given the three project partners come from three different regions in Italy and due to the use of different sources in each region of Italy, the focus will be given to the following regions in Italy: Piedmont (capital city Turin), Lombardy (capital city Milan) and Calabria (capital city Catanzaro). Piedmont and Lombardy are located in the north of Italy, whereas Calabria is located in the south of Italy. Since, the two most involved partners from Italy, based on the person months distribution within the grant agreement, are iiSBE Italia from Piedmont region and Calabria Regione from Calabria region, all case studies within Task 5.3 (*Implementation of the case studies across the EU*) will be selected within Piedmont and Calabria region.

The screenshots of the three aforementioned regional EPC databases are given below to compare them in number, typology and performance of the EPCs results such as:

- Indice di Prestazione Energetica Globale non rinnovabile $EP_{gl,nren}$ medio – average annual non-renewable global energy performance index [kWh/(m^2yr)],

- Indice di Prestazione Energetica Globale rinnovabile $EP_{gl,ren}$ medio – average annual renewable global energy performance index [kWh/(m^2yr)],
- Emissioni di CO_2 medie – average annual CO_2 emission [kg CO_2/(m^2yr)].

On those screenshots the building use (DESTINAZIONE D'USO) is also visible. EPCs in Italy are issued mainly for residential buildings (Residenziale).

Figure 68: Regional EPC database for Piedmont region in Italy named SIPEE

Figure 69: Regional EPC database for Lombardy Region in Italy named CENED

Figure 70: Regional EPC database for Calabria Region in Italy named APE Calabria

3.4 Interaction between the gathered data values and the digital building logbook

Considering that the focus of this deliverable is on the elaboration of the EUB SuperHub digital building logbook data structure, the interaction between the gathered data values and the digital building logbook will be investigated in detail in WP 3 (*EUB SuperHub tools development*) in the following two tasks:

- Task 3.1 Plan of the business logic of the tool taking into consideration ICT standards and GDPR issues,
- Task 3.3 Third party software connections via API.

4 Interaction of the digital building logbook with the PVT and VM module

D2.3 (*The EUB SuperHub Platform modules: Features and functions*), already submitted in November 2022, outlined the functions and features of the EUB SuperHub platform main modules: E-passport cockpit (E-cockpit), Planning and Verification Tool (PVT) module, the Virtual Marketplace (VM) and the E-training module.

The E-cockpit module will allow the user to view key information about the existing building stock and related certificates (EPC, EUB SuperHub certificate, sustainability certificates, SRI, etc.) and make district building analysis, whereas the PVT module will enable building owners to upload, share and store all building-related information. The building information presented in the E-cockpit will originate from the PVT module. The VM module will facilitate the match making connection between the building users, auditors, solution, funding providers as well as other market actors and service providers. The E-training module, as an independent part of the EUB SuperHub platform, will provide training material for the platform users on how to use the EUB SuperHub platform and provide the new generation of energy, sustainability, smart solution experts and assessors with a set of advanced learning and training materials relevant for their field of expertise.

The EUB SuperHub digital building logbook data structure, elaborated within this Task 2.4 (*The digital logbook: data requirements, sources, and collection process*), represents one very important layer within Planning and Verification Tool (PVT) module containing all building-related data. Users will be able to perform what-if simulations within the PVT module to evaluate possible technology neutral interventions and retrofitting options, using data stored within the digital building logbook.

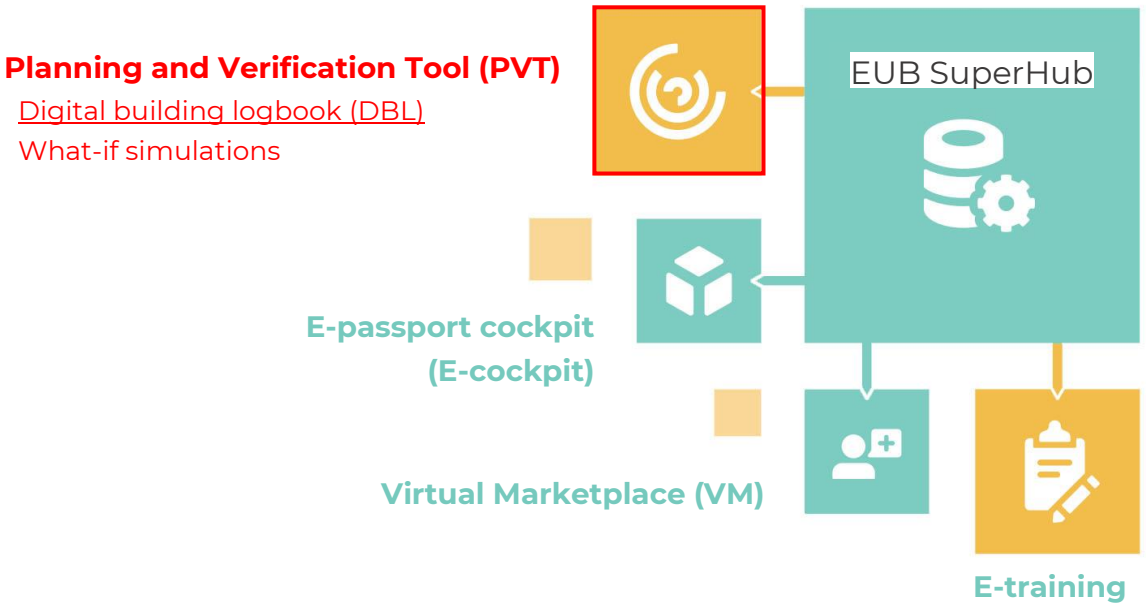


Figure 71: The EUB SuperHub platform containing four modules

The PVT module can be launched from the E-cockpit module only by clicking on the PVT launch icon or by clicking on the edit button after selecting a building in the E-cockpit (see D2.3, chapter 6.1 Function 8: Launch the PVT).

There are in total 22 functions within the PVT module in detail described within D2.3. The following functions refer to digital building logbook (DBL):

Function 13: Building simple data entry

Function 16: Digital Building Logbook (DBL)

Function 17: Verify the Building Logbook

Function 22: Logbook attributes

Function 13 (Building simple data entry) can be used to populate the building logbook with basic information about the building (see D2.3, chapter 6.6 Function 13).

Through Function 16 (Digital Building Logbook), the user can launch the building logbook to edit, update, save or recover the building logbook.

Through Function 17 (Verify the Building Logbook), an auditor can verify the data entered in the building logbook.

Using Function 22 (Logbook attributes), the users will be able to view and search for each entry in the digital building logbook (DBL) in the following categories, elaborated in detail within this deliverable, as long as they have the appropriate access rights:

1. ADMINISTRATIVE INFORMATION
2. GENERAL BUILDING INFORMATION
3. BUILDING ELEMENT INFORMATION
4. BUILDING OPERATION AND USE
5. BUILDING PERFORMANCE
6. SMART READINESS
7. FINANCE
8. BUILDING DOCUMENTATION BIM

The digital building logbook data and the issued certificate can be shared via the PVT platform with service providers in GDPR compliant environment via the Virtual Marketplace (VM) to find energy assessors or consultants, or other service providers.

The elaborated EUB SuperHub platform, containing Digital Building Logbook, will be tested on case studies (*Task 5.3 Implementation of the case studies across the EU*). The main goal of Task 5.3 will be to implement in total of 100 case studies across seven project partner countries involved in this project.

5 Final remarks

Within this Task 2.4 (*The digital logbook: data requirements, sources, and collection process*), the EUB SuperHub team elaborated the EUB SuperHub digital building logbook data structure considering:

- already existing DBL data structures developed within EU projects (iBRoad, ALDREN, X-tendo),
- all the suggestions within the Study on the Development of an EU Framework for Buildings' Digital Logbook (Report 1, Report 2, FINAL REPORT) published by the European Commission in 2020,
- requirements within grant agreement number 101033916,
- requirements defined within already existing EU legislation and the future ones that will be soon adopted (e.g., the proposal for the EPBD recast published in December 2021).

Although it is a common suggestion to keep the DBL data structure as simple as possible, a comprehensive digital building logbook data structure containing eight main modules has been developed within the EUB SuperHub project as a result of the considerations mentioned above.

Many valuable national building-related databases already exist across project partner countries involved in this project, which could be possible data sources for the elaborated digital building logbook. Many of those national databases are not publicly available or are just partly publicly available. Following the last paragraph within Article 19 of the 3rd proposed revision of the Energy Performance of Buildings Directive (December 2021), all national EPC databases will need to be interoperable and integrated with the digital building logbook. When adopted, the 3rd revision of the Energy Performance of Buildings Directive will pave the way to digital building logbooks. The purpose of the digital building logbook is to bring these data sources together and become a common gateway to access data.

The lack of building-related data is recognised as one of many barriers that prevent the renovation rate from growing. Also, one of many obstacles in considering energy efficiency and sustainability when performing real estate valuation is the lack of access to sufficient building-related data (see D1.4 *EPCs, sustainability certifications and buildings' green value* published in May 2022). Having digital building logbooks in place would make it possible to evaluate the correlation between EPCs and property prices.

Given that the European building sector still offers large savings potentials, the availability of reliable building-related data within the elaborated digital building logbook could contribute to an increased renovation rate of European buildings.

Introducing the concept of digital building logbooks to overcome the main challenge of a lack of access to sufficient building-related data is of utmost importance and can contribute to:

- access to information,
- information sharing within the construction sector, among building owners and occupants, financial institutions, and public authorities,
- higher renovation rate of the existing buildings – promote energy renovation by providing the necessary information,

- better informed decision-making,
- simplification of the construction process,
- improved market information and transparency,
- better management of inspections and better operation, use and maintenance of a building,
- better overview of the building stock at all levels,
- better monitor progress towards climate goals – better assessment of the progress of decarbonisation,
- more effective policy making, etc.

At the end of this deliverable, it is noteworthy to repeat the same sentence from the executive summary: "**A digital building logbook is becoming a necessity** in the era of digitalisation containing all relevant building-related data over the whole lifecycle of a building, providing different types of stakeholders with different information for different purposes at the right time. "

References

European Commission

[1] European Commission (2014). 2014/955/EU COMMISSION DECISION of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament and of the Council. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014D0955&from=EN

[2] European Commission (2018). DIRECTIVE (EU) 2018/844 *of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2017/27/EU on energy efficiency*, 30.05.2018.

[3] European Commission (2020). *DEFINITION OF THE DIGITAL BUILDING LOGBOOK – Report 1 of the Study on the development of a European Union Framework for Buildings' Digital Logbook*, July 2020.

[4] European Commission (2020). BUILDING LOGBOOK STATE OF PLAY – *Report 2 of the Study on the development of a European Union Framework for Buildings' Digital Logbook*, July 2020.

[5] European Commission (2020). *Study on the Development of a European Union Framework for Digital Building Logbooks FINAL REPORT*, December 2020.

[6] European Commission (2020). COM(2020) 662 final - *A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives*, 14.10.2020.

[7] European Commission (2021). COM(2021) 802 final – *Proposal for a Directive of the European Parliament and of the Council on the energy performance of buildings (recast)*, 15.12.2021.

[8] European Commission (2021). COM(2021) 802 final – *ANNEXES (1 to 9) to the Proposal for a Directive of the European Parliament and of the Council on the energy performance of buildings (recast)*, 15.12.2021.

[9] European Commission (2022). Digital Building Logbook – *MEETING REPORT – Announcement Webinar Digital Building Logbook Study*, June 2022. Retrieved from: https://www.ecorys.com/sites/default/files/2022-07/DBL%20-%20Meeting%20Report%20-%20Announcement%20Webinar_0.pdf

European standards

[10] EN 15232-1:2017 – Energy performance of buildings – Part 1: Impact of Building Automation, Controls and Building Management

[11] EN 13501-1: 2018 Fire classification of construction products and building elements - Part 1: Classification using test data from reaction to fire tests

[12] EN 15459-1:2017 – Energy performance of buildings - Economic evaluation procedure for energy systems in buildings)

European projects (deliverables, final reports)

[13] ALDREN (2019). D2.6 - ALDREN Methodology note on rendering of the collected data and results in a building renovation passport - Deliverable D2.6.

[14] ALDREN (2020). D2.6 update – *THE OVERALL ALDREN BRP PROTOCOL* (September 2020 update) - Deliverable D2.6.

[15] iBRoad (2018). The logbook data quest – Setting up indicators and other requirements for a renovation passport.

[16] X-TENDO (2020). D4.2 – *Technical specifications of energy performance certificates data handling: understanding the value of data* - Deliverable D4.2.

[17] X-TENDO (2021). *Exploring methodologies and concepts for the implementation of new energy performance certificates features for better data handling logbook,* June 2021.
Retrieved from:
https://x-tendo.eu/wp-content/uploads/2020/01/D4.4-Logbook.pdf

Other

[18] M. Gómez-Gil, M.M. Sesana, G. Salvalai, A. Espinosa-Fernández, B. López-Mesa, The Digital Building Logbook as a gateway linked to existing national data sources: The cases of Spain and Italy, Journal of Building Engineering (2022), doi: https://doi.org/10.1016/j.jobe.2022.105461

[19] EURELECTRIC (2015). Everything you always wanted to know about DEMAND RESPONSE (D/2015/12.105/11)
Retrieved from:
https://cdn.eurelectric.org/media/1940/demand-response-brochure-11-05-final-lr-2015-2501-0002-01-e-h-C783EC17.pdf

[20] SIEMENS (2011). Energy efficiency in building automation and control – Proven applications for heating and cooling supply

[21] Typical life expectancy of building components
https://etoolglobal.com/wp-content/uploads/2015/10/BuildingComponentLifeExpectancy.pdf

[22] Italy – Fascicolo del Fabbricato

https://www.casaeclima.com/ar_43625__fascicolo-digitale-fabbricato-pubblicato-studio-promosso-commissione-europea.html

https://www.studiomadera.it/news/79-fascicolo#:~:text=Il%20Fascicolo%20del%20fabbricato%20%C3%A8,dell'impiantistica%20e%20della%20manutenzione

http://www.sicet.it/archivio-web/documenti/urbanistica/Fascicolo_del_Fabbricato.pdf

http://www.cnpi.eu/wp-content/uploads/2017/02/Linea-Guida-Fasciolo-del-fabbricato.pdf