TRAIN4 SUSTAIN

Establishing future-oriented training and qualification quality standards for fostering a broad uptake of sustainable energy skills in the European construction sector

D2.2 The Competence Quality Standard transition to the CEN Workshop Agreement

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 894514..

Project no. 894514

Project acronym: TRAIN4SUSTAIN

Project title: Establishing future-oriented training and qualification quality standards for fostering a broad uptake of sustainable energy skills in the European construction sector

Call: LC-SC3-EE-3-2019-2020

Start date of project: 01.05.2020.

Duration: 30 months

Deliverable ID: D2.2

Due date of deliverable: 31 December 2020

Organisation name of lead contractor for this deliverable: iiSBE Italia R&D, PP3

1. table

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Dissemination level		
PU	Public	X

3. table

Document history			
Version	Date	Reason	Revised by
01	28/01/2021	Draft	Partners
02	31/01/2021	Final	Geonardo
03	31/10/2022	Updated (CWA)	iiSBE

CEN

WORKSHOP

AGREEMENT

CWA 17939

October 2022

ICS 03.100.30

English version

TRAIN4SUSTAIN Competence Quality Standard

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Foreword

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The final text of this CEN Workshop Agreement was provided to CEN for publication on 2022-10-05.

Results incorporated in this CWA received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 894514 — TRAIN4SUSTAIN — H2020-LC-SC3-2018-2019-2020 / H2020-LC-SC3-EE-2019).

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Contents Page

Introduction 5

1 Scope 6

2 Normative references 6

3 Terms and definitions 6

4 Structure of the Competence Quality Standard 9
4.1 General 9
4.2 Level 1 – Thematic Fields 10
4.3 Level 2 – Macro Areas of Expertise 10
4.4 Level 3 – Areas of Expertise 13
4.5 Level 4 – Learning Outcomes 17

5 Work Fields targeted in the TRAIN4SUSTAIN Competence Quality Standard 17
5.1 General 17
5.2 White collars 18
5.3 Blue collars 19

6 Project's stages 19

7 Reference spatial scales 20

8 Assessment of competence's levels 20

9 Mapping qualification schemes 21

10 Mapping training courses 22

11 Areas of Expertise and Learning Outcomes 22

12 Applicable Areas of Expertise in relation to Work Fields and recommended competence's levels 22

13 Competences' reporting: the European Skill Passport 22

14 Validation of competence assessment 23

Annex A (informative) Areas of Expertise and Learning Outcomes 24
A.1 Dimension: Environment 25
A.2 Dimension: Society 91
A.3 Dimension: Economy 135
A.4 Dimension: Process 148
A.4.6 Thematic field: Interdisciplinary Skills 180
A.4.7 Thematic field: Listed Buildings 187

Annex B (informative) Applicable Areas of Expertise in relation to Work Fields and recommended competence's levels 190

Annex C 207
C.1 Introduction 207
C.2 Vocabulary 207
C.3 Harmonisation of sentences wording 209
C.4 Reference fields for Learning Outcomes 211

Introduction

The construction sector is one of the main drivers of EU's economy. Despite major efforts in harmonising and standardization of qualification and training procedures across the EU, the competence level of sustainability experts and the underlying training and education contents varies significantly between the Member States. The H2020 TRAIN4SUSTAIN project fostered a common understanding of sustainable competences across Europe developing a Competence Quality Standard (CQS), on which this CWA is based, in sustainable building for facilitating transnational recognition of learning outcomes and competence levels of existing qualifications and vocational trainings. The CQS is a tool to evaluate, scoring and report in a comparable and harmonised way the level of competence, skills and knowledge of white and blue collars in sustainable building. The CQS is a tool useful to stimulate demand for competent construction sector professionals through raising acceptance of sustainability qualifications on the EU construction market. To this end, comparability of qualifications and competences is key for increased transparency and penetration power in the market, avoiding confusion and uncertainty. The TRAIN4SUSTAIN CQS intends to be a tool to facilitate the request of qualified professionals and blue collars by public administrations and private clients and to valorise with a transparent common "reporting" system the competences acquired through training courses and experience on field. The TRAIN4SUSTAIN Competence Quality Standard is built on and expands the "European Qualification Scheme and professional profile description about professions related to NZEB design, maintenance and refurbishment" delivered by the Horizon 2020 project "Prof/Trac"..

1 Scope

This document is a Competence Quality Standard addressed to white and blue collars. It provides the Learning Outcomes, expressed in terms of knowledge and skills, necessary to achieve recommended competence's levels in sustainable building. It is a tool useful to assess and report, in a common transnational format (Skill Passport), the level of competence in relation to reference Work Fields. The Competence Quality Standard can also be used to map qualification schemes and training courses and to transparently report the Learning Outcomes provided to white and blue collars. The Competence Quality Standard is useful to identify competence's gaps and to support in the selection of the most appropriate training courses to fill them. It is a tool useful for public authorities and clients to express measurable competence requirements in tenders and to select the most competent professionals. The document provides guidance about how to validate and certify the assessment of competences.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN ISO/IEC 17024:2012, *Conformity assessment – General requirements for bodies operating certification of persons*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
Competence Quality Standard (CQS)
standard to identify and describe competencies and their level with a common procedure.

3.2
European Qualification Framework (EQF)
Common European reference framework whose purpose is to make qualifications more readable and understandable across different countries and systems.

[SOURCE: COUNCIL RECOMMENDATION of 22 May 2017 (2017/C 189/03)]

3.3
qualification
Formal outcome of an assessment and validation process which is obtained when a competent authority determines that an individual has achieved learning outcomes to given standards

3.4
competence
proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development which can be applied with a certain degree of independence and responsibility.
[EQF – Council Recommendation - 2017/C 189/03]

3.5

knowledge

the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study.

[EQF – Council Recommendation - 2017/C 189/03]

3.6

skill

the ability to apply knowledge and use know-how to complete tasks and solve problems.

[EQF – Council Recommendation - 2017/C 189/03]

3.7

learning outcomes

statements regarding what a learner knows, understands and is able to do on completion of a learning process

[EQF – Council Recommendation - 2017/C 189/03]

3.8

formal learning

intentional learning that occurs in a structured environment and is provided by an educational or training body/institution accredited by an official authority; it leads to official qualifications

3.9

informal learning

learning from daily activities related to work; it is not intentionally organised or structures and occasionally it is unintentional

3.10

non formal learning

learning embedded in educational, intentional and structured activities in any area other than a formal learning environment; it does not lead to official qualifications

3.11

validation of learning outcomes

process leading to confirmation and certification that certain learning outcomes have been acquired by an individual

3.12

blue collar

a person who performs manual labour, needing strength or physical skills.

3.13

white collar

professional with a higher education degree in the build environment. Referring to the European Qualification Scheme (EQF), the Qualifications Framework of the European Higher Education Area

(EHEA) and the European Credit Transfer and Accumulation System (ECTS), white collars have one of the following qualification/education levels:

Degree	EQF	EHEA	ECTS
(Different names used in countries)	5	Short cycle	120 credits
Bachelor	6	1st cycle	180-240 credits
Master	7	2nd cycle	90-120 credits
Doctor (PhD)	8	3rd cycle	No ECTS range given

3.14

qualification scheme

organised plan defining the necessary knowledge and skills to obtain a certain qualification

4 Structure of the Competence Quality Standard

4.1 General

The TRAIN4SUSTAIN Competence Quality Standard (CQS) is a framework of Areas of Expertise organised in a hierarchic and modular structure. Each Area of Expertise correspond to a sustainability subject. The sustainability subjects addressed in the CQS have been defined in relation to relevant European standards and frameworks of sustainability indicators, namely:

- Level(s), the common EU framework of core sustainability indicators for office and residential buildings. The Level(s) common framework is based on 6 macro-objectives, which describe what the strategic priorities should be for the contribution of buildings to EU and Member State policy objectives in areas such as energy, material use and waste, water and indoor air quality
- EN 16309 – Sustainability of Construction Works – Assessment of social performance of buildings
- EN 15978 – Sustainability of Construction Works – Assessment of environmental performance of buildings
- EN 16627 – Sustainability of Construction Works – Assessment of economic performance of buildings

The structure of the CQS framework is organised in 4 modules. Each module is articulated in 4 hierarchic levels. The 4 modules are named “Dimensions”. Three of them are “vertical” and correspond to the dimensions of sustainable development as identified in the Agenda 2030 of United Nations: Environment, Society and Economy. The fourth dimension, Process, is “horizontal” and deals with the competences necessary to design, construct and operate a sustainable building. The following table describes the scope of the 4 Dimensions.

Table 1 – Scope of the CQS Dimensions

Dimension	Scope
ENVIRONMENT	to protect the planet from degradation, including through sustainable consumption and production, sustainable managing its natural resources and taking urgent action on climate change, so that it can support the needs of the present and future generations.
SOCIETY	to provide a healthy environment to all human beings.
ECONOMY	to ensure that all human beings can enjoy prosperous and fulfilling lives and that economic, social, and technological progress occurs in harmony with nature.
PROCESS	to raise the capacity of professionals in deploying and manage effective processes during the design, construction and operation of buildings targeted to maximise the performance towards the 3 sustainable development dimensions.

Each Dimension is articulated in 4 hierarchic levels. From the higher to the lower level:

- Level 1 – Thematic Fields
- Level 2 – Macro Areas of Expertise
- Level 3 – Areas of Expertise
- Level 4 – Learning Outcomes

4.2 Level 1 – Thematic Fields

Thematic Fields represent macro sustainability subjects in relation to the 4 Dimensions of the framework. They are 18, coded with 2 letters and listed in the table below.

Table 2 – Thematic Fields

Environment	
EN	Energy
WA	Water
MA	Materials
HA	Habitat
Society	
CO	Comfort and well being
SA	Safety
AC	Accessibility
MO	Mobility
SE	Services
AD	Adaptation and resilience to climate change

Economy	
EQ	Economical Quality
Process	
BD	Sustainable Building Design
ID	Innovative digital solutions
SC	Sustainable construction
MN	Maintenance and operating
BE	Built Environment Certification systems
IS	Interdisciplinary Skills
LD	Listed Buildings

4.3 Level 2 – Macro Areas of Expertise

Macro Areas of Expertise represent a particular aspect pertaining to the Thematic Fields. They are 44, coded with 2 letters and 1 number and listed in the tables below.

Table 3 – Macro Areas of Expertise in Environment

Environment	
EN	Energy
EN1	Energy Performance Assessment
EN2	Energy Management
EN3	Energy Production and HVAC systems
EN4	Energy Reduction
WA	Water
WA1	Water efficiency
WA2	Effluents management

MA	Materials
MA1	Design for Deconstruction, reuse and recycling
MA2	Sustainable materials
MA3	Solid waste
HA	Habitat
HA1	Land Use
HA2	Biodiversity

Table 4 – Macro Areas of Expertise in Society

Society	
CO	Comfort and well being
CO1	Indoor air quality
CO2	Thermal comfort
CO3	Visual comfort
CO4	Acoustic comfort
CO5	Electromagnetic pollution
CO6	Ergonomics
SA	Safety
SA1	Fire protection
SA2	Earthquake
AC	Accessibility
AC1	Barrier free accessibility
MO	Mobility
MO1	Alternative mobility
SE	Services
SE1	Communication
SE2	Services for inhabitants
AD	Adaptation and resilience to climate change
AD1	Climate change resilient buildings

Table 5 – Macro Areas of Expertise in Economy

Economy	
EQ	Economical Quality
EQ1	Cost planning and management
EQ2	Green value
EQ3	Financing schemes and business models
EQ4	Operative costs

Table 6 – Macro Areas of Expertise in Process

Process	
BD	Sustainable Building Design
BD1	Integrative design
ID	Innovative digital solutions
ID1	Building Information Modelling
ID2	Small urban Information Modelling
ID3	GIS Systems
ID4	Lean Management
ID5	Measuring
ID6	Digital Twins Solutions
SC	Sustainable construction
SC1	Sustainable construction management
MN	Maintenance and operating
MN1	Maintenance
BE	Built Environment Certification systems
BE1	Energy Performance Certification
BE2	Building sustainability certification systems
IS	Interdisciplinary Skills
IS1	Procurement
IS2	Quality assurance
IS3	Collaboration and Communication
IS4	Information management
IS5	Safety Assurance

LD	Listed Buildings
LD1	Improving energy performance of listed buildings

4.4 Level 3 – Areas of Expertise

Areas of Expertise represent the specific subjects belonging to each Macro Area of Expertise. They are 108, coded with 2 letters and 2 numbers and listed in the tables below.

Table 7 – Macro Areas of Expertise in Environment

Environment		
EN	Energy	
EN1	Energy Performance Assessment	EN1.1 Energy Simulation
EN2	Energy Management	EN2.1 Smart grid systems EN2.2 Domotic systems EN2.3 Building Management Systems EN2.4 Renewable Energy communities
EN3	Energy Production	EN3.1 Heating and cooling systems EN3.2 Ventilation systems EN3.3 Hot water systems (DHW) EN3.4 Electric heating systems EN3.5 Heat pump system and geothermal energy systems EN3.6 Solar thermal energy systems for heating, cooling and DHW EN3.7 Solar power systems for electricity generation EN3.8 Combined Heat and Power (CHP) generation EN3.9 Mini wind power generation EN3.10 Energy storage systems
EN4	Energy Reduction	EN4.1 Thermal insulation EN4.2 Building air tightness EN4.3 Window and/or glazing systems EN4.4 Solar shading systems EN4.5 Passive systems for cooling and heating EN4.6 Energy saving strategies for lighting EN4.7 Mitigation strategies for urban thermal effects EN4.8 Building occupancy behavior
WA	Water	
WA1	Water efficiency	WA1.1 Outdoor water use management

		WA1.2 Indoor water use management
WA2	Effluents management	WA2.1 Rainwater collection and reuse systems WA2.2 Greywater collection and reuse systems WA2.3 Urban Wastewater Treatment
MA	Materials	
MA1	Design for Deconstruction, reuse and recycling	MA1.1 Materials and components for ease of disassembly MA1.2 Adaptive reuse
MA2	Sustainable materials	MA2.1 Life Cycle Assessment MA2.2 Recycled and reused materials MA2.3 Regenerative materials and technologies
MA3	Solid waste	MA3.1 Solid waste management
HA	Habitat	
HA1	Land Use	HA1.1 Site preservation, regeneration and development HA1.2 Urban and peri-urban agriculture
HA2	Biodiversity	HA2.1 Management of biodiversity on the site

Table 8 – Macro Areas of Expertise in Society

Society		
CO	Comfort and well being	
CO1	Indoor air quality	CO1.1 Low Emitting materials CO1.2 Indoor air pollutants management CO1.3 Outdoor air pollutants management
CO2	Thermal comfort	CO2.1 Indoor Thermal Comfort CO2.2 Outdoor Thermal Comfort
CO3	Visual comfort	CO3.1 Daylighting CO3.2 Indoor lighting CO3.3 Outdoor lighting
CO4	Acoustic comfort	CO4.1 Sound insulation CO4.2 Room acoustics CO4.3 Indoor noise management CO4.4 Environmental noise management
CO5	Electromagnetic pollution	CO5.1 Management of ELF magnetic fields (50 Hz / 60 Hz) CO5.2 Management of indoor exposure to electromagnetic fields (100 kHz-300 GHz)
CO6	Ergonomics	CO6.1 Ergonomic and Active Furnishing
SA	Safety	

SA1	Fire protection	SA1.1 Risk to occupants and facilities from fire
SA2	Earthquake	SA2.1 Risk to occupants and facilities from earthquake
AC	Accessibility	
AC1	Barrier free accessibility	AC1.1 Accessibility of public spaces AC1.2 Design for All
MO	Mobility	
MO1	Alternative mobility	MO1.1 Sustainable mobility strategies
SE	Services	
SE1	Communication	SE1.1 Communication services
SE2	Services for inhabitants	SE2.1 Functional mix SE2.2 Infrastructure and connectivity
AD	Adaptation and resilience to climate change	
AD1	Climate change resilient buildings	AD1.1 Resilience to extreme weather events AD1.2 Sustainable drainage AD1.3 Resilience to heatwaves AD1.4 Resilience to windstorms AD1.5 Resilience to wildfire

Table 9 – Macro Areas of Expertise in Economy

Economy		
EQ	Economical quality	
EQ1	Cost planning and management	EQ1.1 Construction cost planning EQ1.2 Life cycle cost assessment
EQ2	Green value	EQ2.1 Value creation and risk exposure EQ2.2 Communication of green building value
EQ3	Financing schemes and business models	EQ3.1 Financing schemes for sustainable building EQ3.2 Business models preparation
EQ4	Operative costs	EQ4.1 Operating and maintenance cost management EQ4.2 Use stage energy cost management EQ4.3 Use stage water cost management

Table 10 – Macro Areas of Expertise in Process

Process

BD	Sustainable Building Design	
BD1	Integrative Design	BD1.1 Integrated Design Process BD1.2 Quality of site assessment BD1.3 Value engineering
ID	Innovative Digital Solutions	
ID1	Building Information Modelling	ID1.1 Operation of BIM systems
ID2	Small Urban Information Modelling	ID2.1 Operation of DIM systems for small urban areas
ID3	GIS Systems	ID3.1 GIS Systems for design and planning
ID4	Lean Management	ID4.1 Lean Management solutions
ID5	Measuring	ID5.1 Smart meters ID5.2 Smart Building Sensors
ID6	Digital Twins Solutions	ID6.1 Digital Twins systems
SC	Sustainable construction	
SC1	Sustainable construction management	SC1.1 Construction Activity Pollution Management SC1.2 Sustainability awareness
MN	Maintenance and operating	
MN1	Maintenance	MN1.1 Building maintenance MN1.3 Building degradation diagnosis MN1.4 Estimation of materials' service life
BE	Built Environment Certification systems	
BE1	Building sustainability certification	BE1.1 Energy Performance Certification BE1.2 Building sustainability certification systems
BE2	Small urban scale assessment systems	BE2.1 Small urban scale sustainability assessment systems
IS	Interdisciplinary Skills	
IS1	Procurement	IS1.1 GPP Requirements
IS2	Quality assurance	IS2.1 Quality assurance planning and management
IS3	Collaboration and Communication	IS3.1 Motivation and communication - Design Team
IS4	Information management	IS4.1 Management of information in a design process
IS5	Safety Assurance	IS5.1 Risk prevention, safety and health of workers
LB	Listed Buildings	
LB1	Improving energy performance of listed buildings	LB1.1Handling and architectural conservation of listed buildings

4.5 Level 4 – Learning Outcomes

Learning Outcomes (LOs) are the elementary units of the Competence Quality Standard. They are defined as "statements of what a learner knows, understands and is able to do upon completion of a learning process". Following the European Qualification Framework (EQF), in the TRAIN4SUSTAIN Competence Quality Standard the Learning Outcomes are defined in terms of knowledge and skills.

The level of competence of a white or blue collar in relation to a specific subject (Area of Expertise) depends on the Learning Outcomes acquired through both formal, informal and non-formal training.

In this sense, Learning Outcomes provide the information concerning what are the knowledge and skills necessary to achieve a certain competence's levels in relation to a specific sustainability subject (Areas of Expertise). In the Competence Quality Standard, Learning Outcomes are described:

- in concrete terms, they illustrate what the learner knows (knowledge) and what is able to do (skill);
- from the perspective of the learner (white or blue collar), not from the perspective of the trainer.

Learning outcomes do not describe the learning path, but the results achieved at the completion of a learning process. The whole list of LOs is reported in Section 10 "Areas of Expertise and Learning Outcomes".

For each Area of Expertise, Learning Outcomes have been developed in relation to the following aspects of knowledge and skills (see Annex C):

- Fundamentals and metrics
- Technical standards and regulations
- Technical solutions
- Calculation and simulation
- Installation / Construction
- Measurement and verification
- Operation and maintenance

The Learning Outcomes contained in the Competence Quality Standard are listed in Section 10. For each LOs is reported additional information concerning:

- the concerned worker (white and/or blue collars – Sections 5, 11)
- the project's stage in which it is used (concept, design, construction and in use – Section 6)
- the reference spatial scale (building, cluster – Section 6)
- the level of competence for which it is requested (score from 1 to 5 – Section 8).

5 Work Fields targeted in the TRAIN4SUSTAIN Competence Quality Standard

5.1 General

The Competence Quality Standard provides competence's requirements for both white collars and blue collars. Considering that professional titles can be different among countries, white and blue collars workers have been organised in reference professions that are described with a task-based approach. In this way, users of the Competence Quality Standard overcome the differences in professional titles and will focus on the competencies. The tables below summarizes the reference work fields, the corresponding professions and the general description.

5.2 White collars

Table 11 –Work Fields of White Collars

#	Work field	Reference profession(s) within the work field	Definition of the profession
1	Architecture	Architect	Architects investigate, design and oversee the implementation of buildings taking into account functional, architectural, aesthetic, structural, technical, regulatory, cost and contextual requirements with due regard to public health and safety. Specialization is possible on topics like construction safety, thermal performance, acoustics, quality of air, daylighting.
2	Mechanical engineering (HVAC)	Mechanical Engineer	Designer of systems for HVAC and sanitary equipment, considering the limitations imposed by practicality, regulation, safety, and cost.
3	Civil engineering	Structural engineer, Civil Engineer, Construction Engineer, Service engineers	Designer of materials and structures, considering the limitations imposed by practicality, regulation, safety, and cost. Specialization is possible on topics like construction safety, thermal performance, acoustics, building physics.
4	Electrical engineering	Electrical Engineer, ICT Engineer, Building Automation Engineer, Lighting specialist	Designer of power, lighting, data and or communication installations, considering the limitations imposed by practicality, regulation, safety, and cost. Designer of building automation systems, system engineer / system integrator, considering the limitations imposed by practicality, regulation, safety, and cost.
5	Environmental engineering	Environmental engineer, Geologist, Soils engineer, Landscape designer	Designer of solutions to protect human health from environmental hazards, nature's beneficial ecosystems, and to improve environmental-related enhancement of the quality of human life
6	Energy engineering	Energy engineer, Energy Planner, Simulation experts, Energy simulator, Daylighting specialist	Responsible for the optimization of energy usage, as well as the sources from which the energy is derived. Responsible for the EPCs.
7	Construction management	Manager of building process, Constructors	Responsible for quality assurance during on-site construction works in the realization of sustainable buildings
8	Building management	Facility Manager, building operator	Responsible to maintain the real estate as it was realized at the end of the building process. Responsible for overall operation of the building, monitoring of performance, and maintenance.
9	Financing and procurement	Procurer, Project developer	Responsible for facilitating the process of tenders and (sub)contracts. Responsible for the associated risks involved in the building process for the customer and hands over the project to the tenant / buyer after completion and use of the building

5.3 Blue collars

Table 12 –Work Fields of Blue Collars

Construction work	#	Work field	Definition of the profession
Building	10a	Bricklayers	Worker dealing with the construction of the building envelop
	10b	Carpenters	Worker dealing with wood construction
	10c	Façade Workers, Plasterer	Worker dealing with the façade construction and its finishing
	10d	Insulation installers	Worker dealing with the installation of thermal insulation
	10e	Roofers	Worker dealing with the construction of the building's roof
	10f	Window Installers	Worker dealing with the installation of windows or other transparent components of the building envelope
Technical installations	11a	Electrical installers	Worker dealing with the installation of electrical equipment
	11b	Plumber	Worker dealing with the installation of water pipes and devices
	11c	Renewable Energy Systems Installers (Electric)	Worker dealing with the installation of renewable energy systems for producing electricity (e.g. Photovoltaic Panels)
	11d	Renewable Energy Systems Installers (Thermal)	Worker dealing with the installation of renewable energy systems for producing heat (e.g. Solar thermal panels)
	11e	Ventilation and Air Conditioning Installers	Worker dealing with the installation of ventilation and air conditioning systems
	11f	Heating systems installer	Worker dealing with the installation of heating systems (boilers, heaters, etc.9

The applicable Areas of Expertise and the minimum recommended competence's levels per Work Field are described in Section 11.

6 Project's stages

Each Learning Outcome in the Competence Quality Standard is associated to a building project's phase. This information is useful to understand what knowledge and skills are necessary in the different project phases. The project phases considered in the Competence Quality Standard are:

- Concept design. Early phase of the design process, in which the broad outlines of function and form of buildings are articulated. It includes the design of interactions, experiences, processes, and strategies.
- Detailed design. Phase where the design is refined and plans, specifications and estimates are created. All design information required to manufacture and construct the project are completed.
- Construction. Phase where the construction of the building takes place on the base of the construction documents.

- As Built. Phase where the construction is completed but the building is still not occupied. In this phase it is undertaken a review of the project performance, defects are rectified, commissioning is completed.
- In use. Phase where the building is used, operated and maintained.

7 Reference spatial scales

The Competence Quality Standard addresses two spatial scales:

- Building scale. It corresponds to a single building and the area of the plot where the building is located.

- Cluster scale. It corresponds to a small urban area formed by a limited group of buildings that are close together.

The Cluster scale has been included in the CQS because:

- the performance of a single building can be improved creating and exploiting possible synergies with the surrounding constructions;

- the design process could concern more than one building. In this case the design shall take an urban scale approach to maximise the synergies among the single buildings.

8 Assessment of competence's levels

The Competence Quality Standard is a tool useful to assess the level of competence of blue collars and white collars in relation to a set of Areas of Expertise. In the evaluation process not all the Areas of Expertise are always applied. The applicable Areas of Expertise depend on the specific Work Field of the white or blue collar (Section 11). At the end of the evaluation process, for each applicable Area of Expertise, the white or blue collar receives a score that represents his/her level of competence. These scores are reported in the Skill Passport (section 12).

Following the principle of the European Qualification Scheme, the competence's levels are described in terms of Learning Outcomes. The levels range from 1 to 5, where 5 is the highest degree of competence. Level 1 of competence requires Learning Outcomes of EQF 4, level 2 and 3 correspond to Learning Outcomes of EQF 5 or 6, Level 4 calls for learning outcomes comparable to EQF 6 or 7 and level 5 corresponds to EQF 7 or 8.

The TRAIN4SUSTAIN competence levels are not related to the EHEA (European Higher Education Area) qualification or to vocational training qualification, meaning that each building professional having an official EQF level from 5 to 8 (i.e., the EQF range of white collars in terms of education) can add to his/her EQF a TRAIN4SUSTAIN CQS level ranging from 1-5. For instance, a professional with EQF level 7 on architecture without competences on renewable energy systems could achieve through a training course a TRAIN4SUSTAIN CQS level 2 which is additional to the already present competence in architecture.

Similarly, a blue-collar worker having a generic vocational qualification diploma (EQF level 3 or 4), can reach a TRAIN4SUSTAIN CQS level 5 on a specific area of expertise (i.e. installation of insulation components) through the participation in specific skills upgrading training courses or through work experiences.

The following table describes the levels of competence used in the TRAIN4SUSTAIN Competence Quality Standard.

Table 13 – Competences' scoring scale

Level of Competence	Description
1	Has little knowledge and skills with respect to the thematic area. Understands basic principles and is able to take part in project team discussions
2	Understands basic knowledge and has practical skills within the thematic area, is able to solve simple problems by selecting and applying basic methods, tools, materials and information.
3	Has comprehensive, factual and theoretical knowledge and skills within the thematic area, is capable of solving standard problems within the field
4	Has advanced knowledge involving a critical understanding of theories and principles and skills, required to solve complex and unpredictable problems in the field and is aware of the boundaries
5	Has specialized knowledge and problem-solving skills, partly at the forefront of knowledge in the field, in order to develop new knowledge and procedures and to integrate knowledge from different fields

To make possible the evaluation of competence's levels, in the Areas of Expertise each single Learning Outcome is associated with score from 1 to 5 (Table 13) that indicates for which level of competence the Learning Outcome is requested. Consequently, in each Area of Expertise there will be Learning Outcomes corresponding to different competence's levels (scores 1,2,3,4 and 5).

The competences' assessment process takes place in the following steps:

1. Verification of which are the applicable Areas of Expertise on the base of the Work Field of the white or blue collar using the tables in Section 11. The applicable Areas of Expertise (Section 11, Annex B) must be considered as a minimum set to be used in the competences' assessment process. Additional Areas of Expertise, not foreseen for the applicable Work Filed, can be used in the evaluation process to take in consideration specific competencies owned by the White or Blue Collar.
2. For each applicable Area of Expertise:
    a. Check of the list of Learning Outcomes (LOs) and verification of which LOs have been acquired through formal, non-formal and informal learning processes by the blue or white collar;
    b. Evaluation of the level of competence reached in the Area of Expertise. It depends on the acquired LOs and the level of competence for which they are requested. To reach a certain level of competence, the white or blue collar must have acquired **all** the Learning Outcomes of that level and all the LOs belonging to the lower levels of competence. For instance, to reach a competence's level of 3, **all** the Learning Outcomes of level 1,2 and 3 must be positively acquired and verified. If only some LOs are verified, this condition is not sufficient to assign that level of competence at the Area of Expertise. For instance, if all the Learning Outcomes of level 1 and 2 have been acquired but not all the LOs of level 3, the competence level assigned for the Area of Expertise is 2. If in an Area of Expertise there are no Learning Outcomes associated with a competence's level, that competence's level must be ignored in the competences' assessment process, and it can't be assigned. For instance, in the Area of Expertise EN3.1, a Blue Collar can't receive a competence's score of 2 or 4 because there aren't Learning Outcomes of level 2 and 4.

9 Mapping qualification schemes

Qualification schemes can be mapped using the Competence Quality Standard to list the Learning Outcomes that a White or Blue Collar must get from a learning activity to be qualified.

To map a qualification scheme, the scheme owner/operator selects in each Area of Expertise of the Competence Quality Standard the Learning Outcomes requested by the qualification scheme.

This mapping activity is useful for a transparent information about what are the competences (knowledge, skills) requested to receive a qualification and to compare the competence's requirements among qualification schemes.

10 Mapping training courses

Training courses can be mapped using the Competence Quality Standard to report which are the Learning Outcomes that the learner will acquire and what is the level of competence that he/she will reach through the learning process.

To map a training course the training provider selects, for each Area of Expertise in the Competence Quality Standard, the Learning Outcomes that will be provided to the learner.

11 Areas of Expertise and Learning Outcomes

In Annex A "Areas of Expertise and Learning Outcomes", the LOs of the Competence Quality standard are provided.

A table has been elaborated for each Area of Expertise. For each LO the information provided is:

- code of the Learning Outcome (column "LO code")
- description of the Learning Outcome (column "LO description")
- knowledge provided (column "Knowledge")
- skills provided (column "Skills")
- applicability to White Collars and/or Blue Collars (column "B/W". Where B=Blue Collars and W=White collars)
- for which level of competence the Learning Outcome is requested (column "Comp. Level))
- the project's stage addressed (column "Project's stage". Where Co = Concept, D = Detailed design, Cn = Construction, B= as Built, U = in use)

Annex C describes the wording used in the description of Learning Outcomes, Knowledge and Skill in relation to the competence's levels.

12 Applicable Areas of Expertise in relation to Work Fields and recommended minimum competence's levels

Annex B provides information concerning:

- the Areas of Expertise belonging to each Work Field (see Section 5). On the base of his/her Work Field a White or Blue Collar will identify what are the Areas of Expertise to be applied in the assessment of his/her competences' levels;
- the recommended minimum levels of competence for each Area of Expertise in relation to the Work Fields (n.a. = not applicable). The score represents a suggested minimum competence's value for a profitable participation in an integrated design process for a sustainable building.

13 Competences' reporting: the European Skill Passport

The European Skill Passport is the document useful to report the competences' levels of white and blue collars in relation to the Areas of Expertise of the TRAIN4SUSTAIN Competence Quality Standard.

The information provided by the European Skill Passport is:

- Date of issue of the Passport

- Personal data
    - Identification (First Name, Surname, date of birth, Country)
    - Education
        - Organisation
        - Graduation
        - EQF level
        - Period
    - Work Field
    - Profession
    - Membership in chambers or professional associations
    - Qualifications owned
- Competence levels
    - List of all the Areas of Expertise applicable to the Work Field and relative competence's levels

14 Validation of competence assessment

The assessment of competencies of a blue and/or white collars (section 8) can be validated by a third-party organisation. The validation consists in a confirmation of the Learning Outcomes acquired by the white or blue collar through formal, non-formal and informal learning processes. The results of the validation are reported using the Skill Passport format (section 12)

To ensure an effective validation, the process shall include.

- CV examination, supplemented with evidence of work and training experience claimed by the candidate
- Examination of the qualifications owned by the candidate and certificates of participation in training courses
- Test and/or technical interview to investigate the level of competence of the candidate.

The competence assessment has a validity of 5 years. Before that period, the assessment can be updated upon request of the candidate following one of these situations:

- new relevant experiences acquired through professional practice
- new qualifications acquired through formal training
- new competences acquired through informal and non-formal training.

The assessing organisation should be organised to:

- guarantee the necessary requirements of independence, impartiality, transparency, competence and absence from conflicts of interest
- guarantee the consistence of assessments
- define, adopt, and comply with its own documented quality system.

The organisations validating the competence assessments must be accredited by a national accreditation body in relation to the EN ISO/IEC 17024 standard.

Annex A
(informative)

Areas of Expertise and Learning Outcomes

A.1 Dimension: Environment

A.1.1 Thematic field: Energy

A.1.1.1 Macro Area: EN1 - Energy Performance Assessment

Table A.1 – EN1.1 – Energy Simulation

EN1.1	Energy Simulation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN1.1.1	Understanding the importance of building energy performance simulation	Minimal knowledge of: - fundamental principles of energy and heat transfer in buildings; - building energy rating in relation to energy services; - information and documentation to use for building energy simulation.	Participating in discussions for the feasibility study of building energy performance simulation within a design team.	W	1	Co
EN1.1.2	Applying simplified tools for building energy performance simulation	Basic knowledge of: - fundamental principles of energy and heat transfer in buildings; - building energy rating in relation to energy services; - information and documentation to use for building energy simulation; - data gathering and analysis focussed on building energy simulation; - simple calculation methods for residential buildings (quasi-steady state method).	Performing simplified verification to assess energy performance for residential buildings and defining building energy rating.	W	2	D
EN1.1.3	Performing building energy performance simulation (quasi-steady state method) by means of tools compliant with EN standards	Medium knowledge of: - fundamental principles of energy and heat transfer in buildings; - building energy rating in relation to all energy services (heating, cooling, DHW, ventilation, lighting, transportation); - information and documentation to use for building energy simulation (existing and new buildings, residential and non residential); - data gathering and analysis focussed on building energy simulation; - commercial software for thermal analysis (quasi-steady state method) compliant with EN standards.	Performing building energy performance for residential and non residential building, defining building energy rating and considering Minimum Energy Performance Standards (MEPS) from EU regulations.	W	3	Co, D
EN1.1.4	Performing building energy performance simulation (quasi-steady state and hourly dynamic methods) by means of tools compliant with EN standards	Advanced knowledge of: - fundamental principles of energy and heat transfer in buildings; - building energy rating in relation to all energy services (heating, cooling, DHW, ventilation, lighting, transportation); - information and documentation to use for building energy simulation (existing and new buildings, residential and non residential); - data gathering and analysis focussed on building energy simulation and definition of real occupancy profiles (hourly profile over year); - assessment of building energy performance of existing buildings (energy diagnosis and refurbishment design) based on real consumption (tailored rating method); - advanced software for thermal-energy analysis and thermal comfort analysis (hourly dynamic method) based on FEM (thermal bridges, condensation and mould risk) and compliant with EN standards.	Performing dynamic hourly energy simulations by means of advanced BPS tools, considering measured data in monitoring campaigns and assessing indoor thermal comfort. Transferring simulation outcomes into the design process.	W	4	D

EN1.1	Energy Simulation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN1.1.5	Using and implementing advanced tools for building energy performance simulation (hourly dynamic method)	In-depth knowledge of: - fundamental principles of energy and heat transfer in buildings; - building energy rating in relation to all energy services (heating, cooling, DHW, ventilation, lighting, transportation); - information and documentation to use for building energy simulation (existing and new buildings, residential and non residential), weather database; - data gathering and analysis focussed on building energy simulation (also based on in situ measurements) and definition of real occupancy profiles; - assessment of building energy performance of existing buildings (energy diagnosis and refurbishment design) based on real consumption (tailored rating method); - simulation of innovative and traditional energy systems (e.g. heating/cooling passive systems, hybrid ventilation); - advanced software for thermal-energy analysis and thermal comfort analysis (hourly dynamic method) based on FEM (thermal bridges, condensation and mould risk) and compliant with EN standards.	Performing dynamic hourly energy simulations by means of BPS tools in buildings equipped with advanced systems, also implementing and optimising the calculation codes. Considering measured data in monitoring campaigns and assessing indoor thermal comfort. Transferring simulation outcomes into the design practice.	W	5	D

A.1.1.2 Macro Area: EN2 - Energy Management

Table A.2 – EN2.1 – Smart grid systems

EN2.1	Smart grid systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN2.1.1	Understanding the importance of smart grid systems	Minimal knowledge of: - principles, concepts and grid technologies in energy utility basics; - energy demand, energy supply and energy storage.	Participating in discussions for the feasibility study of smart grid systems within a design team.	B, W	1	Co
EN2.1.2	Applying tools for smart grid system simulation	Basic knowledge of: - principles, concepts and grid technologies in energy utility basics; - energy demand, energy supply and energy storage; - building energy profiles.	Performing energy simulations in order to define building energy profiles (e.g. heat load duration curves) based on input from team members.	W	2	D
EN2.1.3	Proposing conceptual solutions for smart grid systems	Medium knowledge of: - energy demand response and distributed energy resources and storage; - smart grids and building energy profiles; - automation, communication and IT systems for advanced metering infrastructures;	Performing a feasibility study to determine the concept design, based on energy saving contribution, costs, restrictions. Defining the energy profile of the building (e.g. energy demand, energy supply and storage profiles) based on input from team members.	W	3	Co, D

EN2.1	Smart grid systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- electric power substations, electric power generators, distribution and transmission lines, controllers, collector nodes, distribution and transmission control centers; - smart meters (sensors and actuators) for electronic digital control of production, distribution and use of electricity.				
EN2.1.4	Engineering the concept design for smart grid systems	Advanced knowledge of: - energy demand response and distributed energy resources and storage; - smart grids and building energy profiles; - automation, communication and IT systems for advanced metering infrastructures; - electric power substations, electric power generators, distribution and transmission lines, controllers, collector nodes, distribution and transmission control centers; - smart meters (sensors and actuators) for electronic digital control of production, distribution and use of electricity; - cost/benefit analysis.	Designing and calculating the smart grid system, based on heat load duration curves and energy simulations. Engineering the automation on distribution grid. Using management and coordination skills to enable grid implementation projects in a complex team.	W	4	D
EN2.1.5	Developing new technical solutions and optimising the detailed design for smart grid systems	In-depth knowledge of: - energy demand response and distributed energy resources and storage; - smart grids and building energy profiles; - automation, communication and IT systems for advanced metering infrastructures; - electric power substations, electric power generators, distribution and transmission lines, controllers, collector nodes, distribution and transmission control centers; - smart meters (sensors and actuators) for electronic digital control of production, distribution and use of electricity; - cost/benefit analysis.	Developing and experimenting innovative solutions for smart grid systems based on emerging components and technologies, interacting with R&D department of companies operating in power electrical engineering. Considering user behaviour (customer databases)	W	5	D
EN2.1.6	Specifying the design for smart grid systems in tender documents	Advanced knowledge of: - technical specifications of smart grid systems and advanced metering infrastructures; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to smart grid systems, ensuring the contribution to energy saving. Writing technical documentation for contracting purpose.	W	4	D
EN2.1.7	Assuring the quality of smart grid systems	Advanced knowledge of: - standards and procedures for quality assurance in smart grid systems; - methods to evaluate quality of smart grid system installation (e.g. check-list survey, first-run inspection).	Managing, instructing and auditing contractors on site during the realisation of a smart grid system, based on information given in tender documents and by the design team.	W	4	Cn
EN2.1.8	Commissioning smart grids to ensure operation as planned	Advanced knowledge of: - standards and procedures for commissioning and quality assurance in smart grid systems; - support to resolution of disputes, subject to terms of the contract documents; - methods to evaluate the operativity of installed smart grid systems.	Commissioning the smart grid system after realisation, in order to check if the system fulfils all demands and functionality. Testing the smart grid system under different conditions.	W	4	Cn, B

EN2.1	Smart grid systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
			Supporting resolution of disputes, subject to terms of the contract documents.			
EN2.1.9	Ensuring optimal operation of smart grids during life cycle	Advanced knowledge of: - standards and procedures for management and maintenance of smart grid systems; - technical writing for reference and training manuals; - interpretation of measured energy consumption data by means of smart energy meters; - methods to evaluate the operativity of installed smart grid systems.	Designing the operative manual and the maintenance plan of the installed smart grid system. Instructing (the energy manager) on monitoring energy parameters, to ensure the system achieves all designed functionalities during its life cycle.	W	4	U

Table A.3 – EN2.2 – Domotic systems

EN2.2	Domotic systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN2.2.1	Understanding the importance of domotic systems	Minimal knowledge of: - domotic systems and their contribution to energy savings; - electronic digital devices (e.g. switches, modules) to control lighting, heating/cooling, security.	Participating in discussions for the feasibility study of domotic systems within a design team.	B, W	1	Co
EN2.2.2	Preliminary assessment of energy saving potential by means of a domotic system	Basic knowledge of: - domotic systems and their contribution to energy savings; - domotic systems and building energy profiles related to occupant behaviour; - electronic digital devices (e.g. switches, modules) to control lighting, heating/cooling, security; - simplified calculation methods (e.g. rules of thumb, datasheet).	Performing simplified calculations in order to assess energy saving potential by means of domotic systems, based on input from team members (e.g. occupant behaviour profiles).	W	2	D
EN2.2.3	Proposing conceptual solutions for domotic systems	Medium knowledge of: - domotic systems and their contribution to energy savings; - domotic systems and building energy profiles related to occupant behaviour; - electronic digital devices (e.g. switches, modules) to control lighting, heating/cooling, security; - communication and IT systems (e.g. IoT based home automation).	Proposing the design concept of the domotic system that fulfils specific needs within the project, based on energy saving contribution. Understanding and assessing technical specifications provided by producers of integrated systems in order to select the most suitable components and system.	W	3	Co, D
EN2.2.4	Engineering the concept design for domotic systems	Advanced knowledge of: - domotic systems and their contribution to energy savings; - domotic systems and building energy profiles related to occupant behaviour;	Engineering solutions for domotic systems, verifying which components and systems are more useful to	W	4	D

EN2.2	Domotic systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- electronic digital devices (e.g. switches, modules) to control lighting, heating/cooling, security; - communication and IT systems (IoT); - cost/benefit analysis.	include in relation to energy savings, and considering cost/benefit analysis. Performing simulations to assess energy reduction by means of a domotic system, considering occupant behaviour profiles.			
EN2.2.5	Developing new technical solutions and optimising the detailed design for domotic systems	n-depth knowledge of: - domotic systems and their contribution to energy savings; - domotic systems and building energy profiles related to occupant behaviour; - electronic digital devices (e.g. switches, modules) to control lighting, heating/cooling, security; - communication and IT systems (IoT); - cost/benefit analysis.	Developing and experimenting innovative solutions for domotic systems based on emerging technologies (e.g. IoT based home automation). Performing simulations to assess energy reduction by means of a domotic system, considering occupant behaviour profiles and optimising with respect to indoor comfort.	W	5	D
EN2.2.6	Specifying the design for domotic systems in tender documents	Advanced knowledge of: - technical specifications for domotic systems; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to domotic systems, ensuring the contribution to energy saving. Writing technical documentation for contracting purpose.	W	4	D
EN2.2.7	Assuring the quality of domotic systems	Advanced knowledge of: - standards and procedures for quality assurance in domotic systems and electrical works; - methods to evaluate quality of domotic system installation (e.g. check-list survey, first-run inspection).	Managing, instructing and auditing contractors on site during the realisation of a domotic system, based on information given in tender documents and given by the designer.	W	4	Cn
EN2.2.8	Commissioning domotic systems to ensure operation as planned	Advanced knowledge of: - standards and procedures for commissioning and quality assurance in domotic systems and electrical works; - support to resolution of disputes, subject to terms of the contract documents; - methods to evaluate the operativity of installed domotic systems; - interpretation of measured energy consumption data by means of smart energy meters.	Commissioning the domotic system after realisation, in order to check if the system fulfils all demands and functionality. Testing the domotic system under different conditions (e.g. in day/night time, in presence/absence of occupants).	W	4	Cn, B
EN2.2.9	Ensuring optimal operation of domotic systems during life cycle	Advanced knowledge of: - standards and procedures for management and maintenance of electrical and domotic systems; - technical writing for reference and training manuals; - interpretation of measured energy consumption data by means of smart energy meters; - methods to evaluate the operativity of installed domotic systems.	Designing the operative manual and the maintenance plan of the installed system, for the facility manager and/or for users. Instructing (the facility manager) on monitoring energy and microclimate parameters, to ensure the system achieves designed energy	W	4	U

Table A.4 – EN2.3 – Building management systems (BMS)

EN2.3	Building management systems (BMS)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN2.3.1	Understanding the importance of BMS	Minimal knowledge of: - BMS and their contribution to energy savings and IEQ; - installations can be automized (e.g. heating, cooling, sun blinds, lighting, security).	Participating in discussions for the feasibility study of BMS within a design team.	B, W	1	Co
EN2.3.2	Preliminary assessment of energy saving potential by means of BMS	Basic knowledge of: - BMS and their contribution to energy savings and IEQ; - installations can be automized (e.g. heating, cooling, sun blinds, lighting, security) and electronic control devices (e.g. switches, modules); - simplified calculation method of energy savings based on BAC factors (according to EN standards).	Performing simplified calculations in order to assess energy saving potential by means of BMS, based on input from team members (e.g. occupant behaviour profiles).	W	2	D
EN2.3.3	Proposing conceptual solutions for BMS	Medium knowledge of: - BMS and their contribution to energy savings and IEQ; - installations can be automized (e.g. heating, cooling, sun blinds, lighting, security) and electronic control devices (e.g. switches, modules); - meaning of BAC, BACS, TMB, BEMS according to EN standards.	Proposing the design concept of the BMS that fulfils specific needs within the project, based on energy savings and IEQ for building users. Understanding and assessing technical specifications provided by producers of BMS in order to select the most suitable components and systems.	W	3	Co, D
EN2.3.4	Engineering the concept design for BMS	Advanced knowledge of: - BMS and their contribution to energy savings and IEQ; - installations can be automized (e.g. heating, cooling, sun blinds, lighting, security) and electronic control devices (e.g. switches, modules); - meaning of BAC, BACS, TMB, BEMS according to EN standards; - detailed calculation method of energy savings with different class of BMS (according to EN standards); - cost/benefit analysis.	Engineering solutions for BMS in a interdisciplinary team, verifying which components and systems are more useful in relation to energy savings and IEQ, considering cost/benefit analysis (investment return). Performing detailed calculations to assess energy reduction by means of a BMS, considering occupant behaviour profiles and all control and management functions of the selected BMS.	W	4	D
EN2.3.5	Developing new technical solutions and optimising the detailed design for BMS	In-depth knowledge of: - BMS and their contribution to energy savings and IEQ; - installations can be automized (e.g. heating, cooling, sun blinds, lighting, security) and electronic control devices (e.g. switches, modules); - meaning of BAC, BACS, TMB, BEMS according to EN standards; - detailed calculation method of energy savings with different class of BMS (according to EN standards); - integration of BMS with heating/cooling passive systems; - cost/benefit analysis.	Developing and experimenting innovative solutions for BMS based on emerging technologies (e.g. combining BEMS and IoT), interacting with R&D department of BMS companies. Integrating passive cooling/heating systems with BMS in smart passive buildings. Performing simulations to assess energy reduction, optimising the BMS design in relation to indoor comfort for users.	W	5	D

EN2.3	Building management systems (BMS)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN2.3.6	Specifying the design for BMS in tender documents	Advanced knowledge of: - technical specifications for BMS; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to BMS, ensuring the contribution to energy saving. Writing technical documentation for contracting purpose.	W	4	D
EN2.3.7	Assuring the quality of BMS	Advanced knowledge of: - standards and procedures for quality assurance in BMS and electrical works; - methods to evaluate quality of BMS installation (e.g. check-list survey, first-run inspection).	Managing, instructing and auditing contractors on site during the realisation of a BMS, based on information given in tender documents and given by the design team.	W	4	Cn
EN2.3.8	Commissioning BMS to ensure operation as planned	Advanced knowledge of: - standards and procedures for commissioning and quality assurance in BMS and electrical works; - support to resolution of disputes, subject to terms of the contract documents; - methods to evaluate the operativity of installed BMS; - interpretation of measured energy consumption data by means of smart energy meters.	Commissioning the BMS after realisation, in order to check if the system fulfils all demands and functionality. Testing the BMS under different conditions (e.g. in day/night time, different seasons, in presence/absence of occupants).	W	4	Cn, B
EN2.3.9	Ensuring optimal operation of BMS during life cycle	Advanced knowledge of: - standards and procedures for management and maintenance of BMS; - technical writing for reference and training manuals; - interpretation of measured energy consumption data by means of smart energy meters; - methods to evaluate the operativity of installed BMS.	Designing the operative manual and the maintenance plan of the installed system, for the facility manager and/or for users. Instructing (the facility manager) on monitoring energy and microclimate parameters, to ensure the BMS achieves designed energy savings and comfort goals during its life cycle.	W	4	U

Table A.5 – EN2.4 – Renewable Energy communities (smart neighbourhoods)

EN2.4	Renewable Energy communities (smart neighbourhoods)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN2.4.1	Understanding the concept of the renewable energy community	Minimal Knowledge of: - renewable energy generation; - energy community.	Participating in discussions within a design team	B, W	1	Co, U
EN2.4.2	Understanding the concept of smart grids	Minimal Knowledge of: - renewable energy generation - energy community;	Understanding the concept of smart grids, connectivity of energy systems, energy generation	W	1	Co, D, U

EN2.4	Renewable Energy communities (smart neighbourhoods)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
	and connectivity of energy systems	- energy supply and distribution; - energy storage.	and distribution. Discussing the concepts within a design team			
EN2.4.3	Proposing basic solutions to energy generation in a cluster scale	Basic knowledge of: - renewable energy generation; - energy community; - energy supply and distribution; - energy storage; - technical standards and regulations.	Performing simplified energy simulation to evaluate and propose systems to generate renewable energy in a cluster scale	W	2	Co, D
EN2.4.4	Determining the energy system concept	Medium knowledge of: - renewable energy community; - energy efficiency and savings; - flexibility, energy storage and smart grid integration; - district heating/ cooling; - dynamic energy simulation; - technical standards and regulations.	Analysing the feasibility of renewable energy generation. Performing medium level of dynamic energy simulations to determine the concept of the energy system. Proposing solutions to smart grid integration.	W	3	Co, D
EN2.4.5	Engineering energy systems to be integrated	Advanced knowledge of: - renewable energy community; - energy efficiency and savings; - flexibility, energy storage and smart grid integration; - district heating; - dynamic energy simulation; - systems monitoring; - technical standards and regulations.	Engineering the whole energy system (generation, distribution, supply and storage). Performing dynamic energy simulation to define the most feasible solutions. Determining the energy network operation (e.g., smart grid systems). Providing tender documents	W	4	Co, D
EN2.4.6	Evaluating the feasibility to a cluster become a renewable energy community	Advanced knowledge of: - financial/ economic analysis; - renewable energy community; - energy efficiency and savings; - flexibility, energy storage and smart grid integration; - energy supply and distribution; - systems monitoring; - district heating/ coo	Evaluating economic and technical aspects of energy systems and the feasibility of a cluster becomes a renewable energy community. Providing cost-benefit analysis. Analysing technical standards and local regulations.	W	4	Co, D, U
EN2.4.7	Assuring the quality of energy systems installation	Advanced knowledge of: - energy auditing, - systems monitoring; - energy generation systems installation; - smart grids; -technical standards and regulations.	Managing, instructing and auditing contractors on construction site. Providing analysis reports.	W	4	Cn, B

EN2.4	Renewable Energy communities (smart neighbourhoods)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN2.4.8	Installing and maintaining different energy generation and conversion systems	In-depth knowledge of: - energy generation systems installation and maintenance; - technical standards and regulations.	Installing and maintaining different energy generation systems, such as, PV, wind turbines, etc, and energy conversion systems, like biomass digesters.	B	5	Cn, U
EN2.4.9	Commissioning energy systems	In-depth knowledge of: - energy auditing, - systems monitoring; - energy generation systems installation; - smart grid/ energy systems integration; - energy distribution; - energy storage; - energy efficiency; -technical standards and regulations.	Managing measurements and evaluation of energy systems. Testing energy generation and distribution systems. Evaluating energy storage. Verifying construction documents and equipment datasheets. Evaluating systems performance and operation. Providing analysis report.	W	5	B
EN2.4.10	Managing energy distribution network	In-depth knowledge of: - energy auditing, consumption monitoring; - energy systems operation and maintenance; - energy distribution and supply; - energy storage; - technical standards and regulations.	Developing an on-going Maintenance Plan for the energy distribution network. Managing measurements and evaluations of energy distribution and storage systems. Providing analysis report.	W	5	U

A.1.1.3 Macro Area: EN3 – Energy Production and HVAC systems

Table A.6 – EN3.1 – Heating and cooling systems

EN3.1	Heating and cooling systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.1.1	Understanding the importance of heating and cooling systems	Minimal knowledge of: - main types of heating and cooling systems (e.g. central/local systems; all air/air-water/all water systems; low temperature radiant panels); - selection of system types based on specific requirements (e.g. indoor thermal comfort, building functions, outdoor climate, thermal mass and insulation of building envelope).	Participating in discussions for the feasibility study of heating and cooling systems within a design team.	B, W	1	Co

EN3.1	Heating and cooling systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.1.2	Applying basic solutions for heating and cooling systems	Basic knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics, psychrometrics; - main types of heating and cooling systems (e.g. central/local systems; all air/air-water/all water systems; low temperature radiant panels) and their own energy performances; - selection of system types based on specific requirements (e.g. indoor thermal comfort, building functions, outdoor climate, thermal mass and insulation of building envelope); - simple calculation methods (rules of thumb, graphic methods, datasheets).	Performing simplified verifications to assess cooling/heating performances of alternative systems, based on input from team members, considering their compliance with energy and indoor comfort requirements.	W	2	D
EN3.1.3	Proposing conceptual solutions for heating and cooling systems	Medium knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics, psychrometrics, sound and vibrations; - main regulations and technical standards on the design of HVAC systems, energy performances, indoor environmental quality (IEQ); - main types of heating and cooling systems (e.g. central/local systems; all air/air-water/all water systems; low temperature radiant panels) and their own energy performances; - selection of system types based on specific requirements (e.g. indoor thermal comfort, building functions, outdoor climate, thermal mass and insulation of building envelope); - heating/cooling system design for residential buildings; - commercial software for thermal power calculation of system components.	Selecting and proposing alternative solutions for heating and cooling systems in residential buildings, specifically in relation to building architectural design and functions, and considering available energy sources (e.g. gas, electricity, district, soil). Pre-sizing the heating/cooling system and assessing the resulting thermal conditions by means of commercial software for building thermal analysis.	W	3	Co, D
EN3.1.4	Engineering the concept design for heating and cooling systems	Advanced knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics, psychrometrics, sound and vibrations; - all regulations and technical standards on the design of HVAC systems, energy performances, indoor environmental quality (IEQ), safety; - all types of heating and cooling systems and their own energy performances; - selection of system types based on specific requirements (e.g. indoor thermal comfort, building functions, outdoor climate, thermal mass and insulation of building envelope); - heating/cooling system design for non residential buildings and complex energy systems; - integration with domotic systems, building management systems (BMS); - operation of heating/cooling systems and how to interact with HVAC companies; - advanced software for HVAC system design, for building thermal analysis and IEQ assessment.	Engineering solutions for heating/cooling systems for non residential buildings and complex installations, performing cost/benefit analysis and fulfilling standard requirements. Performing dynamic energy simulations of the cooling/heating system by means of advanced simulation tools, assessing the energy performance of the system and its impact on indoor thermal comfort.	W	4	D
EN3.1.5	Developing new technical solutions and optimising the detailed	In-depth knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics, psychrometrics, sound and vibrations; - all regulations and technical standards on the design of HVAC systems, energy	Developing and experimenting innovative solutions for heating/cooling systems based on emerging components and technologies, interacting with R&D department of HVAC companies.	W	5	D

EN3.1	Heating and cooling systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
	design for heating and cooling systems	performances, indoor environmental quality (IEQ), safety; - all types of heating and cooling systems and their own energy performances; - selection of system types based on specific requirements (e.g. indoor thermal comfort, building functions, outdoor climate, thermal mass and insulation of building envelope); - heating/cooling system design for non residential buildings and NZEB buildings; - integration with domotic systems, building management systems (BMS); - optimisation of HVAC systems with heating/cooling passive systems; - design of monitoring campaigns to optimise heating/cooling system performances; - advanced software for HVAC system design, for building thermal analysis (winter/summer thermal loads) and IEQ assessment.	Pursuing the integration of active heating/cooling systems with passive systems and building automation systems. Considering occupant behaviour and the interaction with control systems for cooling/heating. Performing dynamic energy simulations of the building envelope by means of advanced simulation tools. Optimizing heating/cooling systems with respect to thermal comfort, IAQ and acoustic comfort for users.			
EN3.1.6	Specifying the design for heating and cooling systems in tender documents	Advanced knowledge of: - technical specifications of heating and cooling systems and their own energy performances; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting components and technical solutions that fit specifications and demands on given quality aspects and economics related to heating and cooling systems, ensuring the contribution to energy saving and IEQ for users. Writing technical documentation for contracting purpose.	W	4	D
EN3.1.7	Assuring the quality of heating and cooling systems	Advanced knowledge of: - standards and procedures for quality assurance in HVAC systems; - methods to evaluate quality of HVAC system installation (e.g. check-list survey, first-run inspection).	Managing, instructing and auditing contractors on site during the realisation of the heating/cooling system, based on information given in tender documents and given by the designer. Giving feedbacks to the design team on design and operation suitability of the installed heating/cooling system.	W	4	Cn
EN3.1.8	Installing traditional systems for heating and cooling	Medium knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on HVAC system installation; - construction waste management and disposal; - main types of heating and cooling systems for residential buildings.	Installing simple heating/cooling systems in a workmanlike manner. Installing complex solutions under supervision of expert team members.	B	3	Cn
EN3.1.9	Installing advanced systems for heating and cooling	In-depth knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on HVAC system installation; - construction waste management and disposal; - main types of heating and cooling systems for complex installations.	Installing advanced and complex solutions for heating/cooling systems (e.g. non residential buildings, integration with passive systems in NZEB buildings). Ability to interact with the design team and producers/suppliers of HVAC systems in order to solve problems on construction site.	B	5	Cn

EN3.1	Heating and cooling systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.1.10	Commissioning heating and cooling systems to ensure operation as planned	Advanced knowledge of: - standards and procedures for commissioning and quality assurance in HVAC systems; - support to resolution of disputes, subject to terms of the contract documents; - methods to evaluate the operativity of installed HVAC systems (e.g. testing and adjusting/balancing of the system, indoor microclimate measurements).	Commissioning the heating/cooling system after realisation, in order to check if the system fullfills all demands and fuctionality. Testing, adjusting and balancing the system under different operating conditions. Measuring indoor thermal comfort conditions for building users.	W	4	Cn, B
EN3.1.11	Ensuring optimal operation of heating and cooling systems during life cycle	Advanced knowledge of: - standards and procedures for management and maintenace of HVAC systems; - technical writing for reference and training manuals; - methods to evaluate the operativity of installed HVAC systems (e.g. testing and adjusting/balancing of the system, indoor microclimate measurements).	Designing the operative manual and the maintenance plan of the installed system, for the facility manager and/or for users. Instructing (the facility manager) on monitoring energy and microclimate parameters, to ensure the system achieves designed energy savings and comfort goals during its life cycle.	W	4	U

Table A.7 – EN3.2 – Ventilation systems

EN3.2	Ventilation systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.2.1	Understanding the importance of ventilation systems	Minimal knowledge of: - difference between natural and mechanical ventilation; - main types of natural ventilation systems (e.g. cross ventilation, stack ventilation); - main types of mechanical ventilation systems (e.g. exhaust ventilation, supply v., balanced v., energy recovery v.).	Participating in discussions for the feasibility study of ventilation systems within a design team.	B, W	1	Co
EN3.2.2	Applying basic solutions for ventilation systems	Basic knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics, psychrometrics; - main regulations on health/safety and technical standards on ventilation and IAQ; - main types of natural ventilation systems (e.g. cross ventilation, stack ventilation) and suitability in relation to climatic conditions; - main types of mechanical ventilation systems (e.g. exhaust ventilation, supply v., balanced v., energy recovery v.) and functionality (centralised/decentralised, simple/dual flow);	Performing simplified verifications of air change rates for alternative ventilation systems, based on input from team members, considering their compliance with IAQ requirements (EN standard method based on predefined air flow rates).	W	2	D

EN3.2	Ventilation systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- simple calculation methods to pre-size ventilation systems (e.g. EN standard method based on predefined air flow rates).				
EN3.2.3	Proposing conceptual solutions for ventilation systems	Medium knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics, psychrometrics, sound and vibrations; - main regulations on health/safety and technical standards on ventilation and IAQ; - main types of natural ventilation systems (e.g. cross ventilation, stack ventilation) and suitability in relation to climatic conditions; - main types of mechanical ventilation systems (e.g. exhaust ventilation, supply v., balanced v., energy recovery v.) and functionality (simple/dual flow, centralised/decentralised); - air handling design (heating, cooling, humidification, dehumidification); - design methods for ventilation air flow rates (e.g. EN standard methods based on perceived air quality / limit values of substance concentration).	Selecting and proposing alternative solutions for ventilation in residential buildings, specifically in relation to building architectural design and functions, and considering climatic conditions for natural ventilation. Designing ventilation air flow rates with methods based on perceived air quality or based on limit values of substance concentration (EN standard methods).	W	3	Co, D
EN3.2.4	Engineering the concept design for ventilation systems	Advanced knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics, psychrometrics, sound and vibrations; - main regulations on health/safety and technical standards on energy performance for ventilation and IAQ; - main types of natural ventilation systems (e.g. cross ventilation, stack ventilation) and suitability in relation to climatic conditions; - main types of mechanical ventilation systems (e.g. exhaust ventilation, supply v., balanced v., energy recovery v.) and functionality (simple/dual flow, centralised/decentralised); - air handling design (heating, cooling, humidification, dehumidification); - integration of mechanical ventilation with natural ventilation; - integration with domotic systems, building management systems (BMS); - advanced software for ventilation design with hourly dynamic calculation (to simulate also passive cooling techniques), based on CFD methods.	Engineering solutions for ventilation systems in non residential buildings and complex installations, performing cost/benefit analysis and fulfilling standard requirements. Pursuing the integration of natural ventilation with mechanical ventilation and building automation systems. Performing dynamic simulations of ventilation and cooling/heating effects by means of advanced simulation tools, assessing the energy performance of the system and its impact on IAQ and indoor thermal comfort.	W	4	D
EN3.2.5	Developing new technical solutions and optimising the detailed design for ventilation systems	In-depth knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics, psychrometrics, sound and vibrations; - main regulations on health/safety and technical standards on energy performance for ventilation and IAQ; - main types of natural ventilation systems (e.g. cross ventilation, stack ventilation) and suitability in relation to climatic conditions; - main types of mechanical ventilation systems (e.g. exhaust ventilation, supply v., balanced v., energy recovery v.) and functionality (simple/dual flow, centralised/decentralised); - air handling design (heating, cooling, humidification, dehumidification); - integration of mechanical ventilation with natural ventilation; - integration with domotic systems, building management systems (BMS); - optimisation of energy performance and IEQ by means of innovative components and solutions; - how to interact with companies for ventilation systems;	Developing and experimenting innovative solutions for ventilation systems based on emerging components and technologies, interacting with R&D of specialised companies and performing in situ measurements of IEQ and energy performances. Pursuing the integration of natural ventilation with passive cooling systems and building automation systems. Considering occupant behaviour and the interaction with control systems for ventilation. Performing dynamic energy simulations of the building by means of advanced simulation tools. Optimizing the ventilation system with respect to energy performance and IAQ, thermal comfort and acoustic comfort for users.	W	5	D

EN3.2	Ventilation systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- advanced software for ventilation design with hourly dynamic calculation (to simulate also passive cooling techniques), based on CFD methods.				
EN3.2.6	Specifying the design for ventilation systems in tender documents	Advanced knowledge of: - technical specifications of ventilation systems and their own energy performances; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting components and technical solutions that fit specifications and demands on given quality aspects and economics related to ventilation systems, ensuring the contribution to energy saving and IEQ for users. Writing technical documentation for contracting purpose.	W	4	D
EN3.2.7	Assuring the quality of ventilation systems	Advanced knowledge of: - standards and procedures for quality assurance in ventilation systems; - methods to evaluate quality of ventilation system installation (e.g. check-list survey, first-run inspection).	Managing, instructing and auditing contractors on site during the realisation of the ventilation system, based on information given in tender documents and given by the designer. Giving feedbacks to the design team on design and operation suitability of the installed ventilation system.	W	4	Cn
EN3.2.8	Installing domestic ventilation systems	Medium knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on ventilation system installation; - main types of ventilation systems for residential buildings.	Installing domestic VMC systems in a workmanlike manner. Installing complex solutions under supervision of expert team members.	B	3	Cn
EN3.2.9	Installing advanced systems for ventilation	In-depth knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on ventilation system installation; - construction waste management and disposal; - main types of ventilation systems for complex installations.	Installing advanced and complex solutions for ventilation systems (e.g. non residential buildings, integration with passive cooling systems) and managing the integration with domotic systems and BMS. Ability to interact with the design team and producers/suppliers of ventilation systems in order to solve problems on construction site.	B	5	Cn
EN3.2.10	Commissioning ventilation systems to ensure operation as planned	Advanced knowledge of: - standards and procedures for commissioning and quality assurance in ventilation systems; - support to resolution of disputes, subject to terms of the contract documents; - methods to evaluate the operativity of installed ventilation systems (e.g. testing and adjusting/balancing of the system).	Commissioning the ventilation system after realisation, in order to check if the system fullfills all demands and fuctionality. Testing, adjusting and balancing the system under different operating conditions. Measuring IAQ and thermal comfort conditions for building users.	W	4	Cn, B
EN3.2.11	Ensuring optimal operation of ventilation systems during life cycle	Advanced knowledge of: - standards and procedures for management and maintenace of ventilation systems; - technical writing for reference and training manuals; - methods to evaluate the operativity of installed ventilation systems (e.g. testing and adjusting/balancing of the system, IAQ and indoor microclimate measurements).	Designing the operative manual and the maintenance plan of the installed ventilation system, for the facility manager and/or for users. Instructing (the facility manager) on monitoring energy and microclimate parameters, to ensure the system achieves designed energy savings and comfort goals during its life cycle.	W	4	U

Table A.8 – EN3.3 – Hot water systems (DHW)

EN3.3	Hot water systems (DHW)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.3.1	Understanding the importance of DHW systems	Minimal knowledge of: - DHW needs in residential buildings; - DHW production with renewable and non-renewable energies.	Participating in discussions for the feasibility study of DHW systems within a design team.	W, B	1	Co
EN3.3.2	Applying basic solutions for DHW systems	Basic knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics; - main regulations on health/safety for potable water and technical standards on DHW; - DHW needs in residential buildings; - DHW production with renewable and non-renewable energies; - main types of DHW production systems (e.g. with tank for water storage, tankless, centralised, decentralised); - simple calculation methods to pre-size DHW systems (e.g. rules of thumb, datasheet).	Performing simplified verifications for alternative DHW systems in residential buildings, considering user needs and based on input from team members.	W	2	D
EN3.3.3	Proposing conceptual solutions for DHW systems	Medium knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics; - main regulations on health/safety for potable water and technical standards on DHW; - DHW needs in residential buildings; - DHW production with renewable energies (e.g. heat pumps, solar thermal energy systems) and non-renewable energies; - main types of DHW production systems (e.g. with tank for water storage, tankless, centralised, decentralised); - storage water sanification and potable water treatment systems; - water metering systems; - calculation of DHW needs in residential buildings.	Selecting and proposing alternative solutions for DHW systems in residential buildings, considering potential energy savings by optimal hydraulic design and tube insulation. Pre-sizing the DHW system in relation to building functions and occupant profiles.	W	3	Co, D
EN3.3.4	Engineering the concept design for DHW systems	Advanced knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics; - main regulations on health/safety for potable water and technical standards on DHW; - DHW needs in non residential buildings (e.g. swimming pool, gym, wellness center); - DHW production with renewable energies (e.g. heat pumps, solar thermal energy systems) and non-renewable energies; - main types of DHW production systems (e.g. with tank for water storage, tankless, centralised, decentralised); - storage water sanification and potable water treatment systems; - water metering systems; - hourly simulation of demand/offer for a DHW system in non residential buildings and complex installations; - cost/benefit analysis.	Engineering solutions for DHW systems in non residential buildings, performing detailed calculation of needed capacity and storage under given conditions and cost/benefit analysis for different solutions. Pursuing the integration of DHW systems with renewable energies (e.g. solar thermal energy systems). Performing detailed simulations of thermal energy demand for the DHW system by means of advanced simulation tools, assessing the energy performance of the system and its impact on energy savings.	W	4	D

EN3.3	Hot water systems (DHW)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.3.5	Developing new technical solutions and optimising the detailed design for DHW systems	In-depth knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics; - main regulations on health/safety for potable water and technical standards on DHW; - DHW needs in non residential buildings (e.g. swimming pool, gym, wellness center); - DHW production with renewable energies (e.g. heat pumps, solar thermal energy systems) and non-renewable energies; - main types of DHW production systems (e.g. with tank for water storage, tankless, centralised, decentralised); - storage water sanification and potable water treatment systems; - water metering systems; - thermal waste recovery in DHW systems; - hourly simulation of demand/offer and energy performance for a DHW system in non residential buildings and complex installations; - cost/benefit analysis.	Developing and experimenting innovative solutions for DHW systems based on emerging components and technologies, interacting with R&D department of specialised companies. Pursuing the integration of DHW systems with other active or passive heating systems, and with building automation systems. Performing dynamic energy simulations of the DHW system by means of advanced simulation tools, in order to optimize the system with respect to energy consumption, occupant profiles and occupant needs.	W	5	D
EN3.3.6	Specifying the design for DHW systems in tender documents	Advanced knowledge of: - technical specifications of DHW systems and their own energy performances; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting components and technical solutions that fit specifications and demands on given quality aspects and economics related to DHW systems, ensuring service for users and the contribution to energy saving. Writing technical documentation for contracting purpose.	W	4	D
EN3.3.7	Assuring the quality of DHW systems	Advanced knowledge of: - standards and procedures for quality assurance in DHW systems; - methods to evaluate quality of DHW system installation (e.g. check-list survey, first-run inspection).	Managing, instructing and auditing contractors on site during the realisation of the DHW system, based on information given in tender documents and given by the designer. Giving feedbacks to the design team on design and operation suitability of the installed DHW system.	W	4	Cn
EN3.3.8	Installing DHW systems	Medium knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on DHW system installation; - main types of DHW systems for residential buildings.	Installing DHW systems in a workmanlike manner for residential buildings. Installing complex solutions under supervision of expert team members.	B	3	Cn
EN3.3.9	Installing advanced systems for DHW	In-depth knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on DHW system installation; - construction waste management and disposal; - main types of DHW systems for complex installations.	Installing advanced and complex solutions for DHW systems (e.g. non residential buildings as swimming pools, gyms) and managing the integration with domotic systems and BMS. Ability to interact with the design team and producers/suppliers of DHW systems in order to solve problems on construction site.	B	5	Cn

EN3.3	Hot water systems (DHW)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.3.10	Commissioning DHW systems to ensure operation as planned	Advanced knowledge of: - standards and procedures for commissioning and quality assurance in DHW systems; - support to resolution of disputes, subject to terms of the contract documents; - methods to evaluate the operativity of installed DHW systems (e.g. testing and adjusting/balancing of the system).	Commissioning the DHW system after realisation, in order to check if the system fullfills all demands and fuctionality. Testing, adjusting and balancing the system under different operating conditions.	W	4	Cn, B
EN3.3.11	Ensuring optimal operation of DHW systems during life cycle	Advanced knowledge of: - standards and procedures for management and maintenace of DHW systems; - technical writing for reference and training manuals; - methods to evaluate the operativity of installed DHW systems (e.g. testing and adjusting/balancing of the system).	Designing the operative manual and the maintenance plan of the installed DHW system for users. Ensuring the system achieves designed energy savings and operativity during its life cycle.	W	4	U

Table A.9 – EN3.4 – Electric heating systems

EN3.4	Electric heating systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.4.1	Understanding the importance of electric heating systems	Minimal knowledge of: - main types of electric heating systems (e.g. IR systems, radiant heating panels on wall/ceiling/floor, electric radiators); - selection of system types based on building functions and specific thermal comfort requirements.	Participating in discussions for the feasibility study of electric heating systems within a design team.	W, B	1	Co
EN3.4.2	Applying basic solutions for electric heating systems	Basic knowledge of: - fundamental principles of energy and heat transfer, thermal comfort; - main types of electric heating systems (e.g. IR systems, radiant heating panels on wall/ceiling/floor, electric radiators); - selection of system types based on building functions and specific thermal comfort requirements. - simple calculation methods to pre-size electric heating systems (rules of thumb, graphic methods, datasheets).	Performing simplified verifications to assess heating performances of alternative electric heating systems, based on input from team members and considering their compliance with energy and thermal comfort requirements.	W	2	D
EN3.4.3	Proposing conceptual solutions for electric heating systems	Medium knowledge of: - fundamental principles of energy and heat transfer, thermal comfort; - main types of electric heating systems (e.g. IR systems, radiant heating panels on wall/ceiling/floor, electric radiators); - selection of system types based on building functions and specific thermal comfort requirements; - assessment of electric contribution by renewable energy sources; - calculation of energy demand, thermal loads and energy consumptions.	Performing a feasibility study to assess if electric heating is appropriate and sustainable under different conditions (e.g. room with low occupation frequency, thermal comfort requirements, construction of wall/ceiling/floor, high insulated building envelope, available heat/energy sources). Selecting and proposing alternative solutions for electric heating systems, specifically in relation to building functions, thermal comfort requirements and available renewable energy sources.	W	3	Co, D
EN3.4.4	Engineering the concept design for	Advanced knowledge of: - fundamental principles of energy and heat transfer, thermal comfort;	Engineering solutions for electric heating systems, performing detailed calculation of needed capacity	W	4	D

EN3.4	Electric heating systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
	electric heating systems	- main types of electric heating systems (e.g. IR systems, radiant heating panels on wall/ceiling/floor, electric radiators); - selection of system types based on building functions and specific thermal comfort requirements; - assessment of electric contribution by renewable energy sources; - operation of electric heating systems and how to interact with specialised companies; - integration with domotic systems and other heating systems; - calculation of hourly energy demand/offer, and thermal comfort conditions for users; - cost/benefit analysis.	for space heating under given conditions thanks to specialistic knowledge on radiant heating (also for design in high spaces) and thermal comfort assessment by PMV index. Performing cost/benefit analysis and assessment of electric contribution by renewable energy sources. Performing dynamic energy simulations of the electric heating system by means of advanced simulation tools, assessing the energy performance of the system and its impact on indoor thermal comfort.			
EN3.4.5	Developing new technical solutions and optimising the detailed design for electric heating systems	In-depth knowledge of: - fundamental principles of energy and heat transfer, thermal comfort; - main types of electric heating systems (e.g. IR systems, radiant heating panels on wall/ceiling/floor, electric radiators); - selection of system types based on building functions and specific thermal comfort requirements; - assessment of electric contribution by renewable energy sources; - operation of electric heating systems and how to interact with specialised companies; - integration with domotic systems and other heating systems; - optimisation of energy demand/offer, and thermal comfort conditions for users; - cost/benefit analysis.	Developing and experimenting innovative solutions for electric heating systems based on emerging components and technologies, interacting with R&D department of specialised companies. Pursuing the integration of electric heating systems with other active or passive heating systems, and with building automation systems. Performing dynamic energy simulations of the electric heating system by means of advanced simulation tools, in order to optimize the system with respect to energy consumption, occupant behaviour (frequency in using a space) and thermal comfort.	W	5	D
EN3.4.6	Specifying the design for electric heating systems in tender documents	Advanced knowledge of: - technical specifications of electric heating systems and their own energy performances; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting components and technical solutions that fit specifications and demands on given quality aspects and economics related to electric heating systems, ensuring the contribution to energy saving and thermal comfort for users. Writing technical documentation for contracting purpose.	W	4	D
EN3.4.7	Assuring the quality of electric heating systems	Advanced knowledge of: - standards and procedures for quality assurance in electric heating systems; - methods to evaluate quality of electric heating system installation (e.g. check-list survey, first-run inspection).	Managing, instructing and auditing contractors on site during the realisation of the electric heating system, based on information given in tender documents and given by the designer. Giving feedbacks to the design team on design and operation suitability of the installed electric heating system.	W	4	Cn
EN3.4.8	Installing traditional systems for electric heating	Medium knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on electric heating system installation; - construction waste management and disposal; - main types of electric heating systems for residential buildings.	Installing simple electric heating systems in a workmanlike manner. Installing complex solutions under supervision of expert team members.	B	3	Cn

EN3.4	Electric heating systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.4.9	Installing advanced systems for electric heating	In-depth knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on electric heating system installation; - construction waste management and disposal; - main types of electric heating systems for complex installations.	Installing advanced and complex solutions for electric heating systems (e.g. non residential buildings, integration with passive systems in NZEB buildings). Ability to interact with the design team and producers/suppliers of electric heating systems in order to solve problems on construction site.	B	5	Cn
EN3.4.10	Commissioning electric heating systems to ensure operation as planned	Advanced knowledge of: - standards and procedures for commissioning and quality assurance in electric heating systems; - support to resolution of disputes, subject to terms of the contract documents; - methods to evaluate the operativity of installed electric heating systems.	Commissioning the electric heating system after realisation, in order to check if the system fullfills all demands and fuctionality. Testing and adjusting the system under different operating conditions. Measuring indoor thermal comfort conditions for building users.	W	4	Cn, B
EN3.4.11	Ensuring optimal operation of electric heating systems during life cycle	Advanced knowledge of: - standards and procedures for management and maintenace of electric heating systems; - technical writing for reference and training manuals; - methods to evaluate the operativity of installed electric heating systems (e.g. testing and adjusting of the system, indoor microclimate measurements).	Designing the operative manual and the maintenance plan of the installed system, for the facility manager and/or for users. Instructing (the facility manager) on monitoring energy and microclimate parameters, to ensure the electric heating system achieves designed energy savings and comfort goals during its life cycle.	W	4	U

Table A.10 – EN3.5 – Heat pump systems

EN3.5	Heat pump systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.5.1	Understanding the importance of heat pump systems	Minimal knowledge of: - main types of heat pumps (e.g. air-air, air-water, water-water); - relationship between heat pump efficiency and source temperature.	Participating in discussions for the feasibility study of heat pump systems within a design team, considering also geothermal energy systems combined with heat pumps.	W, B	1	Co
EN3.5.2	Applying basic solutions for heat pump systems	Basic knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics; - metrics related to energy efficiency of heat pumps (e.g. COP, EER, HSPF, SEER); - main types of heat pumps (e.g. air-air, air-water, water-water, hybrid); - selection of heat pump types in relation to available thermal sources (e.g. air source, ground water source, ground source); - simple calculation methods to pre-size heat pumps (rules of thumb, graphic methods, datasheets).	Performing simplified verifications of energy performance for alternative heat pump systems, based on input from team members and the availability of different thermal sources.	W	2	D

EN3.5	Heat pump systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.5.3	Proposing conceptual solutions for heat pump systems and geothermal heat pumps (GHPs)	Medium knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics; - main regulations and technical standards on the design of heat pumps; - metrics related to energy efficiency of heat pumps (e.g. COP, EER, HSPF, SEER); - main types of heat pumps (e.g. air-air, air-water, water-water, hybrid); - selection of heat pump types in relation to available thermal sources (e.g. air source, ground water source, ground source); - integration with renewable energy sources; - main ground water and geothermal energy systems (e.g. open vs closed, horizontal vs vertical).	Selecting and proposing alternative solutions of heat pump systems for heating/cooling in residential buildings, specifically in relation to available energy sources (e.g. gas, electricity, water, soil). Pre-sizing the heat pump system with respect to thermal loads and for simple domestic installations (hybrid system coupled with boiler).	W	3	Co, D
EN3.5.4	Engineering the concept design for heat pump systems and geothermal heat pumps (GHPs)	Advanced knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics; - all regulations and technical standards on the design of heat pumps and the use of water/ground (e.g. groundwater discharge); - metrics related to energy efficiency of heat pumps (e.g. COP, EER, HSPF, SEER); - all types of heat pumps in relation to available thermal sources (e.g. air source, water source, ground source); - integration with renewable energy sources; - main ground water and geothermal energy systems (e.g. open vs closed, horizontal vs vertical); - heat pump system design for non residential buildings and complex energy systems; - interaction with specialised advisors (e.g. geologist) for suitability assessment of soil composition and GHPs installation; - cost/benefit analysis.	Engineering solutions for heat pump systems in non residential buildings and complex installations, performing cost/benefit analysis with respect to the selected thermal source. Calculating heat loss of the heat pump system, needed capacity, mono or bivalent, energy balances, noise reduction. Interacting with specialised advisors for the assessment of soil suitability (GHP systems) and for codes and regulations regarding groundwater discharge.	W	4	D
EN3.5.5	Developing new technical solutions and optimising the detailed design for heat pump systems and geothermal heat pumps (GHPs)	In-depth knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics; - all regulations and technical standards on the design of heat pumps and the use of water/ground (e.g. groundwater discharge); - metrics related to energy efficiency of heat pumps (e.g. COP, EER, HSPF, SEER); - all types of heat pumps in relation to available thermal sources (e.g. air source, water source, ground source); - main ground water and geothermal energy systems (e.g. open vs closed, horizontal vs vertical); - heat pump system design for NZEB, non residential buildings and complex energy systems; - integration with domotic systems, building management systems (BMS); - optimisation of heat pumps systems with heating/cooling passive systems and/or renewable energy sources;	Developing and experimenting innovative solutions for heat pump systems based on emerging components and technologies (hybrid systems, alternative thermal sources), interacting with R&D department of HP companies. Pursuing integration of heat pumps with passive heating/cooling systems and building automation systems. Optimising the heat pump system exploiting renewable energy sources (e.g. integration with PV system and battery storage system). Performing detailed drawings and hydraulic schemes to define functionality and automatisation strategies. Determining construction site boundaries for GHP systems (e.g. needed area, depth) and investment	W	5	D

EN3.5	Heat pump systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- soil composition and sampling method to determine if geothermal energy can be used; - cost/benefit analysis.	costs based on type of geothermal system and ground conditions.			
EN3.5.6	Specifying the design for heat pump systems in tender documents	Advanced knowledge of: - technical specifications of heat pump systems and their own energy performances; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting components and technical solutions that fit specifications and demands on given quality aspects and economics related to heat pump systems, ensuring the contribution to energy saving. Writing technical documentation for contracting purpose.	W	4	D
EN3.5.7	Assuring the quality of heat pump systems	Advanced knowledge of: - standards and procedures for quality assurance of heat pump systems; - methods to evaluate quality of heat pump system installation (e.g. check-list survey, first-run inspection).	Managing, instructing and auditing contractors on site during the realisation of the heat pump system, based on information given in tender documents and given by the designer. Giving feedbacks to the design team on design and operation suitability of the installed heat pump.	W	4	Cn
EN3.5.8	Installing heat pump systems for domestic use	Medium knowledge of: - construction handbooks, technical datasheets and design boards; - health and safety regulations on heat pump system installation; - main types of heat pump systems for residential buildings and their operation and control logic.	Installing simple heat pump systems in residential buildings in a workmanlike manner. Installing complex solutions under supervision of expert team members.	B	3	Cn
EN3.5.9	Installing advanced heat pump systems	In-depth knowledge of: - construction handbooks, technical datasheets and design boards; - health and safety regulations on heat pump system installation; - main types of heat pump systems for complex installations, geothermal systems, and their operation and control logic.	Installing advanced and complex solutions for heat pump systems with different thermal sources (specifically water pond/lake and geothermal energy systems). Ability to interact with the design team and producers/suppliers of heat pumps in order to solve problems on construction site.	B	5	Cn
EN3.5.10	Commissioning heat pump systems to ensure operation as planned	Advanced knowledge of: - standards and procedures for commissioning and quality assurance in heat pump systems; - support to resolution of disputes, subject to terms of the contract documents; - methods to evaluate the operativity of installed heat pump systems (e.g. testing of the system).	Commissioning the heat pump system after realisation, in order to check if the system fullfills all demands, fuctionality and foreseen energy performance is realised. Testing, adjusting and balancing the system under different operating conditions (full/partial loads, seasonal performance).	W	4	Cn, B
EN3.5.11	Ensuring optimal operation of heat pump systems during life cycle	Advanced knowledge of: - standards and procedures for management and maintenace of heat pump systems; - technical writing for reference and training manuals; - methods to evaluate the operativity of installed heat pump systems (e.g. testing of the system).	Designing the operative manual and the maintenance plan of the installed heat pump system, for the facility manager and/or for users. Instructing (the facility manager) on monitoring energy and microclimate parameters, to ensure the system achieves designed energy savings and comfort goals during its life cycle.	W	4	U

Table A.11 – EN3.6 – Solar thermal energy systems for heating, cooling and DHW

EN3.6	Solar thermal energy systems for heating, cooling and DHW					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.6.1	Understanding the importance of solar thermal energy systems	Minimal knowledge of: - main types of solar thermal systems and components (e.g. flat plates, evacuated tubes, thermodynamic panels, glazed/unglazed, storage tanks) - installation and usage for heating and DHW; - solar radiation exposure and energy production.	Participating in discussions for the feasibility study of solar thermal systems for heating/DHW within a design team, considering also solar thermal for cooling (absorption cooling systems).	W, B	1	Co
EN3.6.2	Applying basic solutions for solar thermal energy systems	Basic knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics; - main types of solar thermal systems and components (e.g. flat plates, evacuated tubes, thermodynamic panels, glazed/unglazed, storage tanks) - installation and usage for heating and DHW; - solar radiation exposure and energy production; - simple calculation methods to pre-size solar thermal systems in residential buildings (rules of thumb, graphic methods, datasheets).	Performing simplified verifications of energy performance and thermal power output for alternative solar thermal systems, based on solar radiation data and other input from team members.	W	2	D
EN3.6.3	Proposing conceptual solutions for solar thermal energy systems	Medium knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics; - main regulations and technical standards on the design of solar thermal systems ; - main types of solar thermal systems and components (e.g. flat plates, evacuated tubes, thermodynamic panels, glazed/unglazed, storage tanks); - installation codes in new/existing buildings and usage for heating, DHW and cooling; - analysis of climatic data and solar radiation exposure vs energy production; - calculation methods to size small solar thermal systems for heating/DHW in residential buildings.	Selecting and proposing alternative solutions of solar thermal systems for heating/DHW in residential buildings, in relation to building functions and architectural features. Designing the architectural integration of solar thermal systems (e.g. on flat/pitched roof, on facade, on the ground), specifically for existing buildings. Sizing the solar thermal system with respect to heating and DHW demand in residential buildings, estimating the needed storage volume and types of storage tanks, and the relation between water storage / peak demand /available solar energy.	W	3	Co, D
EN3.6.4	Engineering the concept design for solar thermal energy systems	Advanced knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics; - all regulations and technical standards on the design of solar thermal systems; - main types of solar thermal systems and components (e.g. flat plates, evacuated tubes, thermodynamic panels, glazed/unglazed, storage tanks); - solar thermal systems for cooling (e.g. absorption cooling with heat tube collectors); - hybrid PV/solar thermal systems; - installation codes in new/existing buildings and usage for heating, DHW and cooling; - environmental impact assessment of solar thermal systems; - analysis of climatic data and solar radiation exposure vs energy production; - solar thermal system design for heating/DHW and cooling in non residential	Engineering solutions for solar thermal systems in non residential buildings and complex installations, also considering solar absorption systems for cooling. Calculating accurate heating and DHW demand of the whole building (hourly simulation), performing a detailed design of the installation, operating principle, automatisation strategy, cost/benefit analysis. Pursuing the integration of PV systems with solar thermal systems, considering electricity demand vs heating/DHW demand. Assessing the impact of solar systems at building and landscape scale.	W	4	D

EN3.6	Solar thermal energy systems for heating, cooling and DHW					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		buildings and complex energy systems (also for industrial processes); - cost/benefit analysis.				
EN3.6.5	Developing new technical solutions and optimising the detailed design for solar thermal energy systems	In-depth knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics; - all regulations and technical standards on the design of solar thermal systems; - main types of solar thermal systems and components (e.g. flat plates, evacuated tubes, thermodynamic panels, glazed/unglazed, storage tanks); - solar thermal systems for cooling (e.g. absorption cooling with heat tube collectors); - hybrid PV/solar thermal systems; - installation codes in new/existing buildings and usage for heating, DHW and cooling; - environmental impact assessment of solar thermal systems; - analysis of climatic data and solar radiation exposure vs energy production; - solar thermal system design for heating/DHW and cooling in non residential buildings and complex energy systems (also for industrial processes); - interaction with R&D companies specialised in solar thermal systems; - hourly simulation of demand/offer extended to thermal energy storage, optimisation of the system energy performance; - cost/benefit analysis.	Developing and experimenting innovative solutions for solar thermal systems based on emerging components and technologies (hybrid systems, new selective surface materials, solar absorption cooling techniques), interacting with R&D department of specialised companies. Pursuing integration of solar thermal systems with passive heating/cooling systems and building automation systems. About cooling, engineering an absorption cooling generation system (e.g. heat tube collectors), calculating accurate cooling demand of the building in order to select the right capacity and considering cost/benefit aspects.	W	5	D
EN3.6.6	Specifying the design for solar thermal energy systems in tender documents	Advanced knowledge of: - technical specifications of solar thermal energy systems and their own energy performances; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting components and technical solutions that fit specifications and demands on given quality aspects and economics related to solar thermal energy systems, ensuring the contribution to energy saving. Writing technical documentation for contracting purpose.	W	4	D
EN3.6.7	Assuring the quality of solar thermal energy systems	Advanced knowledge of: - standards and procedures for quality assurance of solar thermal energy systems; - methods to evaluate quality of solar thermal energy system installation (e.g. check-list survey, first-run inspection).	Managing, instructing and auditing contractors on site during the realisation of the solar thermal energy system, based on information given in tender documents and given by the designer. Giving feedbacks to the design team on design and operation suitability of the installed solar thermal energy system.	W	4	Cn
EN3.6.8	Installing solar thermal energy systems for domestic use	Medium knowledge of: - construction handbooks, technical datasheets and design boards; - health and safety regulations on solar thermal energy system installation; - main types of solar thermal energy systems for residential buildings and their operation and control logic.	Installing simple solar thermal energy systems in residential buildings (heating, DHW) in a workmanlike manner. Installing complex solutions under supervision of expert team members.	B	3	Cn
EN3.6.9	Installing advanced solar thermal energy systems	In-depth knowledge of: - construction handbooks, technical datasheets and design boards; - health and safety regulations on solar thermal energy system installation; - main types of solar thermal energy systems for complex installations, and their operation and control logic.	Installing advanced and complex solutions for solar thermal energy systems (heating, DHW, and cooling). Ability to interact with the design team and producers/suppliers in order to solve problems on construction site.	B	5	Cn

EN3.6	Solar thermal energy systems for heating, cooling and DHW					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.6.10	Commissioning solar thermal energy systems to ensure operation as planned	Advanced knowledge of: - standards and procedures for commissioning and quality assurance in solar thermal energy systems; - support to resolution of disputes, subject to terms of the contract documents; - methods to evaluate the operativity of installed solar thermal systems (e.g. testing of the system).	Commissioning the solar thermal energy system after realisation, in order to check if the system fullfills all demands, fuctionality and foreseen energy performance is realised. Testing and adjusting the solar system under different operating conditions (full/partial loads, seasonal performance).	W	4	Cn, B
EN3.6.11	Ensuring optimal operation of solar thermal energy systems during life cycle	Advanced knowledge of: - standards and procedures for management and maintenace of solar thermal energy systems; - technical writing for reference and training manuals; - methods to evaluate the operativity of installed solar thermal energy systems (e.g. testing of the system).	Designing the operative manual and the maintenance plan of the installed solar thermal energy system, for the facility manager and/or for users. Instructing (the facility manager) on monitoring energy and microclimate parameters, to ensure the system achieves designed energy savings and comfort goals during its life cycle.	W	4	U

Table A.12 – EN3.7 – Solar power systems for electricity generation

EN3.7	Solar power systems for electricity generation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.7.1	Understanding the importance of solar power systems for electricity generation	Minimal knowledge of: - main types of PV systems (e.g. grid tied, off grid, hybrid, w/o battery storage); - main installation types and building integration; - solar radiation exposure and energy production.	Participating in discussions for the feasibility study of solar power systems for electricity generation within a design team, understanding the influence of external aspects on the performance (e.g. orientation, shadowing).	W, B	1	Co
EN3.7.2	Applying basic solutions for solar power systems for electricity generation	Basic knowledge of: - fundamental principles of energy and power, semiconducting materials; - main types of PV systems (e.g. grid tied, off grid, hybrid, w/o battery storage); - main installation types and building integration; - solar radiation exposure and energy production. - simple calculation methods to pre-size PV systems in residential buildings (rules of thumb, graphic methods, datasheets).	Performing simplified verifications of energy efficiency and power output for alternative solutions of PV systems, based on solar radiation data and other input from team members.	W	2	D
EN3.7.3	Proposing conceptual solutions for solar power systems for electricity generation	Medium knowledge of: - fundamental principles of energy and power, semiconducting materials, electrical systems (low voltage); - main types of PV systems (e.g. grid tied, off grid, hybrid, w/o battery storage); - regulations for installation in new/existing buildings;	Selecting and proposing alternative solutions of PV systems in residential buildings, in relation to building functions and architectural features. Designing the architectural integration of PV systems (e.g. on flat/pitched roof, on facade, on the ground),	W	3	Co, D

EN3.7	Solar power systems for electricity generation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- connection process for grid tied PV systems; - main installation types and building integration, BIPV systems; - analysis of climatic data and solar radiation exposure vs energy production; - calculation methods to size small PV systems in residential buildings.	specifically for existing buildings, and considering Building Integrated PV solutions (BIPV) for new buildings. Sizing the PV system with respect to energy demand in residential buildings.			
EN3.7.4	Engineering the concept design for solar power systems for electricity generation	Advanced knowledge of: - fundamental principles of energy and power, semiconducting materials, electrical systems (low voltage); - all regulations and technical standards on the design of PV systems; - main types of PV systems (e.g. grid tied, off grid, hybrid, w/o battery storage); - main installation types and building integration, BIPV systems; - regulations for installation in new/existing buildings; - environmental impact assessment of PV systems; - connection process for grid tied PV systems and smart grid systems; - hybrid PV/solar thermal systems; - analysis of climatic data and solar radiation exposure vs energy production; - PV system design in non residential buildings and complex energy systems (also for industrial processes); - cost/benefit analysis.	Engineering solutions for PV systems in non residential buildings and complex installations, estimating battery storage for power generated by PV cells, and electrical components (e.g. power inverter). Calculating accurate energy demand of the whole building (hourly simulation), performing a detailed design of the installation, operating principle, automatisation strategy, cost/benefit analysis. Pursuing the integration of PV systems with solar thermal systems, considering electricity demand vs heating/DHW demand. Assessing the impact of PV systems at building and landscape scale.	W	4	D
EN3.7.5	Developing new technical solutions and optimising the detailed design for solar power systems for electricity generation	In-depth knowledge of: - fundamental principles of energy and power, semiconducting materials, electrical systems (low voltage); - all regulations and technical standards on the design of PV systems; - main types of PV systems (e.g. grid tied, off grid, hybrid, w/o battery storage); - main installation types and building integration, BIPV systems; - regulations for installation in new/existing buildings; - environmental impact assessment of PV systems; - connection process for grid tied PV systems and smart grid systems; - hybrid PV/solar thermal systems; - advanced cooling techniques of PV modules, innovative materials for PV technology; - interaction with R&D companies specialised in PV systems; - analysis of climatic data and solar radiation exposure vs energy production; - hourly simulation of energy demand/offer extended to energy storage, optimisation of the system energy performance; - PV system design in non residential buildings and complex energy systems (also for industrial processes); - cost/benefit analysis.	Developing and experimenting innovative solutions for PV systems based on emerging components and technologies (e.g. advanced cooling techniques of PV modules, innovative materials for PV technology with low cost and high performances), interacting with R&D department of specialised companies. Pursuing integration of PV systems with other renewable energy sources (e.g. mini wind power generation, geothermal) and with passive heating/cooling systems. Optimising the PV energy production and usage by means of building automation systems. Partecipating to the design process of Smart Grid systems, PV power stations, PV plants for hydrogen production.	W	5	D
EN3.7.6	Specifying the design for solar power systems for electricity generation in tender documents	Advanced knowledge of: - technical specifications of PV systems and their own energy performances; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting components and technical solutions that fit specifications and demands on given quality aspects and economics related to PV systems, ensuring the contribution to energy saving. Writing technical documentation for contracting purpose.	W	4	D
EN3.7.7	Assuring the quality of solar power systems	Advanced knowledge of: - standards and procedures for quality assurance of PV systems; - methods to evaluate quality of PV system installation (e.g. check-list survey, first-	Managing, instructing and auditing contractors on site during the realisation of the PV system, based on information given in tender documents and given by	W	4	Cn

EN3.7	Solar power systems for electricity generation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
	for electricity generation	run inspection).	the designer. Giving feedbacks to the design team on design and operation suitability of the installed PV system.			
EN3.7.8	Installing solar power systems for domestic use	Medium knowledge of: - construction handbooks, technical datasheets and design boards; - health and safety regulations on PV system installation; - main types of PV systems for residential buildings and their operation and control logic.	Installing simple PV systems in residential buildings in a workmanlike manner. Installing complex solutions under supervision of expert team members.	B	3	Cn
EN3.7.9	Installing advanced solar power systems for electricity generation	In-depth knowledge of: - construction handbooks, technical datasheets and design boards; - health and safety regulations on PV system installation; - main types of PV systems for complex installations, and their operation and control logic.	Installing advanced and complex solutions for solar power systems for electricity generation. Ability to interact with the design team and producers/suppliers in order to solve problems on construction site.	B	5	Cn
EN3.7.10	Commissioning solar power systems for electricity generation to ensure operation as planned	Advanced knowledge of: - standards and procedures for commissioning and quality assurance in PV systems; - support to resolution of disputes, subject to terms of the contract documents; - methods to evaluate the operativity of installed PV systems (e.g. testing of the system).	Commissioning the PV system after realisation, in order to check if the system fullfills all demands, fuctionality and foreseen energy performance is realised. Testing and adjusting the PV system under different operating conditions (full/partial loads, seasonal performance).	W	4	Cn, B
EN3.7.11	Ensuring optimal operation of solar power systems for electricity generation during life cycle	Advanced knowledge of: - standards and procedures for management and maintenace of PV systems; - technical writing for reference and training manuals; - methods to evaluate the operativity of installed PV systems (e.g. testing of the system).	Designing the operative manual and the maintenance plan of the installed PV system, for the facility manager and/or for users. Instructing (the facility manager) on monitoring energy production, to ensure the system achieves designed power output and performance during its life cycle.	W	4	U

Table A.13 – EN3.8 – Combined Heat and Power (CHP) generation

EN3.8	Combined Heat and Power (CHP) generation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.8.1	Understanding the importance of CHP generation	Minimal knowledge of: - main types of CHP generation systems and micro-CHP systems; - selection of system types based on available fuel sources and energy production.	Participating in discussions for the feasibility study of CHP generation systems within a design team.	W, B	1	Co

EN3.8	Combined Heat and Power (CHP) generation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.8.2	Applying basic solutions for CHP generation systems	Basic knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics; - primary energy and primary energy factors; - main types of CHP generation systems and micro-CHP systems and their own energy performances; - selection of system types based on available fuels, energy production and usage; - simplified calculation methods to pre-size micro-CHP systems in residential buildings (rules of thumb, datasheets).	Performing simplified verifications of alternative micro-CHP systems, based on input from team members, considering available energy sources, technical demands, regulations.	W	2	D
EN3.8.3	Proposing conceptual solutions for CHP generation systems	Medium knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics; - primary energy and primary energy factors; - main regulations and technical standards on the design of CHP generation systems and safety; - main types of CHP generation systems and micro-CHP systems and their own energy performances; - selection of CHP technology based on heat demand and power demand; - integration with building management systems (BMS) to improve CHP performances; - design for residential buildings, non residential buildings, industrial processes.	Selecting and proposing alternative solutions for CHP generation systems in residential/non residential buildings, performing a feasibility study on the use of CHP regarding technical demands, regulations and costs. Estimating the needed electrical power/heating demand and the needed heat storage in order to define possibilities of CHP.	W	3	Co, D
EN3.8.4	Engineering the concept design for CHP generation systems	Advanced knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics; - primary energy and primary energy factors; - main regulations and technical standards on the design of CHP generation systems and safety; - main types of CHP generation systems and micro-CHP systems and their own energy performances; - selection of CHP technology based on heat demand and power demand; - integration with building management systems (BMS) to improve CHP performances; - environmental impact assessment of CHP generation plants; - design of CHP technology for district heating at cluster scale, storage and load management; - cost/benefit analysis.	Engineering solutions for CHP generation systems for non residential buildings and complex installations (district heating at cluster scale), performing cost/benefit analysis. At building scale, estimating heating/cooling/DHW hourly demand of the building to size the CHP system and defining control strategies by means of BMS technologies. At cluster scale, collaborating in team to design a CHP generator for district heating. Assessing the impact of CHP generation plants at building and landscape scale, and monitoring CHP performances overtime.	W	4	D
EN3.8.5	Developing new technical solutions and optimising the detailed design for CHP generation systems	In-depth knowledge of: - fundamental principles of energy and heat transfer, thermodynamics, fluid mechanics; - primary energy and primary energy factors; - all regulations and technical standards on the design of CHP generation systems and safety; - state-of-the-art on CHP generation systems and micro-CHP systems and their own energy performances; - selection of CHP technology based on heat demand and power demand; - integration with building management systems (BMS) to improve CHP	Developing and experimenting innovative solutions for CHP generator systems based on emerging components and technologies, interacting with R&D department of specialised companies. Partecipating to the design process of district heating at cluster and city scale equipped with CHP generator plants.	W	5	D

EN3.8	Combined Heat and Power (CHP) generation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		performances; - environmental impact assessment of CHP generation plants; - design of CHP technology for district heating at cluster and city scale, storage and load management; - design of monitoring campaigns to assess CHP performance overtime; - cost/benefit analysis.				
EN3.8.6	Specifying the design for CHP generation systems in tender documents	Advanced knowledge of: - technical specifications of CHP generation systems and their own energy performances; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting components and technical solutions that fit specifications and demands on given quality aspects and economics related to CHP generation systems, ensuring the contribution to energy saving and IEQ for users. Writing technical documentation for contracting purpose.	W	4	D
EN3.8.7	Assuring the quality of CHP generation systems	Advanced knowledge of: - standards and procedures for quality assurance in CHP systems; - methods to evaluate quality of CHP system installation (e.g. check-list survey, first-run inspection).	Managing, instructing and auditing contractors on site during the realisation of the CHP system, based on information given in tender documents and given by the designer. Giving feedbacks to the design team on design and operation suitability of the installed CHP system.	W	4	Cn
EN3.8.8	Installing micro-CHP generation systems in residential buildings	Medium knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on micro-CHP system installation; - construction waste management and disposal; - main types of micro-CHP systems for residential buildings.	Installing simple micro-CHP systems for residential buildings. Installing complex solutions under supervision of expert team members.	B	3	Cn
EN3.8.9	Installing advanced systems for CHP generation	In-depth knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on CHP system installation; - construction waste management and disposal; - main types of CHP systems for complex installations.	Installing advanced and complex solutions for CHP systems (e.g. non residential buildings, industrial processes, CHP plants for district heating). Ability to interact with the design team and producers/suppliers of CHP systems in order to solve problems on construction site.	B	5	Cn
EN3.8.10	Commissioning CHP generation systems to ensure operation as planned	Advanced knowledge of: - standards and procedures for commissioning and quality assurance in CHP generation systems; - support to resolution of disputes, subject to terms of the contract documents; - methods to evaluate the operativity of installed CHP systems (e.g. testing and adjusting/balancing of the system).	Commissioning the CHP generation system after realisation, in order to check if the system fullfills all demands and fuctionality. Testing, adjusting and balancing the system under different operating conditions. Measuring energy performance overtime.	W	4	Cn, B
EN3.8.11	Ensuring optimal operation of CHP generation systems during life cycle	Advanced knowledge of: - standards and procedures for management and maintenace of CHP generation systems; - technical writing for reference and training manuals; - methods to evaluate the operativity of installed CHP generation systems (e.g. testing and adjusting/balancing of the system, energy performance measurements).	Designing the operative manual and the maintenance plan of the installed CHP generation system, for the facility manager and/or for users. Instructing (the facility manager) on monitoring energy parameters, to ensure the system achieves designed energy savings and functionality during its life cycle.	W	4	U

Table A.14 – EN3.9 – Mini wind power generation

EN3.9	Mini wind power generation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.9.1	Understanding the importance of mini wind power generation	Minimal knowledge of: - energy production systems from renewable energy sources; - main types of mini wind power generation systems (mounted on tower, on building); - components of mini wind systems (e.g. wind turbine, tower, batteries for stand-alone systems, inverters for grid-connected systems); - selection of system types based on wind availability and energy production.	Participating in discussions for the feasibility study of mini wind power generation systems within a design team. Awareness of constraints and boundary conditions for mini wind system installation (e.g. regulations, construction, available energy sources).	W, B	1	Co
EN3.9.2	Applying basic solutions for mini wind power generation systems	Basic knowledge of: - fundamental principles of energy and electrical engineering, mechanics, turbines; - energy production systems from renewable energy sources; - main types of mini wind power generation systems (mounted on tower, on building); - components of mini wind systems (e.g. wind turbine, tower, batteries for stand-alone systems, inverters for grid-connected systems); - selection of system types based on wind availability and energy production; - climatic data analysis for specific location and site selection; - simplified calculation methods to pre-size mini wind systems for residential buildings (rules of thumb, datasheets).	Performing simplified verifications of alternative mini wind power generation systems, based on input from team members, considering available wind in a specific location, height and orientation of wind turbines, technical demands, regulations.	W	2	D
EN3.9.3	Proposing conceptual solutions for mini wind power generation systems	Medium knowledge of: - fundamental principles of energy and electrical engineering, mechanics, turbines; - main regulations and technical standards on the design and safety of mini wind power generation systems; - permitting and zoning regulations for construction of mini wind power generation systems; - main types of mini wind power generation systems (mounted on tower, on building); - components of mini wind systems (e.g. wind turbine, tower, batteries for stand-alone systems, inverters for grid-connected systems); - selection of system types based on wind availability and energy production. - integration with building management systems (BMS) to improve energy efficiency; - climatic data analysis for specific location and site selection; - energy production assessment from renewable energy sources with respect to energy demand of the building; - design for small size wind power systems in residential buildings.	Selecting and proposing alternative solutions for mini wind power generation systems in residential buildings, performing a feasibility study on the use of mini wind regarding technical demands, regulations and costs. Estimating the needed electrical power demand and the needed storage in order to define possibilities of mini wind power systems, defining the part of mini wind power on total power supply.	W	3	Co, D
EN3.9.4	Engineering the concept design for mini wind power generation systems	Advanced knowledge of: - fundamental principles of energy and electrical engineering, mechanics, turbines; - main regulations and technical standards on the design and safety of mini wind power generation systems; - permitting and zoning regulations for construction of mini wind power generation systems; - main types of mini wind power generation systems (mounted on tower, on building);	Engineering solutions for mini wind power generation systems at building or cluster scale, including batteries and power inverters, in coherence with other power supply sources and based on detailed calculation of the needed power. Partecipating in design team for the connection of wind power generation systems (cluster scale) to urban smart grid systems.	W	4	D

EN3.9	Mini wind power generation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- components of mini wind systems (e.g. wind turbine, tower, batteries for stand-alone systems, inverters for grid-connected systems); - selection of system types based on wind availability and energy production. - integration with building management systems (BMS) to improve energy efficiency; - climatic data analysis for specific location and site selection; - environmental impact assessment of mini wind power systems; - hourly simulation of energy demand/offer at building or cluster scale; - design for mini wind power systems in residential buildings at cluster scale; - cost/benefit analysis.	Engineering of the construction strenght for placing mini-turbine, considering cost/benefit analysis and permitting/zoning local regulations for mini wind installation. Assessing the impact of mini wind power generation systems at building and landscape scale, and monitoring energy performances overtime.			
EN3.9.5	Developing new technical solutions and optimising the detailed design for mini wind power generation systems	In-depth knowledge of: - fundamental principles of energy and electrical engineering, mechanics, turbines; - main regulations and technical standards on the design and safety of mini wind power generation systems; - permitting and zoning regulations for construction of mini wind power generation systems; - main types of mini wind power generation systems (mounted on tower, on building); - components of mini wind systems (e.g. wind turbine, tower, batteries for stand-alone systems, inverters for grid-connected systems); - selection of system types based on wind availability and energy production. - integration with building management systems (BMS) to improve energy efficiency; - integration with other renewable energy sources (e.g. PV systems, geothermal); - climatic data analysis for specific location and site selection; - environmental impact assessment of mini wind power systems; - hourly simulation of energy demand/offer at building or cluster scale; - design for mini wind power systems in residential buildings at cluster scale; - cost/benefit analysis. - design of monitoring campaigns to assess CHP performance overtime; - cost/benefit analysis.	Developing and experimenting innovative solutions for mini wind power generation systems based on emerging components and technologies, interacting with R&D department of specialised companies. Optimising mini wind power systems combining them with multiple renewable energy sources (e.g. PV systems, geothermal) to deliver non-intermittent electric power. Partecipating to the design process of wind power generation plants at cluster and city scale.	W	5	D
EN3.9.6	Specifying the design for mini wind power generation systems in tender documents	Advanced knowledge of: - technical specifications of CHP generation systems and their own energy performances; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting components and technical solutions that fit specifications and demands on given quality aspects and economics related to CHP generation systems, ensuring the contribution to energy saving and IEQ for users. Writing technical documentation for contracting purpose.	W	4	D
EN3.9.7	Assuring the quality of mini wind power generation systems	Advanced knowledge of: - standards and procedures for quality assurance in mini wind power generation systems; - methods to evaluate quality of mini wind system installation (e.g. check-list	Managing, instructing and auditing contractors on site during the realisation of the mini wind power generation system, based on information given in tender documents and given by the designer. Giving feedbacks to the design team on design and	W	4	Cn

EN3.9	Mini wind power generation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		survey, first-run inspection).	operation suitability of the installed mini wind system.			
EN3.9.8	Installing mini wind power generation systems in residential buildings	Medium knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on mini wind power generation system installation; - construction waste management and disposal; - main types of mini wind power generation systems for residential buildings.	Installing simple mini wind power generation systems for residential buildings. Installing complex solutions under supervision of expert team members.	B	3	Cn
EN3.9.9	Installing advanced systems for mini wind power generation systems	In-depth knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on mini wind power generation system installation; - construction waste management and disposal; - main types of mini wind systems for complex installations.	Installing advanced and complex solutions for mini wind power generation systems (at cluster level). Ability to interact with the design team and producers/suppliers of mini wind systems in order to solve problems on construction site.	B	5	Cn
EN3.9.10	Commissioning mini wind power generation systems to ensure operation as planned	Advanced knowledge of: - standards and procedures for commissioning and quality assurance in mini wind power generation systems; - support to resolution of disputes, subject to terms of the contract documents; - methods to evaluate the operativity of installed mini wind systems.	Commissioning the mini wind power generation system after realisation, in order to check if the system fullfills all demands and fuctionality. Testing, adjusting and balancing the system under different operating conditions. Measuring energy performance overtime.	W	4	Cn, B
EN3.9.11	Ensuring optimal operation of mini wind power generation systems during life cycle	Advanced knowledge of: - standards and procedures for management and maintenace of mini wind power generation systems; - technical writing for reference and training manuals; - methods to evaluate the operativity of installed mini wind generation systems (e.g. testing and adjusting/balancing of the system, energy performance measurements).	Designing the operative manual and the maintenance plan of the installed mini wind power generation system, for the facility manager and/or for users. Instructing (the facility manager) on monitoring energy parameters, to ensure the system achieves designed energy savings and functionality during its life cycle.	W	4	U

Table A.15 – EN3.10 – Energy storage systems (long duration storage, central/ decentralised)

EN3.10	Energy storage systems (long duration storage, central/ decentralised)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.10.1	Understanding the different classifications of energy storage	Minimal knowledge of: - energy generation; - energy efficiency; - energy consumption; - energy storage.	Discussing within a design team short-term, mid-term and long-term energy storage systems.	B, W	1	Co, D
EN3.10.2	Understanding the concept of balancing energy generation and consumption	Minimal knowledge of: - energy generation; - energy efficiency; - energy consumption; - energy storage.	Discussing within a design team distribution and storage systems. Understanding the concept of balancing energy generation and consumption.	W	1	U

EN3.10	Energy storage systems (long duration storage, central/ decentralised)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN3.10.3	Proposing basic solutions for energy storage	Basic knowledge of: - energy storage classification; - energy generation; - energy efficiency; - energy consumption; - technical standards and regulations.	Selecting energy storage systems according to the project demand. Proposing basic solutions for the system.	W	2	Co, D
EN3.10.4	Analysing technical solutions for energy storage	Medium knowledge of: - energy storage types according to the classification; - energy generation; - energy efficiency; - energy consumption and distribution network; - energy storage; - green hydrogen concept; - technical standards and regulations.	Analysing technical solutions for energy storage according to the project demand. Checking available technologies and applicable standards and regulations.	W	3	Co, D, U
EN3.10.5	Engineering energy storage systems	Advanced knowledge of: - energy storage types according to the classification; - energy generation; - energy efficiency; - energy consumption and distribution network; - energy storage; - green hydrogen concept; - technical standards and regulations.	Engineering solutions to store energy. Measuring distribution network, energy consumption, load leveling, energy generation, consumer profile. Evaluating technology options, such as green hydrogen for long-term storage.	W	4	Co, D
EN3.10.6	Evaluating the feasibility of energy storage systems	Advanced knowledge of: - financial/ economic analysis; - energy efficiency and savings; - flexibility, energy storage and smart grid integration; - energy supply and distribution; - systems monitoring; - district heating/ cooling; - dynamic energy simulation; - the use of green hydrogen to long-term storage; - technical standards and regulations.	Evaluating economic and technical aspects of energy storage systems and the feasibility of integrating green hydrogen for long-term storage. Providing cost-benefit analysis. Analysing technical standards and local regulations.	W	4	Co, D, U
EN3.10.7	Installing and maintaining energy storage systems	In-depth knowledge of: - energy storage systems installation and maintenance; - systems integration; - technical standards and regulations	Installing, integrating and maintaining energy storage systems	B	5	Cn, B, U
EN3.10.8	Developing a green hydrogen strategy	In-depth knowledge of: - the difference between the sources of hydrogen production; - decarbonization of the energy sector; - long-term energy storage; - energy efficiency; - energy consumption and distribution network;	Formulating a long-term storage strategy based on green hydrogen. Developing a cost-benefit analysis. Optimising generation/storage/ consumption of energy. Evaluating the feasibility of cogeneration plants.	W	5	Co, D, U

EN3.10	Energy storage systems (long duration storage, central/ decentralised)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- district heating/cooling; - performance of systems; - technical standards and regulations.				
EN3.10.9	Commissioning energy storage systems	In-depth knowledge of: - energy auditing, - systems monitoring; - energy generation systems installation; - smart grid/ energy systems integration; - energy distribution; - energy storage; - energy efficiency; -technical standards and regulations.	Managing measurements and evaluation of energy storage systems. Testing systems. Verifying construction documents and equipment datasheets. Evaluating systems performance and operation. Providing analysis report.	W	5	B

A.1.1.4 Macro Area: EN4 - Energy Reduction

Table A.16 – EN4.1 – Thermal insulation

EN4.1	Thermal insulation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN4.1.1	Understanding the importance of thermal insulation	Minimal knowledge of: - fundamental principles of energy and heat transfer; - energy regulations and technical standard requirements; - thermal insulation materials.	Participating in discussions for the feasibility study of thermal insulation within a design team.	W, B	1	Co
EN4.1.2	Applying basic solutions for thermal insulation	Basic knowledge of: - energy performance of building envelope (steady state - winter season); - metrics related to thermal insulation; - energy regulations and technical standard requirements; - thermal insulation materials and simple technical solutions; - simple calculation methods (rules of thumb, datasheet).	Performing simplified energy verification to assess thermal performances of alternative insulation solutions and their compliance with standard requirements.	W	2	D
EN4.1.3	Proposing conceptual solutions for thermal insulation	Medium knowledge of: - energy performance of building envelope (steady state - winter and summer season); - metrics related to thermal insulation; - thermal bridges and corrective measures; - energy regulations and technical standard requirements; - thermal insulation materials and technical solutions; - commercial software for thermal analysis (steady state).	Selecting and proposing alternative insulation solutions, focussing on thermal bridge analysis and correction. Assessing the resulting energy performance of the building envelope by means of commercial energy simulation tools.	W	3	Co, D

EN4.1	Thermal insulation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN4.1.4	Engineering the concept design for thermal insulation	Advanced knowledge of: - energy performance of building envelope in dynamic and steady state; - metrics related to thermal insulation; - thermal mass effect, thermal bridges and corrective measures; - energy regulations and technical standard requirements; - thermal insulation materials and complex technical solutions; - thermal insulation for existing buildings (building renovations) affected by dampness and mold problems; - dynamic thermal energy simulation by means of advanced BPS tools; - cost/benefit analysis.	Engineering solutions for thermal insulation and thermal bridges correction, considering cost/benefit analysis and fulfilling standard requirements. Defining solutions for dampness and mold in existing buildings, considering the most suitable correction techniques. Performing dynamic energy simulations of the building envelope by means of advanced building performance simulation tools (BPS), assessing the impact of thermal insulation on indoor thermal comfort.	W	4	D
EN4.1.5	Developing new technical solutions and optimising the detailed design for thermal insulation	In-depth knowledge of: - energy performance of building envelope in dynamic and steady state; - metrics related to thermal insulation; - thermal mass effect, thermal bridges and corrective measures; - energy regulations and technical standard requirements; - innovative thermal insulation materials (e.g. phase change materials, thermal reflective insulation) and emerging technical solutions; - dynamic thermal energy simulation by means of advanced BPS tools; - cost/benefit analysis.	Developing and experimenting innovative solutions for thermal insulation based on emerging technologies. Performing dynamic energy simulations of the building envelope by means of advanced building performance simulation (BPS) tools, optimizing the thermal insulation with respect to indoor comfort and sound insulation.	W	5	D
EN4.1.6	Specifying the design for thermal insulation in tender documents	Advanced knowledge of: - technical specifications of building envelope and thermal insulation; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to thermal insulation. Writing technical documentation for contracting purpose.	W	4	D
EN4.1.7	Installing thermal insulation in a workmanlike manner	Medium knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on handling thermal insulation materials; - construction waste management and disposal; - thermal insulation materials and technical solutions.	Installing traditional solutions for thermal insulation in a workmanlike manner.	B	3	Cn
EN4.1.8	Installing thermal insulation in advanced buildings	In-depth knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on handling thermal insulation materials; - construction waste management and disposal; - renovations for existing buildings affected by dampness and mold problems; - thermal insulation materials and technical solutions for NZEB envelopes.	Installing advanced solutions for thermal insulation of NZEB envelopes (e.g. air tightness thermal coat) and for existing buildings affected by dampness and mold problems.	B	5	Cn

EN4.1	Thermal insulation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN4.1.9	Assuring the quality of installed thermal insulation	Advanced knowledge of: - standards and procedures for quality assurance in construction works; - qualitative methods to evaluate building quality (e.g. check-list); - quantitative methods to evaluate building quality (e.g. thermographic survey).	Managing, instructing and auditing contractors in construction site on the installation of thermal insulation, based on information given in tender documents and by the design team. Giving feedbacks to the design team on critical aspects of the installed thermal insulation.	W	4	Cn
EN4.1.10	Measuring thermal performances of building envelope	In-depth knowledge of: - standards and procedures for building commissioning; - technical standards on building physics measurements; - infrared methods (advanced thermography ISO 6781-3 compliant); - thermo-flow meter methods; - indoor microclimatic monitoring over time; - support to resolution of disputes, subject to terms of the contract documents.	Performing thermal measurements to detect heat, air and moisture irregularities in building envelope and to assess indoor conditions. Collecting and analysing data in order to evaluate the thermal insulation quality and its effect on building energy performance. Supporting resolution of disputes, subject to terms of the contract documents.	W	5	B, U

Table A.17 – EN4.2 – Building air tightness

EN4.2	Building air tightness					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN4.2.1	Understanding the importance of building air tightness	Minimal knowledge of: - influence of air leakeges on building energy performance; - energy regulations and technical standard requirements; - air tightness properties of openings (e.g. windows, doors).	Participating in discussions for the feasibility study of building air tightness within a design team.	W, B	1	Co
EN4.2.2	Applying basic solutions for building air tightness	Basic knowledge of: - energy performance of building envelope and its airtightness; - metrics related to air permeability of envelopes; - energy regulations, health regulations on IAQ, and technical standard requirements; - airtight materials and simple technical solutions.	Performing simplified energy verification to assess thermal performances of alternative airtightness solutions for building envelope and their compliance with standard requirements.	W	2	D
EN4.2.3	Proposing conceptual solutions for building air tightness	Medium knowledge of: - energy performance of building envelope and its airtightness; - metrics related to air permeability of envelopes; - energy regulations, health regulations on IAQ, and technical standard requirements; - air leakage points (e.g. draughts from envelope gaps), heat losses, condensation	Selecting and proposing alternative solutions for airtight envelopes. Analysing airtightness testing outcomes (e.g. Blower Door test) in order to drive air leakage points analysis and correction.	W	3	Co, D

EN4.2	Building air tightness					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		risk in structures, and corrective measures; - airtight materials, airtight opening devices and technical solutions.				
EN4.2.4	Engineering the concept design for building air tightness	Advanced knowledge of: - energy performance of building envelope in dynamic and steady state; - metrics related to air permeability of envelopes; - energy regulations, health regulations on IAQ, and technical standard requirements; - air leakege points (e.g. draughts from envelope gaps), heat losses, condensation risk in structures, reduced acoustic insulation, and corrective measures; - airtight materials, airtight opening devices and complex technical solutions; - air flow modelling software for air tightness and leakege assessment; - cost/benefit analysis.	Engineering solutions for airtight envelopes and air leakege correction, considering cost/benefit analysis and fulfilling standard requirements. Performing dynamic energy simulations of the building envelope by means of advanced BPS tools, assessing the impact of airthightness on indoor air quality and thermal comfort.	W	4	D
EN4.2.5	Developing new technical solutions and optimising the detailed design for building air tightness	In-depth knowledge of: - energy performance of building envelope in dynamic and steady state; - metrics related to air permeability of envelopes; - energy regulations, health regulations on IAQ, and technical standard requirements; - air leakege points (e.g. draughts from envelope gaps), heat losses, condensation risk in structures, reduced acoustic insulation, and corrective measures; - innovative airtight materials, airtight opening devices and and emerging technical solutions; - air flow modelling software for air tightness and leakege assessment; - cost/benefit analysis.	Developing and experimenting innovative solutions for airtight envelopes and air leakege correction based on emerging technologies. Performing dynamic energy simulations of the building envelope by means of advanced BPS tools, optimizing the airtightness with respect to indoor air quality, thermal comfort and sound insulation.	W	5	D
EN4.2.6	Specifying the design for building air tightness in tender documents	Advanced knowledge of: - technical specifications of building envelope, airtithtness and thermal insulation; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to airtight envelops. Writing technical documentation for contracting purpose.	W	4	D
EN4.2.7	Installing airtight envelopes in a workmanlike manner	Medium knowledge of: - construction handbooks and technical datasheets; - health and safety regulations; - airtight opening systems (e.g. doors, windows); - importance of air tightness measurement methods.	Installing airtight opening systems (e.g. doors, windows) in a workmanlike manner.	B	3	Cn
EN4.2.8	Installing airtight envelopes in advanced buildings	In-depth knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on handling thermal insulation materials; - airtight insulation materials and technical solutions for NZEB envelopes; - air tightness measurement methods.	Installing advanced solutions for thermal insulation of NZEB envelopes (e.g. airtight thermal coat).	B	5	Cn
EN4.2.9	Assuring the quality of installed airtight envelopes	Advanced knowledge of: - standards and procedures for quality assurance in construction works; - qualitative methods to evaluate building quality (e.g. check-list); - quantitative methods to evaluate building quality (e.g. thermographic survey).	Managing, instructing and auditing contractors in construction site on the installation of airtight materials and opening systems for building airtightness, based on information given in tender	W	4	Cn

EN4.2	Building air tightness					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
			documents and by the design team. Giving feedbacks to the design team on critical aspects of the installed thermal airtightness envelope.			
EN4.2.10	Measuring airtight performances of building envelope	In-depth knowledge of: - standards and procedures for building commissioning; - technical standards on building physics measurements; - Blower-Door test methods; - infrared methods (advanced thermography ISO 6781-3 compliant); - indoor microclimatic monitoring over time; - support to resolution of disputes, subject to terms of the contract documents.	Performing air leakege measurements to detect heat, air and moisture irregularities in building envelope and to assess indoor conditions. Collecting and analysing data in order to evaluate the thermal insulation quality and its effect on building energy performance. Supporting resolution of disputes, subject to terms of the contract documents.	W	5	B, U

Table A.18 – EN4.3 – Window and glazing systems

EN4.3	Window and glazing systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN4.3.1	Understanding the importance of window/glazing systems	Minimal knowledge of: - window/glazing systems in relation to daylighting performance; - energy regulations and technical standard requirements; - thermal and optical properties of glazing systems.	Participating in discussions for the feasibility study of window/glazing systems within a design team.	W, B	1	Co
EN4.3.2	Applying basic solutions for window/glazing systems	Basic knowledge of: - window/glazing systems in relation to daylighting and energy performance of buildings; - metrics related to thermal and optical properties of glazing systems (e.g. U-value, G-value, light transmittance); - energy regulations and technical standard requirements; - simple calculation methods (rules of thumb, datasheet).	Performing simplified verification to assess daylight factor and thermal performances of alternative glazing solutions for building envelope, considering their compliance with standard requirements.	W	2	D
EN4.3.3	Proposing conceptual solutions for window/glazing systems	Medium knowledge of: - window/glazing systems in relation to daylighting, acoustic and energy performance of buildings; - metrics related to optical, thermal and acoustic properties of glazing systems (e.g. g-value, U-value, light transmittance, sound transmission loss); - regulations and technical standard requirements on energy performance, daylighting, sound insulation; - static glazing technologies (e.g. multipane glazing, low-emissivity coatings, vacuum glazing) and daylight systems (e.g. solartubes); - commercial software for thermal and daylighting analysis.	Selecting and proposing alternative solutions for windows or glazing envelopes, focussing on thermal insulation and seasonal solar heat gain. Assessing the resulting energy and daylighting performance of the building envelope by means of commercial energy simulation tools.	W	3	Co, D
EN4.3.4	Engineering the concept design for	Advanced knowledge of: - window/glazing systems in relation to daylighting, acoustic and energy performance of buildings;	Engineering solutions for glazing envelopes, fixing thermal bridging, considering cost/benefit analysis and fulfilling standard requirements.	W	4	D

EN4.3	Window and glazing systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
	window/glazing systems	- metrics related to optical, thermal and acoustic properties of glazing systems (e.g. U-value, G-value, light transmittance, sound transmission loss); - regulations and technical standard requirements on energy performance, daylighting, sound insulation; - static glazing technologies (e.g. multipane glazing, low-emissivity coatings, vacuum glazing) and daylight systems (e.g. solartubes); - thermal bridging correction around windows/glazing systems (e.g. in relation to window frame and wall); - dynamic energy simulation software for thermal/daylight analysis; - cost/benefit analysis.	Performing dynamic energy simulations of the glazing envelope by means of advanced simulation tools, assessing the energy performance of the building and its impact on indoor thermal comfort.			
EN4.3.5	Developing new technical solutions and optimising the detailed design for window/glazing systems	In-depth knowledge of: - window/glazing systems in relation to daylighting, acoustic and energy performance of buildings; - metrics related to optical, thermal and acoustic properties of glazing systems (e.g. U-value, G-value, light transmittance, sound transmission loss); - regulations and technical standard requirements on energy performance, daylighting, sound insulation; - static glazing technologies (e.g. multipane glazing, low-emissivity coatings, vacuum glazing) and daylight systems (e.g. solartubes); - dynamic glazing technologies (e.g. electrochromic, photochromic, thermochromic, PCM glazing) and- double skin facades; - thermal bridging correction around windows/glazing systems (e.g. in relation to window frame and wall); - dynamic energy simulation software for thermal/daylight analysis, building acoustic simulation software; - cost/benefit analysis.	Developing and experimenting innovative solutions for glazing envelopes based on emerging technologies (e.g. smart glazing with passive/active dynamic control), interacting with R&D department of glazing companies. Performing dynamic energy simulations of the building envelope by means of advanced simulation tools. Optimizing glazing envelope solutions with respect to visual comfort (sunlight glare control) and acoustic comfort (facade sound insulation), considering optical and acoustic properties of glazing systems.	W	5	D
EN4.3.6	Specifying the design for window/glazing systems in tender documents	Advanced knowledge of: - technical specifications of building envelope and window/glazing systems; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to window/glazing systems. Writing technical documentation for contracting purpose.	W	4	D
EN4.3.7	Installing windows in a workmanlike manner	Medium knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on building sites; - transparent components, windows and technical solutions.	Installing traditional solutions for glazing (windows, skylights) in a workmanlike manner. Installing complex solutions under supervision of expert team members.	B	3	Cn
EN4.3.8	Installing windows and glazing systems in advanced buildings	In-depth knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on building sites; - thermal bridging correction; - advanced solutions for glazing (e.g. dynamic glazing technologies, solartubes); - automatic and remote window openers.	Installing advanced solutions for glazing (e.g. dynamic glazing technologies, solartubes) and automatic window openers. Ability to interact with the design team and producers/suppliers of glazing systems in order to solve problems on construction site.	B	5	Cn

EN4.3	Window and glazing systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN4.3.9	Assuring the quality of installed windows and glazing systems	Advanced knowledge of: - standards and procedures for quality assurance in constr works; - qualitative methods to evaluate building quality (e.g. check-list); - quantitative methods to evaluate building quality (e.g. thermographic survey); - domotic systems and window openers.	Managing, instructing and auditing contractors in construction site on the installation of windows and glazing systems, based on information given in tender documents and by the design team. Giving feedbacks to the design team on critical aspects of the installed glazing systems.	W	4	Cn
EN4.3.10	Measuring thermal, lighting and acoustic performances of windows and glazing systems	In-depth knowledge of: - standards and procedures for building commissioning; - technical standards on building physics measurements; - infrared methods (advanced thermography ISO 6781-3 compliant); - thermo-flow meter methods; - photometric and colorimetric measurements; - building acoustic measurements; - support to resolution of disputes, subject to terms of the contract documents.	Performing thermal measurements to detect heat and air leakeges in windows/glazing systems. Performing photometric/colorimetric measurements to assess optical properties of glazing. Performing building acoustic measurements to assess sound insulation properties of glazing. Collecting and analysing data in order to evaluate building energy performance, daylighting and sound insulation loss. Supporting resolution of disputes, subject to terms of the contract documents.	W	5	B, U

Table A.19 – EN4.4 – Window and glazing systems

EN4.4	Solar shading systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN4.4.1	Understanding the importance of solar shading systems	Minimal knowledge of: - solar shading systems in relation to indoor cooling and daylighting performances; - energy regulations and technical standard requirements; - thermal and optical properties of solar shading systems.	Participating in discussions for the feasibility study of solar shading systems within a design team.	W, B	1	Co
EN4.4.2	Applying basic solutions for solar shading systems	Basic knowledge of: - solar shading systems in relation to indoor cooling and daylighting performances; - metrics related to thermal and optical properties of solar shading (e.g. G-value, light transmittance for interior screens); - energy regulations and technical standard requirements; - simple calculation methods for solar shading analysis of buildings (graphic methods, rules of thumb).	Performing simplified verification to assess sun/shadow tracking of alternative solar shading solutions for building envelope, considering their compliance with standard requirements.	W	2	D
EN4.4.3	Proposing conceptual solutions for solar shading systems	Medium knowledge of: - solar shading systems in relation to seasonal energy and daylighting performances; - metrics related to optical and thermal properties of solar shading systems (e.g. g-value, U-value, light transmittance for interior screens); - regulations and technical standard requirements on energy performance, daylighting; - movable and fixed solar shading systems for interior/external application (e.g.	Selecting and proposing alternative solutions for solar shading systems with respect to adopted glazing system, focussing on seasonal solar heat gain (benefits and drawbacks in summer/winter usage). Assessing the resulting thermal-energy and daylighting performance of the building envelope by means of commercial energy simulation tools.	W	3	Co, D

EN4.4	Solar shading systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		overhang, louvers, light-shelf, blind system); - control logics for movable shading devices; - commercial software for thermal and daylighting analysis.				
EN4.4.4	Engineering the concept design for solar shading systems	Advanced knowledge of: - solar shading systems in relation to seasonal thermal-energy and daylighting performances; - metrics related to optical and thermal properties of solar shading systems (e.g. g-value, U-value, light transmittance for interior screens); - regulations and technical standard requirements on energy performance, daylighting; - movable and fixed solar shading systems for interior/external application (e.g. overhang, louvers, light-shelf, blind system); - control logics for movable shading devices; - dynamic energy simulation software for sun/shadow tracking and thermal/daylight analysis; - cost/benefit analysis.	Engineering solutions for solar shading systems in relation to cooling/heating demand, considering integration with adopted glazing system and with natural ventilation, performing cost/benefit analysis and fulfilling standard requirements. Performing dynamic energy simulations of the solar shading system by means of advanced simulation tools, assessing the energy performance of the building and its impact on indoor thermal comfort.	W	4	D
EN4.4.5	Developing new technical solutions and optimising the detailed design for solar shading systems	In-depth knowledge of: - solar shading systems in relation to seasonal thermal-energy and daylighting performances; - metrics related to optical and thermal properties of solar shading systems (e.g. g-value, U-value, light transmittance for interior screens); - regulations and technical standard requirements on energy performance, daylighting, sound insulation; - emerging technologies for movable and fixed solar shading systems (e.g. automatic movable shading systems, building-integrated PV shading types, combination of electrochromic windows and overhangs), waterfall facades, green barriers; - building controllers for automatic movable shading systems (e.g. bus line protocols, motor controllers, light sensors and weather station); - dynamic energy simulation software for sun/shadow tracking and thermal/daylight analysis, building acoustic simulation software; - cost/benefit analysis.	Developing and experimenting innovative solutions for solar shading based on emerging technologies (e.g. automatic movable shading systems, building-integrated PV shading types, combination of electrochromic windows and overhangs), interacting with R&D department of companies specialised in glazing and solar shading systems and Building Management Systems. Performing dynamic energy simulations of the building envelope by means of advanced simulation tools. Optimizing solar shading solutions with respect to visual comfort (sunlight glare control) and acoustic comfort (facade sound insulation), considering optical and acoustic properties of shading screens.	W	5	D
EN4.4.6	Specifying the design for solar shading systems in tender documents	Advanced knowledge of: - technical specifications of solar shading systems and building automation; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to solar shading systems. Writing technical documentation for contracting purpose.	W	4	D
EN4.4.7	Installing solar shading systems in a workmanlike manner	Medium knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on building sites; - fixed solar shading systems for interior/exterior application.	Installing traditional solutions for solar shading (e.g. interior vertical screens and blinds) in a workmanlike manner.	B	3	Cn

EN4.4	Solar shading systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN4.4.8	Installing solar shading systems in advanced buildings	In-depth knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on building sites; - advanced solutions for solar shading and building automation (e.g. automatic movable shading systems, building-integrated PV shading types,).	Installing advanced solutions for solar shading (e.g. automatic movable shading systems, building-integrated PV shading types,). Ability to interact with the design team and producers/suppliers of shading systems in order to solve problems on construction site.	B	5	Cn
EN4.4.9	Assuring the quality of installed solar shading systems	Advanced knowledge of: - standards and procedures for quality assurance in construction works; - qualitative methods to evaluate solar shading systems (e.g. check-list); - quantitative methods to evaluate solar shading systems (e.g. functionality test); - building automation systems for solar shading.	Managing, instructing and auditing contractors in construction site on the installation of solar shading systems, based on information given in tender documents and by the design team. Giving feedbacks to the design team on critical aspects of the installed shading systems.	W	4	Cn

Table A.20 – EN4.5 – Passive systems for cooling and heating

EN4.5	Passive systems for cooling and heating					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN4.5.1	Understanding the importance of passive systems for cooling and heating	Minimal knowledge of: - difference between active and passive systems for cooling and heating; - regulations on building energy performance; - importance of climate based design.	Participating in discussions for the feasibility study of passive systems for cooling and heating within a design team.	W, B	1	Co
EN4.5.2	Applying basic solutions for passive systems for cooling and heating	Basic knowledge of: - passive systems for cooling and heating and their performances (e.g. free-cooling, ground air tubes, shading and ventilation solutions, high performance glazing, trombe wall and thermal mass solutions, solar greenhouse); - regulations and technical standards on building energy performance and indoor comfort; - metrics related to thermal properties of building materials (e.g. U-value, heat capacity, G-value); - climate conditions related to the location; - simple calculation methods for pre-sizing passive systems (graphic methods, rules of thumb, datasheets).	Performing simplified verifications to assess cooling/heating performances of alternative passive systems, based on input from team members, considering their compliance with energy and indoor comfort requirements.	W	2	D
EN4.5.3	Proposing conceptual solutions for passive systems for cooling and heating	Medium knowledge of: - passive systems for cooling/heating and their performances (e.g. free-cooling, ground air tubes, shading and ventilation solutions, high performance glazing, trombe wall and thermal mass solutions, solar greenhouse); - regulations and technical standards on building energy performance and IEQ; - metrics related to thermal properties of building materials (e.g. U-value, heat capacity, G-value); - climate condition analysis and adaptation to specific location, weather databases; - renewable energy exploitation into passive building design;	Selecting and proposing alternative solutions for passive systems (cooling and/or heating) based on climate condition analysis, focussing on seasonal solar heat gain (benefits and drawbacks in summer/winter usage), and architectural design and functions of the building. Considering available energy sources in passive system design (e.g. gas, electricity, district, soil, renewable energies).	W	3	Co, D

EN4.5	Passive systems for cooling and heating					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- integration of HVAC systems into passive building design; - occupant behaviour and interaction with control systems for HVAC; - commercial software for thermal analysis.	Assessing the resulting thermal-energy performance of the building by means of commercial energy simulation tools.			
EN4.5.4	Engineering the concept design for passive systems for cooling and heating	Advanced knowledge of: - passive systems for cooling/heating and their performances (e.g. free-cooling, ground air tubes, shading and ventilation solutions, high performance glazing, trombe wall and thermal mass solutions, solar greenhouse); - regulations and technical standards on building energy performance and IEQ; - metrics related to thermal properties of building materials (e.g. U-value, heat capacity, G-value); - climate condition analysis and adaptation to specific location, weather databases; - renewable energy exploitation into passive building design; - integration of HVAC systems into passive building design; - occupant behaviour and interaction with control systems for HVAC; - software for thermal comfort analysis based on dynamic method calculation and weather data, CFD software for ventilation analysis; - cost/benefit analysis.	Engineering solutions for passive systems in relation to cooling/heating demand, exploiting renewable energies, considering integration with adopted HVAC systems and/or natural ventilation, and cost/benefit analysis (investement return). Performing dynamic energy simulations of the passive system by means of advanced simulation tools, assessing energy performances of the building and its impact on indoor thermal comfort.	W	4	D
EN4.5.5	Developing new technical solutions and optimising the detailed design for passive systems for cooling and heating	In-depth knowledge of: - state-of-the-art on passive systems for cooling/heating and their performances (e.g. free-cooling, ground air tubes, shading and ventilation solutions, high performance glazing, trombe wall and thermal mass solutions, solar greenhouse); - regulations and technical standards on building energy performance and IEQ; - metrics related to thermal properties of building materials (e.g. U-value, heat capacity, G-value); - climate condition analysis and adaptation to specific location, weather databases; - renewable energy exploitation into passive building design; - integration of HVAC systems into passive building design; - occupant behaviour and interaction with control systems for HVAC; - in situ measured data as feedback for passive system management and control; - software for thermal comfort analysis based on dynamic method calculation and weather data, CFD software for ventilation analysis; - cost/benefit analysis.	Developing and experimenting innovative solutions for passive systems (cooling and/or heating) based on emerging materials and technologies, interacting with R&D department and specialised advisors in passive building design. Considering occupant behaviour and the interaction with control systems for cooling/heating. Performing dynamic energy simulations of the building envelope by means of advanced simulation tools. Optimizing passive systems with respect to visual comfort (sunlight glare control) and acoustic comfort (facade sound insulation), considering optical and acoustic properties of passive solutions (e.g. overhangs and/or shading screens, massive walls).	W	5	D
EN4.5.6	Specifying the design for passive systems for cooling and heating in tender documents	Advanced knowledge of: - technical specifications of passive systems for cooling and heating; - technical drawing representation; - in situ measurements of passive system performances; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting technical solutions that fit specifications and demands on given quality aspects and economics related to passive systems for cooling and heating. Writing technical documentation for contracting purpose.	W	4	D
EN4.5.7	Installing passive systems for cooling and heating	Medium knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on building sites; - construction works and cooling/heating system installation.	Installing passive systems for cooling/heating under supervision of expert team members.	B	3	Cn

EN4.5	Passive systems for cooling and heating					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN4.5.8	Installing passive systems for cooling and heating in advanced buildings	In-depth knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on building sites; - advanced solutions for passive systems and their integration with building automation.	Installing advanced and complex solutions for passive cooling/heating systems integrated with renewable energies and building automation systems. Ability to interact with the design team in order to solve problems on construction site.	B	5	Cn
EN4.5.9	Assuring the quality of installed passive systems for cooling and heating	Advanced knowledge of: - standards and procedures for quality assurance in construction works; - qualitative methods to evaluate construction quality of passive systems (e.g. check-list); - quantitative methods to evaluate passive system functionality and efficacy (e.g. in situ measurements of energy performance and IEQ); - building automation systems for passive heating/cooling.	Managing, instructing and auditing contractors in construction site on the installation/realisation of passive systems for cooling/heating, based on information given in tender documents and by the design team. Giving feedbacks to the design team on critical aspects of the realised passive systems.	W	4	Cn

Table A.21 – EN4.6 – Energy saving strategies for lighting

EN4.6	Energy saving strategies for lighting					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN4.6.1	Understanding the importance of energy saving for lighting	Minimal knowledge of: - artificial lighting for indoor spaces and its integration with daylight; - user needs and technical standard requirements.	Participating in discussions for the feasibility study of energy saving for lighting within a design team.	W, B	1	Co
EN4.6.2	Applying basic solutions of energy saving for lighting	Basic knowledge of: - photometric quantities and metrics on visual comfort; - photometric and energy performance of main light sources and luminaires; - simple calculation methods (LENI simplified calculation method, EN standard compliant).	Performing simplified calculation to assess energy saving in relation to different lighting systems.	B	2	D
EN4.6.3	Proposing conceptual solutions of energy saving for lighting	Medium knowledge of: - metrics on visual comfort in indoor workplaces; - all relevant standards on energy performance for lighting; - photometric and energy performance of light sources, luminaires and control systems; - commercial software for lighting design.	Selecting and proposing alternative lighting systems, considering the most energy efficient lamp/luminaire combination and indoor space configuration. Assessing energy performance of the lighting system by means of commercial simulation tools.	B	3	Co, D
EN4.6.4	Engineering energy saving strategies for lighting	Advanced knowledge of: - state-of-the-art on lighting quality metrics and energy saving strategies; - all relevant standards on energy performance for lighting and visual comfort; - photometric and energy performance of light sources, luminaires and control systems; - software for lighting design with energy performance calculation (LENI detailed calculation method, EN standard compliant).	Engineering solutions for energy saving in lighting by means of high efficiency light sources (e.g. Solid State Lighting, retrofitting solutions), light control systems, daylight integration. Defining the most suitable lighting system with respect to energy performance, performing LENI detailed calculations (Lighting Energy Numeric Indicator) and comparing energy comsumption of different lighting systems.	B	4	D

EN4.6	Energy saving strategies for lighting					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN4.6.5	Optimising energy saving strategies for lighting	In-depth knowledge of: - state-of-the-art on lighting quality metrics and energy saving strategies; - all relevant standards on energy performance for lighting and visual comfort; - photometric and energy performance of light sources, luminaires and control systems; - software for lighting design with energy performance calculation (LENI detailed calculation method, EN standard compliant).	Optimising the lighting system with respect daylight and building occupancy, defining the most suitable lighting system with respect to energy performance, visual comfort and cost/benefit analysis. Experimenting innovative solutions for lighting control and daylight harvesting, interacting with R&D department of lighting companies and building automation system companies.	B	5	D
EN4.6.6	Specifying energy saving technologies for lighting in tender documents	Advanced knowledge of: - lighting technologies to reduce energy consumption; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to energy saving for lighting. Writing technical documentation for contracting purpose.	W	4	D

Table A.22 – EN4.7 – Mitigation strategies for urban thermal effects

EN4.7	Mitigation strategies for urban thermal effects					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN4.7.1	Understanding the importance of mitigation strategies for urban thermal effects	Minimal knowledge of: - thermal comfort risk assessment in outdoor spaces; - urban heat island and urban canyon effects.	Participating in discussions within a design team to define how thermal comfort concepts can be introduced into the design process.	W	1	Co
EN4.7.2	Proposing conceptual solutions for mitigation strategies for urban thermal effects	Medium knowledge of: - metrics on thermal comfort based on human heat balance (PMV, SET, PET indices); - main standards on thermal comfort and thermal stress; - urban heat island and urban canyon effects; - design strategies to mitigate thermal environment in urban outdoor spaces (at cluster scale); - commercial software for thermal analysis (e.g. Energy Balance Model, EMB).	Selecting and proposing alternative mitigating strategies for thermal environment in urban outdoor spaces, focussing on urban geometry (compact or open outdoor spaces), vegetation (tree areas, grasslands), reflective surfaces (high albedo pavements), water bodies (ponds, fountains), in order to improve thermal comfort for pedestrians at cluster urban scale. Assessing the resulting performance of mitigating strategies by means of commercial simulation tools (EBM method).	W	3	Co, D
EN4.7.3	Optimising mitigation strategies for urban thermal effects	In-depth knowledge of: - state-of-the-art on metrics for thermal stess (WBGT, WCI indices) and thermal comfort (PMV, SET, PET indices) based on human heat balance; - occupancy behaviour design (metabolic energy, clothing insulation);	Optimising the control of outdoor thermal environment considering interactions among different mitigation strategies (urban geometry, vegetation, reflective surfaces, water bodies) at	W	5	D

EN4.7	Mitigation strategies for urban thermal effects					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- all relevant standards on thermal comfort and thermal stress; - urban heat island and urban canyon effects; - design strategies to mitigate thermal environment in urban outdoor spaces (at neighbourhood scale); - advanced software for thermal analysis of urban outdoor spaces (e.g. Computational Fluid Dynamics, CFD).	neighbourhood urban scale. Experimenting innovative materials for pavements/facades (cool materials) to improve thermal comfort for pedestrians in urban canyons. Assessing the resulting performance of mitigating strategies by means of advanced simulation tools (CFD method).			

Table A.23 – EN4.8 – Building occupancy behavior and prediction methods

EN4.8	Building occupancy behavior and prediction methods					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EN4.8.1	Understanding the importance of occupant behavior in building energy policies	Minimal knowledge of: - building energy policies; - occupant behavior modeling and prediction related to IEQ and energy management; - smart building systems.	Participating in discussions within a design team to define how occupant behavior and prediction methods can be introduced in building energy policies.	W	1	Co
EN4.8.2	Collecting data as base for modeling occupant behavior	Basic knowledge of: - building energy policies; - standards on in situ measurements of IEQ and building energy performance; - subjective survey methods to collect information of the occupant; - sensor technologies to monitor both environmental parameters and occupant behavior; - smart building systems and IoT.	Collecting data and/or performing measurements of environmental parameters (related to thermal, visual, acoustic comfort and IAQ), electric power and water consumption, occupancy (by means of presence sensors).	W	2	D, U
EN4.8.3	Processing data and defining objectives for modeling occupant behavior	Medium knowledge of: - building energy policies; - standards on IEQ and building energy performance; - occupant behavior modeling (e.g. use of HVAC systems, use of lighting and shading systems) and occupant prediction (e.g. occupant presence and density inside spaces) related to IEQ and energy management; - subjective survey methods to collect information of the occupant; - sensor technologies to monitor both environmental parameters and occupant behavior; - smart building systems and IoT.	Processing collected raw data (e.g. data cleaning, integration, reduction) and defining objectives for occupancy models (e.g. occupancy detection, occupancy estimation, occupancy prediction, behavior analysis and prediction).	W	3	Co, D, U
EN4.8.4	Selecting and evaluating algorithms for modeling occupant behavior	Advanced knowledge of: - state-of-the-art on building energy policies; - all relevant standards on IEQ and building energy performance; - occupant behavior modeling (e.g. use of HVAC systems, use of lighting and shading systems) and occupant prediction (e.g. occupant presence and density inside spaces) related to IEQ and energy management; - socio-environmental aspects and psychological factors related to usage of	Selecting and executing algorithms (e.g. Monte-carlo, Markov models, regression methods, random forest) by means of open platform simulation tools, in order to evaluate model convergence, efficiency and prediction accuracy determinig the performance of the model.	W	4	D, U

EN4.8	Building occupancy behavior and prediction methods					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		building-systems and energy saving behavior; - subjective survey methods to collect information of the occupant; - sensor technologies to monitor both environmental parameters and occupant behavior; - smart building systems and IoT; - machine learning methodologies, OB modeling algorhitms, data mining techniques.				
EN4.8.5	Optimising occupant behavior models by machine learning methods	In-depth knowledge of: - state-of-the-art on building energy policies; - all relevant standards on IEQ and building energy performance; - occupant behavior modeling (e.g. use of HVAC systems, use of lighting and shading systems) and occupant prediction (e.g. occupant presence and density inside spaces) related to IEQ and energy management; - socio-environmental aspects and psychological factors related to usage of building-systems and energy saving behavior; - subjective survey methods to collect information of the occupant; - sensor technologies to monitor both environmental parameters and occupant behavior; - smart building systems and IoT; - machine learning methodologies, OB modeling algorhitms, data mining techniques.	Optimising occupant behavior models applying machine learning models and data mining to deal with missing data and to improve prediction accuracy to a large extent. Considering and analysing socio-economic and emotional behavior of occupant that can affect building energy consumptions.	W	5	D, U

A.1.2 Thematic field: Water

A.1.2.1 Macro Area: WA1 - Water efficiency

Table A.24 – WA1.1 – Outdoor water use management

WA1.1	Outdoor water use management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
WA1.1.1	Understanding basic solutions to reduce water consumption for outdoor uses	Minimal knowledge of: - water consumption patterns in building - potential design strategies to reduce water consumption for irrigation based on the efficiency-first concept (e.g., use an alternative water source for irrigation, use smart sensor technology irrigation controls).	Participating in discussions in a project team regarding solutions for sustainable landscape areas.	W	1	Co

WA1.1	Outdoor water use management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
WA1.1.2	Proposing basic solutions for water management	Basic knowledge of: - organizational infrastructures and specialistic skills related to water distribution sector and water management techniques - regulations and technical standards requirements - the site conditions and construction constraints.	Proposing water management techniques in the neighborhood and higher levels, up to the management at the building level.	W	2	Co, D
WA1.1.3	Determining the concept of sewerage systems	Medium knowledge of: - water savings from wastewater reuse - integrated water management of wastewater, greywater and potable water - types of sewerage systems (combined systems, separate systems, other alternative systems). - the network of pipes, pumping stations, and appurtenances that convey sewage from its points of origin to a point of treatment and disposal.	Determining the effect of the application of different types of sewerage systems, based on the size of the project, flow rates, pumping stations, and costs.	W	3	Co, D
WA1.1.4	Performing control of soil quality based on soil samples' analysis under laboratory conditions.	Medium knowledge of: - different soil sampling procedures, tools, physical, chemical and mechanical properties of soils.	Performing the measurement, and testing of soil properties and interpreting the changes in soil quality.	W	3	Co
WA1.1.5	Determining the concept of purification system to entering the sewer network	Medium knowledge of: - different types of purification systems and processes (e.g., filtration systems, disinfection systems, etc.). - natural treatment technique (e.g., combined drainage and subsurface irrigation).	Determining the effect of application of different types of water purification systems, and costs.	W	3	Co, D, B, U
WA1.1.6	Engineering the automation and control of water conveyance and distribution equipment	Advanced knowledge of: - automation solutions to operate basic mechanical equipment and automated devices of water and sewage networks (e.g., on-site sensors, analyzers, meters, control systems, communications systems) - appropriate safety features - operation and maintenance requirements of the systems.	Engineering the automated water and wastewater system and sorting equipment. Managing the required safety features. Managing the secondary water system for landscape irrigation.	W	4	D, Cn, B, U
WA1.1.7	Engineering the concept of environmentally friendly measures for water management systems	Advanced knowledge of: - the elements of biofilter, natural urban drainage and wastewater treatment and disposal systems (e.g., water retention ponds, constructed wetlands, stabilization ponds, soil filters, drip irrigation, etc.). - metrics related to environmental and water management systems.	Engineering of the most feasible option for natural water management systems based on environmental considerations, and cost-effectiveness of the installations.	W	4	D, B, U
WA1.1.8	Engineering the control and management of water resources	In-depth knowledge of: - principles of fluid mechanics, hydrology, pipelines, mechanics of sediment transport, physical modelling, water systems, drainage systems - the flow and conveyance of fluids, principally water and sewage	Developing application of fluid mechanics to water flowing in an isolated environment (pipe, pump) or in an open channel (river, lake, ocean), performing dynamic simulations. Restoring neighbourhood streams.	W	5	D, U
WA1.1.9	Understanding the principles of operating the equipment of water and wastewater treatment technologies	Basic knowledge of: - water and wastewater treatment technologies, and the operational tasks of the applied equipment	Participating in discussions within a design team. Performing technical assistance services regarding water and wastewater treatment technologies.	B	2	Co, B, U

WA1.1	Outdoor water use management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
WA1.1.10	Proposing basic strategies to reduce water consumption for outdoor uses	Basic knowledge of: - water consumption patterns in building - potential design strategies to reduce water consumption for irrigation based on the efficiency-first concept (use an alternative water source for irrigation, use smart sensor technology irrigation controls).	Participating in discussions in a project team suggesting strategies to reduce the water demand for efficient landscape areas.	B	2	Co
WA1.1.11	Assuring the quality of in-use operation and maintenance processes and control tasks of water supply systems	In-depth knowledge of: - methodologies to apply discharge pipe networks (line routing, network systems, new or improved pipeline sections and the related installation tasks). - operation and maintenance requirements of the systems.	Investigating in-use operation of the installed water network systems, maintenance and repair requirements.	B	5	B, U

Table A.25 – WA1.2 – Indoor water use management

WA1.2	Indoor water use management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
WA1.2.1	Understanding the principles of water consumption patterns in buildings and strategies in relation to reducing water consumption for indoor uses	Minimal knowledge of: - water savings from wastewater reuse - water-efficient products (e.g., low-flow bathroom fixtures and toilets, etc.)	Participating in discussions within the project team suggesting strategies concerning water-saving systems for indoor uses.	W	1	Co
WA1.2.2	Determining the concept of indoor water use	Basic knowledge of: - water savings from wastewater reuse - water-efficient products (e.g., low-flow bathroom fixtures and toilets) - notions about budget, statutory, national and regional regulatory frameworks, applying to water use management.	Identifying the regulatory agencies and applicable codes for the intended uses. Applying the principles of sustainability to the economic management of water.	W	2	Co, D
WA1.2.3	Proposing and selecting indoor water-efficient appliances	Medium knowledge of: - water savings from wastewater reuse - calculating methods for estimating and improving water efficiency, and water-saving alternatives - potential design strategies for indoor uses, based on the efficiency-first concept (reduce the water demand through low-flush and low-flow fixtures and fittings, e.g., use an alternative water source for flushing toilets).	Evaluating the effect of the application of different types of equipment that use water (e.g., faucets, toilets, showerheads, kitchen equipment, cooling towers, boilers, etc.), and types of plumbing fixtures or devices within the facility, addressing the issues that affect water consumption. Performing a primary analytical tool concerning the performance of the selected facilities. Identifying the best options, based on the capital costs, and operational costs.	W	3	Co, D, U

WA1.2	Indoor water use management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
WA1.2.4	Determining the concept of sewage treatment plants for housing units	Medium knowledge of: - water savings from wastewater reuse - housing units sewage treatment plants and their maintenance requirements.	Determining the effect of the application of sewage treatment plants for housing units and apartment complexes, addressing the issues that affect water consumption.	W	3	Co, D
WA1.2.5	Engineering the concept of water saving installation requirements	Advanced knowledge of: - design and operation of domestic hybrid rainwater-greywater systems (HRG) - distribution, treatments and water savings systems and sustainable drainage - dynamic water performance of the building's water installations - metrics related to indoor water use facilities - water simulations methodologies - regulations, technical standards, and public health regulatory frameworks requirements.	Determining the solutions for indoor water-saving systems, and sustainable drainage based on the guidelines and biological and environmental criteria. Performing dynamic simulations to assess sustainability and cost-effectiveness of water installations.	W	4	D
WA1.2.6	Developing water-efficient facilities for indoor water use management	In-depth knowledge of: - principles of water-efficient management - design and operation of domestic hybrid rainwater-greywater systems (HRG), and low-flow plumbing fixtures and aerators - measuring and evaluating the water installations of the building and their effect on building water performance - regulations, technical standards, and public health regulatory framework requirements.	Developing a water management plan, through measuring and monitoring water use, evaluating plumbing-fixture types, implementing water-saving measures, and conducting a cost-benefit analysis.	W	5	D, Cn, B, U
WA1.2.7	Understanding the principles of water-saving facilities	Basic knowledge of: - the building's plumbing system operation for integrated water management of wastewater, greywater and potable water - types of water-efficient equipment, and materials - technical standard requirements.	Understanding plumbing systems operation. Performing technical assistance services (fixing or applying technological solutions).	B	2	Cn, U
WA1.2.8	Understanding the principles of water-saving facilities	Advanced knowledge of: - types of water-efficient types of equipment, and materials - technical standard requirements - Knowledge of water-efficient equipment installation in a workmanlike manner	Assembly and Installing water-efficient equipment (e.g., low-flow plumbing fixtures and aerators) in a workmanlike manner.	B	4	Cn
WA1.2.9	Assuring the quality of in-use operation and maintenance provision as technical assistance services	In-depth knowledge in detecting the deficiencies in the optimal water consumption (techniques or user application), and in-use operation.	Investigating in-use operation of the installed distribution, treatments and water savings systems, and their components for testing, maintenance requirements, and services.	B	5	U

A.1.2.2 Macro Area: WA2 - Effluents management

Table A.26 – WA2.1 – Rainwater collection and reuse systems

WA2.1	Rainwater collection and reuse systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
WA2.1.1	Understanding the principles of rainwater harvesting and reuse systems in relation to efficient water-saving measures	Minimal knowledge of: - water demand and supply, water cycle, supply net - fundamentals of rainwater harvesting and reuse possibilities, plumbing and materials - metrics related to rainwater harvesting - technical standards requirements.	Explaining efficient water-saving measures. Discussing rainwater collection and reuse possibilities in simple projects.	W	1	Co
WA2.1.2	Proposing and selecting basic solutions for rainwater harvesting and reuse systems	Basic knowledge of: - water demand and supply, water cycle, supply net - rainwater harvesting systems (catchment characterisation, conveyance, and storage tanks (sizes and types, materials)) - metrics related to rainwater harvesting - regulations and technical standards requirements - the site conditions and construction constraints.	Performing initial simulation-based water performance assessment (quantifying water use in the building), evaluating, and proposing alternative solutions for collection and storage systems and cisterns in the building and/or the site.	W	2	Co, D
WA2.1.3	Proposing and selecting basic solutions for rainwater harvesting and reuse systems	Basic knowledge of: - water demand and supply, water cycle, supply net - rainwater harvesting systems, and reuse possibilities - metrics related to rainwater harvesting - regulations and technical standards requirements - the site conditions and construction constraints.	Performing initial simulation-based water performance assessment. Proposing alternative solutions for onsite water reuse possibilities in the building and/or the site.	W	2	Co, D
WA2.1.4	Determining the RWH systems, storage tanks and cisterns concept	Medium knowledge of: - water demand and supply, water cycle, supply net - water balance (rainwater harvesting, flow in drainage systems, general water resource management), - RWH systems, and reuse possibilities - metrics related to RWH - regulations and technical standards requirements - the site conditions and construction constraints (soil type and surface permeability, location of the tank(s), etc.).	Determining the effect of application of different types of tanks (multiple tank options, tanks above or below ground, sizes, materials, etc.), and collection systems on the water performance of the building. Evaluating optimal positioning of the storage system(s). Performing medium-level simulation concerning the performance of the selected systems.	W	3	D
WA2.1.5	Engineering the concept of rainwater harvesting systems	Advanced knowledge of: - water balance solutions (rainwater harvesting, flow in drainage systems), - RWH systems, reuse possibilities (catchment area and collection, conveyance, storage tanks and, cisterns (sizes and types, materials), and the required components (collection, first-flush, storage, treatment, and distribution systems), - metrics related to RWH, - dynamic simulations methodologies, - regulations, technical standards and applicable code requirements.	Determining the most feasible options for RWH systems (e.g., the type of treatment plants, storage size and types, type of the pump, etc.), optimal positioning of storage systems, and monetary savings, performing dynamic simulations, calculations, and analysis.	W	4	D

WA2.1	Rainwater collection and reuse systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
WA2.1.6	Specifying the concept of rainwater harvesting facilities in tender documents	Advanced knowledge of: - specification of rainwater harvesting systems, methods (surface runoff and rooftop harvesting), products, and suppliers for contracting purposes. - detailed descriptions and drawings of the design.	Selecting products that fit specifications and demands on given quality aspects. Defining the installation, testing and commissioning conditions of RWH systems for contracting purposes. Defining the level of operation and maintenance needed.	W	4	D, Cn
WA2.1.7	Assuring the quality of harvested rainwater	Advanced knowledge of: - methodologies to measure water quality and organoleptic tests.	Determining the organoleptic quality, potability and other treatment need on-site.	W	4	B, U
WA2.1.8	Commissioning rainwater harvesting and reuse systems	In-depth knowledge of: - measuring and evaluating the different types of collection and storage systems for water reuse possibilities - evaluating the performance of the systems.	Commissioning and installation of the planned rainwater harvesting and reuse systems and operational inspections. Managing the required safety features.	W	5	Cn, B, U
WA2.1.9	Commissioning building green roofs	In-depth knowledge of: - Green roof systems, catchments surfaces (impervious, gravel and green roofs) - lightweight vegetated roof system - green roof design considerations.	Commissioning and installation of the best alternative solution for stormwater management through green roofs, and operational inspections.	W	5	Cn, B, U
WA2.1.10	Understanding the principles of rainwater harvesting and reuse systems in relation to efficient water-saving measures	Minimal knowledge of: - principals of rainwater harvesting systems, storage types, plumbing, irrigation systems and materials - technical standards requirements.	Explaining efficient water-saving measures in simple projects. Assisting in plumbing, and/or irrigation systems installation practices.	B	1	Co
WA2.1.11	Installing rainwater conveyance systems	Medium knowledge of: - the site conditions and construction constraints (soil type and surface permeability, location of the tank(s), type of systems, etc.). - the networks of pipes (simple or complex), sizing, and their proper installation.	Installing separated sewer networks and rainwater recovery systems, pipes, and gutters (plumbing).	B	3	Cn
WA2.1.12	Installing rainwater harvesting and reuse systems in a workmanlike manner	Advanced knowledge of different types of rainwater treatment systems and processes (e.g., filtration systems).	Assembling and installing rainwater collection and reuse systems in a workmanlike manner.	B	4	Cn
WA2.1.13	Assuring the quality of in-use operation and maintenance provision for water harvesting systems	In-depth knowledge of: - methodologies to measure quality, (e.g., potable/non-potable water use requirements), - operation and maintenance requirements of the collection and treatment systems.	Investigating of in-use operation of the installed systems (e.g., plumbing, irrigation systems, on-site rainwater treatment systems, control systems, cisterns, etc.) for maintenance requirements, and repairs.	B	5	Cn, B

Table A.27 – WA2.2 – Greywater collection and reuse systems

WA2.2	Greywater collection and reuse systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
WA2.2.1	Understanding the principles of greywater reuse systems in relation to efficient water-saving measures	Minimal knowledge of: - water savings from greywater reuse system - fundamentals of greywater reuse measures, storage systems, plumbing and materials - technical standards requirements.	Discussing storage needs and materials, according to supply, and reuse possibilities for preliminary decisions, within the project team. Understanding the problems of accumulation and reuse possibilities.	W	1	Co
WA2.2.2	Proposing and selecting basic solutions for greywater reuse systems	Basic knowledge of: - water performance of the greywater reuse systems - types of greywater systems (e.g., pumped systems, indoor greywater use), infiltration, conveyance, and storage tanks - metrics related to greywater systems - regulations and technical standards requirements - the site conditions and construction constraints.	Performing initial simulation-based water performance assessment. Evaluating and proposing alternative solutions for greywater treatment and reuse systems.	W	2	Co, D
WA2.2.3	Analysing the concept of greywater collection and reuses possibilities	Basic knowledge of: - notions about budget, statutory, national and regional regulatory frameworks, applying to greywater use, relevant to local permit requirements, and problems of accumulation and reuse possibilities.	Identifying the regulatory agencies and applicable codes. Evaluating the feasibility of possible greywater system types for the specific building and the purposes.	W	2	Co
WA2.2.4	Determining the concept of greywater treatment and reuse systems	Medium knowledge of: - water savings from greywater reuse system - types of greywater systems (e.g., pumped systems, indoor greywater use), and their components - metrics related to greywater systems - regulations and technical standards requirements - the site conditions and construction constraints.	Determining the effect of application of different types of greywater reuse systems and their components on the water performance of the building. Evaluating possible solutions for treatment and infiltration of the greywater. Performing medium-level simulation concerning the performance of the selected system.	W	3	Co, D
WA2.2.5	Engineering the greywater treatment systems	Advanced knowledge of: - water savings from greywater reuse systems - types of decentralized greywater treatment systems (e.g., pumped systems, indoor greywater use), and their components (infiltration, conveyance, storage tanks), distribution systems, and system controls - metrics related to greywater systems - dynamic simulations methodologies - energy regulations, technical standards and applicable codes requirements.	Determining the most feasible option for greywater reuse (e.g., for toilet flushing, irrigation, car washing, and other non-potable uses), optimal positioning of storage systems, and monetary savings. Performing simulations, calculations and analyses concerning the water performance of the system.	W	4	D
WA2.2.6	Specifying the concept of greywater systems in tender documents	Advanced knowledge about: - specification of the type of greywater system, storage technology, the required components, and suppliers for contracting purposes - detailed descriptions and drawings of the design.	Selecting products that fit specifications and demands on given quality aspects. Defining the installation, testing and commissioning conditions of RWH systems for contracting purposes. Defining the level of operation and maintenance needed.	W	4	D, Cn
WA2.2.7	Assuring the quality of greywater treatment	Advanced knowledge about: - non-potable reuse standards, chemical and physical processes, disinfection methods, and methodologies to measure water quality.	Analysing of water quality, and health check reports of the systems.	W	4	Cn, B, U

WA2.2	Greywater collection and reuse systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- technical measures, limits, and procedures of greywater treatment, and how to evaluate its effect on building water performance.				
WA2.2.8	Commissioning greywater treatment system	In-depth knowledge of: - performing the systems, foresing installation requirements and adopting appropriate safety features - evaluating the performance of the systems.	Commissioning and installing the planned greywater treatment systems, and operational inspections. Managing the required safety features.	W	5	Cn, B, U
WA2.2.9	Installing greywater collection and treatment systems in a workmanlike manner	Advanced knowledge of: - different types of greywater treatment systems and processes (e.g., filtration systems, disinfection systems, etc.). - assembly and installing the systems.	Assembling and installing a greywater system in a workmanlike manner.	B	4	Cn
WA2.2.10	Investigating the in-use operation and maintenance provision for greywater treatment systems	In-depth knowledge of: - requirements of different types of greywater treatment systems and processes, and level monitoring. - operation and maintenance requirements of the systems.	Investigating in-use operation of the installed systems (e.g., plumbing, grounds and landscape, irrigation systems, on-site greywater treatment systems, control systems, cisterns, etc.) for testing, maintenance requirements, and repairs.	B	5	B, U

Table A.28 – WA2.3 – Urban Waste Water Treatment

WA2.3	Urban Waste Water Treatment					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
WA2.3.1	Understanding the principles of wastewater reuse systems in relation to efficient water-saving measures	Minimal knowledge of: - fundamentals of using greywater and rainwater to enhance local water supplies, demand, and the water cycle - types of urban rainwater/ greywater systems, and materials - metrics related to wastewater systems - technical standard requirements.	Discussing the basis of water demand and supply, water storage, and reuse possibilities, in the project team.	W	1	Co
WA2.3.2	Proposing and selecting basic solutions for wastewater reuse systems	Basic knowledge of: - water savings from wastewater reuse - types of urban rainwater/ greywater systems, and materials - metrics related to wastewater systems - regulations and technical standards requirements.	Performing initial simulation-based water performance assessment. Evaluating Net wastewater needs based on the project specification (e.g., population, Net water demand, wastewater capacity needs, financial savings).	W	2	Co
WA2.3.3	Proposing and selecting basic requirements for wastewater collection and purification	Basic knowledge of: - notions about budget, statutory, national and regional regulatory frameworks, applying to the reclamation of wastewater, related to zoning laws and regulations.	Identifying the regulatory agencies and applicable codes. Evaluating the feasibility of possible solutions for rainwater, harvested from highways, roads and other hard surfaces, based on the zoning laws.	W	2	Co

WA2.3	Urban Waste Water Treatment					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
WA2.3.4	Proposing basic solutions for surface water drainage systems	Medium knowledge of: - the requirements of the rainwater runoff for new developments - The solutions for reducing stormwater runoff (e.g., surface water drainage systems, on-site detention tanks, permeable paving, swales, planting a rain garden)	Defining the best alternative solution for reducing stormwater runoff, and surface water drainage systems.	W	3	Co
WA2.3.5	Determining the concept of the catchment, and storage systems	Medium knowledge of: - water savings from wastewater reuse - types of urban rainwater/ greywater systems (Catchment, and Storage systems) - metrics related to wastewater systems - regulations and technical standards requirements - the site conditions and construction constraints.	Determining the effect of application of different types of wastewater reuse solutions on water savings of the site. Evaluating alternative solutions (types of collection and storage system according to reuse possibilities, treatment and infiltration) of wastewater. Performing a primary analytical tool (e.g., systems modelling) concerning the performance of the selected systems.	W	3	Co, D
WA2.3.6	Determining the concept of sewerage systems	Medium knowledge of: - water savings from wastewater reuse - integrated water management of wastewater, greywater and potable water - types of sewerage systems (combined systems, separate systems, other alternative systems) - the network of pipes, pumping stations, and appurtenances that convey sewage from its points of origin to a point of treatment and disposal.	Determining the effect of the application of different types of sewerage systems, based on the size of the project, flow rates, pumping stations, and costs.	W	3	Co, D
WA2.3.7	Evaluating the wastewater treatment plants installation requirements	Medium knowledge of: - foreseeing installation requirements and adopting appropriate safety features - evaluation of the performance of the systems.	Performing the measurements, inspecting, evaluating, and testing of every operational component of wastewater treatment plants, catchments, and purification systems for installation and maintenance process. Managing the required safety features. Conducting the health check reports of the systems.	W	3	Cn, B
WA2.3.8	Proposing basic solutions for surface water drainage systems	Medium knowledge of: - the requirements of the rainwater runoff for new developments - The solutions for reducing stormwater runoff (e.g., surface water drainage systems, on-site detention tanks, permeable paving, swales, planting a rain garden)	Defining the best alternative solution for reducing stormwater runoff, and surface water drainage systems.	W	3	Co
WA2.3.9	Engineering the urban wastewater treatment plants	Advanced knowledge of: - the size and capacity of wastewater treatment systems, based on the generated sewage, and anticipated inflows and infiltration of the project - off-line water retention systems - regulatory agencies and applicable codes.	Engineering the most feasible options for treatment systems (on-lot, clustered, or centralized) configuration according to the size and the capacity needs, and factors such as the geographical scenario, sewer connections, average and peak flows, etc. Optimizing design solutions based on regulatory effluent limits, technological feasibility, energy consumption, and the operations and maintenance costs involved. Developing construction phases.	W	4	D
WA2.3.10	Engineering the concept of environmentally	Advanced knowledge of: - water performance of the wastewater reuse system - types of natural urban drainage and wastewater treatment and disposal systems	Engineering of the most feasible option for natural wastewater treatment measures based on environmental considerations.	W	4	D, Cn

WA2.3	Urban Waste Water Treatment					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
	friendly measures for wastewater treatment	(e.g., water retention ponds, constructed wetlands, stabilization ponds, soil filters, drip irrigation, groundwater recharge, etc.). - metrics related to greywater systems.				
WA2.3.11	Assuring the quality of wastewater purification (health factors)	In-depth knowledge about: - water quality parameters, and treatment levels - local environmental conditions and governmental standards - purification systems, and quality requirements based on the possible reuse (e.g., irrigation, groundwater recharge, etc.).	Analysing of water quality, disinfection and treatment processes, and health check reports of the purification system, acceptable for the considered usage.	W	5	B, U
WA2.3.12	Understanding the principles of wastewater reuse systems in relation to efficient water-saving measures	Medium knowledge of: - fundamentals of using greywater and rainmwater to enhance local water supplies, demand, and the water cycle - types of urban rainwater/ greywater systems, and materials - technical standard requirements.	Participating in discussions within a design team. Performing technical assistance services regarding water and wastewater treatment technologies.	B	3	Co, B, U
WA2.3.13	Installing wastewater treatment plants in construction phase	In-depth knowledge on: - different elements of treatment systems and processes (e.g., pumping, filtration systems, disinfection systems, surface water drainage systems, etc.) - assembly and installing the systems.	Assembling, installing, and testing the systems in a workmanlike manner.	B	5	Cn
WA2.3.14	Investigating the in-use operation and maintenance provision for Wastewater Treatment Plants	In-depth knowledge of: - exploiting, operating and maintaining Wastewater Treatment Plants	Investigating in-use operation of the installed systems (e.g., catchment systems, treatment systems, control systems, cisterns, etc.), and their components for testing, maintenance requirements, and services.	B	5	B, U

A.1.3 Thematic field: Materials

A.1.3.1 Macro Area: MA1 - Design for Deconstruction, reuse and recycling

Table A.29 – MA1.1 – Materials and components for ease disassembly

MA1.1	Materials and components for ease disassembly					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
MA1.1.1	Understanding the concept of design to disassembly.	Minimal knowledge of: - building materials/ components reuse; - waste management; - resource depletion; - circular economy.	Explaining the concept of design to disassembly. Discussing on reuse of materials and building components in simple projects.	B, W	1	Co, D

MA1.1	Materials and components for ease disassembly					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
MA1.1.2	Understanding the concept of building as material bank (BAMB) and building material passport	Minimal knowledge of: - building materials/ components reuse; - waste management; - resource depletion; - circular economy; - building material passport; - reuse/ recycling potential.	Discussing the concept of building as material bank (BAMB) in simple projects. Understanding building materials passport	B, W	1	Co, D
MA1.1.3	Proposing basic design solutions to minimize resources depletion and waste generation.	Basic knowledge of: - main design strategies to reduce resource depletion and waste generation (e.g. reuse of buildings and/or components, design for disassembly) - circular economy.	Proposing possible strategies to reduce resources depletion and waste generation over the lifespan of a building.	W	2	Co, D
MA1.1.4	Interpreting engineering drawings. Demonstrating practical skills in operation and demolition processes.	Basic knowledge in: - interpretation of engineering drawings of high-rise structures, high roofs, flat roofs, industrial structures, building engineering, building electrical regulations, auxiliary structures. - demolition processes, waste management (e.g. CDW separation).	Interpreting engineering drawings (e.g., building structures, high and flat roofs and the related professional structures, building engineering, building electrical wiring, fittings, etc). Demonstrating practical skills in demolition processes, machine operation, waste management (e.g. CDW separation).	B	2	Cn, B
MA1.1.5	Considering the end-of-life stage	Medium knowledge of: - design solutions for ease of disassembly; - circular economy; - materials embodied energy; - waste management; - LCA; - technical standards and regulations.	Considering the end-of-life stage in the initial stages of a project (design and planning). Proposing solutions for easy disassembly.	W	3	Co, D
MA1.1.6	Engineering structural solutions for disassembly	Advanced knowledge of: - structural solutions for ease of disassembly; - circular economy; - materials embodied energy; - waste management; - LCA; - technical standards and regulations; - refurbishment/adaptation of the existing structures; - modular technologies and prefabricated structures.	Engineering structural solutions for ease of disassembly, considering the end-of-life stage during the design phase. Evaluating existing structures for refurbishment/ adaptation as much as possible. Providing tender documents, calculations, and analysis. Using modular technologies and prefabricated structures.	W	4	Co, D
MA1.1.7	Installing materials and components for ease disassembly	In-depth knowledge of: - modular technologies and prefabricated structures; - dry construction methods; - mechanical connections.	Installing materials and components for ease of disassembly. Performing mechanical connections as much as possible.	B	5	Cn
MA1.1.8	Performing materials maintenance	In-depth knowledge of: - building materials and components reuse; - materials connections; - construction methods;	Performing materials maintenance to guarantee its durability and extend its lifetime.	B	5	U

MA1.1	Materials and components for ease disassembly					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- materials maintenance.				
MA1.1.9	Optimising design solutions considering the different lifecycles of the construction materials	In-depth knowledge of: - LCA; - Materials maintenance; - impacts of materials lifetime period for maintenance and demolition - BAMB concept - materials passport.	Considering the materials lifetime periods to optimise design solutions. Performing LCA to select materials with a similar life cycle. Developing drawings and project specifications for contractors' work. Analysing and interpreting materials datasheet.	W	5	Co, D
MA1.1.10	Commissioning and inspection of building parts, structure, and materials	In-depth knowledge of: - LCA; - building materials and components reuse; - materials connections; - construction methods; - materials maintenance.- impacts of materials lifetime period for maintenance and demolition.	Commissioning and inspection of building parts, structure and materials considering their potential future value.	W	5	B, U

Table A.30 – MA1.2 – Adaptive reuse

MA1.2	Adaptive reuse					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
MA1.2.1	Understanding the benefits of extending the building service life	Minimal knowledge about: - construction environmental impacts; - building lifecycle; - conservation of resources; - circular economy.	Discussing within the project team concerning building service life, conservation of resources and circular economy. Understanding the environmental benefits of extend the building service life.	W	1	Co
MA1.2.2	Applying green design methods (e.g., LCA, design for disassembly, design for the environment, design for deconstruction, etc)	Basic knowledge of: - construction environmental impacts; - building lifecycle; - conservation of resources; - circular economy; - deconstruction methods; - design for disassembly; - reuse of buildings, materials and structures.	Proposing basic design solutions using green design methods. Applying the principles of circular economy and adaptive reuse of buildings.	W	2	Co, D, Cn, U
MA1.2.3	Designing for deconstruction	Medium knowledge of: - design solutions for ease disassembly; - circular economy; - deconstruction methods; - disassembly sequence planning; - materials embodied energy; - waste management; - LCA; - technical standards and regulations.	Considering the end-of-life stage in design solutions. Explaining the principles and methods of design for deconstruction.	W	3	Co, D, U

MA1.2	Adaptive reuse					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
MA1.2.4	Analysing building structure to reuse	Advanced knowledge of: - structure pathologies; - structure refurbishment/ reinforcement; - structure adaptability; - technical standards and regulations.	Analysing the building structure conditions to reuse. Investigating pathologies and technical wear. Evaluating costs for repairments. Providing analysis reports and documents.	W	4	U
MA1.2.5	Using BIM for adaptive reuse projects	In-depth knowledge of: - BIM tools; - LCA; - construction environmental impacts; - building lifecycle; - conservation of resources; - circular economy; - deconstruction methods; - design for disassembly; - reuse of buildings, materials and structures; - technical standards and regulations.	Developing BIM models to optimise solutions, evaluate deconstruction methods, perform LCA and LCC, elaborate a disassembly plan.	W	5	Co, D, U
MA1.2.6	Planning the adaptive reuse process	In-depth knowledge of: - deconstruction planning; - LCA; - construction environmental impacts; - building lifecycle; - conservation of resources; - circular economy; - deconstruction methods; - design for disassembly; - reuse of buildings, materials and structures; - technical standards and regulations.	Planning the sequence of activities to implement the adaptive reuse process (e.g., selective deconstruction, construction, works for redevelopment, adaptation, expansion, etc).	W	5	Co, D, U

A.1.3.2 Macro Area: MA2 - Sustainable materials

Table A.31 – MA2.1 – Life Cycle Assessment (building scale)

MA2.1	Life Cycle Assessment (building scale)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
MA2.1.1	Understanding minimal environmental principles needed to do the job successfully.	Minimal knowledge about: - environmental principles.	Understanding and discussing environmental principles for a project.	B, W	1	Co, Cn
MA2.1.2	Understanding the principles of a life cycle assessment approach to reduce the environmental impact of the built environment.	Minimal knowledge of: - life cycle assessment methodology and its potential in the reduction of the environmental impact of the construction sector.	Discussing the basis of a life cycle approach and its value.	W	1	Co
MA2.1.3	Applying LCA analysis in a design process.	Basic knowledge on: - LCA of buildings, in terms of recycling of materials; - impacts benefiting new usages of buildings; - recyclability and degradability of buildings; - technical standards and regulations.	Proposing a balance and area of consideration on LCA calculation, knowing how to use databanks and literature to define the impact of products and comparing solutions.	W	2	Co, D
MA2.1.4	Evaluating and selecting construction products and systems based on LCA analysis.	Medium knowledge on: - impacts of construction products and building systems considering the life cycle of a building; - the use of LCA in the selection of products and systems; - technical standards and regulations.	Analysing the LCA and proposing design solutions, selecting building porducts and choose building systems. Explaining LCA advantages within the project.	W	3	Co, D
MA2.1.5	Performing the LCA analysis.	Advanced knowledge of: - impacts of construction products and building systems considering the life cycle of a building; - LCA analysis; - the use of LCA in the selection of products and systems; - technical standards and regulations.	Performing the LCA analysis, providing solutions, optimising environmental effects, comparing different results for different solutions and systems. Discussing with the design team and proposing solutions.	W	4	Co, D, U
MA2.1.6	Developing solutions in different fields based on LCA analysis.	In-depth knowledge of: - impacts of resource savings in construction, efficient use of land, energy and water, biodiversity on LCA of buildings; - the use of LCA in the selection of products and systems; - technical standards and regulations.	Defining, developing, optimising effects LCA in various fields. Discussing with the design team and proposing solutions.	W	5	Co, D

Table A.32 – MA2.2 – Recycled and reused materials

MA2.2	Recycled and reused materials					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
MA2.2.1	Understanding of the importance of using recycled and recovered materials for buildings.	Minimal knowledge of: - recycled and recovered materials for buildings.	Discussing within the project concerning recycled and recovered materials for buildings.	W	1	Co
MA2.2.2	Applying recycled and recovered materials in buildings.	Minimal knowledge of: - recycled and recovered materials for buildings.	Working, installing and applying recycled and recovered materials for buildings.	B	1	Cn
MA2.2.3	Considering recyclability of building materials and components in modernisation measures.	Basic knowledge of: - how to use reused/ recycled materials reused in a modernisation measure; - technical standards and regulations.	Selecting building materials and components for recyclability in the course of modernisation measures.	W	2	Co, D
MA2.2.4	Explaining the concept of circular economy and how recycled and reused materials could help it.	Medium knowledge of: - circular economy principles and the benefits of using recycled and reused materials; technical standards and regulations.	Explaining and applying circular economy principles to select recycled and/or reused materials	W	3	Co, D, Cn
MA2.2.5	Designing based on circular economy principles.	Advanced knowledge in: - design for disassembly; - circular economy; - reverse supply chain; - reclaimed, recycled and reused materials; - technical standards and regulations.	Designing based on circular economy principles. Selecting recycled and reused materials. Evaluating materials' supply chain.	W	4	Co, D, Cn
MA2.2.6	Assuring the quality in applicability of recycled and reused materials.	In-depth knowledge in: - LCA, LCC; - circular economy; - design for disassembly; - the best application of a reused and/ or recycled material; - technical standards and regulations.	Managing and instructing contractors and designers regarding the best application of a reused/ recycled material. Using of methodologies, such as LCA and LCC to evaluate the best applicability.	W	5	D, Cn, B

Table A.33 – MA2.3 – Regenerative materials and technologies

MA2.3	Regenerative materials and technologies					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
MA2.3.1	Understanding the importance of using nature-based materials in a building construction.	Minimal knowledge of: - definition of nature-based materials and their applicability.	Discussing within the project concerning nature-based materials and technologies.	B, W	1	Co, Cn
MA2.3.2	Selecting nature-based materials. Applying technical standards and regulations.	Basic knowledge of: - how to select and apply nature-based materials; - technical standards and regulations; - design solutions.	Selecting nature-based materials. Applying related technical standards, identifying regulatory agencies and applicable codes. Proposing basic design solutions.	W	2	Co, D
MA2.3.3	Evaluating and proposing building materials according to ecological factors and primary energy consumption.	Medium knowledge of: - ecological properties of materials; - primary energy consumption in the production of building materials; - technical standards and regulations.	Proposing building materials according to their ecological properties. Analysing primary energy consumption in the production of building materials.	W	3	Co, D
MA2.3.4	Assuring the quality of nature-based materials installation.	Advanced knowledge of: - nature-based materials and technologies; - methodologies and techniques of nature-based materials application.	Managing and instructing contractors, artisans and workers regarding the installation of nature-based materials. Evaluating the quality of the techniques to apply nature-based materials.	W	4	Cn, B
MA2.3.5	Engineering structural solutions using nature-based technologies.	Advanced knowledge of: - building structure using nature-based technologies (e.g., wood structure, earth blocks, hempcrete, etc); - technical standards and regulations.	Engineering structural solutions using nature-based technologies. Providing calculations and construction documents. Evaluating different solutions.	W	4	Co, D
MA2.3.6	Performing materials maintenance	In-depth knowledge of: - non conventional nature-based materials maintenance; - repairing techniques.	Performing nature-based materials maintenance to guarantee its durability and extend its lifetime.	B	5	U
MA2.3.7	Developing and optimising solutions for nature-based materials. Creating new applications for nature-based materials.	In-depth knowledge of: - nature-based technologies; - building structure using nature-based technologies; - technical standards and regulations; - methodologies and techniques of nature-based materials application.	Developing and optmising solutions take into account the best applicability of a nature-based material. Creating new applications for nature-based materials according to the building design.	W	5	Co, D, Cn
MA2.3.8	Installing specific non-conventional nature-based materials according to the proposed techniques (e.g., earth blocks, straw bales, hempcrete, etc).	In-depth knowledge of: - procedures and techniques to properly install non-conventional nature-based materials.	Installing non-conventional building materials according to the specific technique.	B	5	Cn

A.1.3.3 Macro Area: MA3 - Solid waste

Table A.34 – MA3.1 – Solid waste management

MA3.1	Solid waste management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
MA3.1.1	Understanding the benefits and principles of recyclable building materials and components.	Minimal knowledge about: - the recyclability of building materials and components.	Discussing of material recyclability, inspecting and classifying building materials and components for recycling.	B, W	1	Co, Cn
MA3.1.2	Proposing basic solutions to reduce environmental impacts of waste generation	Basic knowledge of: - potential strategies to reduce the amount of waste generated during construction activities; - Building as material banks (BAMB) principles; - how to increase the percentage of waste recycled, reused, and diverted from landfills; - technical standards and regulations.	Proposing basic strategies that can be implemented during design and construction stages to reduce the waste generated by the construction sector. Understanding the basic concept of the environmental impacts caused by waste generation.	W	2	Co, D, Cn
MA3.1.3	Proposing basic solutions to reduce environmental impacts of waste generation during in-use stage	Basic knowledge of: - distance from collect points (containers) to the buildings; - educational campaigns about recycling; - technical standards and regulations.	Determining the correct area to place the collect points (containers). Proposing educational campaings about recycling and waste generation reduction.	W	2	U
MA3.1.4	Explaining waste management on site	Medium knowledge of: - how to manage the waste in the site construction (e.g., how to properly separate the waste); - technical standards and regulations.	Interpreting the waste categories and legislation. Implementing waste management on site.	B	3	Cn, B
MA3.1.5	Proposing strategies to reduce waste generation.	Medium knowledge of: - which construction waste is generated during the removal of building; materials, components and equipment; - how construction waste can be disposed off; - technical standards and regulations.	Proposing strategies for the management of construction waste generated during the removal and disposal of construction materials, components and equipment.	W	3	Co, D, Cn
MA3.1.6	Developing a Construction and Demolition Waste (CDW) Management Plan	Advanced knowledge in: - strategies to reduce the generation of waste during design and construction stages; - circular economy principles; - LCA; -reused and recycled materials and source reduction design strategies; - technical standards and regulations.	Developing a CDW Management Plan indetifying strategies to reduce the generation of waste. Evaluating desing strategies and the reuse of materials. Establishing waste diversion goals for the project. Providing guidelines for the CDW Management Plan implementation	W	4	D, Cn
MA3.1.7	Optimising size, assemble and fix workpieces and knowing how to mix	In-depth knowledge on: - the measuring and cutting methods and measuring tools; - how to handle all types of waste professionally.	Managing the disposal of different types of wastes. Optimising the dimensions of the workpieces in orther to reduce waste generation.	B	5	Cn, B

MA3.1	Solid waste management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
	construction material mixtures.					
MA3.1.8	Managing environmental issues of a construction operation	In-depth knowledge on: - different techniques/ systems for correct management of waste, energy and water consumption on site; - technical standards and regulations.	Managing the site organization to reduce waste, energy and water consumption. Optimising energy and water consumption on site. Measuring the waste generation according to de CDW Management Plan.	W	5	Cn, B

A.1.4 Thematic field: Habitat

A.1.4.1 Macro Area: HA1 - Land Use

Table A.35 – HA1.1 – Site preservation, regeneration, and development

HA1.1	Site preservation, regeneration, and development					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
HA1.1.1	Understanding the value of sustainable development strategies	Minimal knowledge of: - principles and strategies for sustainable developments and exterior design (e.g., habitat conservation and restoration, open space availability, ground coverages, reduction of light pollution, dust generation, and air pollution).	Participating in discussions within the project team, suggesting strategies to develop sustainable development in the site.	W	1	Co, D
HA1.1.2	Determining the concept of watercourses quality management	Basic knowledge of: - measures to protect local species - measures to prevent contamination of watercourses - monitoring of surface water quality - the site conditions and the relevant legal regulations.	Performing daily initial surface water quality assessment in the site, based on environmental sustainability and nature conservation considerations, as part of water management.	W	2	Cn, U
HA1.1.3	Proposing and selecting basic solutions for conservation of nature, in relation to forestry issues	Basic knowledge of: - operating in the forestry sector, combining management with nature conservation - Natura 2000, and project LIFE GoProFor - regulations and technical standards requirements.	Performing simplified tools for the conservation of nature, in relation to forestry issues on the specific project sites. Monitoring the habitats and landscape features to ensure that they are unaffected by the new development and continue to support wild fauna and flora.	W	2	Cn, U
HA1.1.4	Determining the concept of restoration programme for soil and vegetation	Medium knowledge of: - suitable native species - restoration techniques - the types, physical and chemical properties of soils to support key functions (e.g., promote healthy plant and animal growth, filter and retain water and nutrients, resist and recover from degradative processes)	Analysing restoration techniques for soil and vegetation to reinstate appropriate vegetation types post-impact. Evaluating soil qualification and classification. Proposing solutions for soil and vegetation to reinstate.	W	3	Co, B
HA1.1.5	Conducting awareness training and site induction	Medium knowledge of: - sensitive species and risks associated with any dangerous animals - restoration trials and prohibitions on access	Awareness training to the relevant construction participants, regarding the issues of the site preservation (e.g., sensitive species, risks associated	W	3	Co, D, B, U

HA1.1	Site preservation, regeneration, and development					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- provisions that being made to minimise impacts on biodiversity - the site conditions and construction constraints.	with any dangerous animals). Explain the meaning of signs.			
HA1.1.6	Engineering environmental impact management	Advanced knowledge of: - environmental impact of construction projects on the sites and on adjacent areas, and land consumption aspects - related codes of practice, standards and regulations, conservation, biodiversity, and wildlife legislations.	Engineering site preservation requirements in the designing stage for construction developments. Monitoring and evaluating the environmental impacts due to construction project activities on the site.	W	4	D, Cn, U
HA1.1.7	Commissioning landscape and habitat management requirements	In-depth knowledge of: - mitigation of landscape and visual impacts, minimisation of habitat disturbance and injury/nuisance to fauna - infrastructure provision requirements - the site conditions (e.g., soil type and surfaces permeability) - urban and landscape legislation, and European Territorial Agenda.	Developing landscape and habitat management plans to minimise impacts (e.g., habitat destruction, fragmentation and species isolation) to preserve, enhance or rerebuildocal ecological networks.	W	5	D, Cn, B, U
HA1.1.8	Understanding the principles of watercourses quality management	Minimal knowledge of: - solutions to protect local species - solutions to prevent deposition of soil into watercourses - monitoring of surface water quality	Understanding the importance of maintaining and establishing protected areas. Performing assistance services regarding watercourses quality management.	B	1	Cn, B, U
HA1.1.9	Understanding the concept of the information and data required for a comprehensive site assessment	Basic knowledge of: - information and data required to assess site condition prior to design to evaluate sustainable options in relation to the decisions about the site design.	Participating in discussions within the project team defining the main content of a preliminary site assessment. Performing assistance services for a comprehensive site assessment.	B	2	Co
HA1.1.10	Proposing a waste management plan	Basic knowledge of: - waste disposal facilities to reduce the risk of exposure of birds to potentially damaging waste products	Defining the best alternative solution for waste management (storage, transfer), and reducing dust deposition on vegetation. Monitoring dust generation, and operations with vegetation removal within the project targets.	B	2	Cn, U

Table A.36 – HA1.2 – Urban and peri-urban agriculture

HA1.2	Urban and peri-urban agriculture					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
HA1.2.1	Understanding the importance of urban farming	Minimal knowledge of: - the concept of urban/peri-urban farming, and cultivation methods.	Explaining types of urban farming techniques, and discussing the farming possibilities in a site or a building.	W	1	Co

HA1.2	Urban and peri-urban agriculture					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
HA1.2.2	Applying involvement of Community Supported Agriculture	Basic knowledge of: - the concept of social farming - growing plants, food and nutrition - production and distribution process - therapeutic gardens.	Instructing about growing plants, handling food and raising awareness about the environment and nutrition for the destinated community.	W	2	D, B, U
HA1.2.3	Determining the concept of farm types, business models and cultivation practices	Medium knowledge of: - types of urban/peri-urban farming, and cultivation methods - different marketing strategies for (peri-) urban farms - specific products to reduce production costs and tailored to urban infrastructure.	Determining the best alternative for a farm type, business model, and crop selection and cultivation decisions.	W	3	D, B
HA1.2.4	Determining the concept of building zero-acreage farming	Medium knowledge of: - zero-acreage farming - types of building-related food production (rooftop gardens, rooftop greenhouses, edible walls or indoor farming), and cultivation methods.	Determining the effect of application of different types of zero-acreage farming on a new/ retrofitting building.	W	3	Co, D
HA1.2.5	Engineering Soil Organic Matter Management	Advanced knowledge of: - agricultural parks - contaminated soil of vacant urban land - Land degradation (erosion, salinization, compaction, organic matter loss) - soil properties.	Analysing soil quality and associated soil health assessment for agricultural lands. Evaluating soil qualification and classification. Determining soils' ability to provide services.	W	4	D
HA1.2.6	Commissioning building zero-acreage farming	In-depth knowledge of: - zero-acreage farming - types of building-related food production (rooftop gardens, rooftop greenhouses, edible walls or indoor farming) - cultivation methods from low-tech approaches to high-tech solutions (soil-less hydroponic growing systems, reusing waste heat and water from the building) - evaluating the performance of the systems.	Commissioning and installation of the planned agriculture involving production inside or on urban structures, and operational inspections. Managing the required safety features.	W	5	Cn, B, U
HA1.2.7	Commissioning soil-free farmings	In-depth knowledge of: - soil-free practices such as aeroponics and hydroponic farming - maintenance of the systems.	Commissioning and installation of soil-free farming systems in buildings, and operational inspections. Managing the required safety features.	W	5	Cn, B, U
HA1.2.8	Understanding the importance of urban farming	Minimal knowledge of: - the concept of urban/peri-urban farming, and cultivation methods.	Performing technical assistance services regarding urban farming techniques.	B	1	D
HA1.2.9	Installing vertical farming in advanced buildings	In-depth knowledge of vertical farming buildings' installations for hydroponic and aeroponic systems.	Installing a farming construction inside or on building structures.	B	5	Cn

A.1.4.2 Macro Area: HA2 - Biodiversity

Table A.37 – HA2.1 – Management of biodiversity on the site

HA2.1	Management of biodiversity on the site					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
HA2.1.1	Understanding the principles of qualitative rapid biodiversity survey	Minimal knowledge of: - the practical elements of protected species - biodiversity performance indicators	Participating in discussions within a project team. Performing assistance services regarding the qualitative rapid biodiversity survey.	W	1	Co, U
HA2.1.2	Analysing the concept of biodiversity management	Basic knowledge of: - the practical elements of protected species, and biodiversity indicators - local permit requirements, and national and regional regulatory frameworks, regarding environmental considerations in the site. - the site conditions and construction constraints.	Identifying the regulatory agencies and applicable codes. Evaluating the feasibility of the alternative solutions and primary planned designs for the especific building and its purposes.	W	2	Co, U
HA2.1.3	Applying an ecological survey and establishing a baseline	Medium knowledge of: - ecological survey and collecting baseline biodiversity information (e.g., locations of sensitive habitats, priority biodiversity features) - a working understanding of environmental issues and the construction/engineering process.	Surveying the biodiversity elements of a site. Evaluating and proposing alternative solutions for alleviating biodiversity impacts of the new developments on the site, through appropriate mitigation measures, during a project design and implementation phase.	W	3	Co, D
HA2.1.4	Management and monitoring of day to day ecological impacts during the construction process	Medium knowledge of: - the environmental impacts of construction activities on ecologically valuable receptors (designated sites, sensitive habitats and protected species) - sensitive habitats and species - the construction/engineering process.	Translating mitigation requirements of the management plans into practical measures on the ground and being able to be responsive to changeable and less predictable situations. Ensuring that all staff are fully aware of the environmental sensitivities of the site and their responsibilities. Providing weekly reports. Supervising the works and moving any species discovered away from the works.	W	3	Cn
HA2.1.5	Developing an ecological matrix of the territory	Medium knowledge of: - territorial systems of open spaces, biodiversity conservation and ecological connectivity. - Sustainable landscape planning and management.	Managing measurements and evaluation of sustainability indicators, regarding ecosystems and their relation with urban areas. Performing medium level simulation.	W	3	D, B, U
HA2.1.6	Engineering the strategy for achieving "no net loss" on biodiversity	Advanced knowledge of: - pre-construction (Project design) commitments to be checked and verified during the site works. - minimising the footprint of the project infrastructure and the areas of land.	Engineering of the most feasible measures for minimising the impacts and footprint of the project infrastructure and the areas of land on a project site	W	4	Co, D
HA2.1.7	Consultanting environmental impact assessment	In-depth knowledge of: - environmental impact assessment (EIA) for the proposed development areas - related codes of practice, standards and regulations, and conservation, biodiversity, and wildlife legislation.	Providing ecological risk assessment for the site, ensuring to avoid or mitigate any potentially adverse impacts. Producing hazard maps regarding the location of particularly sensitive habitats and species. Determining the effect of a plan on biodiversity or designated conservation areas.	W	5	Co, D

HA2.1	Management of biodiversity on the site					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
HA2.1.8	Commissioning the biodiversity management plan	In-depth knowledge about: - specification of sites with high biodiversity importance and a high risk of impacts on biodiversity from operations, Biodiversity Risk Matrix - (local, national) formal biodiversity plans, and standard methods of biodiversity management.	Commissioning the biodiversity management plan, complying with national laws and policies, addressing stakeholder concerns relating to biodiversity and ecosystem services, and specifying the required monitoring.	W	5	Cn, B
HA2.1.9	Understanding the importance of natural habitats in relation to the conservation of biodiversity	Minimal knowledge of: - the importance of natural parks and biodiversity heritage	Performing technical assistance services regarding regular, basic-level monitoring of the sites.	B	1	Co, Cn
HA2.1.10	Proposing basic solutions for managing biodiversity	Basic knowledge of: -the practical elements of protected species of the site - biodiversity performance indicators - a working understanding of environmental issues and the construction/engineering process.	Participating in discussions within a design team. Handling of species that they may have to move and the recognition of sensitive habitats.	B	2	Co, Cn
HA2.1.11	Determining the features of the silvicultural landscape and its main forms of government	Advanced knowledge of: - the main types of forestry, the Natura 2000 network and how to apply sustainable forest management.	Determining the most common silvicultural interventions for a site, considering their potential criticalities and how to apply tree silviculture.	B	4	Co, D

A.2 Dimension: Society

A.2.1 Thematic field: Comfort and well being

A.2.1.1 Macro Area: CO1 - Indoor air quality

Table A.38 – CO1.1 – Low-emitting materials

CO1.1	Low-emitting materials					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO1.1.1	Understanding the importance of low-emitting materials	Minimal knowledge of: - air pollution and its impact on human health; - hazardous substances emitted by insulation and fit-out materials.	Participating in discussions within a design team to select low-emitting materials for building insulation and fit-out products and how can be introduced into the design process.	B, W	1	Co

CO1.1	Low-emitting materials					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO1.1.2	Selecting low-emitting materials for building insulation and fit-out products	Basic knowledge of: - air pollution and its impact on human health; - Total VOCs emitted by insulation and fit-out materials; - main standards on Indoor Air Quality (IAQ); - main ecolabel schemes for low-emitting materials certification; - simple assessment methods (selection based on product datasheets).	Selecting low-emitting materials for building insulation and fit-out products considering the emission classes declared in technical datasheets with respect to VOCs and other hazardous substances.	W	2	D
CO1.1.3	Proposing source control strategies with respect to building insulation and fit-out products	Medium knowledge of: - air pollution and its impact on human health; - metrics on Total VOCs, CMR VOCs, formaldehyde; - main standards on Indoor Air Quality (IAQ) and air pollutants emission from construction materials/products; - main ecolabel schemes for low-emitting materials certification; - design strategies to control indoor pollution sources.	Selecting and proposing alternative strategies to control indoor pollution sources, focussed on low-emitting materials for building insulation and fit-out products. Considering building use patterns (e.g. occupant density of each building area) and user expectation levels related to IAQ.	W	3	Co, D
CO1.1.4	Engineering source control strategies with respect to building insulation and fit-out products	Advanced knowledge of: - air pollution and its impact on human health; - state-of-the-art on metrics for Total VOCs, CMR VOCs, formaldehyde; - all relevant standards on Indoor Air Quality (IAQ) and air pollutants emission from construction materials/products; - all relevant ecolabel schemes for low-emitting materials certification; - design strategies to control indoor pollution sources based on ventilation methods, occupancy behaviour and selection of low-emitting products; - advanced software based on CFD models for assessing air pollutant concentration.	Engineering strategies to control indoor pollution from building insulation and fit-out products, defining the most effective solution with respect to building constraints (e.g renovation projects), cost/benefit analysis, standard requirements on IAQ. Achieving concentration reductions of TVOCs and other hazardous substances with natural or mixed ventilation techniques besides the selection of low-emitting materials. Performing IAQ analysis by means of dynamic simulations based on Computational Fluid Dynamic (CFD) models.	W	4	D
CO1.1.5	Optimising source control strategies with respect to building insulation and fit-out products	In-depth knowledge of: - air pollution and its impact on human health; - state-of-the-art on metrics for Total VOCs, CMR VOCs, formaldehyde; - all relevant standards on Indoor Air Quality (IAQ) and air pollutants emission from construction materials/products; - all relevant ecolabel schemes for low-emitting materials certification; - design strategies to control indoor pollution sources based on ventilation methods, occupancy behaviour and selection of low-emitting products; - advanced software based on CFD models for assessing air pollutant concentration.	Optimising the design strategies to reduce indoor pollution from fit-out products with respect to indoor comfort and building energy performance. Experimenting nature-based solutions (e.g. green fit-out products, green insulation materials) and innovative systems for natural ventilation to reduce concentrations of VOCs and other hazardous substances.	W	5	D
CO1.1.6	Specifying the use of low-emitting materials in tender documents	Advanced knowledge of: - technical specifications of low-emitting materials for building insulation and fit-out products; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to indoor air quality control and low-emitting materials selection. Writing technical documentation for contracting purpose.	W	4	D
CO1.1.7	Installing low-emitting materials (building insulation, fit-out	Medium knowledge of: - construction handbooks and technical datasheets;	Installing low-emitting materials for building insulation and fit-out products in a workmanlike manner.	B	3	Cn

CO1.1	Low-emitting materials					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
	products) in a workmanlike manner	- health and safety regulations on handling insulation materials; - main ecolabel schemes for low-emitting materials certification.				

Table A.39 – CO1.2 – Indoor air pollutants management

CO1.2	Indoor air pollutants management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO1.2.1	Understanding the importance of indoor air pollution control	Minimal knowledge of: - air pollution sources and their impact on human health; - hazardous substances emitted by insulation and fit-out materials.	Participating in discussions within a design team to control indoor air pollutants and how can be introduced into the design process.	W	1	Co
CO1.2.2	Applying basic solutions to control indoor air pollution	Basic knowledge of: - air pollution sources and their impact on human health; - pollutants predominantly from indoor sources; - main standards on Indoor Air Quality (IAQ); - simple calculation methods (rules of thumb, graphic methods).	Performing simplified verifications for alternative ventilation strategies, based on predefined ventilation airflow rates.	W	2	D
CO1.2.3	Proposing conceptual solutions to control indoor air pollution	Medium knowledge of: - air pollution sources and their impact on human health; - metrics on pollutants predominantly from indoor sources (Total VOCs, CMR VOCs, formaldehyde, CO2 and other bio-effluents); - main standards on Indoor Air Quality (IAQ); - ventilation strategies to control indoor pollution sources; - risk assessment for damp and mould and mitigation strategies.	Selecting and proposing alternative strategies to control indoor air pollutants, focussing on design of the building fabric and ventilation system to meet target ventilation rates. Designing solutions for cold bridging and damage from humidity (damp and mould) identified in renovated buildings and air-tightness buildings.	W	3	Co, D
CO1.2.4	Engineering solutions to control indoor air pollution	Advanced knowledge of: - air pollution sources and their impact on human health; - metrics on pollutants predominantly from indoor sources (Total VOCs, CMR VOCs, formaldehyde, CO2 and other bio-effluents); - all relevant standards on Indoor Air Quality (IAQ); - ventilation strategies to control indoor pollution sources; - risk assessment for damp and mould and mitigation strategies. - advanced software based on CFD models for assessing air pollutant concentration.	Engineering strategies to control indoor air pollutants, defining the most effective solution with respect to building constraints, cost/benefit analysis, standard requirements on IAQ. Considering the expectation levels on indoor environmental quality (standard EN 16798-1) as basis for the ventilation design, and methods based on perceived air quality or concentration limits of a pollutant in indoor air (e.g. CO2). Performing IAQ analysis by means of dynamic simulations based on Computational Fluid Dynamic (CFD) models.	W	4	D
CO1.2.5	Optimising the detailed design of indoor air pollution control	In-depth knowledge of: - air pollution sources and their impact on human health; - metrics on pollutants predominantly from indoor sources (Total VOCs, CMR VOCs, formaldehyde, CO2 and other bio-effluents); - all relevant standards on Indoor Air Quality (IAQ); - ventilation strategies to control indoor pollution sources;	Optimising the ventilation design by means of localised ventilation strategies to control indoor point sources in parts of the building, considering emitting materials as insulation and fit-out products (VOCs emission), and occupation schedule of main building zones (CO2 and bio-effluents emission). Experimenting nature-based solutions (e.g. green fit-	W	5	D

CO1.2	Indoor air pollutants management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- risk assessment for damp and mould and mitigation strategies. - advanced software based on CFD models for assessing air pollutant concentration.	out products and insulation materials) reducing air pollutant emissions in order to decrease ventilation rates, and considering natural or hybrid ventilation systems to reduce energy consumptions.			
CO1.2.6	Measuring indoor air pollution in workplaces and residential buildings	In-depth knowledge of: - standards and procedures for building commissioning; - technical standards on air pollutant measurements; - survey methods for post-occupancy evaluation of indoor air quality; - in situ monitoring of indoor air quality (Total VOCs, CMR VOCs, formaldehyde, CO2, bio-effluents).	Performing in situ measurements of pollutants concentration overtime (Total VOCs, CMR VOCs, formaldehyde, CO2, bio-effluents) to assess indoor air quality. Collecting and analysing data in order to evaluate the building category of indoor environmental quality. Carrying on post-occupancy evaluation of indoor air quality to support data analysis of monitoring campaigns.	W	5	B,U

Table A.40 – CO1.3 – Outdoor air pollutants management

CO1.3	Outdoor air pollutants management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO1.3.1	Understanding the importance of outdoor air pollution control	Minimal knowledge of: - air pollution sources and their impact on human health; - effects of industrial or heavily trafficked areas on air quality inside buildings.	Participating in discussions within a design team to control outdoor air pollutants and how can be introduced into the design process.	W	1	Co
CO1.3.2	Applying basic solutions to control outdoor air pollution	Basic knowledge of: - air pollution sources and their impact on human health; - pollutants predominantly from outdoor sources (PM2.5, PM10, ozone, benzene, CO2, radon); - main standards on Indoor Air Quality (IAQ); - simple calculation methods (rules of thumb, graphic methods).	Performing simplified verifications of air changes for alternative ventilation strategies, based on predefined ventilation airflow rates.	W	2	D
CO1.3.3	Proposing conceptual solutions to control outdoor air pollution	Medium knowledge of: - air pollution sources and their impact on human health; - metrics on pollutants predominantly from outdoor sources (PM2.5, PM10, ozone, benzene, CO2, radon); - main standards on Indoor Air Quality (IAQ); - ventilation strategies to control outdoor pollution sources; - risk assessment for radon and mitigation strategies.	Selecting and proposing alternative strategies to control outdoor air pollutants, focussing on design of the building fabric and ventilation systems to meet target ventilation rates. Risk assessment for radon considering potential sources from soil and building materials.	W	3	Co, D
CO1.3.4	Engineering solutions to control outdoor air pollution	Advanced knowledge of: - air pollution sources and their impact on human health; - metrics on pollutants predominantly from outdoor sources (PM2.5, PM10, ozone, benzene, CO2, radon);	Engineering strategies to control outdoor air pollutants, defining the most effective solution with respect to building constraints, cost/benefit analysis, standard requirements on IAQ.	W	4	D

CO1.3	Outdoor air pollutants management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- all relevant standards on Indoor Air Quality (IAQ); - ventilation strategies to control outdoor pollution sources; - filter specification for intakes of outdoor air; - risk assessment for radon and mitigation strategies; - advanced software based on CFD models for assessing air pollutant concentration and distribution.	Performing IAQ analysis by means of dynamic simulations based on Computational Fluid Dynamic (CFD) models. Designing solutions to reduce the risk of radon in case of high levels in buildings, considering mitigation startegies as sealing of surfaces in contact with soil, soil gas barriers, passive/active ventilation of unoccupied ground areas, passive/active soil de-pressurisation.			
CO1.3.5	Optimising the detailed design of outdoor air pollution control	In-depth knowledge of: - air pollution sources and their impact on human health; - metrics on pollutants predominantly from outdoor sources (PM2.5, PM10, ozone, benzene, CO2, radon); - all relevant standards on Indoor Air Quality (IAQ); - ventilation strategies to control outdoor pollution sources; - filter specification for intakes of outdoor air; - risk assessment for radon and mitigation strategies. - advanced software based on CFD models for assessing air pollutant concentration and distribution.	Optimising the ventilation design with the definition of outdoor air quality categories (ODA) for the building location, and filter categories (SUP) for the supply air. Experimenting nature-based solutions (e.g. green fit-out products and insulation materials) reducing air pollutant emissions in order to decrease ventilation rates, and considering natural or hybrid ventilation systems to reduce energy consumptions.	W	5	D
CO1.3.6	Measuring outdoor air pollution in workplaces and residential buildings	In-depth knowledge of: - standards and procedures for building commissioning; - technical standards on air pollution measurements; - survey methods for post-occupancy evaluation of indoor air quality; - in situ monitoring of pollutants predominantly from outdoor sources (PM2.5, PM10, ozone, benzene, CO2, radon).	Performing in situ measurements of pollutants concentration overtime (PM2.5, PM10, ozone, benzene, CO2, radon) to assess indoor air quality. Collecting and analysing data in order to evaluate the building category of indoor environmental quality. Carrying on post-occupancy evaluation of indoor air quality to support data analysis of monitoring campaigns.	W	5	B, U

A.2.1.2 Macro Area: CO2 - Thermal comfort

Table A.41 – CO2.1 – Indoor Thermal Comfort

CO2.1	Indoor Thermal Comfort					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO2.1.1	Understanding the importance of thermal comfort for indoor spaces	Minimal knowledge of: - thermal comfort risk assessment in indoor spaces; - user needs and technical standard requirements.	Participating in discussions within a design team to define how thermal comfort design concepts can be introduced into the design process.	W	1	Co

CO2.1	Indoor Thermal Comfort					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO2.1.2	Applying basic solutions for indoor thermal comfort	Basic knowledge of: - thermal quantities and metrics based on operative temperature; - main standards on thermal comfort in indoor workplaces; - envelope design solutions to control thermal comfort; - simple calculation methods (rules of thumb, graphic methods).	Performing simplified verification for alternative solutions of building envelope (thermal insulation and mass) to assess indoor operative temperature.	W	2	D
CO2.1.3	Proposing conceptual solutions for indoor thermal comfort	Medium knowledge of: - metrics on thermal comfort based on human heat balance (PMV/PPD and SET indices); - main standards on thermal comfort in buildings with mechanical ventilation; - design strategies to control thermal comfort at building level (envelope, structure, HVAC system) and site location (orientation, obstructions, urban microclimate); - commercial software for thermal analysis.	Selecting and proposing alternative strategies for thermal environment control at building level and site location, focussing on thermal comfort analysis for mechanical ventilated spaces. Assessing the resulting performance of technical solutions and strategies by means of commercial simulation tools (steady state models), in order to fulfil standard requirements as thermal comfort categories.	W	3	Co, D
CO2.1.4	Engineering the concept design for indoor thermal comfort	Advanced knowledge of: - state-of-the-art on metrics for thermal comfort in buildings with and without mechanical ventilation (adaptive comfort models); - occupancy behaviour design (metabolic energy, clothing insulation); - all relevant standards on thermal comfort and risk assessment overtime; - design strategies to control thermal comfort at building level (without mechanical ventilation) and related to site location; - software for thermal comfort analysis based on dynamic method calculation and weather data; - cost/benefit analysis.	Engineering strategies for thermal comfort at building level and site location, defining the most suitable solution with respect to building constraints and functions, cost/benefit analysis, standard requirements on thermal comfort. Achieving energy use reduction in thermal environment control by means of natural or mixed ventilation. Performing thermal comfort analysis for multi-seasonal risk assessment by means of dynamic simulation models based on weather data.	W	4	D
CO2.1.5	Optimising the detailed design for indoor thermal comfort and developing new technical solutions	In-depth knowledge of: - state-of-the-art on metrics for thermal comfort (with/without mechanical ventilation) and localised thermal discomfort; - occupancy behaviour design (metabolic energy, clothing insulation); - all relevant standards on energy performance of buildings addressing thermal comfort overtime; - thermal environment control by nature-based solutions and landscape design; - software for thermal comfort analysis based on dynamic method calculation and weather data, BIM integrated.	Optimising the design strategies for thermal environment control considering localised thermal discomfort (draughts, air temperature differences, radiant temperature asymmetry) and its impact on building energy performance. Experimenting innovative systems of natural ventilation and nature-based solutions (e.g. green-roofs, shading and cooling function of vegetation, soil and reflective surfaces around the building) to improve indoor thermal comfort and reduce energy consumption.	W	5	D
CO2.1.6	Specifying the design for indoor thermal comfort in tender documents	Advanced knowledge of: - technical specifications for thermal environment control; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to thermal environment control for indoor spaces. Writing technical documentation for contracting purpose.	W	4	D

CO2.1	Indoor Thermal Comfort					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO2.1.7	Measuring thermal comfort in indoor workplaces and residential buildings	In-depth knowledge of: - standards and procedures for building commissioning; - technical standards on thermal comfort in field measurement; - survey methods for post-occupancy evaluation of indoor comfort; - microclimatic monitoring (air temperature, relative humidity, mean radiant temperature, air velocity) by means of thermal comfort analysers, data logging systems, thermographic cameras.	Performing microclimatic measurements overtime (air temperature, relative humidity, radiant temperature, air velocity) to assess global thermal comfort and localised discomfort in indoor spaces. Collecting and analysing data in order to evaluate thermal comfort indices (PMV/PPD and SET indices). Carrying on post-occupancy evaluation of thermal comfort to support data analysis of monitoring campaigns.	W	5	B, U

Table A.42 – CO2.2 – Outdoor Thermal Comfort

CO2.2	Outdoor Thermal Comfort					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO2.2.1	Understanding the importance of thermal comfort for urban outdoor spaces	Minimal knowledge of: - thermal comfort risk assessment in outdoor spaces; - urban heat island and urban canyon effects.	Participating in discussions within a design team to define how thermal comfort design concepts can be introduced into the design process.	W	1	Co
CO2.2.2	Proposing conceptual solutions for outdoor thermal comfort	Medium knowledge of: - metrics on thermal comfort based on human heat balance (PMV, SET, PET indices); - main standards on thermal comfort and thermal stress; - urban heat island and urban canyon effects; - design strategies to mitigate thermal environment in urban outdoor spaces (at cluster scale); - commercial software for thermal analysis (e.g. Energy Balance Model, EMB).	Selecting and proposing alternative mitigating strategies for thermal environment in urban outdoor spaces, focussing on urban geometry (compact or open outdoor spaces), vegetation (tree areas, grasslands), reflective surfaces (high albedo pavements), water bodies (ponds, fountains), in order to improve thermal comfort for pedestrians at cluster urban scale. Assessing the resulting performance of mitigating strategies by means of commercial simulation tools (EBM method).	W	3	Co, D
CO2.2.3	Optimising the detailed design for outdoor thermal comfort and developing new technical solutions	In-depth knowledge of: - state-of-the-art on metrics for thermal stess (WBGT, WCI indices) and thermal comfort (PMV, SET, PET indices) based on human heat balance; - occupancy behaviour design (metabolic energy, clothing insulation); - all relevant standards on thermal comfort and thermal stress; - urban heat island and urban canyon effects; - design strategies to mitigate thermal environment in urban outdoor spaces (at neighbourhood scale); - advanced software for thermal analysis of urban outdoor spaces (e.g. Computational Fluid Dynamics, CFD).	Optimising the control of outdoor thermal environment considering interactions among different mitigation strategies (urban geometry, vegetation, reflective surfaces, water bodies) at neighbourhood urban scale. Experimenting innovative materials for pavements/facades (cool materials) to improve thermal comfort for pedestrians in urban canyons. Assessing the resulting performance of mitigating strategies by means of advanced simulation tools (CFD method).	W	5	D

CO2.2	Outdoor Thermal Comfort					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO2.2.4	Measuring thermal comfort in urban outdoor spaces	In-depth knowledge of: - technical standards on field measurements for thermal comfort; - survey methods for subjective evaluation of outdoor thermal comfort; - microclimatic monitoring in outdoor spaces (air temperature, relative humidity, radiant temperature, wind velocity) by means of thermal comfort analysers, data logging systems, thermographic cameras.	Performing microclimatic measurements overtime (air temperature, relative humidity, radiant temperature, surface temperature, wind velocity) to assess global thermal comfort and localised discomfort in outdoor spaces. Collecting and analysing data in order to evaluate thermal comfort indices (PMV/PPD, SET, PET indices). Carrying on subjective evaluations of thermal comfort to support data analysis of monitoring campaigns.	W	5	B, U

A.2.1.3 Macro Area: CO3 - Visual comfort

Table A.43 – CO3.1 – Daylighting

CO3.1	Daylighting					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO3.1.1	Understanding the importance of daylighting	Minimal knowledge of: - daylighting in indoor spaces and daylight harvesting; - user needs and technical standard requirements.	Participating in discussions for the feasibility study of daylight harvesting within a design team.	B, W	1	Co
CO3.1.2	Applying basic solutions for daylighting	Basic knowledge of: - simplified metrics for daylight based on Daylight Factor ratio; - standards and regulations on Daylight Factor; - optical properties of glazing materials; - simple calculation methods (rules of thumb, graphic methods).	Performing simplified calculation of average Daylight Factor to size windows in order to fulfil daylighting requirements.	W	2	D
CO3.1.3	Proposing conceptual solutions for daylighting	Medium knowledge of: - daylight metrics and energy savings; - all relevant standards on daylighting and visual comfort (daylight glare metrics); - optical properties of glazing materials and light transport systems (e.g. light pipes, light shelves); - commercial software for daylighting design.	Selecting and proposing alternative daylighting solutions (e.g. side-lighting, top-lighting, core-lighting) focussing on energy savings and visual comfort analysis. Performing daylighting analysis by means of professional simulation tools, in order to fulfil standard requirements and to visualize render images of the lighting design concept.	W	3	Co, D

CO3.1	Daylighting					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO3.1.4	Engineering the concept design for daylighting	Advanced knowledge of: - state-of-the-art on daylight metrics (dynamic methods based on climate database) and energy saving strategies; - all relevant standards on daylighting, energy savings, visual comfort (daylight glare metrics); - optical properties of glazing materials, light transport systems and daylight harvesting systems; - professional software for daylight/artificial lighting integrated design.	Engineering the daylight design, defining the most suitable solution with respect to building constraints and functions, cost/benefit analysis, standard requirements on visual comfort. Modelling light-pipe performances (vertical and horizontal light-pipes). Achieving energy use reduction for artificial lighting by means of daylight harvesting solutions.	W	4	D
CO3.1.5	Developing new technical solutions and optimising the detailed design for daylighting	In-depth knowledge of: - circadian lighting metrics (e.g. Equivalent Melanopic Lux) and daylight metrics (dynamic methods based on climate database); - all relevant standards on non-visual aspects of light, daylighting, energy savings, visual comfort (daylight glare metrics); - optical properties of glazing materials, light transport systems and daylight harvesting systems; - software for circadian lighting design, BIM for daylighting integration with artificial lighting.	Optimising the daylight access for energy savings and for circadian health of users, performing daylight simulations by means of tools based on dynamic methods and climate database. Experimenting innovative solutions for daylight harvesting based on emerging technologies (e.g. light sensor networks, task tuning, LED continuous dimming).	W	5	D
CO3.1.6	Specifying the design for daylighting in tender documents	Advanced knowledge of: - technical specifications for glazing materials, light transport systems (e.g. light pipes), daylight harvesting systems; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to daylight harvesting. Writing technical documentation for contracting purpose.	W	4	D
CO3.1.7	Installing windows, skylights and light transport systems	Medium knowledge of: - technical datasheets and operation manuals; - technical drawing representation; - glazing materials and light transport technology (e.g. light pipes).	Installing the daylighting system according to the specified design documentation, taking account of installation procedure and safety regulations.	B	3	Cn
CO3.1.8	Installing daylight harvesting systems	In-depth knowledge of: - technical datasheets and operation manuals; - technical drawing representation; - electrical safety regulations; - light sensor networks, light control systems.	Installing advanced solutions for daylight harvesting systems (light sensor networks, light control systems) according to the specified design documentation and installation procedures.	B	5	Cn
CO3.1.9	Assuring the quality of installed daylighting systems	Advanced knowledge of: - standards and procedures for quality assurance in electrical and construction works; - configuration of the light control system for daylight harvesting; - installation procedures for light transport systems; - Daylight Factor measurement by means of portable photometers (e.g. luxmeter).	Managing, instructing and auditing contractors on critical aspects during the installation of daylighting systems (e.g. windows, light-pipes, daylight harvesting systems). Performing spot measurements of Daylight Factor to confirm design values to specified lighting criteria. Verifing and delivering operation and maintenance instructions.	W	4	Cn
CO3.1.10	Measuring visual comfort in indoor workplaces and residential buildings lit by daylight	In-depth knowledge of: - standards and procedures for building commissioning; - technical standards on visual comfort with daylight (glare metrics); - illuminance and luminance spot measurements by portable photometers; - luminance mapping distribution by imaging luminance measurement device	Performing photometric measurements to assess visual comfort in indoor workplaces lit by daylight (Daylight Factor distribution and uniformity, luminance distribution, daylight glare evaluation from windows) and light-pipe performances verification (luminous flux decay, spectral	W	5	B, U

CO3.1	Daylighting					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		(ILMD); - spectral distribution measurement of daylight by spectrophotometer.	distribution). Collecting and analysing data in order to evaluate the quality of daylighting and its effect on visual comfort.			

Table A.44 – CO3.2 – Indoor lighting

CO3.2	Indoor lighting					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO3.2.1	Understanding the importance of indoor lighting	Minimal knowledge of: - artificial lighting for indoor spaces and its integration with daylight; - user needs and technical standard requirements.	Participating in discussions for the feasibility study of a indoor lighting system within a design team.	B, W	1	Co
CO3.2.2	Applying basic solutions for indoor lighting	Basic knowledge of: - photometric quantities and metrics on visual comfort; - main standards on visual comfort in indoor workplaces; - photometric performance of light sources and light luminaires; - simple calculation methods (rules of thumb, datasheet).	Performing simplified calculation to size alternative solutions of the indoor lighting system. Applying fundamentals of visual comfort in simple projects.	W	2	D
CO3.2.3	Proposing conceptual solutions for indoor lighting	Medium knowledge of: - metrics on visual comfort in indoor workplaces (light quantity approach); - all relevant standards on visual comfort and performance of light luminaires; - photometric and energy performance of light sources, luminaires and control systems; - commercial software for lighting design.	Selecting and proposing alternative lighting systems, focussing on visual comfort analysis for indoor workplaces. Assessing the resulting performance of the lighting system by means of commercial simulation tools, in order to fulfil standard requirements and to visualize render images of the lighting design concept.	W	3	Co, D
CO3.2.4	Engineering the concept design for indoor lighting	Advanced knowledge of: - state-of-the-art on lighting quality metrics and energy saving strategies; - all relevant standards on visual comfort for indoor workplaces, emergency lighting, energy saving and electrical safety for lighting; - photometric and energy performance of light sources, luminaires and control systems; - software for lighting design with BIM integration.	Engineering solutions for indoor lighting, defining the most suitable lighting system with respect to building constraints and functions, cost/benefit analysis, standard requirements on visual comfort. Achieving energy use reduction for artificial lighting by means of high efficiency light sources (e.g. Solid State Lighting for retrofitting solutions), light control systems, daylight integration.	W	4	D
CO3.2.5	Developing new technical solutions and optimising the detailed design for indoor lighting	In-depth knowledge of: - circadian lighting metrics (e.g. Equivalent Melanopic Lux) and lighting quality metrics; - all relevant standards on non-visual aspects of light, visual comfort, emergency lighting, energy saving and electrical safety for lighting; - circadian lighting technology (e.g. tunable white LEDs);	Optimising the artificial lighting system for indoor workplaces to provide users with appropriate light exposure for maintaining circadian health and aligning the circadian rhythm with the day-night cycle. Experimenting innovative solutions for circadian lighting based on emerging technologies (e.g. tunable	W	5	D

CO3.2	Indoor lighting					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- software for circadian lighting design, BIM for artificial lighting integration with daylighting.	white LEDs, control systems to enhance daylight access).			
CO3.2.6	Specifying the design for indoor lighting in tender documents	Advanced knowledge of: - technical specifications for indoor lighting systems; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to lighting systems for indoor workplaces. Writing technical documentation for contracting purpose.	W	4	D
CO3.2.7	Installing the lighting system according to specified design documentation	Medium knowledge of: - technical datasheets and operation manuals; - lighting scheme representation; - electrical safety regulations; - lighting products and system connectivity.	Installing the lighting system according to the specified design documentation, taking account of installation procedure and safety regulations.	B	3	Cn
CO3.2.8	Installing the lighting system evaluating product equivalence criteria	In-depth knowledge of: - technical datasheets and operation manuals; - lighting scheme representation; - electrical safety regulations; - lighting products and technical solutions; - product equivalence criteria.	Installing alternative lighting products based on the evaluation of product equivalence* according to the following criteria: aesthetic, light output and colour tonality, energy consumption, construction quality. (*) If a product replacement is allowed through the process by the contract.	B	5	Cn
CO3.2.9	Assuring the quality of installed lighting systems	Advanced knowledge of: - standards and procedures for quality assurance in electrical works; - configuration of the light control system; - illuminance measurement by means of portable photometers (e.g. luxmeter).	Managing, instructing and auditing contractors on critical aspects during the installation of the lighting system. Performing spot measurements of illuminance on visual tasks to confirm design values to specified lighting criteria. Verifing and delivering operation and maintenance instructions.	W	4	Cn
CO3.2.10	Measuring visual comfort in indoor workplaces and residential buildings lit by artificial lighting	In-depth knowledge of: - standards and procedures for building commissioning; - technical standards on photometric and colorimetric measurements; - illuminance and luminance spot measurements by portable photometers; - luminance mapping distribution by imaging luminance measurement device (ILMD); - spectral distribution measurement of light sources and colorimetric properties (CCT, CRI) by spectrophotometer.	Performing photometric measurements to assess visual comfort in indoor workplaces (illuminance levels and uniformity, luminance distribution, glare) and lighting performance verification (flickering, spectral distribution, colour temperature, colour rendering index). Collecting and analysing data in order to evaluate the lighting quality and its effect on visual comfort.	W	5	B, U

Table A.45 – CO3.3 – Outdoor lighting (architectural lighting for building facades, outdoor private spaces)

CO3.3	Outdoor lighting (architectural lighting for building facades, outdoor private spaces)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO3.3.1	Understanding the importance of outdoor lighting	Minimal knowledge of: - architectural lighting (building facades) and outdoor lighting for private spaces (parking lots, gardens, pedestrian paths); - user needs and technical standard requirements.	Participating in discussions for the feasibility study of an outdoor lighting system within a design team.	B, W	1	Co
CO3.3.2	Applying basic solutions for outdoor lighting	Basic knowledge of: - photometric quantities; - main standards on lighting for outdoor spaces; - photometric performance of light sources and light luminaires; - simple calculation methods (rules of thumb, datasheet).	Performing simplified calculation to size alternative solutions of the outdoor lighting system. Applying fundamentals of photometry in simple projects.	W	2	D
CO3.3.3	Proposing conceptual solutions for outdoor lighting	Medium knowledge of: - metrics on disability and discomfort glare; - all relevant standards on outdoor lighting and light fitting performances; - photometric and energy performances of light sources, luminaires and control systems; - commercial software for lighting design.	Selecting and proposing alternative lighting systems, focussing on visual effects and lighting patterns for building facades and outdoor spaces. Assessing the resulting performance of the lighting system by means of commercial simulation tools, in order to fulfil standard requirements and to visualize render images of the lighting design concept.	W	3	Co, D
CO3.3.4	Engineering the concept design for outdoor lighting	Advanced knowledge of: - state-of-the-art on lighting quality metrics and energy saving strategies for outdoor lighting; - all relevant standards on light pollution, glare control, energy saving and electrical safety for outdoor lighting; - photometric and energy performance of light sources, luminaires and control systems; - professional software for lighting design with BIM integration.	Engineering solutions for outdoor lighting, defining the most suitable lighting system and its placement with respect to building constraints and functions, cost/benefit analysis, standard requirements on light pollution and visual comfort. Achieving energy use reduction for artificial lighting by means of high efficiency light equipment (e.g. Solid State Lighting, retrofit policies).	W	4	D
CO3.3.5	Developing new technical solutions and optimising the detailed design for outdoor lighting	In-depth knowledge of: - analysis of the state-of-the-art in lighting of urban elements (methods, tools, practice); - state-of-the-art on lighting quality metrics and energy saving strategies for outdoor lighting; - all relevant standards on light pollution, glare control, energy saving and electrical safety for outdoor lighting; - photometric and energy performances of light sources, luminaires and control systems; - professional software for virtual reality design of the lighting scene.	Optimising the lighting system for outdoor spaces considering adaptive light control sensors besides LED retrofit, in order to reduce energy consumption. Experimenting innovative methods to create lighting patterns (e.g. floodlighting, luminance gradient, light grazing. image projections) carrying out field trials and analysing glare risk.	W	5	D
CO3.3.6	Specifying the design for outdoor lighting in tender documents	Advanced knowledge of: - technical specifications for outdoor lighting systems; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to lighting systems for outdoor spaces. Writing technical documentation for contracting purpose.	W	4	D

CO3.3	Outdoor lighting (architectural lighting for building facades, outdoor private spaces)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO3.3.7	Installing the lighting system according to specified design documentation	Medium knowledge of: - technical datasheets and operation manuals; - lighting scheme representation; - electrical safety regulations; - lighting products and system connectivity.	Installing the lighting system according to the specified design documentation, taking account of installation procedure and safety regulations.	B	3	Cn
CO3.3.8	Installing the lighting system evaluating product equivalence criteria	In-depth knowledge of: - technical datasheets and operation manuals; - lighting scheme representation; - electrical safety regulations; - lighting products and technical solutions; - product equivalence criteria.	Installing alternative lighting products based on the evaluation of product equivalence* according to the following criteria: aesthetic, light output and colour tonality, energy consumption, construction quality. (*) If a product replacement is allowed through the process by the contract.	B	5	Cn
CO3.3.9	Assuring the quality of installed lighting systems	Advanced knowledge of: - standards and procedures for quality assurance in electrical works; - configuration of the light control system; - illuminance measurements by means of portable photometers (e.g. luxmeter).	Managing, instructing and auditing contractors on critical aspects during the installation of the lighting system. Performing spot measurements of illuminance on areas of interest to confirm design values to specified lighting criteria. Verifing and delivering operation and maintenance instructions.	W	4	Cn
CO3.3.10	Measuring visual comfort in outdoor spaces lit by artificial lighting	In-depth knowledge of: - standards and procedures for building commissioning; - technical standards on photometric and colorimetric measurements; - illuminance measurements (horizontal and semicylindrical) by portable photometers; - luminance mapping distribution by imaging luminance measurement device (ILMD); - spectral distribution measurements of light sources and colorimetric properties (CCT, CRI) by spectrophotometer.	Performing photometric measurements to assess visual comfort in outdoor spaces (illuminance levels and uniformity, luminance distribution, glare analysis) and lighting performance verification (light pollution, spectral distribution). Collecting and analysing data in order to evaluate the lighting quality and its effect on visual comfort.	W	5	B, U

A.2.1.4 Macro Area: CO4 - Acoustic comfort

Table A.46 – CO4.1 – Sound insulation

CO4.1	Sound insulation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO4.1.1	Understanding the importance of sound insulation	Minimal knowledge of: - differences between sound insulation and sound absorption interventions; - technical standard requirements and regulations on sound insulation; - sound insulation materials.	Participating in discussions for the feasibility study of sound insulation within a design team.	B, W	1	Co

CO4.1	Sound insulation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO4.1.2	Applying basic solutions for sound insulation	Basic knowledge of: - fundamental principles of sound transmission in buildings (airborne noise, impact noise); - metrics related to sound insulation; - technical standard requirements and regulations on sound insulation; - sound attenuation properties of building elements, insulation materials and technical solutions; - simple calculation methods (rules of thumb, graphic methods, datasheets).	Performing simplified acoustic verifications to assess soundproofing performances of alternative insulation solutions and their compliance with standard requirements.	W	2	D
CO4.1.3	Proposing conceptual solutions for sound insulation	Medium knowledge of: - fundamental principles of sound transmission in buildings (airborne noise, impact noise); - metrics related to sound insulation; - flanking transmission analysis and corrective measures; - technical standard requirements and regulations on sound insulation; - sound attenuation properties of building elements, insulation materials and technical solutions; - professional software for building acoustic analysis.	Selecting and proposing alternative insulation solutions, focussing on flanking transmission analysis and correction. Assessing the soundproofing performance of building elements by means of standard calculation models for sound insulation.	W	3	Co, D
CO4.1.4	Engineering the concept design for sound insulation	Advanced knowledge of: - fundamental principles of sound transmission in buildings (airborne noise, impact noise); - metrics related to sound insulation; - flanking transmission analysis and corrective measures; - technical standard requirements and regulations on sound insulation; - sound attenuation properties of building elements, insulation materials and complex technical solutions; - advanced software for building acoustic analysis (e.g. FEM acoustic analysis); - cost/benefit analysis.	Engineering solutions for sound insulation and flanking transmission correction, considering cost/benefit analysis and fulfilling standard requirements. Performing acoustic simulations of building elements by means of advanced simulation tools, assessing the impact of sound insulation on indoor acoustic comfort.	W	4	D
CO4.1.5	Developing new technical solutions and optimising the detailed design for sound insulation	In-depth knowledge of: - fundamental principles of sound transmission in buildings (airborne noise, impact noise); - metrics related to sound insulation; - flanking transmission analysis and corrective measures; - technical standard requirements and regulations on sound insulation; - eco-efficient sound insulation materials and complex technical solutions; - advanced software for building acoustic analysis integrated with BIM; - cost/benefit analysis.	Developing and experimenting innovative solutions for sound insulation based on emerging technologies and eco-efficient materials. Performing acoustic simulations of building elements by means of advanced simulation tools, optimising the sound insulation related to thermal insulation properties and its impact on indoor comfort.	W	5	D
CO4.1.6	Specifying the design for sound insulation in tender documents	Advanced knowledge of: - technical specifications of building envelope and sound insulation; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to sound insulation. Writing technical documentation for contracting purpose.	W	4	D

CO4.1	Sound insulation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO4.1.7	Installing sound insulation in a workmanlike manner	Medium knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on handling sound insulation materials; - sound insulation materials and technical solutions.	Installing traditional solutions for sound insulation in a workmanlike manner.	B	3	Cn
CO4.1.8	Installing sound insulation in advanced buildings	In-depth knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on handling sound insulation materials; - sound insulation materials and technical solutions for NZEB envelopes.	Installing advanced solutions for sound insulation of NZEB envelopes.	B	5	Cn
CO4.1.9	Assuring the quality of installed sound insulation	Advanced knowledge of: - standards and procedures for quality assurance in construction works; - qualitative methods to check quality installation of sound insulation materials (e.g. check-list); - quantitative methods to assess airborne and impact sound insulation (acoustic survey method).	Managing, instructing and auditing contractors on critical aspects in construction site referred to the installation of sound insulation.	W	4	Cn
CO4.1.10	Measuring acoustic performance of building elements	In-depth knowledge of: - standards and procedures for building commissioning; - technical standards on field measurements of airborne and impact sound insulation; - measuring acoustical properties of building elements by means of sound level meters and standardized sound sources (omnidirectional sound source, tapping machine).	Performing in field sound insulation measurements (airborne and impact) to detect flanking transmission and other critical issues in building elements. Collecting and analysing data in order to evaluate the sound insulation quality of the building and its effect on acoustic comfort.	W	5	B, U

Table A.47 – CO4.2 – Room acoustics

CO4.2	Room acoustics					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO4.2.1	Understanding the importance of room acoustics	Minimal knowledge of: - differences between sound absorption and sound insulation interventions; - technical standard requirements and regulations on reverberation time; - sound absorption materials.	Participating in discussions for the feasibility study of sound absorption within a design team.	B, W	1	Co
CO4.2.2	Applying basic solutions for room acoustics	Basic knowledge of: - fundamental principles of sound propagation in closed space; - metrics related to reverberation time; - technical standard requirements and regulations on reverberation time; - sound absorption materials and simple technical solutions; - simple calculation methods (rules of thumb, graphic methods, datasheets).	Performing simplified verifications to assess the reverberation time related to alternative acoustic treatments and their compliance with standard requirements.	W	2	D
CO4.2.3	Proposing conceptual solutions for room acoustics	Medium knowledge of: - fundamental principles of sound propagation in closed space; - metrics related to reverberation time and speech intelligibility; - technical standard requirements and regulations on room acoustic quality;	Selecting and proposing alternative solutions for room acoustics, focussing on reverberation time and speech intelligibility. Assessing the acoustic quality by means of tools	W	3	Co, D

CO4.2	Room acoustics					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- technical solutions for sound absorption and diffusion; - professional software for room acoustics analysis.	based on standard calculation codes for sound absorption.			
CO4.2.4	Engineering the concept design for room acoustics	Advanced knowledge of: - fundamental principles of sound propagation in closed space; - metrics related to reverberation time and speech intelligibility; - room acoustic issues (e.g. flutter echoes, focusing) and corrective measures; - technical standard requirements and regulations on room acoustic quality; - technical solutions for sound absorption and diffusion; - advanced software for room acoustic analysis (e.g. ray-tracing method); - cost/benefit analysis.	Engineering solutions to control reverberation time and increase speech intelligibility, considering cost/benefit analysis and fulfilling standard requirements. Performing acoustic simulations by means of advanced simulation tools, assessing the acoustic quality of a room for speech.	W	4	D
CO4.2.5	Developing new technical solutions and optimising the detailed design for room acoustics	In-depth knowledge of: - fundamental principles of sound propagation in closed space; - metrics related to reverberation time, speech intelligibility and other quality acoustic parameters (e.g. clarity, definition, early decay time); - room acoustic issues (e.g. flutter echoes, focusing) and corrective measures; - technical standard requirements and regulations on room acoustic quality; - technical solutions for sound absorption and diffusion; - advanced software for room acoustic analysis (e.g. ray-tracing method, auralization) and BIM integrated; - cost/benefit analysis.	Developing and experimenting innovative solutions of acoustic treatments based on emerging technologies and eco-efficient materials. Performing acoustic simulations of the indoor space by means of advanced simulation tools, optimising the acoustic treatment for spaces devoted to music listening.	W	5	D
CO4.2.6	Specifying the design for room acoustics in tender documents	Advanced knowledge of: - technical specifications for room acoustic treatments; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to room acoustics. Writing technical documentation for contracting purpose.	W	4	D
CO4.2.7	Installing acoustic treatment in a workmanlike manner	Medium knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on handling sound absorption materials; - sound absorption materials and technical solutions.	Installing traditional solutions for sound absorption in a workmanlike manner.	B	3	Cn
CO4.2.8	Installing advanced acoustic treatment (spaces for speech and music)	In-depth knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on handling sound absorption materials; - technical solutions for sound absorption and sound diffusion.	Installing advanced acoustic treatments for spaces devoted to speech and music listening (e.g. sound absorber panels, bass traps, reflectors, sound diffuser panels).	B	5	Cn
CO4.2.9	Assuring the quality of installed acoustic treatment	Advanced knowledge of: - standards and procedures for quality assurance in construction works; - qualitative methods to check quality installation of acoustic treatment (e.g. check-list); - simplified measurements of reverberation time (handclap/balloon impulse source method).	Managing, instructing and auditing contractors on critical aspects in construction site referred to the installation of acoustic treatment. Performing simplified acoustic measurements by means of low cost sound analysers (e.g. applications for smartphone).	W	4	Cn
CO4.2.10	Measuring acoustic quality of indoor spaces	In-depth knowledge of: - standards and procedures for building commissioning; - technical standards on measurement of reverberation time, speech intelligibility	Performing measurements of reverberation time, speech intelligibility and other quality acoustic parameters concerning room acoustics.	W	5	B, U

CO4.2	Room acoustics					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		and other quality acoustic parameters (e.g. clarity, definition, early decay time); - professional measuring instruments for room acoustics (sound level meter, omnidirectional sound source, ear&mouth simulator, applications for sound analysis).	Collecting and analysing data in order to evaluate the acoustic quality of the indoor space and to verify the installed acoustic treatment.			

Table A.48 – CO4.3 – Indoor noise management

CO4.3	Indoor noise management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO4.3.1	Understanding the importance of indoor noise management	Minimal knowledge of: - differences between sound insulation and sound absorption interventions; - technical standard requirements and regulations on noise due to service equipment; - sound insulation materials and noise reduction devices.	Participating in discussions within a design team for the feasibility study of noise reduction for service equipment (HVAC systems, water supply/waste installations, lifts).	B, W	1	Co
CO4.3.2	Applying basic solutions for indoor noise management	Basic knowledge of: - fundamental principles of sound transmission in buildings (airborne noise, structure borne noise); - metrics related to acoustic performance of service equipment elements and sound levels in buildings; - technical standard requirements and regulations on sound insulation for service equipment; - sound attenuation properties of building elements, insulation materials and noise reduction devices for service equipment; - simple calculation methods (rules of thumb, graphic methods, datasheets).	Performing simplified acoustic verifications to assess noise reduction of alternative insulation solutions and their compliance with standard requirements.	W	2	D
CO4.3.3	Proposing conceptual solutions for indoor noise management	Medium knowledge of: - fundamental principles of sound transmission in buildings (airborne noise, structure borne noise); - metrics related to acoustic performance of service equipment elements and sound levels in buildings; - technical standard requirements and regulations on sound insulation for service equipment; - sound attenuation properties of building elements, insulation materials and noise reduction devices for service equipment; - structure-borne and airborne sound transmission through pipes/ducts and corrective measures; - professional software for building acoustic analysis.	Selecting and proposing alternative attenuation solutions to reduce noise due to service equipment, focussing on acoustic performance of equipment elements. Assessing the sound levels of equipment elements by means of standard calculation models for sound insulation.	W	3	Co, D
CO4.3.4	Engineering the concept design for indoor noise management	Advanced knowledge of: - fundamental principles of sound transmission in buildings (airborne noise, structure borne noise); - metrics related to acoustic performance of service equipment elements and sound levels in buildings;	Engineering solutions for noise reduction with respect both to building and equipment elements acoustic performance, considering cost/benefit analysis and fulfilling standard requirements. Performing acoustic simulations of building and	W	4	D

CO4.3	Indoor noise management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- technical standard requirements and regulations on sound insulation for service equipment; - sound attenuation properties of building elements, insulation materials and noise reduction devices for service equipment; - structure-borne and airborne sound transmission through pipes/ducts and corrective measures; - advanced software for building acoustic analysis (e.g. FEM acoustic analysis); - cost/benefit analysis.	equipment elements by means of advanced simulation tools, assessing the impact of acoustic performance of service equipment on indoor acoustic comfort.			
CO4.3.5	Developing new technical solutions and optimising the detailed design for indoor noise management	In-depth knowledge of: - fundamental principles of sound transmission in buildings (airborne noise, structure borne noise); - metrics related to acoustic performance of service equipment elements and sound levels in buildings; - technical standard requirements and regulations on sound insulation for service equipment; - sound attenuation properties of building elements, insulation materials and noise reduction devices for service equipment; - structure-borne and airborne sound transmission through pipes/ducts and corrective measures; - advanced software for building acoustic analysis integrated with BIM; - cost/benefit analysis.	Developing and experimenting innovative solutions for noise reduction devices (e.g. active or passive noise reduction technologies). Performing acoustic simulations of building and equipment elements by means of advanced simulation tools, assessing the impact of acoustic performance of service equipment on indoor acoustic comfort.	W	5	D
CO4.3.6	Specifying the design for indoor noise management in tender documents	Advanced knowledge of: - technical specifications of noise reduction solutions for service equipment; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to acoustic performance of service equipment. Writing technical documentation for contracting purpose.	W	4	D
CO4.3.7	Installing noise reduction treatment and devices in a workmanlike manner	Medium knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on handling sound insulation materials; - sound insulation materials and noise reduction devices for structure-borne and airborne sound transmission due to service equipment.	Installing solutions for noise reduction of service equipment in a workmanlike manner.	B	3	Cn
CO4.3.8	Assuring the quality of installed noise reduction treatment and devices	Advanced knowledge of: - standards and procedures for quality assurance in construction works; - qualitative methods to check quality installation of sound insulation materials (e.g. check-list); - measurement of noise levels in buildings (acoustic survey method).	Managing, instructing and auditing contractors on critical aspects in construction site referred to the installation of acoustic treatment or noise reduction devices for service equipment. Performing in field noise measurements by means of sound level meters to assess acoustic performance of noise reduction solutions.	W	4	Cn

Table A.49 – CO4.4 – Environmental noise management

CO4.4	Environmental noise management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO4.4.1	Understanding the importance of environmental noise management	Minimal knowledge of: - differences between sound insulation and sound absorption interventions; - technical standard requirements and regulations on noise from transportation, industry, outdoor activities; - sound insulation materials and noise mitigation strategies.	Participating in discussions within a design team for the feasibility study of noise mitigation strategies for transportation (e.g. roads, railways, aircrafts, waterways), industry (e.g. plant operations), outdoor activities (e.g. restaurants, sport and concert venues).	B, W	1	Co
CO4.4.2	Applying basic solutions for environmental noise management	Basic knowledge of: - fundamental principles of sound propagation in open field; - metrics related to sound levels in outdoor spaces and buildings; - technical standard requirements and regulations on environmental noise; - sound attenuation properties of building facades, insulation materials and noise mitigation strategies; - simple calculation methods (rules of thumb, graphic methods, datasheets).	Performing simplified acoustic verifications to assess noise at building facades and their compliance with standard requirements.	W	2	D
CO4.4.3	Proposing conceptual solutions for environmental noise management	Medium knowledge of: - fundamental principles of sound propagation in open field; - metrics related to sound levels in outdoor spaces and buildings; - prediction models for road traffic noise; - technical standard requirements and regulations on environmental noise; - sound attenuation properties of building facades, insulation materials and noise mitigation strategies; - professional software for environmental noise simulations.	Selecting and proposing alternative strategies to mitigate environmental noise, focussing on sound barriers for traffic noise. Assessing the sound levels at urban scale by means of standard prediction models.	W	3	Co, D
CO4.4.4	Engineering the concept design for environmental noise management	Advanced knowledge of: - fundamental principles of sound propagation in open field; - metrics related to sound levels in outdoor spaces and buildings; - advanced prediction models for noise from transportation, industry, outdoor activities; - technical standard requirements and regulations on environmental noise; - sound attenuation properties of building facades, insulation materials and noise mitigation strategies; - advanced computer techniques for environmental noise simulations; - cost/benefit analysis.	Engineering strategies to mitigate noise with respect both to urban scale and building facades, considering cost/benefit analysis and fulfilling standard requirements against noise. Achieving noise reduction in outdoor/indoor spaces by means of strategies based on artificial/natural barriers, sound absorption surfaces, urban geometry. Performing acoustic simulations of environmental noise propagation at urban scale by means of advanced computer techniques.	W	4	D
CO4.4.5	Developing new technical solutions and optimising the detailed design for environmental noise management	In-depth knowledge of: - fundamental principles of sound propagation in open field; - metrics related to sound levels in outdoor spaces and buildings; - state-of-the-art on prediction models for noise from transportation, industry, outdoor activities; - all relevant technical standards and regulations on environmental noise; - sound attenuation properties of building facades, insulation materials and noise mitigation strategies; - noise mapping development and definition at urban scale; - advanced computer techniques for environmental noise simulations; - cost/benefit analysis.	Developing strategic noise maps as management tool of environmental noise at urban scale. Experimenting innovative solutions to mitigate noise in urban spaces (e.g. street canyon effect) based on sound absorption surfaces for road pavings and facades. Performing acoustic simulations of environmental noise propagation at urban scale by means of advanced computer techniques.	W	5	D

CO4.4	Environmental noise management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO4.4.6	Specifying the design for outdoor noise management in tender documents	Advanced knowledge of: - technical specifications for mitigation strategies of environmental noise; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to acoustic performance of noise mitigation strategies. Writing technical documentation for contracting purpose.	W	4	D
CO4.4.7	Installing noise mitigation treatment and devices in a workmanlike manner	Medium knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on handling sound insulation materials; - sound insulation materials and noise reduction devices for environmental noise (e.g. sound barriers, acoustic louvers, soundproof enclosures and silencers for service equipment).	Installing technical solutions for mitigation of environmental noise in a workmanlike manner.	B	3	Cn
CO4.4.8	Assuring the quality of installed noise mitigation treatment and devices	Advanced knowledge of: - standards and procedures for quality assurance in construction works; - qualitative methods to check quality installation of sound insulation materials (e.g. check-list); - measurement of noise levels in outdoor/indoor spaces (acoustic survey method).	Managing, instructing and auditing contractors on critical aspects in construction site referred to the installation of acoustic treatment or noise reduction devices to mitigate environmental noise. Performing in field noise measurements by means of sound level meters to assess acoustic performance of noise mitigation solutions.	W	4	Cn
CO4.4.9	Measuring environmental noise in outdoor spaces	In-depth knowledge of: - standards and procedures for construction commissioning; - metrics related to sound levels in outdoor spaces and buildings; - technical standards on measurement of noise from transportation, industry, outdoor activities; - professional measuring instruments for environmental acoustics (sound level meters equipped with frequency analyzer and data logging).	Performing measurements of sound levels in open field by spot measures and noise monitoring overtime. Collecting and analysing data in order to evaluate the sound propagation in urban spaces with respect to predicted noise maps, and to verify the efficacy of adopted mitigation strategies.	W	5	B, U

A.2.1.5 Macro Area: CO5 - Electromagnetic pollution

Table A.50 – CO5.1 – Management of ELF magnetic fields (50 Hz / 60 Hz)

CO5.1	Management of ELF magnetic fields (50 Hz / 60 Hz)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO5.1.1	Understanding the importance of ELF	Minimal knowledge of: - health effects of ELF magnetic fields exposure; - main ELF magnetic fields sources in buildings (e.g. electrical wiring, electrical	Participating in discussions within a design team for the feasibility study of ELF magnetic fields mitigation strategies related to indoor exposure.	B, W	1	Co

CO5.1	Management of ELF magnetic fields (50 Hz / 60 Hz)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
	magnetic fields management	panels, grounding systems, appliances and machinery) and outdoor (e.g. overhead power lines, underground cables, substations).				
CO5.1.2	Applying basic solutions for ELF magnetic fields management	Basic knowledge of: - fundamental principles of ELF magnetic fields propagation in open field and buildings, health effects to ELF exposure; - metrics related to ELF magnetic fields levels in outdoor spaces and buildings; - technical standard requirements and regulations on ELF magnetic fields exposure and safe levels; - main ELF magnetic fields sources in buildings (e.g. electrical wiring, electrical panels, grounding systems, appliances and machinery) and outdoor (e.g. overhead power lines, underground cables, substations); - ELF magnetic fields attenuation properties of building structures, shielding materials and mitigation strategies; - simple calculation methods based on source distance (rules of thumb, graphic methods, datasheets).	Performing simplified verifications to assess ELF magnetic fields exposure in indoor spaces (e.g. check list evaluation, EMF source distance law) with respect to alternative mitigation strategies defined by a design team.	W	2	D
CO5.1.3	Proposing conceptual solutions for ELF magnetic fields management	Medium knowledge of: - fundamental principles of ELF magnetic fields propagation in open field and buildings, health effects to ELF exposure; - metrics related to ELF magnetic fields levels in outdoor spaces and buildings; - technical standard requirements and regulations on ELF magnetic fields exposure and safe levels; - main ELF magnetic fields sources in buildings (e.g. electrical wiring, electrical panels, grounding systems, appliances and machinery) and outdoor (e.g. overhead power lines, underground cables, substations); - ELF magnetic fields attenuation properties of building structures, shielding materials and mitigation strategies; - measurement methods for ELF magnetic fields propagation and exposure.	Selecting and proposing alternative strategies to reduce ELF magnetic fields exposure, focussing on mitigation solutions at building level. Interpreting measured data from monitoring campaigns of ELF exposure inside buildings and inhabited areas.	W	3	Co, D
CO5.1.4	Engineering the concept design for ELF magnetic fields management	Advanced knowledge of: - fundamental principles of ELF magnetic fields propagation in open field and buildings, health effects to ELF exposure; - metrics related to ELF magnetic fields levels in outdoor spaces and buildings; - technical standard requirements and regulations on ELF magnetic fields exposure and safe levels; - main ELF magnetic fields sources in buildings (e.g. electrical wiring, electrical panels, grounding systems, appliances and machinery) and outdoor (e.g. overhead power lines, underground cables, substations); - ELF magnetic fields attenuation properties of building structures, shielding materials and mitigation strategies (e.g. phase cancellation, limiting voltage/current flow levels); - advanced prediction models for ELF magnetic fields propagation and professional software for simulations; - cost/benefit analysis.	Engineering strategies to mitigate ELF, considering cost/benefit analysis and fulfilling standard requirements on safe levels of ELF exposure. Achieving ELF levels reduction in inhabited outdoor/indoor spaces by means of strategies based on site arrangement, design change, phase cancellation, shielding or a combination of those methods. Performing ELF exposure simulations by means of professional software based on advanced prediction models.	W	4	D
CO5.1.5	Developing new technical solutions and optimising the detailed design for ELF	In-depth knowledge of: - fundamental principles of ELF magnetic fields propagation in open field and buildings, health effects to ELF exposure; - metrics related to ELF magnetic fields levels in outdoor spaces and buildings;	Experimenting innovative solutions to mitigate ELF exposure inside buildings based on new materials with shielding properties. Performing simulations of ELF propagation at cluster	W	5	D

CO5.1	Management of ELF magnetic fields (50 Hz / 60 Hz)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
	magnetic fields management	- technical standard requirements and regulations on ELF magnetic fields exposure and safe levels; - main ELF magnetic fields sources in buildings (e.g. electrical wiring, electrical panels, grounding systems, appliances and machinery) and outdoor (e.g. overhead power lines, underground cables, substations); - ELF magnetic fields attenuation properties of building structures, shielding materials and mitigation strategies (e.g. phase cancellation, limiting voltage/current flow levels); - ELF magnetic fields exposure mapping development and definition at cluster/urban scale; - state-of-the-art on prediction models for ELF magnetic fields propagation and professional software for simulations; - cost/benefit analysis.	scale, related to outdoor sources (e.g. HV overhead power lines, underground cables) by means of advanced computer techniques.			
CO5.1.6	Specifying the design for ELF magnetic fields management in tender documents	Advanced knowledge of: - technical specifications for mitigation strategies of ELF magnetic fields exposure; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to ELF mitigation strategies. Writing technical documentation for contracting purpose.	W	4	D
CO5.1.7	Installing ELF magnetic fields shielding materials and mitigation devices in a workmanlike manner	Advanced knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on handling ELF shielding materials; - shielding materials and mitigation strategies (e.g. phase cancellation, limiting voltage/current flow levels).	Installing technical solutions for mitigation of ELF magnetic fields in a workmanlike manner.	B	5	Cn
CO5.1.8	Assuring the quality of installed ELF magnetic fields shielding materials and mitigation devices	Advanced knowledge of: - standards and procedures for quality assurance in construction works; - qualitative methods to check quality installation of ELF shielding materials and mitigation solutions (e.g. check-list); - measurement of ELF levels in outdoor/indoor spaces (EMF survey method).	Managing, instructing and auditing contractors on critical aspects in construction site referred to the installation of ELF shielding materials or ELF reduction devices to mitigate exposure. Performing in field ELF measurements by means of EMF meters to assess shielding performance of mitigation solutions.	W	4	Cn
CO5.1.9	Measuring ELF magnetic fields exposure levels in indoor/outdoor spaces	In-depth knowledge of: - standards and procedures for construction commissioning; - metrics related to ELF level exposure in inhabited areas and buildings; - technical standards on measurement exposure from ELF indoor/outdoor sources; - professional measuring instruments for EMF monitoring (for spot measures and data logging overtime).	Performing measurements of ELF exposure levels inside buildings by spot measures and exposure monitoring overtime. Collecting and analysing data in order to evaluate the ELF propagation in inhabited spaces and areas with respect to predicted ELF maps, and to verify the efficacy of adopted mitigation strategies.	W	5	B, U

Table A.51 – CO5.2 – Management of indoor exposure to electromagnetic fields (100 kHz-300 GHz)

CO5.2	Management of indoor exposure to electromagnetic fields (100 kHz-300 GHz)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO5.2.1	Understanding the importance of RF/MW-EMF management	Minimal knowledge of: - health effects of RF/MW-EMF exposure; - main RF/MW-EMF sources (e.g. broadcasting and 5G antennas, mobile phones, wifi networks, appliances and machinery).	Participating in discussions within a design team for the feasibility study of RF/MW-EMF mitigation strategies related to indoor exposure.	B, W	1	Co
CO5.2.2	Applying basic solutions for RF/MW-EMF management	Basic knowledge of: - fundamental principles of RF/MW-EMF propagation in open field and buildings, health effects to ELF exposure; - metrics related to RF/MW-EMF levels in outdoor spaces and buildings; - technical standard requirements and regulations on RF/MW-EMF exposure and safe levels; - main RF/MW-EMF sources (e.g. broadcasting and 5G antennas, mobile phones, wifi networks, appliances and machinery); - RF/MW-EMF attenuation properties of building structures, shielding materials and mitigation strategies; - simple calculation methods based on source distance (rules of thumb, graphic methods, datasheets).	Performing simplified verifications to assess ELF-EMF exposure in indoor spaces (e.g. check list evaluation, EMF source distance law) with respect to alternative mitigation strategies defined by a design team.	W	2	D
CO5.2.3	Proposing conceptual solutions for RF/MW-EMF management	Medium knowledge of: - fundamental principles of RF/MW-EMF propagation in open field and buildings, health effects to RF/MW exposure; - metrics related to RF/MW-EMF levels in outdoor spaces and buildings; - technical standard requirements and regulations on RF/MW-EMF exposure and safe levels; - main RF/MW-EMF sources (e.g. broadcasting and 5G antennas, mobile phones, wifi networks, appliances and machinery); - RF/MW-EMF attenuation properties of building structures, shielding materials and mitigation strategies; - measurement methods for RF/MW-EMF propagation and exposure.	Selecting and proposing alternative strategies to reduce RF/MW-EMF exposure, focussing on mitigation solutions at building level. Interpreting measured data from monitoring campaigns of RF/MW-EMF exposure inside buildings and inhabited areas.	W	3	Co, D
CO5.2.4	Engineering the concept design for RF/MW-EMF management	Advanced knowledge of: - fundamental principles of RF/MW-EMF propagation in open field and buildings, health effects to RF/MW exposure; - metrics related to RF/MW-EMF levels in outdoor spaces and buildings; - technical standard requirements and regulations on RF/MW-EMF exposure and safe levels; - main RF/MW-EMF sources (e.g. broadcasting and 5G antennas, mobile phones, wifi networks, appliances and machinery); - RF/MW-EMF attenuation properties of building structures, shielding materials and mitigation strategies; - advanced prediction models for RF/MW-EMF propagation and professional software for simulations; - cost/benefit analysis.	Engineering strategies to mitigate RF/MW-EMF, considering cost/benefit analysis and fulfilling standard requirements on safe levels of RF/MW-EMF exposure. Achieving RF/MW-EMF levels reduction in inhabited outdoor/indoor spaces by means of strategies based on site arrangement, design change, shielding or a combination of those methods. Performing RF/MW exposure simulations by means of professional software based on advanced prediction models.	W	4	D
CO5.2.5	Developing new technical solutions and optimising the detailed design for RF/MW-EMF management	In-depth knowledge of: - fundamental principles of RF/MW-EMF propagation in open field and buildings, health effects to RF/MW exposure; - metrics related to RF/MW-EMF levels in outdoor spaces and buildings; - technical standard requirements and regulations on RF/MW-EMF exposure and safe levels;	Experimenting innovative solutions to mitigate RF/MW-EMF exposure inside buildings based on new materials with shielding properties. Performing simulations of RF/MW-EMF propagation at cluster scale, related to outdoor sources (e.g.	W	5	D

CO5.2	Management of indoor exposure to electromagnetic fields (100 kHz-300 GHz)					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- main RF/MW-EMF sources (e.g. broadcasting and 5G antennas, mobile phones, wifi networks, appliances and machinery); - RF/MW-EMF attenuation properties of building structures, shielding materials and mitigation strategies; - advanced prediction models for RF/MW-EMF propagation and professional software for simulations; - RF/MW-EMF exposure mapping development and definition at cluster/urban scale; - state-of-the-art on prediction models for RF/MW-EMF propagation and professional software for simulations; - cost/benefit analysis.	broadcasting and 5G antennas) by means of advanced computer techniques.			
CO5.2.6	Specifying the design for RF/MW-EMF management in tender documents	Advanced knowledge of: - technical specifications for mitigation strategies of RF/MW-EMF exposure; - technical drawing representation; - terminology and form for contracting purpose; - cost/benefit analysis.	Selecting products and technical solutions that fit specifications and demands on given quality aspects and economics related to RF/MW-EMF mitigation strategies. Writing technical documentation for contracting purpose.	W	4	D
CO5.2.7	Installing RF/MW-EMF shielding materials and mitigation devices in a workmanlike manner	Advanced knowledge of: - construction handbooks and technical datasheets; - health and safety regulations on handling RF/MW-EMF shielding materials; - shielding materials and mitigation strategies.	Installing technical solutions for mitigation of RF/MW-EMF in a workmanlike manner.	B	5	Cn
CO5.2.8	Assuring the quality of installed RF/MW-EMF shielding materials and mitigation devices	Advanced knowledge of: - standards and procedures for quality assurance in construction works; - qualitative methods to check quality installation of RF/MW-EMF shielding materials and mitigation solutions (e.g. check-list); - measurement of RF/MW-EMF levels in outdoor/indoor spaces (EMF survey method).	Managing, instructing and auditing contractors on critical aspects in construction site referred to the installation of RF/MW-EMF shielding materials or RF/MW reduction devices to mitigate exposure. Performing in field RF/MW-EMF measurements by means of EMF meters to assess shielding performance of mitigation solutions.	W	4	Cn
CO5.2.9	Measuring RF/MW-EMF exposure levels in indoor/outdoor spaces	In-depth knowledge of: - standards and procedures for construction commissioning; - metrics related to RF/MW-EMF level exposure in inhabited areas and buildings; - technical standards on measurement exposure from RF/MW-EMF indoor/outdoor sources; - professional measuring instruments for EMF monitoring (for spot measures and data logging overtime).	Performing measurements of RF/MW-EMF exposure levels inside buildings by spot measures and exposure monitoring overtime. Collecting and analysing data in order to evaluate the RF/MW-EMF propagation in inhabited spaces and areas with respect to predicted RF/MW maps, and to verify the efficacy of adopted mitigation strategies.	W	5	B, U

A.2.1.6 Macro Area: CO6 - Ergonomics

Table A.52 – CO6.1 – Ergonomic and Active Furnishing

CO6.1	Ergonomic and Active Furnishing					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
CO6.1.1	Understanding the impact of ergonomics on human health	Minimal knowledge of: - ergonomic concept; - work-related musculoskeletal disorders (MSDs).	Participating in discussions related to risks of injury associated with body posture. Understanding ergonomic principles.	W	1	Co
CO6.1.2	Understanding the concept of active furnishing	Minimal knowledge of: - health problems related to sedentary behavior; - active workstations.	Understanding the negative health outcomes related to sedentary behavior.	W	1	Co
CO6.1.3	Selecting ergonomic furniture and active workstations	Basic knowledge of: - ergonomic concept; - adjustable furniture; - customization of workstations; - active workstations (e.g. treadmill and bicycle desks, stepper machines); - technical standards and regulations.	Proposing basic solutions to improve ergonomics, and encourage movement and postural breaks.	W	2	Co, D, U
CO6.1.4	Determining strategies to improve ergonomics at workplaces	Medium knowledge of: - ergonomic concept and principles; - work-related musculoskeletal disorders (MSDs); - adjustable furniture; - customization of workstations; - active workstations (e.g. treadmill and bicycle desks, stepper machines); - technical standards and regulations.	Evaluating workstations and identifying possible MSD hazards. Proposing design solutions based on ergonomic principles. Determining an ergonomic process.	W	3	U
CO6.1.5	Designing ergonomic and active furnishing	Advanced knowledge of: - ergonomic concept; - adjustable furniture; - active workstations (e.g. treadmill and bicycle desks, stepper machines); - customization of workstations; - work-related musculoskeletal disorders (MSDs), - health problems related to sedentary behavior; - technical standards and regulations.	Designing workstations that support neutral body positions and accommodate all users. Providing ergonomic design solutions to facilitate furniture customizability. Using active furnishing (e.g. sit-stand, treadmill desk) to encourage movement.	W	4	Co, D, U
CO6.1.6	Developing an ergonomic program	In-depth knowledge of: - work-related musculoskeletal disorders; - health problems related to sedentary behavior	Identifying and assessing ergonomic problems in the workplace. Consulting the key stakeholders (e.g., human resources, occupational safety, employees) to evaluate workplace hazards. Informing employees of ergonomics and its benefits. Providing training to the employees. Evaluating the progress of the ergonomic process and proposing corrective action procedures.	W	5	U

A.2.2 Thematic field: Safety

A.2.2.1 Macro Area: SA1 - Fire protection

Table A.53 – SA1.1 – Risk to occupants and facilities from fire

SA1.1	Risk to occupants and facilities from fire					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
SA1.1.1	Understanding the importance of fire safety protection in buildings and materials	Minimal knowledge of: - passive fire protection, following legal requirements.	Participating in discussions within a design team regarding the fire safety features.	W	1	Co
SA1.1.2	Proposing and selecting basic solutions for materials based on fire regulation measures	Basic knowledge of: - principles of fire protection and the impact of fire protection measures on construction and thermal insulation.	Selecting building material with regard to fire protection and defining the effects of thermal insulation measures on fire protection.	W	2	Co
SA1.1.3	Determining the concept of passive solutions for fire protection	Medium knowledge of: - Fire risk assessment based on the premises, and the activities carried on - physical fire precautions and management arrangements - health and safety laws enforced by the local authority.	Evaluating if the fire safety procedures, fire prevention measures, and fire precautions (plans, systems and equipment) are all in place and working properly. Identifying the fire hazards.	W	3	Cn, B, U
SA1.1.4	Determining the concept of passive solutions for fire protection	Medium knowledge of: - passive structural protection - passive envelope protection - elements that require fire protection - Building Regulations.	Determining the effect of application of different types of construction elements for fire prevention in buildings. Evaluating possible solutions for fire safety in the plans.	W	3	Co, D
SA1.1.5	Engineering the concept of the emergency plan	Advanced knowledge of: - fire safety precautions in specific buildings, for the in-use phase - Legal Requirements.	Preparing an emergency plan for dealing with fire situations in specific buildings, based on the fire risk assessment.	W	4	B, U
SA1.1.6	Engineering the concept of fire Hazards in Construction	Advanced knowledge of: - fire hazards in construction - fire control measures in construction - combustible materials and fuels - Legal Requirements for fire safety on construction sites.	Preparing or modifying designs, and planning to manage, monitor and coordinate health and safety in the pre-construction phase of a project to eliminate or control foreseeable risks.	W	4	D
SA1.1.7	Commissioning in Fire safety	In-depth knowledge of: - precautions and safe working practices, and the joint Fire Codes to ensure that adequate detection and prevention measures are incorporated during the design and planning stages and that work on a site is undertaken to the highest standard of fire safety.	Contributing advice and information on civil engineering aspects of the design.	W	5	Cn, B
SA1.1.8	Understanding the importance of occupational safety,	Minimal knowledge of: - general occupational safety - environmental and fire regulations of the industry.	Understanding the importance of occupational safety, environmental and fire regulations in a project.	B	1	Cn

SA1.1	Risk to occupants and facilities from fire					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
	environmental and fire regulations					
SA1.1.9	Installing fire safety systems in the construction phase	Advanced knowledge on: - different elements of fire safety systems (e.g., fire suppression systems, smoke detectors, sprinkler systems, etc.) - assembly and installing the systems.	Assembling, and installing the fire safety systems in a workmanlike manner.	B	4	Cn
SA1.1.10	Investigating the in-use operation and maintenance provision for fire safety systems	In-depth knowledge of: - fire detection and warning systems, emergency lighting systems, safety torches, and all firefighting equipment.	Investigating in-use operation of the installed fire safety systems such as fire alarms, fire extinguishers, lighting, signs, fire exits and fire doors for testing, and routine maintenance services.	B	5	B, U

A.2.2.2 Macro Area: SA2 - Earthquake

Table A.54 – SA2.1 – Risk to occupants and facilities from earthquake

SA2.1	Risk to occupants and facilities from earthquake					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
SA2.1.1	Understanding the importance of the major principle of earthquake design	Minimal knowledge of: - the major principle of earthquake design, and types of structures and infrastructures.	Participating in discussions within a design team regarding the major principle of earthquake design.	W	1	Co
SA2.1.2	Proposing and selecting basic cost-effective solutions for seismic-resistant infrastructure systems	Basic knowledge of: - Types of seismic-resistant structures and infrastructures, and their deterioration mechanism	Performing simplified simulations to evaluate lifetime structural performance and propose alternative infrastructure systems based on cost-effective management	W	2	Co
SA2.1.3	Proposing and selecting basic solutions for earthquake-resistant design of steel and concrete buildings	Basic knowledge of: - new generation reinforcing steels and retrofit options for steel and concrete buildings - Related building codes and standards	Performing simplified simulations to evaluate and propose alternative reinforcing systems and retrofit options for steel and concrete buildings.	W	2	Co
SA2.1.4	Determining the concept of the Sustainable Structural Design (SSD) Method	Medium knowledge of: - the sustainability impacts of any seismic intervention - conventional seismic design and sustainable seismic design methods - multi-performance and life cycle-oriented approach, related to energy	Determining the effect of the application of different types of construction methods on the sustainable seismic-resistant structural design approach. Performing simplified performance-based assessment concerning the multi-performance and	W	3	Co, D

SA2.1	Risk to occupants and facilities from earthquake					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		consumption and CO2 emissions, in structural design - Related building codes and standards	life cycle-oriented approach in seismic-resistant structural design.			
SA2.1.5	Determining the concept of seismic risk mitigation of building structures	Medium knowledge of: - differences between conventional seismic design and sustainable seismic design Methods - Methods for evaluation of the vulnerability of the existing buildings	Performing astute assessment of seismic risk (collapse probabilities for buildings designed using traditional prescriptive approaches) in delivering earthquake resilience, and analysing the retrofit methods.	W	3	Co, D, U
SA2.1.6	Engineering the concept of seismic risk mitigation	Advanced knowledge of: - differences between conventional seismic design and sustainable seismic design Methods - retrofitting measures - new structural elements (e.g., prestressed concrete, high-strength steel and concrete, fiber-reinforced composites), and improved methods for intervention in the existing fabric to increase earthquake resistance - Eurocode 8 and seismic codes and standards	Evaluating the seismic resistance of the building, and assessment and prediction of structural performance. Engineering the best solutions for strengthening existing buildings and infrastructure for those with insufficient seismic resistance, and for designing new facilities, in delivering earthquake resilience. Ensuring all quality checks are carried out in accordance with the inspection test plans.	W	4	D, U
SA2.1.7	Commissioning the earthquake risk reduction in buildings and infrastructures	In-depth knowledge of: - earthquake-resistant construction systems, and retrofitting measures - seismic design codes and standards	Managing measurements and evaluation for developing earthquake-resistant construction systems for new and existing facilities.	W	5	D, B
SA2.1.8	Understanding the earthquake-resistant constructions in a workmanlike manner	Minimal knowledge of: - earthquake-resistant constructions - the common building materials and details	Undertaking concrete coring and other relevant labouring duties e.g. general reinstatement of concrete, and reinforced concrete, in a workmanlike manner.	B	1	Cn
SA2.1.9	Investigating the in-use operation and maintenance provision for systems	Advanced knowledge of: - prefabricated reinforced concrete	Installing reinforced concrete structures (foundations, columns, beams and roof trusses, etc).	B	4	Cn

A.2.3 Thematic field: Accessibility

A.2.3.1 Macro Area: AC1 - Barrier free accessibility

Table A.55 – AC1.1 – Accessibility of public spaces

AC1.1	Accessibility of public spaces					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
AC1.1.1	Understanding accessibility standards, codes and regulations	Minimal knowledge of: - accessibility standards, codes and regulations.	Discussing within a design team the main accessibility standards, codes and regulations	B, W	1	Co, Cn
AC1.1.2	Applying accessibility standards, codes and regulations	Basic knowledge of: - accessibility standards, codes and regulations; - universal design principles.	Applying accessibility standards, codes and regulations within a design process. Proposing basic design solutions regarding accessibility.	W	2	Co
AC1.1.3	Determining design considerations for accessible public spaces	Medium knowledge of: - accessibility definition; - accessibility standards, codes and regulations; - inclusive design; - universal design principles.	Considering accessible opportunities within a design process. Determining design considerations to guarantee the accessibility of public spaces. Analysing accessibility standards, codes and regulations.	W	3	Co, D
AC1.1.4	Designing spaces to be inclusive and accessible	Advanced knowledge of: - accessibility definition; - accessibility standards, codes and regulations; - universal design principles and goals; - inclusive design; - technologies to provide accessibility of spaces (e.g., audio and visual equipment, web access, automatic doors, information systems, etc).	Designing spaces to provide a variety of accessible opportunities and social interactions. Evaluating the utilization of public spaces. Selecting materials products, and equipment that fit specifications and accessibility codes and regulations. Providing tender documents.	W	4	Co, D
AC1.1.5	Measuring the accessibility of a public space	In-depth knowledge of: - accessibility definition; - accessibility standards, codes and regulations; - universal design principles and goals; - inclusive design; - technologies to provide accessibility of spaces (e.g., audio and visual equipment, web access, automatic doors, information systems, etc); - methods to measure accessibility.	Evaluating the quality and utilization of public spaces. Determining the methods to measure the accessibility of public spaces (e.g., questionaries, indicators, etc). Providing reports with the measurement findings. Proposing solutions to improve accessibility.	W	5	B, U

Table A.56 – AC1.2 – Design for All

AC1.2	Design for All					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
AC1.2.1	Understanding the principles of universal design	Minimal knowledge of: - equitable use; - flexibility in use; - simple and intuitive use; - perceptible information; - tolerance for error; - low physical effort; - size and space approach and use.	Discussing within a design team the basic principles of universal design.	W	1	Co

AC1.2	Design for All					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
AC1.2.2	Understanding the differences between universal design and accessible design	Minimal knowledge of: - accessibility regulations and codes; - universal design principles	Discussing within a design team the main differences between compliance with accessibility codes and regulations and adoption of universal design.	W	1	Co
AC1.2.3	Proposing basic universal design solutions	Basic knowledge of: - universal design principles; - accessibility regulations and codes; - wayfinding solutions; - inclusive design; - technologies (e.g., audio and visual equipment, web access, automatic doors, information systems, etc).	Proposing alternatives and basic design solutions to implement the universal design. Applying guidelines, codes and regulations. Selecting technologies to help achieve universal design goals.	W	2	Co
AC1.2.4	Designing strategies that promote inclusion	Medium knowledge of: - universal design principles; - accessibility regulations and codes; - wayfinding solutions; - inclusive design; - social integration; - technologies (e.g., audio and visual equipment, web access, automatic doors, information systems, etc) - safety standards and regulations.	Investigating design strategies that support physical, social and emotional health. Checking and applying accessibility codes and regulations.	W	3	Co, D
AC1.2.5	Determining design goals to adopt universal design principles	Advanced knowledge of: - universal design principles and goals; - accessibility regulations and codes; - wayfinding solutions; - inclusive design; - technologies (e.g., audio and visual equipment, web access, automatic doors, information systems, etc); - safety standards and regulations.	Designing to promote flexible, usable and intuitive spaces. Incorporating personalized solutions to adapt to the needs of the individuals. Providing tender documents and design guidelines.	W	4	Co, D
AC1.2.6	Developing building operational policies and programs that support inclusion	In-depth knowledge of: - universal design principles and goals; - accessibility regulations and codes; - inclusion and diversity programs and policies; - building maintenance and operations; - safety standards and regulations.	Managing building operations to accommodate a diverse range of needs (e.g., diversity and inclusion training, flexible working hours). Creating building operational policies and programs to support an inclusive environment.	W	5	U
AC1.2.7	Integrating universal design strategies with other design approaches	In-depth knowledge of: - universal design principles and goals; - accessibility regulations and codes; - wayfinding solutions; - inclusive design; - technologies (e.g., audio and visual equipment, web access, automatic doors, information systems, etc); - safety standards and regulations;	Incorporating universal design strategies with other design approaches (e.g., active design, biophilic design, etc). Integrating strategies and providing diverse design options. Providing tender documents and design guidelines.	W	5	Co, D

AC1.2	Design for All					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- active design.				

A.2.4 Thematic field: Mobility

A.2.4.1 Macro Area: MO1 - Alternative mobility

Table A.57 – MO1.1 – Sustainable mobility strategies

MO1.1	Sustainable mobility strategies					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
MO1.1.1	Understanding the concept of sustainable mobility	Minimal knowledge of: - green mobility; - walkability; - transit networks.	Discussing within the design team the concept of sustainable mobility	W	1	Co
MO1.1.2	Understanding the concept of shared mobility	Minimal knowledge of: - the shared use of travel modes; - green mobility.	Discussing within the design team the concept of shared mobility	W	1	Co
MO1.1.3	Proposing basic solutions for sustainable mobility	Basic Knowledge of: - green mobility; - walkability; - transit networks.	Proposing basic solutions for sustainable mobility, such as bicycle parking spaces, electrical vehicle charging stations, shared scooters, etc. Selecting products (e.g., bicycle racks) and materials.	W	2	Co, D
MO1.1.4	Mapping and calculating travel modes networks and connectivity	Medium knowledge of: - green mobility; - walkability; - transit networks; - transport connectivity; - geographic information system (GIS); - urban databases - codes and standards	Interpreting urban maps, diagrams and databases. Assessing data to map and calculate travel modes networks and connectivity. Proposing solutions for sustainable mobility.	W	3	Co, D, U
MO1.1.5	Designing circulation networks to promote sustainable mobility	Advanced knowledge of: - site analysis; - pedestrian-friendly environment; - circulation networks; - green mobility; - transport connectivity; - codes and standards;	Providing sustainable mobility infrastructure, such as bicycle parking spaces, electric vehicle charging stations, shared mobility stations, etc. Connecting proposed networks to the public services.	W	4	Co, D, U

MO1.1	Sustainable mobility strategies					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- land-use laws.				
MO1.1.6	Developing a Sustainable Mobility Plan	In-depth knowledge of: - shared mobility solutions; - site analysis; - pedestrian-friendly environment; - circulation networks; - green mobility; - transport connectivity; - codes and standards; - land-use laws.	Developing a Sustainable Mobility Plan. Integrating sustainable mobility solutions and infrastructure.	W	5	Co, D, U

A.2.5 Thematic field: Services

A.2.5.1 Macro Area: SE1 - Communication

Table A.58 – SE1.1 – Communication Services

SE1.1	Communication Services					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
SE1.1.1	Understanding Information and Communication Technologies (ICTs)	Minimal knowledge of: - ICTs; - communication and integration standards; - communication tools and platforms.	Discussing within the team concerning Information and Communication Technologies.	B, W	1	Co, Cn
SE1.1.2	Understanding the concept of intelligent buildings	Minimal knowledge of: - ICTs; - communication and integration standards; - communication tools and platforms; - building automation.	Discussing within the design team concerning intelligent buildings and ICTs	W	1	Co
SE1.1.3	Proposing basic solutions for intelligent buildings	Basic knowledge of: - ICTs; - communication and integration standards; - communication tools and platforms; - building automation - internet of things (IoT).	Selecting information and communication technologies. Proposing basic solutions for intelligent buildings.	W	2	Co, D

SE1.1	Communication Services					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
SE1.1.4	Determining the concept of information and communication systems	Medium knowledge of: - ICTs; - communication and integration standards; - communication tools and platforms; - building automation and interoperability of systems; - communication protocols; - internet of things (IoT).	Analysing information and communication technologies. Determining the concept of information and communication systems and interoperability of systems. Checking applicable standards and regulations.	W	3	D
SE1.1.5	Engineering information and communication systems	Advanced knowledge of: - ICTs; - technical standards and regulations; - software tools and platforms; - building automation and interoperability of systems; - smart features and remote access; - communication protocols; - Web services; - internet of things (IoT); - Building Management systems (BMS) and Building Energy Management Systems (BEMS).	Engineering solutions for information and communication systems and interoperability of systems. Exploring the potential of intelligent mechanisms to control building energy and water consumption, occupancy, systems efficiency, air quality monitoring, waste management, among others. Evaluating the most cost-benefit solutions. Providing tender documents.	W	4	D,Cn
SE1.1.6	Assuring the quality of building information and communication systems installation	Advanced knowledge of: - ICTs; - technical standards and regulations; - software tools and platforms; - building automation and interoperability of systems; - Building Management systems (BMS) and Building Energy Management Systems (BEMS) - systems auditing.	Managing, instructing and auditing contractors on construction sites. Checking construction documents. Providing analysis reports.	W	4	Cn, B
SE1.1.7	Installing and maintaining building information and communication systems	In-depth knowledge of: - installation and maintenance of building information and communication systems; - technical standards and regulations.	Installing, integrating and maintaining building information and communication systems	B	5	Cn, B, U
SE1.1.8	Commissioning information and communication systems	In-depth knowledge of: - ICTs; - technical standards and regulations; - software tools and platforms; - building automation and interoperability of systems; - smart features and remote access; - communication protocols; - Web services; - internet of things (IoT); - Building Management systems (BMS) and Building Energy Management Systems (BEMS); - systems auditing.	Managing measurements and evaluation of information and communication systems. Testing systems and protocols. Verifying construction documents and equipment datasheets. Evaluating systems performance and operation. Providing analysis report.	W	5	B,U

A.2.5.2 Macro Area: SE2 - Services for inhabitants

Table A.59 – SE2.1 – Functional mix

SE2.1	Functional mix					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
SE2.1.1	Understanding the concept of functional mix	Minimal knowledge of: - mixed-use neighborhoods; - walkability; - basic services.	Discussing within the design team functional mix, the diversity of land-use, and availability of services.	W	1	Co
SE2.1.2	Defining functional mix	Basic knowledge of: - functional mix categories; - mixed-use neighborhoods; - walkability; - transport connectivity; - basic services.	Applying urban categorizations, measurements and maps functional mix within a project.	W	2	Co
SE2.1.3	Mapping and calculating functional mix	Medium knowledge of: - functional mix categories; - mixed-use neighborhoods; - walkability; - transport connectivity; - geographic information system (GIS); - metrics for the land-use mix - urban databases - codes and standards - land-use laws.	Interpreting urban maps, diagrams and databases. Assessing data to map and calculate functional mix.	W	3	Co, D
SE2.1.4	Designing to promote functional mix	Advanced Knowledge of: - functional mix categories; - mixed-use neighborhoods; - walkability; - transport connectivity; - geographic information system (GIS); - metrics for the land-use mix - urban databases - codes and standards - land-use laws.	Providing design solutions to promote walkability, transport connectivity, healthy and safety conditions, and connection to services.	W	4	D, U
SE2.1.5	Developing site analysis to support design decisions	In-depth Knowledge of: - functional mix categories; - mixed-use neighborhoods; - walkability;	Developing site analysis take into consideration functional mix concept. Evaluating urban databases, codes, land-use laws, and functional mix calculations. Performing site surveys. Using land-use mix indices	W	5	Co, D, U

SE2.1	Functional mix					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- transport connectivity; - geographic information system (GIS); - metrics for the land-use mix - urban databases - codes and standards - land-use laws.	and complementary indicators to support design decisions.			

Table A.60 – SE2.2 – Infrastructure and connectivity

SE2.2	Infrastructure and connectivity					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
SE2.2.1	Understanding the importance of infrastructure as services for inhabitants	Minimal Knowledge of: - the added value of the infrastructures as services for inhabitants; - green mobility.	Understanding the importance of good infrastructure network to provide services for inhabitants	W	1	Co
SE2.2.2	Understanding the importance of buildings to the existing infrastructure network	Minimal Knowledge of: - the added value of the infrastructures as services for inhabitants; - green mobility; - site analysis.	Discussing within the project concerning infrastructure networks distribution	W	1	Co
SE2.2.3	Understanding the concept of green infrastructure	Minimal knowledge of: - benefits of green infrastructure; - stormwater management; - heat island effect mitigation; - air quality improvement.	Discussing within the project concerning green infrastructure	B, W	1	Co, Cn
SE2.2.4	Applying the concepts of green infrastructure within a project	Basic knowledge of: - benefits of green infrastructure; - stormwater management; - heat island effect mitigation; - air quality improvement; - geographic information system (GIS).	Proposing basic solutions for green infrastructure. Selecting products and materials.	W	2	Co
SE2.2.5	Proposing solutions to promote walkability and connectivity to services	Medium knowledge of: - site analysis; - pedestrian-friendly environment; - circulation networks; - green mobility; - sidewalk shading solutions; - geographic information system (GIS); - code and standards.	Proposing solutions that support and encourage safe, comfortable, and interesting walking trips. Analysing existing infrastructure and connectivity to services.	W	3	Co, D, U
SE2.2.6	Mapping and analysing services, transport	Medium knowledge of: - site analysis; - pedestrian-friendly environment;	Interpreting urban maps, diagrams and databases. Assessing data to map services, transport network availability, and green mobility network. Analysing	W	3	Co, D, U

SE2.2	Infrastructure and connectivity					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
	network availability, green mobility network	- circulation networks; - green mobility; - transport connectivity; - geographic information system (GIS); - urban databases; - codes and standards; - land-use laws.	the main existing infrastructure within a project. Supporting design team decisions.			
SE2.2.7	Designing circulation networks	Advanced knowledge of: - site analysis; - pedestrian-friendly environment; - circulation networks; - green mobility; - transport connectivity; - services connectivity - geographic information system (GIS); - urban databases; - codes and standards; - land-use laws.	Designing circulation networks that encourage daily physical activities. Evaluating existing public transport networks and green mobility facilities.	W	4	Co, D
SE2.2.8	Providing green mobility infrastructure	Advanced knowledge of: - site analysis; - pedestrian-friendly environment; - circulation networks; - green mobility; - transport connectivity; - codes and standards; - land-use laws.	Providing green mobility infrastructure, such as bicycle parking spaces, electric vehicle charging stations, shared mobility stations, etc.	W	4	Co, D
SE2.2.9	Engineering green infrastructure	In-depth knowledge of: - benefits of green infrastructure; - stormwater management; - heat island effect mitigation; - air quality improvement; - geographic information system (GIS); - codes and standards; - land-use laws.	Engineering green infrastructure, such as stormwater management systems, strategies to mitigate the heat island effect; green corridors (e.g., tree-lined and shaded streetscapes), etc. Developing solutions to promote sustainability and resilience.	W	5	Co, D
SE2.2.10	Installing and maintaining green infrastructure	In-depth knowledge of: - benefits of green infrastructure; - stormwater management; - heat island effect mitigation; - codes and standards.	Installing and maintaining green infrastructure, such as stormwater management systems, strategies to mitigate the heat island effect (e.g., green roofs); green corridors (e.g., tree-lined and shaded streetscapes), etc.	B	5	Cn, B, U

A.2.6 Thematic field: Adaptation and resilience to climate change

A.2.6.1 Macro Area: AD1 - Climate change resilient buildings

Table A.61 – AD1.1 – Resilience to extreme weather events

AD1.1	Resilience to extreme weather events					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
AD1.1.1	Understanding the importance of building resilience to extreme weather events	Minimal knowledge of: - strategies to boost building resilience to extreme weather events.	Participating in discussions within a design team, regarding the importance of building resilience to extreme weather events.	W	1	Co
AD1.1.2	Proposing and selecting basic solutions for floodproofing concepts	Basic knowledge of: - floodproofing solutions - different hazards of floods on buildings (hydrostatic pressure, hydrodynamic force of flowing water, erosion and scour, the impact of ice and other flood-borne debris, damage from flood-borne contaminants) - Flood Insurance Program regulations, floodplain management laws.	Selecting and evaluating floodproofing concepts for floodproofing of vulnerable buildings. Performing simplified tools to evaluate alternative solutions, based on their costs and benefits.	W	2	Co
AD1.1.3	Determining the wet floodproofing concept for buildings in Flood Hazard Areas	Medium knowledge of: - Floodproofing (dry and wet) solutions - Flood-resistant materials - different hazards of floods on buildings (hydrostatic pressure, hydrodynamic force of flowing water, erosion and scour, the impact of ice and other flood-borne debris, damage from flood-borne contaminants) - Flood Insurance Program regulations, floodplain management laws.	Determining the modifications that can be made to a house as part of a wet floodproofing project, and protection of service equipment. Identifying other hazards that the building encountered for considering alternative retrofitting methods.	W	3	Co, U
AD1.1.4	Determining the structural floodproofing concept in buildings in Flood Hazard Areas	Medium knowledge of: - structural/basement floodproofing methods (e.g., Sump and Pump Systems) - drainage channels, and cavity drain systems - different hazards of floods on buildings (hydrostatic pressure, hydrodynamic force of flowing water, erosion and scour, the impact of ice and other flood-borne debris, damage from flood-borne contaminants) - National Flood Insurance Program regulations, floodplain management laws.	Determining the modifications that must be made to a house as part of structural floodproofing, including a cavity drain membrane system with a sump and pump system. Identifying other hazards that the building encounters for considering alternative retrofitting methods.	W	3	Co, U
AD1.1.5	Engineering the wet floodproofing requirements in Flood Hazard Areas	Advanced knowledge of: - wet Floodproofing solutions - modifications required for wet floodproofing - flood-resistant materials - protecting service equipment (utility lines, ductwork, etc.) requirements inside and outside the house - Flood Insurance Program regulations, floodplain management laws.	Modifying required installations for Wet Floodproofing, such as installing wall openings in foundation walls and in garage walls. Performing relevant calculations or simulations concerning the performance of the proposed solutions.	W	4	Cn
AD1.1.6	Assuring the quality of water penetration resistance of joints in buildings	Advanced knowledge of: - water tightness test for windows and external wall joints - Water tightness test standards.	Providing quality assurance and the water-tightness check of joints on the installed windows and external walls of a building to evaluate enclosure components in terms of water penetration resistance.	W	4	B, U

AD1.1	Resilience to extreme weather events					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
AD1.1.7	Managing building resiliency to extreme weather	In-depth knowledge of: - strategies to boost building resilience to extreme weather (e.g., floodproofing - dry and wet, resilient elevators, backwater valves, sump pumps/internal drainage systems) - community's floodplain management ordinance or law.	Commissioning and inspection of the potential/applied protection technologies for making the building resistant to (potential) damage caused by floods, for retrofitting and new buildings. Managing the required safety features.	W	5	D, B, U
AD1.1.8	Checking facade air permeability	Basic knowledge of: - the permeability of building envelopes (curtain walling, doors, windows, cladding, roof lights and composite roofs), and the facade leakage.	Applying facade air permeability testing on the site.	B	2	B, U
AD1.1.9	Installing the wet floodproofing requirements for buildings in Flood Hazard Areas	Advanced knowledge of: - wet Floodproofing solutions - modifications required for wet floodproofing - Flood-resistant materials.	Installing the wet floodproofing requirement, such as wall openings in foundation walls and in garage walls.	B	4	Cn, U
AD1.1.10	Installing the structural waterproofing systems for buildings in Flood Hazard Areas	In-depth knowledge of: - basement floodproofing methods - drainage channels, and cavity drain systems.	Installing structural waterproofing systems (cavity drain systems, multi layer renders, epoxy coatings)	B	5	Cn, U

Table A.62 – AD1.2 – Sustainable drainage

AD1.2	Sustainable drainage					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
AD1.2.1	Understanding the importance of catchment/network regarding potential flood risk	Minimal knowledge of: - the importance of soil properties and drainage systems for stormwater management planning - detention and retention facilities of the drainage system.	Understanding of the nature and condition of the catchment/network. Participating in discussions within a design team.	W	1	Co, U
AD1.2.2	Proposing and selecting basic solutions for flood control based on flood control channels and basins	Basic knowledge of: - methods of flood control (flood control structures, channels and detention basins) - characterising a catchment on the basis of the vulnerability/ risk assessment - water quality and quantity regulatory requirements, and planning permission.	Defining an initial list of metrics to measure the issues and potentials of a project's performance, regarding the project's goals.	W	2	D, B

AD1.2	Sustainable drainage					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
AD1.2.3	Determining the concept of the drainage development	Medium knowledge of: - effects of building layout on flood risk - effective surface flow pathways and storage areas provision on building layout, and other infrastructures - natural drainage of the site - topography funnelling issues - wastewater resilience metrics - drainage performance standards - planning permission, building regulations, drainage construction consents.	Determining the data/characteristics of the site or the project for the new developments. Identifying criteria for drainage design, and incorporating sustainability into drainage designs. Evaluating possible solutions for the reduction of vulnerabilities of the drainage system of the site. Performing medium-level simulations concerning the drainage performance.	W	3	Co, D
AD1.2.4	Developing the initial drainage concept	Medium knowledge of: - the impact of an extreme wet weather event on sewer capacity - topography funnelling issues - catchment vulnerability assessment - wastewater resilience metrics - drainage performance standards - planning permission, building regulations, drainage construction consents.	Determining the data/characteristics implies the level of vulnerability in a catchment system, against an extreme weather event, through the modelling assessment for the catchments. Proposing provisions for the reduction of specific vulnerabilities of the drainage system.	W	3	Co, D, U
AD1.2.5	Assuring the quality of wastewater purification (health factors)	Medium knowledge of: - water quality parameters, and treatment levels - local environmental conditions and governmental standards - purification systems, and quality requirements based on the possible reuse (e.g., irrigation, groundwater recharge, etc.).	Analysing water quality, disinfection and treatment processes, and apply the necessary interventions.	W	3	U
AD1.2.6	Engineering the uncertainty quantification concept	Advanced knowledge of: - Catchment vulnerability assessment - wastewater resilience metrics - drainage performance standards and planning permission, building regulations, drainage construction consent.	Engineering probabilistic modelling and analysis for risk-informed decisions in infrastructures (e.g., corroded pressurised pipelines). Performing simulations concerning the drainage performance. Designing detailed data of drainage systems, and preparing cost estimations.	W	4	D, U
AD1.2.7	Evaluating the drainage system installation requirements	Advanced knowledge of: - performing the systems, foresing installation requirements and adopting appropriate safety features. - evaluating the performance of the systems.	Performing the measurements, testing, and evaluation of drainage systems for installation and maintenance process. Visiting sites to understand the project requirements and note any complexities. preparing technical reports. Managing the required safety features.	W	4	Cn, B, U
AD1.2.8	Commissioning risk assessment and control approaches for stormwater flood and pollution management	In-depth knowledge of: - risks associated with extreme exceedance flows and overland flow routes, as well as diffuse pollution and receiving water ecology, in addition to planning and source control issues - rain barrels to catch runoff and use water for landscape maintenance.	Overseeing the production of drainage designs, models, calculations and drawings. Managing measurements and evaluation of urban drainage infrastructure, to identify contemporary and future threats and uncertainties. Designing drainage systems (major and minor). Developing sustainable solutions to exceedance flooding (e.g., providing rain barrels at downspouts)	W	5	D, B, U
AD1.2.9	Maintaining the drainage flow in a workmanlike manner	Minimal knowledge of: - clearing drains solutions (e.g., water jetting), and the careful management of using high-powered equipment.	Clearing drains to remove congealed masses that have formed in the sewer system.	B	1	B, U

AD1.2	Sustainable drainage					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
AD1.2.10	Maintaining public sewerage systems in a workmanlike manner	Medium knowledge of: - the importance of soil properties and drainage systems for stormwater management - the condition of the collection system infrastructure (wastewater and stormwater pipes, stormwater outfalls).	Investigating in-use operation and maintenance of drainage and sewerage systems, which includes sewers carrying surface water away from impermeable areas.	B	3	B, U
AD1.2.11	Installing flood testing of roofing systems	In-depth knowledge of: - waterproofing membrane installations applied to horizontal surfaces (Roofing systems).	Investigating in-use operation of waterproofing membrane and flashings and repairing the deficiencies (e.g., determining the leakage, and blisters).	B	5	B, U

Table A.63 – AD1.3 – Resilience to heatwaves

AD1.3	Resilience to heatwaves					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
AD1.3.1	Understanding the importance of cooling load avoidance	Minimal knowledge of: - cooling load avoidance strategies regarding building design, material selection, and landscaping.	Understanding of cooling load issue associated with the rise of heat and moisture in the space. Participating in discussions within a design team.	W	1	Co
AD1.3.2	Assessing heat management strategies	Basic knowledge of: - cooling load avoidance strategies regarding building design, material selection, landscaping, and building management.	Performing simplified model simulations to evaluate the proposed alternative site-specific solutions, for managing heat in a building.	W	2	Co
AD1.3.3	Determining the concept of cooling-load-avoidance measures	Medium knowledge of: - cooling load avoidance strategies regarding building design, material selection, landscaping, and building management (e.g., size of windows, low-solar-transmittance glazings, shadings, etc.).	Determining the effect of application of different types of measures on cooling-load-avoidance of the building. Performing medium-level simulation concerning the indoor thermal conditions of the building.	W	3	Co, U
AD1.3.4	Determining the concept of cool materials to reduce heat sensitivity	Medium knowledge of: - cool roofing products (highly reflective and emissive materials, e.g., coatings, asphalt shingles, metal, clay tiles, and concrete tiles) based on the building - cool pavement materials.	Determining the effect of application of different types of cool materials on solar reflectance of the building/ site. Performing medium-level energy simulation concerning the performance of the cool roof/ pavement. Defining technical information about design, and costs.	W	3	Co, U
AD1.3.5	Assessing heat management strategies for indoor environment	Medium knowledge of: - cooling system's robustness to cover the critical thermal conditions - systems adaptability to respond to the original thermal conditions - energy systems backup and emergency control possibility.	Performing vulnerability assessment of the performance of the designed building's features and technologies to identify the risk factors (e.g., heat waves combined with power outages, urban heat island effects) of the indoor thermal conditions.	W	3	D, U

AD1.3	Resilience to heatwaves					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
AD1.3.6	Engineering the internal gains concept and conductive and infiltration heat gains	Advanced knowledge of: - strategies for reducing internal gains (e.g., energy-efficient electrical equipment, insulation of cooling system ducts/ hot water tanks, spot ventilation of concentrated heat sources) - strategies for reducing conductive heat gains (e.g., radiant barriers, insulation, reflective roof/wall surfaces, good attic/ roof ventilation) - strategies for reducing infiltration heat gains (e.g., airtight construction, and isolation of humidity sources of occupied spaces).	Engineering solutions for reducing internal gains and conductive and infiltration heat gains. Performing energy modelling concerning the energy performance of the building. Performing vulnerability assessment concerning the building performance against different disruptions scenarios (long-term, short-term).	W	4	D, U
AD1.3.7	Managing building´s internal gains	In-depth knowledge of: - how to measure and evaluate the conductive and infiltration heat gains and their effect on energy performance - comprehensive heat response plan that combines individual strategies into an integrated approach.	Commissioning and installation of construction solutions for reducing internal gains and conductive and infiltration heat gains in the building. Evaluating the performance of the applied systems.	W	5	Cn, B, U
AD1.3.8	Installing insulation of HVAC ductwork, pipes and tanks	Advanced knowledge of: - thermal insulation's installation in a workmanlike manner.	Installing thermal insulation for HVAC ductwork, pipes and tanks in a workmanlike manner	B	4	Cn, U
AD1.3.9	Installing cool roofing, and/or cool pavement systems	Advanced knowledge of: - cool roofing and/or cool pavement materials and types.	Implementing site-specific cool roofing and/or cool pavement installation and maintenance service	B	4	Cn, U
AD1.3.10	Maintaining heating and air conditioning systems in advanced buildings	In-depth knowledge of: - heat management strategies for indoor environment of residential and commercial buildings - installation and servicing of the heating and air conditioning systems.	Installing and investigating in-use operation and maintenance of heating and air conditioning systems, such as central air conditioners, heat pumps, evaporative air conditioners, and ductless mini-split systems, based on heat management strategies.	B	5	Cn, B, U

Table A.64 – AD1.4 – Resilience to windstorms

AD1.4	Resilience to windstorms					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
AD1.4.1	Understanding the effects of severe windstorms on buildings	Minimal knowledge of: - structural design principles regarding the wind safety - wind detailing requirements and limitations prescribed in the codes	Understanding of the structural design principles regarding wind safety. Participating in discussions within a design team.	W	1	Co
AD1.4.2	Proposing and selecting basic	Basic knowledge of: - structural design principals	Performing simplified wind load performance simulations to evaluate and propose alternative	W	2	Co

AD1.4	Resilience to windstorms					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
	solutions for wind load strength of a type of structure/ envelope	- the effect of wind loads on structural response and materials resistance - building codes, and standards	solutions for envelope or structure. Providing the relevant working drawings.			
AD1.4.3	Determining the concept of the required protection of the building's structure and enclosure	Medium knowledge of: - effects of wind-borne debris on structures - the components and cladding pressures towards winds, and protection of openings.	Determining the appropriate design wind speed for a project. Determining design loads based on the risk associated with failure of the building's structure and enclosure. Analysing risk of windborne debris for structural damage during severe windstorms and hurricanes to residential developments.	W	3	Co
AD1.4.4	Determining the concept of the wind load bearing systems	Medium knowledge of: - structural design principals - wind load requirements of a building - wind load-bearing systems (e.g., lightweight steel framing) - metrics for assessing the infrastructure resilience to windstorms -building codes, and standards.	Determining the wind load strength of a type of envelope, fixing details, windows, etc. for the wind load performance of the building. Developing wind loading preliminary calculations and analysis based on the standards, for evaluating possible solutions for the structure and other elements of low-rise buildings.	W	3	Co, D
AD1.4.5	Engineering the wind load strength of building structure	Advanced knowledge of: - structural design principals - wind load requirements of a building - wind load-bearing systems (e.g., Lightweight Steel Framing) - dynamic simulation of the envelope and structure of the building - standard testing methods for pre-testing of framed elements, windows, etc., to be resistant to wind load - building codes, and standards.	Computing wind load calculations by analytical method for building structure and envelop elements for the required strength and resistance. Performing dynamic simulations concerning the wind load performance of envelope and structure.	W	4	D
AD1.4.6	Engineering the mitigation actions and vulnerability analyses	Advanced knowledge of: - predicting wind effects on structures, and critical infrastructure - standards and technologies for structural retrofitting and restoration of the existing building and critical infrastructure - dynamic simulation of the envelope and structure of the building - metrics for assessing the infrastructure resilience to windstorms - building codes, and standards.	Evaluating the response of the existing building and critical infrastructure to wind events by investigating aerodynamic response, load path, ultimate capacity and the performance of the building envelope. Exploring the near-ground and channelling/shielding effects of winds on buildings through testing and instrumentation. Vulnerability modelling of buildings.	W	4	D, U
AD1.4.7	Evaluating the building´s structure	In-depth knowledge of: - wind load-bearing systems (e.g., Lightweight Steel Framing) - measuring and evaluating the wind load performance of buildings.	Commissioning and installing the measures concerning the wind load performance of the building. Managing the required safety features.	W	5	D, B, U
AD1.4.8	Installing wind resistance doors and windows	Advanced knowledge of: - architectural glazing installations with the required wind loading - structural and architectural requirements for the installation - test methods - local codes.	Assembling, and installing doors and windows for large openings, resistant to wind load.	B	4	Cn

AD1.4	Resilience to windstorms					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
AD1.4.9	Conducting wind loads resistance tests	In-depth knowledge of: - wind resistance testing service of facades, for their ability to withstand high winds, tunnelling and peak pressure loading caused by storms.	Conducting wind resistance tests for the facades, according to the instructions.	B	5	Cn, B, U
AD1.4.10	Installing wind resistance curtain walls	In-depth knowledge of: - resistance curtain walls to wind load - structural and architectural requirements for the installation - Test methods - local codes.	Assembling, and installing the curtain walls in the site, resistant to wind load.	B	5	Cn

Table A.65 – AD1.5 – Resilience to wildfire

AD1.5	Resilience to wildfire					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
AD1.5.1	Understanding the importance of fire safety protection in buildings and materials	Minimal knowledge of: - passive measure strategies to be more resilient to wildfire in wildfire zones.	Understanding the importance of fire safety protection in buildings and materials. Participating in discussions within a design team.	W	1	Co
AD1.5.2	Proposing and selecting basic solutions for reducing structure loss in fire-prone wildland areas	Basic knowledge of: - passive measure strategies to be more resilient to wildfire in wildfire zones (defensible space, protect high-risk areas, wildfire home preparedness checklist) - fire-resistant materials (ice concrete, fire-resistance bricks, steel or metal, gypsum drywall, fire-resistant glass, fire-resistant wood) - building codes and regulations.	Performing simplified tests to evaluate the relative performance of exterior construction materials and assemblies of a building, and proposing alternative solutions. Identifying areas where more detailed risk assessment models should be implemented.	W	2	Co
AD1.5.3	Determining the fire performance concept of building materials and design	Medium knowledge of: - passive fire-resistant measures for roofs, walls, and the structure concerning the hardening of the building to resist damages - fire-resistant materials (ice concrete, fire-resistance bricks, steel or metal, gypsum drywall, fire-resistant glass, fire-resistant wood) - fire-resistant simulation methodology - performance-based building codes.	Determining the effect of application of different types of construction elements on fire performance of a building. Evaluating possible solutions for mitigating vulnerability to wildfire management problems. Performing medium-level wildfire behaviour simulation to support wildfire management.	W	3	Co, D, U
AD1.5.4	Determining the fire performance concept of landscape area	Medium knowledge of: - fire landscaping strategies in wildfire zones, including defensible space, fire resistance plants, using non-combustible materials for plant separations, fuel treatments implementation, fire towers and water tank construction, etc. - fire-resistant simulation methodology - performance-based building codes.	Determining the effect of application of different types of landscape solutions on fire protection of a building. Evaluating possible solutions for mitigating vulnerability to wildfire management problems. Performing landscape wildfire behaviour modelling simulations, concerning the performance of a designed or existing building to support wildfire management.	W	3	Co, D, U
AD1.5.5	Determining the fire safety systems in the construction phase	Medium knowledge of: - the performance of active systems for use in imminent threats, such as exterior sprinklers that don't require electricity, large fire blankets that can cover a house,	Determining the fire safety systems to be used in a building.	W	3	Co, D, U

AD1.5	Resilience to wildfire					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		and fire-retardant foam that can be sprayed on structures. - conventional fire safety systems (e.g., fire suppression systems, smoke detectors, sprinkler systems, etc.).				
AD1.5.6	Engineering the fire resistance concept of buildings	Advanced knowledge of: - passive fire-resistant measures for roofs, walls, and the structure concerning the hardening of the building to resist damages - metrics related to fire protection performance - fire-resistant simulation methodologies - building codes and regulations.	Engineering the structural consideration measures for strengthening resilience against wildfire. Performing fire-resistant simulations, concerning the performance of a designed or existing building to support wildfire management.	W	4	D, Cn
AD1.5.7	Assuring the quality of building wildfire preparedness	Advanced knowledge of: - wildfire hazard potential drivers - critical components of effective wildfire prevention strategies - wildfire vulnerability of wildland-urban interface - risk assessment, fire compartmentation surveys - metrics related to fire protection performance and fire behaviour deriving - fire-resistant simulation methodologies - performance-based building codes.	Managing holistic fire management in fire-prone areas. Performing a combination of wildfire exposure, vulnerability and risk assessment as an integrated framework for assessing the likelihood of a fire occurring, the associated fire behaviour, and the impacts of the fire. Performing wildfire hazard assessment to identify local wildfire threats and assess the risks to a building. Delivering detailed reports and action plans.	W	4	D, B, U
AD1.5.8	Commissioning buildings for fire, life safety	In-depth knowledge of : - buildings´ elements and their effect on fire resistance performance - metrics related to fire protection performance - fire-resistant simulation methodologies - building codes and regulations	Commissioning and inspection of measures concerning the holistic wildfire management and implementation plans based on wildfire risk scenarios. Managing the required safety features.	W	5	Cn, B, U
AD1.5.9	Installing fire-resistant walls	Medium knowledge on: - the materials and techniques in a wall's construction, resistant against damage from heat and flames.	Assembling, and installing fire-resistant wallboards and claddings in a workmanlike manner based on the approved plan.	B	3	Cn
AD1.5.10	Installing fire-resistant roofing and siding	Advanced knowledge on: - types of non-combustible and fabricated fire-resistant materials for roofing and siding.	Assembling, and installing a type of fire-resistant roof and siding in a workmanlike manner based on the approved plan.	B	4	Cn
SA1.5.11	Installing fire safety systems in the construction phase	Advanced knowledge on: - different elements of fire safety systems (e.g., fire suppression systems, smoke detectors, sprinkler systems, etc.) - assembly and installing the systems.	Assembling, and installing the fire safety systems in a workmanlike manner.	B	4	Cn
AD1.5.12	Assuring the quality of fire-rated construction elements in buildings	In-depth knowledge of: - fire-Resistant test for construction elements - fire-Resistant test standards	Providing quality assurance and the fire-resistant regulated testing of fire-rated construction from the foundation to the roof, and its assembly of materials, like wood studs, insulation, gypsum board and siding.	B	5	B, U
SA1.5.13	Investigating the in-use operation and maintenance provision for fire safety systems	In-depth knowledge of: - fire detection and warning systems, emergency lighting systems, safety torches, and all firefighting equipment.	Investigating in-use operation of the installed fire safety systems such as fire alarms, fire extinguishers, lighting,	B	5	B, U

AD1.5	Resilience to wildfire					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
			signs, fire exits and fire doors for testing, and routine maintenance services.			

A.3 Dimension: Economy

A.3.1 Thematic field: Economical quality

A.3.1.1 Macro Area: EQ1 - Cost planning and management

Table A.66 – EQ1.1 – Construction cost planning

EQ1.1	Construction cost planning					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EQ1.1.1	Understanding the procedures to produce a construction cost planning	Minimal knowledge of: - procedures to produce a construction cost planning	Discussing construction costs.	W, B	1	Co
EQ1.1.2	Applying costs planning and estimating construction budget.	Basic knowledge of: - steps for pricing materials for bidding, fees for work, and other costs; - building organization tasks; - cost calculations - standards and regulations.	Applying cost planning and estimating construction budget. Performing initial calculations and construction schedule. Producing a preliminary construction cost planning	W	2	D, Cn
EQ1.1.3	Naming and describing construction processes. Performing tasks of organizing and preparing investments. Performing construction quantity calculations.	Medium knowledge of: - construction processes; - methods of organizing and preparing investments; - methods of construction quantity calculations; - standards and regulations.	Carrying out professional calculations related to cost planning and budget estimation. Explaining construction processes. Organizing and preparing documents for investment.	W	3	D, Cn
EQ1.1.4	Proposing solutions and planning costs for building renovation.	Medium knowledge of: - BBC (bâtiment Basse consommation) compatible renovation solutions; - building renovation techniques; - building retrofit - standards and regulations.	Analysing and proposing cost-benefit solutions for building renovations. Investigating BBC compatible renovation solutions. Planning costs for building renovation.	W	3	D, U

EQ1.1	Construction cost planning					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EQ1.1.5	Evaluating cost development over time	Advanced knowledge of: - costs of different individual activities on-site; - life cycle cost assessment; - construction processes - standards and regulations.	Calculating the price range of different techniques/systems. Evaluating the relationship between costs and time.	W	4	D, Cn
EQ1.1.6	Evaluating the feasibility of design and methodological solutions	Advanced knowledge of: - design analysis and feasibility techniques; - costs of different individual activities on-site; - life cycle cost assessment; - construction processes - standards and regulations.	Verifying the feasibility of the choices identified. Defining the most suitable design solution.	W	4	D
EQ1.1.7	Evaluating costs of modernisation and optimization measures in existing buildings	Advanced knowledge of: - costs of modernisation and building renovations; - building retrofit; - life cycle cost assessment - standards and regulations.	Performing amortization and profitability calculations. Measuring expected savings. Providing cost-benefit analysis.	W	4	U
EQ1.1.8	Using BIM tools to access costs databases and models	In-depth knowledge of: - BIM methodology (4D/5D); - costs and prices databases; - construction processes; - life cycle cost assessment - standards and regulations.	Using BIM tools to automate the prices databases and to generate the budgets of the projects. Scheduling construction activities and predicting construction costs.	W	5	D, Cn
EQ1.1.9	Selecting and applying for funding opportunities for sustainable construction	In-depth knowledge about: - fundings for sustainable construction; - codes and regulations.	Selecting and applying for funding opportunities for sustainable construction	W	5	Cn, B, U
EQ1.1.10	Finding market opportunities for energy efficiency investments and cost savings.	In-depth knowledge of: - the energy market (energy production, distribution, transmission, supply); - energy market players (i.e. Energy Manager, Energy management expert, ESCO, energy suppliers, …); - standards and regulations.	Evaluating energy market context. Proposing options and making comparisons for energy efficiency investments.	W	5	D, Cn
EQ1.1.11	Managing cost control	In-depth knowledge of: - costs and prices databases; - construction processes; - life cycle cost assessment; - cost deviation; - economic efficiency - standards and regulations.	Managing cost control. Evaluating cost deviations and cost performance.	W	5	Cn, B

Table A.67 – EQ1.2 – Life cycle cost assessment

EQ1.2	Life cycle cost assessment					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EQ1.2.1	Understanding the principles of Life Cycle Cost assessment	Minimal knowledge of: - Initial costs/ investments; - Primary energy use; - Water usage; - operating; costs; - maintenance costs; - life cycle stages; - service life.	Discussing the basis of a life cycle cost approach and its value.	W, B	1	Co
EQ1.2.2	Understanding the impacts of Life Cycle Cost assessment	Minimal knowledge of: - impacts of resource-saving construction; - environmental costs; - efficient use of land, energy and water.	Defining and understanding the effects of LCC in various fields. Taking part in project discussions.	W	1	Co
EQ1.2.3	Applying LCC analysis in buildings and clusters	Basic knowledge of: - building costs; - recycling of materials; - impacts benefiting new usages of buildings; - recyclability and degradability of buildings and clusters - standards and regulations.	Defining a balance and area of consideration on LCC calculation. Accessing databanks and literature to define the impact of products. Making basic comparisons between solutions and products.	W	2	Co, D
EQ1.2.4	Applying the "Green Purchasing" concept	Basic knowledge of: - the environmental impacts of the products over their life cycle; - Initial costs; - Primary energy use; - Water usage; - life cycle stages; - service life - standards and regulations.	Selecting products based on the environmental impacts over their life cycle.	W	2	Co, D, U
EQ1.2.5	Proposing design solutions considering capital costs and use stage costs	Medium knowledge of: - energy savings; - Initial costs; - Primary energy use; - operating and maintenance costs; - life cycle stages; - service life; - environmental costs - standards and regulations.	Proposing design solutions considering the relationship between upfront capital costs and use stage costs. Estimating operational and replacement costs for buildings and building materials.	W	3	Co, D
EQ1.2.6	Performing cost-benefit calculations of modernisation measures using LCC methodology	Advanced knowledge of: - energy savings; - LCC assessment; - Initial costs; - Primary energy use; - operating and maintenance costs; - life cycle stages; - service life; - calculations methods for construction costs;	Performing a cost-benefit calculation of modernisation measures using LCC methodology. Calculating and comparing monetary energy savings and costs for modernisation measures	W	4	D, B, Cn, U

EQ1.2	Life cycle cost assessment					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- building retrofit technologies - standards and regulations.				
EQ1.2.7	Performing an LCC assessment	Advanced knowledge of: - energy savings; - Initial costs; - Primary energy use; - operating and maintenance costs; - life cycle stages; - service life; - calculations methods for construction costs; - life cycle cost software tools; - standards and regulations.	Performing an LCC assessment. Determining the scope of the life cycle stages scenarios.	W	4	D
EQ1.2.8	Developing an operating, maintenance, and replacement plan	Advanced knowledge of: - operating and maintenance costs - building operations and maintenance; - life cycle stages; - service life; - environmental costs; - standards and regulations.	Developing an operating, maintenance and replacement plan to reduce costs caused by mal-function equipment/infrastructure.	W	4	B,U
EQ1.2.9	Optimising the life cycle cost calculation	In-depth knowledge of: - life cycle assessment; - Global Warming Potential (GWP); - Initial costs; - Primary energy use; - operating and maintenance costs; - life cycle stages; - service life; - calculations methods for construction costs; - life cycle cost software tools; - standards and regulations.	Performing a Life Cycle Assessment (LCA) to optimise life cycle costs. Interpreting results and identifying opportunities. Proposing solutions and design options. Finding trade-offs between improving life cycle cost and environmental performance.	W	5	D
EQ1.2.10	Using BIM tools to estimate and model costs	In-depth knowledge of: - BIM methodology; - costs and prices databases; - construction processes; - Initial costs; - Primary energy use; - operating and maintenance costs; - life cycle stages; - service life; - calculations methods for construction costs; - standards and regulations.	Performing an LCC assessment using BIM tools. Estimating costs and modelling based on the client's requirements and detailed designs for each life cycle stage.	W	5	D, Cn

EQ1.2	Life cycle cost assessment					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EQ1.2.11	Monitoring maintenance and replacement costs	In-depth knowledge of: - costs and prices databases; - construction processes; - Initial costs; - Primary energy use; - operating and maintenance costs; - life cycle stages; - service life; - calculations methods for construction costs.	Verifying as-built costs, checking final costs and the as-built specifications. Monitoring maintenance and replacement costs.	W	5	B,U

A.3.1.2 Macro Area: EQ2 - Green value

Table A.68 – EQ2.1 – Value creation and risk exposure

EQ2.1	Value creation and risk exposure					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EQ2.1.1	Understanding the values of sustainable design	Minimal knowledge of: - the costs and values of green buildings (e.g., energy savings over time, money savings due to healthier environments, etc.) - the integration of sustainability aspects and market value	Understanding and articulating the values of a green building, and how costs, revenues and values can be influenced in practice by sustainability features.	W, B	1	Co
EQ2.1.2	Proposing and selecting basic solutions for improved sustainability value creation	Basic knowledge of: - the costs and values of green buildings - metrics related to the value creation in relation to sustainability	Measuring and tracking the positive influence of improved sustainability performance on a property's financial valuation and risk rating through the relevant indicators, and providing the qualitative report.	W	2	Co, U
EQ2.1.3	Managing value optimisation of operational costs	Medium knowledge of: - design features that influence the future value and minimise risks - the detailed appraisal and value engineering of the project - measurable ESG factors - the product's performance requirements at the lowest possible LCC, and high quality - operational overheads and expenditure	Determining the operating cost savings of a green building that influence the value (optimisation) of a project. Value engineering of the operational and maintenance expenses besides initial costs, for the determined design decisions. Demonstrating the possible future risks affecting the value of the project.	W	3	Co, D, U
EQ2.1.4	Identifying financial benefits of ESG (Environmental, Social, Governance) criteria on a Real State value	Advanced knowledge of: - measurable ESG factors - the connection of ESG performance with operational plans and financial outcomes - evolving ESG requirements - life-cycle based ESG audit	Analysing the implications of the application of ESG factors on a life-cycle of a Real State value (the value, operational overheads, and risk of a sustainable building), providing ESG reporting. Performing ESG software, concerning the climate-related financial	W	4	Co, D, B, U

EQ2.1	Value creation and risk exposure					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- ESG risk-based audit - ESG regulations and certifications	risks for the real state and financial outcomes of the design decisions.			
EQ2.1.5	Assuring value optimisations and performance risks reduction on site	In-depth knowledge of: - multidisciplinary management - value engineering techniques - sustainability design features that influence the future value and minimise risks - cost control on-site (value and risks) - possible future risks to the performance and the value - innovative technology to track costs	Assuring value engineering (optimisations) and risk exposure reduction regarding the sustainability targets of the design decisions, through multidisciplinary management of the project´s stakeholders. Managing solutions to minimise exposure to the risks, unplanned costs and claims.	W	5	D, Cn, U

Table A.69 – EQ2.2 – Communication of green building value

EQ2.2	Communication of green building value					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EQ2.2.1	Articulating environmental and social benefits of GBs, related to market values	Minimal knowledge of: - environmental and social benefits of GBs - marketing opportunities for GBs - triple bottom line concept	Articulating how GBs can contribute to a sustainable recovery and support environmental and public health, providing marketing opportunities.	W	1	Co
EQ2.2.2	Reporting of green buildings	Basic knowledge of: - costs and benefits of GBs - Energy Performance Certifications (EPCs) - marketing and public communication - digital marketing - strategic sustainability storytelling and results-reporting	Generating news and advertisement about the potential financial benefits of investments in green buildings and green certifications, through reporting on public and social media platforms, to incentivise marketplace engagement.	W	2	Co, D, Cn, B, U
EQ2.2.3	Promoting the concept of financial benefits of GBs certifications	Medium knowledge of: - costs and benefits of GBs - marketing and public communication - membership and certification benefits - the future of design and construction and new smart technologies	Promoting the potential financial benefits of GBs certifications, and training for the owners and the project´s decision-makers. Explaining the minimum costs required to obtain prerequisites and credits for the GBs certifications.	W	3	Co
EQ2.2.4	Advising on the financial benefits of Energy Services certifications	Advanced knowledge of: - costs and benefits of optimal energy usage - advising and public communication - membership and certification benefits - IoT technologies for smart energy management	Advising and supporting a client regarding the costs and financial benefits of energy audit, and certifications relevant to Energy Services. Explaining the costs required for HVAC and other energy-efficiency utilities, and IoT technologies.	W	4	Co, U

EQ2.2	Communication of green building value					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EQ2.2.5	Managing strategic communication regarding the most effective strategies to encourage green and healthy building	In-depth knowledge of: - costs and benefits of GBs - economic benefits of green building - effective advisory competency - communicate sustainability initiatives - the value of incorporating green solutions into business practices - incentive measures and financial analyses (e.g., return on investment, triple bottom line, increased productivity, the value proposition for implementing strategies) to support green buildings adaption and implementation	Managing strategic communication with developers and stakeholders regarding the cost savings and financial benefits of undertaking a GB, and incorporating innovative, sustainable solutions for new business practices, based on the cost of implementation, operation and impact on building occupants. Articulating the values of a healthy building to support the understanding of social and economic benefits.	W	5	Co, D, U

A.3.1.3 Macro Area: EQ3 - Financing schemes and business models

Table A.70 – EQ3.1 – Financing schemes for sustainable building

EQ3.1	Financing schemes for sustainable building					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EQ3.1.1	Understanding the concepts and benefits of green finance	Minimal knowledge of: - ethical investments; - environmental benefits; - energy consumption and natural resources.	Discussing with developers and stakeholders the benefits of green finance.	W	1	Co
EQ3.1.2	Understanding the most effective and more popular strategies to encourage green buildings	Minimal knowledge of: - ethical investments; - environmental benefits; - energy consumption and natural resources; - possible incentive strategies to encourage green buildings.	Discussing with developers and stakeholders the most effective and popular strategies to incentivize the spread of certified green buildings	W	1	Co
EQ3.1.3	Selecting national funding options for sustainable buildings, focussing on climate adaptation and resilience	Basic knowledge of: - ethical investments; - funding opportunities for sustainable buildings; - finance schemes; - national regulations and policies.	Identifying and selecting different national funding opportunities for sustainable buildings, focussing on climate adaptation and resilience.	W	2	Co, D
EQ3.1.4	Using tools to establish the cost of works, estimate the eligible financial aid and present the cost to the client	Medium knowledge of: - incentive strategies for green buildings; - calculation methods of the general costs of a renovation; - financial aids; - green finance instruments (e.g., green bonds/loans, green building insurance, green mortgages, etc); - life cycle costs (LCC); - regulations and policies.	Applying the assessment method for the general costs of a renovation. Estimating the eligible financial aid the client can get. Performing an LCC analysis. Explaining finance schemes and green finance instruments (e.g., green bonds/loans, green building insurance, green mortgages, etc).	W	3	Co, D

EQ3.1	Financing schemes for sustainable building					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EQ3.1.5	Evaluating policies and financial instruments	Advanced knowledge of: - incentive strategies for green buildings; - calculation methods of the general; - financial aids; - green finance instruments (e.g., green bonds/loans, green building insurance, green mortgages, etc); - life cycle costs (LCC); - Environmental, Social, Governance (ESG) benchmarks; - regulations and policies.	Evaluating policies and financial instruments designed to promote economic transition and positive environmental outcomes. Evaluating ESG benchmarks. Performing LCC calculations. Providing cots-benefit analysis.	W	4	Co, D, Cn
EQ3.1.6	Evaluating green building insurance for sustainability-certified buildings	Advanced knowledge of: - incentive strategies for green buildings; - calculation methods of the general; - financial aids; - green finance instruments (e.g., green bonds/loans, green building insurance, green mortgages, etc); - life cycle costs (LCC); - sustainability certification for buildings; - regulations and fundings.	Evaluating green building policies and benefits for sustainability-certified buildings. Measuring risks and benefits associated with the environmental performance of the building. Providing a risk and cost analysis.	W	4	B, U
EQ3.1.7	Carrying out economic evaluations of investments	Advanced knowledge of: - the incentive systems for green buildings; - economic evaluations of investments; - the principles of financial engineering; - methods of financing and incentives for sustainable buildings; - green finance instruments (e.g., green bonds/loans, green building insurance, green mortgages, etc); - life cycle costs (LCC); - Environmental, Social, Governance (ESG) benchmarks; - regulations and policies.	Carrying out economic evaluations of investments. Performing a LCC analysis. Evaluating methods of financing and incentives for sustainable buildings. Evaluating ESG benchmarks.	W	4	Co, D, Cn
EQ3.1.8	Planning and implementing financial schemes for sustainable buildings	In-depth knowledge of: - the incentive systems for green buildings; - economic evaluations of investments; - the principles of financial engineering; - methods of financing and incentives for sustainable buildings; - green finance instruments (e.g., green bonds/loans, green building insurance, green mortgages, etc); - life cycle costs (LCC); - Environmental, Social, Governance (ESG) benchmarks; - regulations and policies.	Planning and implementing financial schemes for sustainable buildings. Evaluating green finance instruments. Providing financial markets with actionable insights, ESG data and benchmarks. Using critical drivers to assist construction firms and financiers to understand green finance instruments.	W	5	Co, D, Cn, B, U
EQ3.1.9	Promoting green mortgage	In-depth knowledge of: - the incentive systems for green buildings; - economic evaluations of investments; - the principles of financial engineering;	Promoting green mortgage as a financing model to encourage homeowners or investors to choose green buildings over other forms of property. Using a green mortgage to finance the renovation of historical	W	5	U

EQ3.1	Financing schemes for sustainable building					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- methods of financing and incentives for sustainable buildings; - green finance instruments (e.g., green bonds/loans, green building insurance, green mortgages, etc); - life cycle costs (LCC); - regulations and policies.	buildings under sustainable criteria. Developing a cost analysis showing the reductions of costs associated with energy savings and other environmental benefits of sustainable buildings.			

Table A.71 – EQ3.2 – Business models preparation

EQ3.2	Business models preparation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EQ3.2.1	Understanding the importance of a sustainable business model	Minimal knowledge of: - sustainable business model preparation; - business model elements.	Discussing contracting models for sustainable construction	W	1	Co
EQ3.2.2	Applying incentives for sustainable buildings	Basic knowledge of: - financial terminology (e.g., economic rates of return - payback); investment formulas; - calculation of depreciation and amortization; - financial projections, deviations, risk analysis, estimates of cost-saving.	Applying incentives for sustainable buildings in business model preparation. Selecting a proper economic assessment considering the lifetime, related costs, and financial measures. Making basic calculations.	W	2	Co, D
EQ3.2.3	Integrating process management skills for the environmental, safety, energy and quality sectors	Medium knowledge of: - regulations relating to quality management, environmental management systems, and safety; - risks, opportunities, and possibilities analysis; - integrated management, - regulations and policies.	Integrating process management for the environmental, safety, energy, and quality sectors. Implementing it for specific industries to reduce costs and optimise systems.	W	3	Co, D, Cn
EQ3.2.4	Identify the elements for a sustainable business model preparation	Advanced knowledge of: - sustainable construction principles; - risks, opportunities, and possibilities analysis; - life cycle costs (LCC); - benefits of sustainable buildings; - integrated management; - business model elements; - Environmental, Social, Governance (ESG) benchmarks; - regulations and policies.	Evaluating and selecting the target market. Evaluating the possibilities for creating a sustainable strategy. Adding value through the inclusion of economic, environmental, and social aspects. Identifying ESG benchmarks.	W	4	Co, D, Cn, B, U
EQ3.2.5	Developing a collaborative business model	In-depth knowledge of: - financial terminology (e.g., economic rates of return - payback); investment formulas; - calculation of depreciation and amortization; - financial projections, deviations, risk analysis, estimates of cost saving; - risks, opportunities, and possibilities analysis; - integrated management;	Creating innovative business models through a collaborative approach between different professionals. Establishing interdisciplinary collaborations and multi-stakeholder partnerships. Attracting investors using sustainability criteria. Demonstrating the advantages of sustainable buildings over the life cycle.	W	5	Co, D, Cn, B, U

EQ3.2	Business models preparation					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- business model elements; - regulations and policies.				
EQ3.2.6	Creating a sustainable construction value proposition	In-depth knowledge of: - sustainable construction principles; - risks, opportunities, and possibilities analysis; - life cycle costs (LCC); - life cycle assessment (LCA); - sustainability assessment methods; - sustainability certifications systems; - high-performance buildings; - benefits of sustainable buildings; - integrated management; - business model elements; - regulations and policies.	Creating a sustainable construction value proposition. Evaluating Environmental, Social, and Governance (ESG) aspects. Targeting customers aligned with sustainable principles. Using sustainable assessment tools to evaluate and measure building performance.	W	5	Co, D, Cn, B, U

A.3.1.4 Macro Area: EQ4 - Operative costs

Table A.72 – EQ4.1 – Operating and maintenance cost management

EQ4.1	Operating and maintenance cost management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EQ4.1.1	Understanding maintenance costs	Minimal knowledge of: - maintenance cost KPIs - preventive maintenance costs - operational maintenance costs.	Discussing total maintenance cost (maintenance, repair, operations), concerning all expenses that result in keeping physical assets in optimal working condition.	W, B	1	Co, B, U
EQ4.1.2	Applying costs of operating and maintenance strategies	Basic knowledge of: - procurement and the different forms of service - design-maintenance relationship - building maintenance certifications (e.g., HVAC Certification, Building Systems Maintenance Certification, Building Operator Certification, etc.) - cost calculations - standards and regulations.	Applying costs of preventive maintenance strategies, based on the requirements of the relevant environmental certifications for buildings maintenance.	W, B	2	Co, D, U

EQ4.1	Operating and maintenance cost management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EQ4.1.3	Calculating operating and maintenance costs in tender documents	Basic knowledge of: - maintenance contract management - procurement and the different forms of service - design-maintenance relationship - cost calculations - standards and regulations.	Calculating operational and maintenance costs through the developed service agreements and contracts, and construction plans.	W	2	Co, D
EQ4.1.4	Defining the costs and spending maintenance performance metrics	Medium knowledge of: - operating and maintenance performance metrics relevant to costs and spending (Maintenance Cost as Percent of Replacement Asset Value (RAV), Maintenance Cost Per Unit, Life Cycle, Utility Consumption (per utility), etc.) - design-maintenance relationship - standards and regulations.	Defining the operating and maintenance performance metrics relevant to costs and spending of the project´s systems, based on the project´s operating and maintenance plan. Performing medium-level simulation.	W	3	Co, D
EQ4.1.5	Estimating the operating and maintenance costs of the energy-efficient construction systems	Advanced knowledge of: - operating and maintenance cost estimation for energy-efficient construction systems for outer walls and roofs (envelopes), MEP components, water equipment, outer surfaces of internal elements - inventory management solution - CMMS solution - maintenance organisations - standards and regulations.	Estimating operating and maintenance costs (maintenance, repair, replacement, refurbishment, operation) of energy-efficient construction systems. Performing standardized calculation methods and/ or automated cost estimation techniques for maintenance (e.g., CMMS). Proposing options and making comparisons for energy efficiency investments.	W	4	Co, D, U
EQ4.1.6	Managing operating and maintenance costs	Advanced knowledge of: - operating and maintenance cost management strategies - inventory management solution - CMMS solution - monitoring technology - proactive maintenance strategies - standards and regulations.	Managing operating and maintenance costs, by tracking maintenance expenses. Finding and eliminating problem areas. Implementing modern CMMS solutions to track maintenance expenses.	W	4	D, Cn, B, U
EQ4.1.7	Managing and Monitoring costs on the BIM model of the construction site	In-depth knowledge of: - operating and maintenance cost management strategies - cost estimation and monitoring techniques on BIM models - maintenance organisations - data management platforms - standards and regulations.	Managing and Monitoring the cost of scheduled maintenance of the new developments on the BIM, based on the interface management of information between different stakeholders and planners, and using data management platforms.	W	5	D, Cn, B

Table A.73 – EQ4.2 – Use stage energy cost management

EQ4.2	Use stage energy cost management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EQ4.2.1	Understanding in-use energy costs savings of the green domestic systems	Minimal knowledge of: - data collection methods useful for the energy audit - green domestic systems	Understanding energy-audit related information and in-use energy costs savings of the green domestic systems.	W, B	1	Co, U
EQ4.2.2	Analysing utility tariffs for energy supply cost reduction	Basic knowledge of: - metering equipment - energy tariffs and tariff structures - partial cost accounting concept - assess factors of the energy audit findings - standards and regulations	Analysing energy-audit related information and energy tariffs (e.g., the collected data in place, time of use rates, peak charges, usage profile, demand charges, green power offerings and contractual obligations). Proposing alternative green solutions for energy supply cost reduction.	W	2	U
EQ4.2.3	Performing energy-saving benefit evaluation	Medium knowledge of: - energy cost metrics - cost-effective energy savings - post-occupancy cost assessment - financial terminology (economic rates of return (payback), investment formulas, calculation of depreciation and amortization, financial projections, deviations, risk analysis, estimates of cost-saving) - energy-saving condition monitoring devices - standards and regulations	Performing post-occupancy cost assessment to provide the right energy-related cost information for the green equipment and services, based on the floor size and specific property subtype. Illustrating if the cost-effective venture goals are accomplished. Performing relevant Estimation Models (e.g., GRESB's Asset Estimation Model).	W	3	B, U
EQ4.2.4	Providing the energy-related cost information	Advanced knowledge of: - energy cost metrics - cost-effective energy savings - financial terminology (economic rates of return (payback), investment formulas, calculation of depreciation and amortization, financial projections, deviations, risk analysis, estimates of cost-saving) - Building Management Systems (BMS) - standards and regulations	Providing the right energy-related cost information for the proposed types of equipment and services, based on the market opportunities for energy efficiency investments and cost savings, in a project. Analyzing the implications of energy consumption characteristics of types of equipment on cost accounting.	W	4	Co, D
EQ4.2.5	Estimating the service life prediction (SLP) of the operational energy use	In-depth knowledge of: - energy cost metrics - operational energy costs (e.g. for the heating system and other building-related installed services) - the cost of energy consumption, and energy delivery - life cycle cost which considers the energy-saving benefit - flow cost accounting - energy-saving condition monitoring devices - cost calculations - standards and regulations	Accounting life cycle cost of the operational energy use of the building. Analyzing the total energy-related consumption and losses of the building's equipment, in order to save the costs of energy flows, cost management deficiencies and defects.	W	5	D, B, U

Table A.74 – EQ4.3 – Use stage water cost management

EQ4.3	Use stage water cost management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
EQ4.3.1	Collecting water-audit related information	Minimal knowledge of: - data collection methods useful for the water-audit - assess factors of the energy audit findings green domestic systems	Understanding water-audit related information and in-use water costs savings of the green domestic systems.	W, B	1	Co
EQ4.3.2	Analysing utility tariffs for water supply cost reduction	Basic knowledge of: - metering equipment - water tariffs and tariff structures - partial cost accounting concept - assess factors of the water-audit findings - standards and regulations	Analysing water-audit-related information and water utility tariffs (e.g., the collected data in place, peak charges, usage profile, demand charges, green power offerings and contractual obligations). Proposing alternative green solutions for water supply cost reduction.	W	2	B, U
EQ4.3.3	Performing water-saving benefit evaluation	Medium knowledge of: - water cost metrics - cost-effective water savings - post-occupancy cost assessment - financial terminology (economic rates of return (payback), investment formulas, calculation of depreciation and amortization, financial projections, deviations, risk analysis, estimates of cost saving) - water-saving condition monitoring devices - standards and regulations	Performing post-occupancy cost assessment to provide the right water-related cost information for the green equipment and services in the use stage, and illustrating if the cost-effective venture goals are accomplished.	W	3	Cn
EQ4.3.4	Providing the water-related cost information	Advanced knowledge of: - water cost metrics - cost-effective water savings - financial terminology (economic rates of return (payback), investment formulas, calculation of depreciation and amortization, financial projections, deviations, risk analysis, estimates of cost saving) - cost calculations - smart water monitoring devices - standards and regulations	Providing the right water-related cost information for the proposed types of equipment and services, based on the market opportunities for water efficiency investments and cost savings, in a project. Analyzing the implications of water consumption characteristics of types of equipment on cost accounting. Appling regulatory and technological constraints for managing the costs of the water distribution system.	W	4	Co, D, U
EQ4.3.5	Performing water management audit	In-depth knowledge of: - water cost metrics - operational water costs (e.g. for the water-efficient systems and other building-related installed services), distribution systems auditing - life cycle cost which considers the water-saving benefits - flow cost accounting - smart water monitoring devices - standards and regulations	Accounting life cycle stage of the operational water use of the building. Identifying and analyzing the total water-related consumption and losses of the building's equipment, in order to save the costs of water flows, cost management deficiencies and defects.	W	5	D, B, U

A.4 Dimension: Process

A.4.1 Thematic field: Sustainable Building Design

A.4.1.1 Macro Area: BD1 - Integrative design

Table A.75 – BD1.1 – Integrated Design Process

BD1.1	Integrated Design Process					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
BD1.1.1	Understanding the Integrated Design Process (IDP)	Minimal knowledge of: - IDP procedures	Taking part in discussions about the benefits of implementing the IDP.	W	1	Co
BD1.1.2	Applying IDP approach	Basic knowledge of: - IDP procedures and methodology; - high-performance sustainable buildings.	Selecting guidelines and recommendations to properly implement the IDP.	W	2	Co
BD1.1.3	Analysing the interrelation among building systems	Medium knowledge of: - IDP procedures and methodology; - high-performance sustainable buildings; - building systems; - BIM; - guidelines, standards and regulations.	Analysing the interrelationship among building systems and how it could affect the environmental performance of the building. Identifying integrated sustainability strategies for the projects. Proposing design solutions.	W	3	Co, D
BD1.1.4	Analysing project design and execution phases	Medium knowledge of: - IDP procedures and methodology; - IDP framework; - high-performance sustainable buildings; - Tools for IDP implementation; - methods (e.g., design charrette, workshops, etc); - BIM; - guidelines, standards and regulations.	Defining the work plan, and the design elements. Determining the design goals. Processing data and information. Applying different analytic and evaluative tools as needed.	W	3	Co, D
BD1.1.5	Analysing technical specifications of the project	Medium knowledge of: - technologies for construction products; - IDP procedures and methodology; - high-performance sustainable buildings; - building systems; - guidelines, standards and regulations.	Identifying possible design solutions in compliance with the relationship among form/function/implementation. Checking technical information, and product/ systems specifications.	W	3	Co, D
BD1.1.6	Providing construction documents in IDP	Advanced knowledge of: - IDP procedures and methodology; - IDP framework; - high-performance sustainable buildings; - building systems;	Providing construction documents and specifications according to the established performance criteria. Providing tender documents with a clear explanation of innovative aspects, and contractor responsibilities for green building documentation. Developing a	W	4	Co, D

BD1.1	Integrated Design Process					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- the interconnectivity of systems; - construction technologies; - sustainable construction; - sustainability assessment methods; - BIM; - collaborative methods for contracts (e.g., Integrated Project Delivery Method - IPD); - guidelines, standards and regulations	commissioning plan. Establishing collaborative methods for contracts (e.g., Integrated Project Delivery Method - IPD).			
BD1.1.7	Implementing an IDP	In-depth knowledge of: - IDP procedures and methodology; - IDP framework; - high-performance sustainable buildings; - tools for IDP implementation; - methods (e.g., design charrette, workshops, etc); - BIM; - building systems; - the interconnectivity of systems; - construction technologies; - sustainable construction; - sustainability assessment methods; - collaborative methods for contracts (e.g., Integrated Project Delivery Method - IPD); - guidelines, standards and regulations.	Establishing the basis of an integrative design approach. Comparing the IDP with the standard linear approach (system thinking, early analysis of interrelations among systems). Explaining the benefits (cost-effective project outcomes, etc), and the pros and cons with simple examples. Proposing the methods (charrette, workshop, recurrent analysis, etc) and available instruments (dynamic simulation, LCA, etc).	W	5	Co, D
BD1.1.8	Optimising building sustainable performance through IDP	In-depth knowledge of: - IDP procedures and methodology; - IDP framework; - high-performance sustainable buildings; - building systems; - the interconnectivity of systems; - construction technologies; - systems optimization; - tools for IDP implementation; - sustainability assessment methods; - BIM; - guidelines, standards and regulations	Optimising building sustainable performance through IDP. Guiding the implementation of integrative design studies. Implementing an integrative design workflow to inform the optimisation of building systems (e.g.; energy efficiency, water consumption, construction technologies, etc). Identifying and using opportunities to achieve synergies across disciplines and building systems. Performing dynamic simulations to evaluate building systems. Providing construction documents.	W	5	Co, D
BD1.1.9	Managing construction operations through IDP	In-depth knowledge of: - IDP procedures and methodology; - high-performance sustainable buildings; - building systems; - the interconnectivity of systems; - construction technologies; - sustainable construction; - commissioning; - sustainability assessment methods; - BIM;	Managing construction operations through IDP. Recording drawings of the built project. Providing commissioning reports and including ongoing commissioning activities on operation and maintenance manuals. Orienting and training construction site workers, maintenance and operations staff. Hosting regular site meetings to review design approach and sustainable practices.	W	5	Cn, B

BD1.1	Integrated Design Process					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- collaborating methods for contracts (e.g., Integrated Project Delivery Method - IPD); - guidelines, standards and regulations				
BD1.1.10	Managing building operations through IDP	In-depth knowledge of: - IDP procedures and methodology; - high-performance sustainable buildings; - building systems; - the interconnectivity of systems; - building performance evaluations; - sustainable construction; - re-commissioning; - sustainability assessment methods; - BIM; - facility management; - guidelines, standards and regulations	Evaluating building performance and presenting results. Updating building documents. Educating staff and occupants on the building's performance and sustainable features. Providing training and education materials. Developing and implementing a re-commissioning plan. Creating an environmental management program.	W	5	U

Table A.76 – BD1.2 – Quality of site assessment

BD1.2	Quality of site assessment					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
BD1.2.1	Understanding the importance of quality of site assessment	Minimal knowledge of: - site assessment criteria; - environmental evaluation.	Discussing within the design team the importance of a quality of site assessment	W	1	Co
BD1.2.2	Collecting and assessing information about the site	Basic knowledge of: - site assessment criteria; - environmental evaluation; - guidelines, standards and regulations.	Mapping and assessing existing site conditions. Performing preliminary data collection. Reviewing available information on site history.	W	2	Co
BD1.2.3	Identifying, assessing, and documenting existing building materials and technical facilities	Medium knowledge of: - site assessment criteria; - environmental evaluation; - building physics; - contamination remediation;	Identifying, assessing, and documenting the existing building materials and technical facilities from the point of view of building physics and technology. Investigating potential contaminations. Proposing remediation solutions.	W	3	Co, D, U

BD1.2	Quality of site assessment					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- hazardous materials; - guidelines, standards and regulations.				
BD1.2.4	Proposing sustainable strategies for the site based on the site assessment	Medium knowledge of: - site assessment criteria; - environmental evaluation; - ecosystems protection; - contamination remediation; - hazardous materials; - guidelines, standards and regulations.	Using the site assessment to identify opportunities to protect and improve ecosystem services. Evaluating and proposing sustainable options for the site design.	W	3	Co, D
BD1.2.5	Setting up the construction site based on the site assessment	Advanced knowledge of: - site assessment criteria; - environmental evaluation; - ecosystems protection; - contamination remediation; - hazardous materials; - surveying and tracking techniques on-site; - construction processes; - site construction management; - guidelines, standards and regulations.	Providing the best practices to prevent erosion and sedimentation in the site construction. Evaluating the site assessment report. Performing sustainable practices for the site construction.	W	4	Cn, B
BD1.2.6	Developing a site assessment report	In-depth knowledge of: - site assessment criteria; - environmental evaluation; - ecosystems protection; - contamination remediation; - hazardous materials; - surveying and tracking techniques on-site; - investigation techniques; - GIS (geographic information system); - guidelines, standards and regulations.	Developing a site assessment report. Performing a site investigation, analysing and compiling results from the investigation. Evaluating site historical data, maps and GIS data. Determining solutions for site contamination remediation. Estimating remediation costs.	W	5	Co, D, Cn
BD1.2.7	Implementing a remediation process in contaminated sites	In-depth knowledge of: - site assessment criteria; - environmental evaluation; - ecosystems protection; - contamination remediation; - hazardous materials; - surveying and tracking techniques on-site; - investigation techniques; - GIS (geographic information system); - brownfield sites; - site clean-up processes; - guidelines, standards and regulations.	Implementing a remediation process in contaminated sites. Conducting a clean-up process that is effective, safe, and appropriate for the planned use of the site. Documenting the site's final status. Performing tests to ensure the remediation process.			

Table A.77 – BD1.3 – Value engineering

BD1.3	Value engineering					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
BD1.3.1	Understanding the value engineering (VE) concept	Minimal knowledge of: - VE concept; - the ratio of function and cost in VE.	Discussing within the design team the implementation of VE approach	W	1	Co
BD1.3.2	Applying VE job plan	Basic knowledge of: - VE concept; - the ratio of function and cost in VE; - VE methodology; - VE guidelines and standards.	Selecting guidelines and recommendations to implement the VE. Applying VE methodology and selecting the phases of implementation	W	2	Co, D
BD1.3.3	Defining sustainable project goals through VE	Medium knowledge of: - VE concept; - the ratio of function and cost in VE; - VE methodology; - VE guidelines and standards, - SDGs; - sustainable construction.	Using VE approach to define sustainable project goals, functions, objectives, requirements, design criteria and scope of work. Analysing cost-benefit solutions and making sustainable recommendations.	W	3	Co, D
BD1.3.4	Facilitating a VE process	Advanced knowledge of: - VE concept; - the ratio of function and cost in VE; - VE methodology; - VE guidelines and standards; - SDGs; - sustainable construction; - Value methodology (VM); - team management; - life cycle costs.	Performing a VE process. Leading the project team during the VE process. Managing the team to work efficiently. Identifying opportunities to remove unnecessary costs while assuring quality, reliability, and performance. Evaluating sustainable aspects of the project and how to improve them. Developing and implementing the VE job plan.	W	4	Co, D, Cn
BD1.3.5	Performing VE change proposals	Advanced knowledge of: - VE concept; - the ratio of function and cost in VE; - VE methodology; - VE guidelines and standards; - SDGs; - sustainable construction; - Value methodology (VM); - life cycle costs.	Evaluating design documents. Identifying value engineering opportunities. Recommending project changes. Considering sustainable aspects and how to implement them on the construction site.	W	4	Cn
BD1.3.6	Optimising building sustainable performance through VE	In-depth knowledge of: - VE concept; - the ratio of function and cost in VE; - VE methodology; - VE guidelines and standards; - SDGs; - sustainable construction; - sustainable assessment tools;	Optimising building sustainable performance through VE. Implementing a VE process to inform the optimisation of building systems (e.g.; energy efficiency, water consumption, construction technologies, etc). Providing the best possible sustainable solutions. Integrating sustainability and cost-effective design solutions. Performing dynamic simulations to evaluate proposed solutions.	W	5	Co, D

BD1.3	Value engineering					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- Value methodology (VM); - life cycle costs; - BIM.				

A.4.2 Thematic field: Innovative Digital Solutions

A.4.2.1 Macro Area: ID1 - Building Information Modelling

Table A.78 – ID1.1 – Operation of BIM systems

ID1.1	Operation of BIM systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
ID1.1.1	Understanding the BIM process	Minimal Knowledge of: - BIM process and concept; - BIM tools and software; - codes and standards.	Taking part in discussions about BIM processes within a project.	W	1	Co
ID1.1.2	Applying BIM data management	Basic Knowledge of: - BIM process and concept; - BIM tools and software; - IFC (Industrial Foundation Class); - codes and standards; - management of BIM data.	Performing simplified models. Applying basic data management through a BIM system. Obtaining information and data from a virtual model.	W	2	Co, D
ID1.1.3	Designing according to BIM principles	Medium knowledge of: - BIM process and concept; - BIM tools and software; - codes and standards; - management 3D models and formats; - extraction of the necessary information from the model; - BIM dimensions; - IFC (Industrial Foundation Class); - Common data environment (CDE).	Designing according to BIM principles. Using BIM to document, store and extract data. Ensuring the availability of data during the course of the project.	W	3	Co, D
ID1.1.4	Verifying the compliance to regulatory methods using dynamic building modelling	Medium Knowledge of: - BIM process and concept; - BIM tools and software; - codes and standards; - management 3D models and formats; - extraction of the necessary information from the model; - BIM dimensions; - IFC (Industrial Foundation Class);	Using the BIM model to perform dynamic simulations (e.g., energy simulation). Verifying the assessment method for the characterisation of the indicator related to the compliance of the buildings' plans to regulatory methods.	W	3	Co, D

ID1.1	Operation of BIM systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- Common data environment (CDE); - simulation tools.				
ID1.1.5	Using 3D scanner technologies to model existing buildings	Advanced Knowledge of: - BIM Methodology; - Common data environment (CDE); - BIM Tools and software; - BIM dimensions; - IFC (Industrial Foundation Class); - standards and codes; - 3D scanner technologies.	Using 3D scanner technologies to model existing buildings. Developing BIM models from point clouds.	W	4	Co, D, U
ID1.1.6	Designing and engineering solutions through BIM models	Advanced knowledge of: - BIM process and concept; - BIM tools and software; - codes and standards; - management 3D models and formats; - extraction of the necessary information from the model; - calculations using BIM models; - BIM dimensions; - IFC (Industrial Foundation Class); - software to review and coordinate projects; - Common data environment (CDE).	Designing and engineering solutions through BIM models. Performing clash detections and interference problems between project specialties. Coordinating the BIM process during the design and construction stages. Developing calculations. Providing tender documents.	W	4	D, Cn
ID1.1.7	Using the BIM model for construction planning and costing	Advanced knowledge of: - BIM Methodology; - BIM process maps; - Common data environment (CDE); - BIM Tools and software; - BIM dimensions (especially 4D and 5D); - IFC (Industrial Foundation Class); - standards and codes.	Using the BIM model for construction planning and costing. Providing construction sequence and cost estimation.	W	4	D, Cn, B
ID1.1.8	Evaluating and monitoring non-conformities on the site construction	In-depth knowledge of: - BIM Methodology; - BIM process maps; - Common data environment (CDE); - BIM Tools and software; - BIM dimensions (especially 4D and 5D); - IFC (Industrial Foundation Class); - software to review and coordinate projects; - standards and codes.	Implementing digitally monitored processes. Checking non-conformities on the site construction. Evaluating and monitoring cost performance and schedule.	W	5	Cn, B
ID1.1.9	Managing and updating the BIM model during design, construction and as-built stages	In-depth Knowledge of: - BIM Methodology; - BIM process maps; - Common data environment (CDE);	Managing and updating the BIM model during different stages of a project. Evaluating project incompatibilities, construction planning and	W	5	Co, D, Cn, B

ID1.1	Operation of BIM systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- BIM Tools and software; - BIM dimensions; - software to review and coordinate projects; - IFC (Industrial Foundation Class); - standards and codes.	schedluing. Accessing the model to extract and update project information.			
ID1.1.10	Integrating Building Sustainability Assessment (BSA) methods in a BIM model	In-depth Knowledge of: - BIM methodology; - Building Sustainability Assessment (BSA); - BIM dimensions (especially 7D); - Common data environment (CDE); - IFC (Industrial Foundation Class); - BIM Tools and software; - standards and codes.	Integrating Building Sustainability Assessment (BSA) methods in a BIM model. Using BIM to evaluate sustainable performance in buildings. Designing solutions to enhance building sustainability.	W	5	Co, D, Cn, B
ID1.1.11	Integrating Life Cycle Assessment (LCA) and Life Cycle Cost Assessment (LCC) in the BIM process	In-depth knowledge of: - BIM Methodology; - BIM process maps; - Common data environment (CDE); - BIM Tools and software; - software to review and coordinate projects; - IFC (Industrial Foundation Class); - BIM dimensions; - standards and codes.	Performing LCA and LCC using BIM. Evaluating Life Cycle Costs through the BIM model. Finding trade-offs between improving life cycle cost and environmental performance. Proposing and evaluating solutions and design options.	W	5	Co, D, Cn
ID1.1.12	Creating a digital twin through a BIM process	In-depth knowledge of: - digital twins solutions; - BIM Methodology; - BIM process maps; - Common data environment (CDE); - BIM Tools and software; - software to review and coordinate projects; - IFC (Industrial Foundation Class); - BIM dimensions; - standards and codes.	Creating a digital twin through a BIM process (digital twin as an output of a BIM process). Using digital twins to visualize, monitor and optimise operational assets, processes and resources.	W	5	B, U

A.4.2.2 Macro Area: ID2 - Small urban Information Modelling

Table A.79 – ID2.1 – Operation of DIM systems for small urban areas

ID2.1	Operation of DIM systems for small urban areas					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
ID2.1.1	Understanding the concept of District	Minimal Knowledge of: - BIM process and concept;	Taking part in discussions about DIM processes within a project.	W	1	Co

ID2.1	Operation of DIM systems for small urban areas					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
	Information Modelling (DIM)	- Geographic Information System (GIS) information; - Information and Communication Technologies (ICT); - codes and standards.				
ID2.1.2	Operating of DIM systems	Basic Knowledge of: - BIM process and concept; - Geographic Information System (GIS) information; - Information and Communication Technologies (ICT); - integration of BIM and GIS tools; - codes and standards.	Applying DIM concepts within a project. Managing, at a basic level, an architectural plan through a DIM system.	W	2	Co, D
ID2.1.3	Analysing DIM data	Medium Knowledge of: - BIM process and concept; - Geographic Information System (GIS) information; - Information and Communication Technologies (ICT); - integration of BIM and GIS tools; - codes and standards.	Analysing and interpreting DIM data. Using BIM models and GIS information to visualize, monitoring and collect data.	W	3	Co, D, Cn
ID2.1.4	Engineering and building transport facilities through the use of DIM Systems	Advanced Knowledge of: - BIM process and concept; - BIM models; - Geographic Information System (GIS) information; - Information and Communication Technologies (ICT); - interoperability of systems; - IFC (Industrial Foundation Class); - CityGML; - integration of BIM and GIS tools; - district systems; - codes and standards.	Engineering and building transport facilities through the use of DIM Systems. Using GIS information to engineer transport facilities and BIM models to connect them with the buildings (on a cluster scale).	W	4	Co, D, Cn
ID2.1.5	Developing a DIM framework	In-depth Knowledge of: - BIM process and concept; - BIM models; - Geographic Information System (GIS) information; - Information and Communication Technologies (ICT); - interoperability of systems; - - IFC (Industrial Foundation Class); - CityGML; - integration of BIM and GIS tools; - district systems; - codes and standards.	Developing a DIM framework using BIM and GIS. Evaluating interoperability of systems, integration of BIM and GIS. Providing data information. Creating advanced 3D urban modelling of the buildings characteristics and the surrounding environment.	W	5	Co, D, Cn, B, U
ID2.1.6	Optimising energy performance through the DIM system	In-depth knowledge of: - BIM process and concept; - BIM models; - Geographic Information System (GIS) information; - Information and Communication Technologies (ICT);	Optimising energy performance through the DIM system. Managing and simulating energy production, distribution, and consumption at the district (cluster) level. Monitoring energy systems through DIM.	W	5	D, Cn, B, U

ID2.1	Operation of DIM systems for small urban areas					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- interoperability of systems; - IFC (Industrial Foundation Class); - CityGML; - integration of BIM and GIS tools; - district systems; - smart grids; - energy simulation tools; - codes and standards.				
ID2.1.7	Integrating Urban Sustainability Assessment methods in a DIM framework	In-depth Knowledge of: - DIM and BIM methodologies; - Urban Sustainability Assessment methods; - Geographic Information System (GIS) information; - BIM dimensions (especially 7D); - Common data environment (CDE); - interoperability of systems; - IFC (Industrial Foundation Class); - CityGML; - integration of BIM and GIS tools; - BIM Tools and software; - standards and codes.	Integrating Urban Sustainability Assessment methods in a DIM framework. Using BIM to evaluate sustainable performance in buildings and GIS for spatial analysis. Designing solutions to enhance sustainability in clusters.	W	5	Co, D, Cn, B, U

A.4.2.3 Macro Area: ID3 - GIS Systems

Table A.80 – ID3.1 – GIS Systems for design and planning

ID3.1	GIS Systems for design and planning					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
ID3.1.1	Understanding the use of the GIS Systems for design and planning	Minimal knowledge of: - GIS systems.	Understanding the use of the GIS Systems for design and planning. Discussing GIS systems within the design team.	W	1	Co
ID3.1.2	Applying GIS systems	Basic knowledge of: - GIS systems; - standards and regulations.	Applying different GIS elements from different databases to design urban plans in general terms.	W	2	Co
ID3.1.3	Selecting GIS information to perform simplified models	Basic knowledge of: - GIS systems; - modelling techniques; - standards and regulations.	Selecting GIS information to perform simplified models. Making objects through solid construction geometry. Applying GIS information to two-dimensional and three-dimensional graphics of building and architectural drawings.	W	2	Co, U
ID3.1.4	Analysing GIS data	Medium knowledge of: - GIS systems; - location information;	Analysing and interpreting GIS information. Checking spatial information (coordinates, the	W	3	Co, D, U

ID3.1	GIS Systems for design and planning					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- spatial information; - conditions; - trends; - patterns; - standards and regulations.	spatial relationship between features and additional non-spatial attributes).			
ID3.1.5	Designing a parametric three-dimensional model	Advanced knowledge of: - computer science applied techniques; - GIS systems; - Information and Communication Technologies (ICT); - BIM process and concept; - BIM tools and software; - IFC (Industrial Foundation Class); - CityGML; - integration of BIM and GIS tools; - standards and regulations.	Designing and engineering solutions through a parametric three-dimensional model by using GIS data. Evaluating interoperability of systems (e.g., BIM models and GIS). Developing calculations. Providing tender documents.	W	4	Co, D, U
ID3.1.6	Assessing urban sustainable development through GIS systems	In-depth Knowledge of: - Urban Sustainability Assessment methods ; - Geographic Information System (GIS) information; - integration of sustainability assessment methods and GIS; - standards and codes.	Using GIS systems to assess urban sustainable development. Planning and designing solutions to enhance sustainability in clusters. Identifying key parameters and priority interventions.	W	5	Co, D, U
ID3.1.7	Developing site analysis using GIS tools	In-depth Knowledge of: - urban indices; - mixed-use neighborhoods; - walkability; - transport connectivity; - geographic information system (GIS); - maps; - urban databases - codes and standards - land-use laws.	Developing site analysis using GIS tools. Evaluating urban databases, codes, land-use laws, etc. Performing site surveys. Using urban indices and complementary indicators to support design decisions.	W	5	Co, D, U

A.4.2.4 Macro Area: ID4 - Lean Management

Table A.81 – ID4.1 – Lean Management solutions

ID4.1	Lean Management solutions					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
ID4.1.1	Understanding the Lean philosophy and principles	Minimal knowledge of: - Lean philosophy; - Lean basic principles.	Discussing the basic principles of Lean Management. Understanding Lean philosophy.	W	1	Co
ID4.1.2	Applying the Lean basic principles within a project	Basic knowledge of: - Lean philosophy; - Lean basic principles - Integration between Lean and sustainability.	Applying Lean basic principles in order to improve a project's performance	W	2	Co, D
ID4.1.3	Selecting the proper Lean solution based on the project stage (e.g., planning, conceptual design, detailed design, construction, etc)	Basic knowledge of: - Lean philosophy; - Lean basic principles - Integration between Lean and sustainability.	Selecting the most adequate Lean solution according to the project stage. Applying basic methods in each stage of the project.	W	2	Co, D, Cn, B, U
ID4.1.4	Adopting Lean practices in the design process	Medium knowledge of: - Lean philosophy; - Lean basic principles; - design structure matrix; - Last Planner System (LPS); - Virtual design; - Integration between Lean and sustainability.	Adopting Lean practices in the design process to improve the project's performance.	W	3	Co, D
ID4.1.5	Developing environmentally conscious customers and building operators.	Medium knowledge of: - Lean philosophy; - Lean basic principles; - Sustainable practices for building operations; - Waste reduction principles; - Integration between Lean and sustainability.	Creating awareness regarding sustainable practices. Applying Lean waste reduction concepts for building operations. Training and educating building users and operators about recyclable materials, reusable materials, and environment-friendly practices and operations.	W	3	U
ID4.1.6	Measuring a project performance through Lean principles	Advanced knowledge of: - Lean philosophy; - Lean principles; - Virtual design; - BIM Methodology; - BIM process maps; - Common data environment (CDE); - BIM Tools and software; - Integration between Lean and sustainability.	Measuring a project performance through Lean principles. Providing data and performance reports.	W	4	Co, D, Cn, B, U
ID4.1.7	Managing construction based on Lean principles	In-depth knowledge of: - Lean philosophy; - Lean principles; - Virtual design; - BIM Methodology;	Managing construction based on Lean principles. Applying Lean principles during the construction stage to reduce waste, prevent quality issues, optimise the sequence of activities, minimise delays	W	5	Cn, B

ID4.1	Lean Management solutions					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- BIM process maps; - Common data environment (CDE); - BIM Tools and software; - Integration between Lean and sustainability.	and disruptions. Measuring construction performance and providing data and reports.			
ID4.1.8	Combining Lean principles and BIM	In-depth knowledge of: - Lean philosophy; - Lean principles; - Virtual design; - BIM Methodology; - BIM process maps; - Common data environment (CDE); - BIM Tools and software; - Integration between Lean and sustainability.	Implementing and using Lean construction and BIM. Combining both processes to reduce waste, improve quality control, reduce costs and improve effectiveness.	W	5	Co, D, Cn, B, U
ID4.1.9	Optimising sustainability in the design stage through the application of Lean Construction (LC) tools	In-depth knowledge of: - Lean philosophy; - Lean principles; - Lean construction tools; - Sustainable Assessment Methods; - Sustainable construction; - Sustainable design strategies; - Integration between Lean and sustainability.	Optimising sustainability in the design through the application of Lean Construction tools. Using the LC tools to have a more environmentally conscious design and planning.	W	5	Co, D
ID4.1.10	Optimising sustainability in construction through the application of Lean Construction (LC) tools	In-depth knowledge of: - Lean philosophy; - Lean principles; - Lean construction tools; - Sustainable Assessment Methods; - Sustainable construction; - Integration between Lean and sustainability.	Optimising sustainability in construction through the application of Lean construction tools. Using the LC tools to reduce environmental impacts, improve efficiency, and help the implementation of sustainable assessment methods.	W		Cn, B

A.4.2.5 Macro Area: ID5 – Measuring

Table A.82 – ID5.1 – Smart meters

ID5.1	Smart meters					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
ID5.1.1	Understanding the benefits of smart meters use	Minimal knowledge of: - smart technologies; - communication protocols; - smart grids; - systems measurement (e.g., energy, HVAC, etc).	Discussing within the design team the application and benefits of smart meters.	B, W	1	Co, Cn
ID5.1.2	Applying basic solutions for smart meters	Basic knowledge of: - smart technologies; - communication protocols; - smart grids; - systems measurement (e.g., energy, HVAC, etc); - technical standards and regulations.	Performing simplified models to evaluate smart meters solutions. Proposing basic solutions.	W	2	Co
ID5.1.3	Analysing and validating the results of measurements with measuring and metering equipment.	Medium Knowledge of: - Metering and measurement equipment (i.e. steam analysers, thermographic cameras, loggers, manometers, thermometers, laser measurement equipment). - Data analysis tools; - technical standards and regulations.	Identifying and managing the equipment to carry out an energy audit. Interpreting and analysing results obtained from measurement equipment.	W	3	Co, D, U
ID5.1.4	Managing and processing metering data	Advanced knowledge of: - smart technologies; - communication protocols; - smart grids; - interoperability of systems; - systems measurement (e.g., energy, HVAC, etc); - technical standards and regulations	Managing measurements and evaluating data of metering systems.	W	4	U
ID5.1.5	Engineering smart metering solutions	Advanced knowledge of: - smart technologies; - communication protocols; - smart grids; - information and communication technology (ICT); - interoperability of systems; - systems measurement (e.g., energy, HVAC, etc); - data process; - technical standards and regulations	Engineering smart metering solutions. Evaluating systems interoperability and connectivity. Designing integrated energy systems. Providing tender documents	W	4	Co, D, U
ID5.1.6	Installing and maintaining smart meters	In-depth knowledge of: - smart technologies; - information and communication technology (ICT); - smart grids; - interoperability of systems; - systems measurement (e.g., energy, HVAC, etc); - technical standards and regulations	Installing and maintaining smart meters. Connecting different systems and testing equipment.	W	5	Cn, B, U
ID5.1.7	Commissioning metering systems	In-depth knowledge of: - smart technologies; - communication protocols; - smart grids; - information and communication technology (ICT); - interoperability of systems; - systems measurement (e.g., energy, HVAC, etc);	Testing metering systems and their interoperability. Verifying construction documents and equipment datasheets. Evaluating systems performance and operation. Providing analysis report.	W	5	Cn, B, U

ID5.1	Smart meters					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- technical standards and regulations				
ID5.1.8	Optimising energy systems performance via smart metering	In-depth knowledge of: - smart technologies; - communication protocols; - smart grids; - information and communication technology (ICT); - interoperability of systems; - systems measurement (e.g., energy, HVAC, etc); - data process; - technical standards and regulations	Optimising energy systems performance via smart metering. Using data collection and exchange of information from multiple systems to support a flexible integrated energy system (e.g., interoperability between electromobility and buildings energy systems). Providing advanced solutions for integrated systems.	W	5	D, B, U

Table A.83 – ID5.2 – Smart Building Sensors

ID5.2	Smart Building Sensors					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
ID5.2.1	Understanding the benefits of smart building sensors use	Minimal knowledge of: - smart buildings concept; - Internet of Things (IoT); - information and communication technology.	Discussing within the design team the application and benefits of smart building sensors.	W	1	Co
ID5.2.2	Selecting smart building sensors	Basic knowledge of: - smart technologies (e.g., temperature sensors, humidity sensors, motion sensors, air quality sensors, etc); - smart buildings concept; - Internet of Things (IoT); - information and communication technology; - technical standards and regulations.	Selecting smart building sensors based on project primary needs (e.g., data information, activities information).	W	2	Co, D
ID5.2.3	Proposing smart building sensors	Medium knowledge of: - smart technologies (e.g., temperature sensors, humidity sensors, motion sensors, air quality sensors, etc); - smart buildings concept;	Proposing smart building sensors based on the project needs (e.g., energy savings, indoor environmental quality, etc). Analysing building	W	3	Co, D, U

ID5.2	Smart Building Sensors					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- Internet of Things (IoT); - information and communication technology; - technical standards and regulations.	systems design solutions and investigating the best and most cost-benefit options.			
ID5.2.4	Using smart sensors to analyse the occupant behavior pattern.	Advanced knowledge of: - smart technologies (e.g., temperature sensors, humidity sensors, motion sensors, air quality sensors, etc); - smart buildings concept; - Internet of Things (IoT); - information and communication technology; - indoor environmental quality parameters; - technical standards and regulations.	Using smart sensors to analyse the occupant behavior pattern (e.g., occupancy sensors to improve energy savings, environmental parameters, etc). Using different types of sensors to understand the indoor environmental characteristics and occupant behavior.	W	4	D, U
ID5.2.5	Managing optimal energy savings and occupant comfort by using different sensors	In-depth knowledge of: - common practice in measuring, - building automation and mechanisms of regulation and control; - smart technologies (e.g., temperature sensors, humidity sensors, motion sensors, air quality sensors, etc); - smart buildings concept; - Internet of Things (IoT); - information and communication technology; - indoor environmental quality parameters; - technical standards and regulations.	Managing optimal energy savings and occupant comfort by using different sensors. Developing the best combination of sensing technology to achieve an energy-efficient and the healthy built environment.	W	5	D, U
ID5.2.6	Installing and maintaining smart building sensors	In-depth knowledge of: - smart technologies (e.g., temperature sensors, humidity sensors, motion sensors, air quality sensors, etc); - information and communication technology (ICT); - Internet of Things (IoT) - interoperability of systems; - technical standards and regulations.	Installing and maintaining smart building sensors. Connecting smart sensors to the building monitoring system and testing equipment.	B	5	Cn, B, U
ID5.2.7	Commissioning sensing systems	In-depth knowledge of: - common practice in measuring, - building automation and mechanisms of regulation and control; - smart technologies (e.g., temperature sensors, humidity sensors, motion sensors, air quality sensors, etc); - smart buildings concept; - Internet of Things (IoT); - information and communication technology; - indoor environmental quality parameters; - technical standards and regulations.	Testing smart sensor systems and their interoperability with HVAC systems, metering systems, building management systems. Verifying construction documents and equipment datasheets. Evaluating systems performance and operation. Providing analysis report.	W	5	B,U
ID5.2.8	Auditing energy systems	In-depth knowledge of: - common practice in measuring, computing and reporting savings; - building automation and mechanisms of regulation and control; - smart technologies (e.g., temperature sensors, humidity sensors, motion sensors, air quality sensors, etc); - smart buildings concept; - Internet of Things (IoT); - information and communication technology;	Auditing energy systems through smart sensors data evaluation. Developing a monitoring plan within the scope of the energy audit and calculating the energy savings. Assessing energy savings and making corrective actions.	W	5	U

ID5.2	Smart Building Sensors					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- indoor environmental quality parameters; - technical standards and regulations.				

A.4.2.6 Macro Area: ID6 - Digital Twins Solutions

Table A.84 – ID6.1 – Digital Twins Systems

ID6.1	Digital Twins Systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
ID6.1.1	Understanding the concept of the digital twins	Minimal knowledge of: - virtual models; - basic simulation tools.	Understanding the concept of the digital twins and how it can be applied in the construction field	W	1	Co
ID6.1.2	Applying basic data integration through digital twins systems	Basic knowledge of: - virtual models; - basic simulation tools; - BIM; - data management; - technical standards and regulations.	Performing simplified virtual models. Applying basic data integration through digital twins systems.	W	2	Co
ID6.1.3	Proposing conceptual solutions based on a digital twin simulation	Medium knowledge of: - virtual models; - simulation tools; - BIM; - Information and Communication Technologies (ICT); - artificial intelligence (AI); - data management; - technical standards and regulations.	Performing virtual models. Analysing digital twin data. Simulating scenarios and predicting building performance. Proposing solutions based on the digital twin simulations.	W	3	Co, D
ID6.1.4	Using digital twins to support data communication	Advanced knowledge of: - virtual models; - simulation tools; - BIM; - Information and Communication Technologies (ICT); - artificial intelligence (AI); - data management; - internet of things (IoT); - augmented reality (AR) and virtual reality (VR) technologies;	Using digital twins to support data communication among project participants. Combining the digital twins with ICT (e.g., augmented reality for immersive data communication) to improve communication and data exchange.	W	4	Co, D, Cn, B

ID6.1	Digital Twins Systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- technical standards and regulations.				
ID6.1.5	Using digital twins to improve the sustainability performance of buildings	Advanced knowledge of: - virtual models; - simulation tools; - BIM; - Information and Communication Technologies (ICT); - artificial intelligence (AI); - data management; - internet of things (IoT); - augmented reality (AR) and virtual reality (VR) technologies; - technical standards and regulations.	Evaluating virtual models and predictions to improve sustainability performance. Simulating scenarios for energy systems optimisation, waste production reduction, circular economy, and materials performance. Evaluating future scenarios for building operation and maintenance during the design stage.	W	4	Co, D, Cn
ID6.1.6	Optimising construction operations through digital twins	In-depth knowledge of: - virtual models; - simulation tools; - BIM; - Information and Communication Technologies (ICT); - artificial intelligence (AI); - data management; - internet of things (IoT); - augmented reality (AR) and virtual reality (VR) technologies; - data mining; - technical standards and regulations.	Using digital twins to predict the future construction process. Optimising construction operations by arranging work and staffing according to the changeable site conditions. Using digital twins to simulate task execution and worker cooperation.	W	5	Cn, B
ID6.1.7	Managing data for anomaly detection and operation and maintenance of building systems	In-depth knowledge of: - virtual models; - simulation tools; - BIM; - Information and Communication Technologies (ICT); - artificial intelligence (AI); - data management; - internet of things (IoT); - augmented reality (AR) and virtual reality (VR) technologies; - data mining; - Building management systems (BMS); - technical standards and regulations.	Managing data for anomaly detection and operation and maintenance of building systems. Integrating BIM models and digital inspection systems for preventive maintenance. Using digital twins to create self-learning systems capable of optimising building systems and maintenance (e.g., optimising energy consumption, maintenance scheduling, etc). Monitoring building performance.	W	5	U

A.4.3 Thematic field: Sustainable construction

A.4.3.1 Macro Area: SC1 - Sustainable construction management

Table A.85 – SC1.1 – Construction Activity Pollution Management

SC1.1	Construction Activity Pollution Management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
SC1.1.1	Defining the deconstruction method in the site	Minimal knowledge of: - deconstruction for reuse and selective demolition methods: - control of exposure to silica dust	Defining deconstruction and selective demolition methods in the site. Identifying what C&D materials can be salvaged for reuse during the deconstruction.	W	1	Co
SC1.1.2	Proposing and selecting basic solutions for pollution prevention	Basic knowledge of: - businesses´ responsibility for their created pollution - risk being fined for breaking environmental laws - financial incentives of environmental impact reductions	Proposing pollution prevention strategies, especially for avoidable or manageable practices.	W	2	Co
SC1.1.3	Performing the assessment and control of Silica Dust Hazards	Basic knowledge of: - the importance of controlling airborne dust on a construction site - methods of control of exposure to silica dust - policies, legislation and standards relating to waste management	Performing the assessment, control and review model to measure and control Silica Dust Hazards.	W	2	Cn
SC1.1.4	Preparing the details of tender documentation based on the pollution prevention plans	Basic knowledge of: - the roles and responsibilities of the contractors - contractors' management plan - relevant policies, legislation and standards	Defining the roles and responsibilities of the company and contractors (and subcontractors) based on the details of specific control measures of the management plans.	W	3	D
SC1.1.5	Providing employees with Awareness of Control of Substances Hazardous to Health (COSHH)	Medium knowledge of: - hazardous-containing materials - COSHH risk assessment and the different control measures that can be implemented to manage risks that hazardous substances can cause - Control of Substances Hazardous to Health Regulations - relevant policies, legislation and standards	Identifying training needs for the contractor staff at the outset before construction works commence, and developing a training plan. Providing comprehensive knowledge needed to identify hazardous substances in the workplace and how to comply with the control of the legal requirements of COSHH.	W	3	D
SC1.1.6	Proposing and selecting alternative solutions for pollution management	Medium knowledge of: - Waste Minimization Techniques - sensitive lands protection - different types of pollution that may be produced as a result of construction activities - pollution prevention strategies - relevant policies, legislation and standards	Determining the effect of application of different types of construction activities on generating pollution on the site. Evaluating possible methods for generating less waste and pollution from a project. Proposing ways to manage and reduce different types of pollution produced by construction activities during the design and construction process.	W	3	D
SC1.1.7	Determining solutions for pollution management	Advanced knowledge of: - construction-related prerequisite - an integrated approach to pollution prevention and waste management - the erosion and sedimentation requirements - best management practices (BMP) (e.g., preservation of vegetation, vehicle and equipment management, run-off and erosion control) - different types of pollution produced by construction activities - environmental compliance and permitting requirements - relevant policies, legislation and standards	Developing an erosion and sedimentation control plan for all construction activities associated with the project, describing the measures implemented. Disseminating of the information to the relevant stakeholders.	W	4	D

SC1.1	Construction Activity Pollution Management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
SC1.1.8	Commissioning pollution management plans	In-depth knowledge of: - environmental compliance and permitting requirements - waste management on the site - best management practices (BMP) (e.g., preservation of the vegetation, vehicle and equipment management, run-off and erosion control) - relevant policies, legislation and standards	Implementing precautionary solutions in place based on the erosion and sedimentation control plan, and having a follow-up corrective action based on the inspections. Monitoring and maintaining construction progress regarding the measurements of the erosion and sedimentation control plan, meeting specific regulatory needs. Proving reports or checklists.	W	5	Cn
SC1.1.9	Assuring pollution prevention implementation	In-depth knowledge of: - environmental compliance and permitting requirements - best management practices (BMP) (e.g., preservation of vegetation, vehicle and equipment management, run-off and erosion control) - different types of pollution produced by construction activities - relevant policies, legislation and standards	Monitoring and maintaining construction operations regarding the measurements of the erosion and sedimentation control plan. Proving reports or checklists.	B	5	Cn

Table A.86 – SC1.2 – Sustainability awareness

SC1.2	Sustainability awareness					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
SC1.2.1	Providing the public community with environmental awareness training	Minimal knowledge of: - the concept of sustainability - environmentally responsible behaviour - consequence of any action and lifestyle routines in the future - conscious lifestyle	Promoting environmental awareness and education to public communities and the occupants, through group/private learning (inside or outside of the classroom), informational and inspirational seminars,campaigns, etc.	W	1	Cn, B, U
SC1.2.2	Providing employees with environmental awareness training	Basic knowledge of: - the concept of sustainability and sustainability measures - environmentally responsible behaviour - safety provision requirements in workplaces based on the regulations - labours' rights and working conditions	Providing basic knowledge to workers of all disciplines to understand their responsibility to work in a sustainable, environmentally friendly way, and how they can support their workplace's initiatives regardless of their position as a general employee or manager.	W	2	D, Cn
SC1.2.3	Providing representatives on-site with environmental awareness training	Medium knowledge of: - the concept of sustainability and sustainability measures - environmentally responsible management - environmentally responsible supply chain management	Providing professional training to implement sustainability practices for site managers and representatives on-site, regarding environmental	W	3	D, Cn

SC1.2	Sustainability awareness					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- safety provision requirements in workplaces based on the regulations - labours' rights and working conditions	issues on construction sites, which the sub-contract chain is required to prove to major contractors.			
SC1.2.4	Providing professional training for integrating sustainable knowledge into all practices of an organization	Advanced knowledge of: - sustainability strategy based on an organization's purpose - environmentally responsible management - environmentally responsible supply chain management - responsibility and accountability of the employers, and labours' rights - national laws and regulations	Providing comprehensive knowledge to employers of a certain discipline regarding the sustainability strategy underscores and amplifies the purpose of the organization, the organization's best opportunity for impact in sustainability, moving sustainability from awareness to action and beyond. Articulating the relevant strategies, approaches and regulatory requirements.	W	4	Co, D, Cn
SC1.2.5	Providing professional training for integrating sustainable knowledge into all practices of a design team	In-depth knowledge of: - sustainability strategy based on the design requirements and the purposes - environmentally responsible management - environmentally responsible supply chain management - national laws and regulations	Providing professional training regarding strategies, approaches and regulatory requirements within a specific environmental issue framework to a specific design team.	W	5	Co, D

A.4.4 Thematic field: Maintenance and operating

A.4.4.1 Macro Area: MN1 - Maintenance

Table A.87 – MN1.1 – Building maintenance

MN1.1	Building maintenance					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
MN1.1.1	Understanding maintenance routine and its environmental benefits	Minimal knowledge of: - preventive maintenance routine - environmental benefits of building maintenance strategies	Understanding and discussing preventive maintenance routine and its benefits on risk reduction for a project.	W	1	Co
MN1.1.2	Proposing and selecting basic	Basic knowledge of: - sustainability criteria and objectives in the maintenance process and their	Proposing and selecting preventive maintenance strategies for operational improvement during the	W	2	Co

MN1.1	Building maintenance					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
	solutions for preventive maintenance strategies, based on sustainability criteria and objectives	prerequisites - design-maintenance relationship - building maintenance management - circular economy principles for repair	design phase, based on the sustainability criteria, and relevant to the project´s objectives.			
MN1.1.3	Specifying the preventive maintenance concept in tender documents	Medium knowledge of: - building maintenance management - procurement and the different forms of service - maintenance contract management	Performing procurement and the different forms of service agreements and contracts available that fit the demands of the maintenance planning.	W	3	D
MN1.1.4	Performing preventive maintenance and monitoring strategies to manage the indoor air quality and energy efficiency passive solutions	Medium knowledge of: - the importance of energy losses in buildings - causes and effects of envelope leaks, and condensation issues - relevant maintenance and preventive activities to the indoor air quality - management of key pollutants features of buildings (e.g., particulates microbiological, gases)	Determining preventive maintenance and monitoring strategies, and efficiency and durability solutions to manage the indoor air quality of a building during the operation phase, and tracking the process's status in green buildings.	W	3	D, B, U
MN1.1.5	Defining the efficient maintenance performance metrics for Mechanical, Electrical and Plumbing (MEP) building technology(s)	Advanced knowledge of: - maintenance performance metrics - design-maintenance relationship - efficient MEP component's serviceability factors and their testing methods - LCC assessment of the components - automated maintenance techniques - national laws and regulations	Determining and managing the associated maintenance performance metrics for operational improvement of MEP components. Evaluating possible solutions for the predicted risks. Using automated maintenance techniques (e.g., CMMS, energy management system, predictive analytics).	W	4	D, U
MN1.1.6	Managing the preventive maintenance planning provision	In-depth knowledge of: - maintenance performance metrics for tracking a specific process's status - preventive maintenance - routine maintenance activities - design-maintenance relationship - interface management of the information - maintenance organisations - Lean Maintenance - national laws and regulations	Managing and directing a scheduled maintenance plan, based on the preventive measures and routine maintenance objectives, through interface management of the information, compliance with the latest regulations, and cost-effectiveness. Involving in hiring and training maintenance supervisors.	W	5	D, Cn
MN1.1.7	Supervising the maintenance activities for the envelopes components	In-depth knowledge of: - the building components' serviceability factors, concerning climate change impacts - the properties of building materials and their testing methods - preventive maintenance - routine maintenance activities - contractor selection - national laws and regulations.	Supervising the maintenance activities of sustainable construction systems of outer walls and roofs (envelopes) (e.g., green walls and roofs) in place, based on the project´s objectives, and overseeing and tracking the repairs. Inspecting and evaluating the risks. Involving in hiring and training maintenance technicians and workers.	W	5	Co, D, U
MN1.1.8	Supervising the maintenance activities for Mechanical, Electrical and Plumbing (MEP) building technology(s)	In-depth knowledge of: - handling the efficient MEP component's serviceability factors and their testing methods - preventive maintenance - routine maintenance activities	Supervising the maintenance activities for efficient MEP components in place, based on the project´s objectives, and overseeing and tracking the repairs. Inspecting and evaluating the risks. Involving in hiring and training maintenance technicians and workers.	W	5	Cn, B, U

MN1.1	Building maintenance					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- contractor selection - national laws and regulations.				
MN1.1.9	Executing general Planned Maintenance Systems (PMS) and repairs	In-depth knowledge of: - Executing general maintenance and repairs based on the developed plans - cleaning the equipment and the facility.	Executing general maintenance and repair works, based on the given tasks.	B	1	Cn, B, U
MN1.1.10	Executing maintenance and repairs of the elements related to the indoor air quality	In-depth knowledge of: - relevant maintenance activities to the indoor air quality of buildings (e.g., envelope leaks, condensation issues) - installing and upgrading equipment.	Executing preventive maintenance and repairs for the elements related to the indoor air quality of a building, based on the maintenance and monitoring plan.	B	b	Cn, B, U

Table A.88 – MN1.2 – Building degradation diagnosis

MN1.2	Building degradation diagnosis					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
MN1.2.1	Providing initial building pathologies diagnosis	Minimal knowledge of: - building pathologies and diagnostic techniques - sick building syndromes - initial intervention solutions	Providing initial building pathologies diagnosis to identify possible failures, and discussing initial sustainable strategies that lead to an improvement of the situation.	W	1	Co
MN1.2.2	Investigating the causes of sick building symptoms in a building	Minimal knowledge of: - most frequent problems and damage of the techniques and materials relevant to indoor air quality	Investigating the causes of sick building symptoms in a building. Proposing initial alternative solutions.	W	2	B, U
MN1.2.3	Investigating indoor air quality problems	Medium knowledge of: - building diagnostic techniques, hypothesis formation, and hypothesis testing for indoor air quality (e.g., envelope leaks, condensation issues) - the HVAC systems - possible pollutant pathways - hygrothermal behaviour of buildings - possible contaminant sources - optimal intervention solutions - smart technologies for detecting the deficiencies	Investigating indoor air quality deficiencies based on the diagnosing techniques, and providing a report. Proposing alternative optimal interventions for the problems. Performing appropriate tests of the hypothesis.	W	3	Co, B, U
MN1.2.4	Engineering solutions for building pathologies and diagnostic techniques	Advanced knowledge of: - solutions to sick building syndrome - the HVAC systems - possible pollutant pathways - hygrothermal behaviour of buildings - possible contaminant sources - durability and service life analysis of materials and components	Determining building deficiencies and the causes, and the consequences of indoor air quality problems. Engineering an effective and economic remedy for the deficiencies. Using smart technologies for tracking the process's status and selecting the right tools and professionals in responding to specific indoor air quality problems.	W	4	D, B, U

MN1.2	Building degradation diagnosis					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- smart technologies for detecting deficiencies - national laws and regulations				
MN1.2.5	Commissioning building pathologies and diagnostic techniques for indoor air quality	In-depth knowledge of: - remedial and preventive indoor air quality management - the HVAC systems - possible pollutant pathways - hygrothermal behaviour of buildings - possible contaminant sources - durability and service life analysis of materials and components - smart technologies for detecting deficiencies - optimal intervention solutions - national laws and regulations	Commissioning building pathologies and diagnostic techniques for indoor air quality, by combining experimental testing with theoretical calculations and techno-economic assessment to manage measurements and evaluation. Interface managing of building occupants, and maintenance personnel. Identifying areas outside optimal performance by continually gathering and analyzing relevant data, and helping operators resolve the issues.	W	5	D, Cn, B, U
MN1.2.6	Assuring the quality of building performance	In-depth knowledge of: - building pathologies and diagnostic techniques relevant to indoor air quality (e.g., envelope leaks, condensation issues) - smart technologies for detecting deficiencies - initial intervention solutions	Providing initial building disease diagnosis for indoor areas to identify possible failures, and executing sustainable strategies that lead to an initial improvement of the situation.	B	5	Co, B, U

Table A.89 – MN1.3 – Estimation of materials service life

MN1.3	Estimation of materials service life					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
MN1.3.1	Understanding the materials and product's service life	Minimal knowledge of: - factors that affect the service life of a product - LCA and LCC methodologies - environmental impacts of construction materials' replacement.	Understanding and discussing the materials and products' service life in use, and the replacement impacts of the construction materials.	W	1	Co
MN1.3.2	Calculating service life using BIM tools	Basic knowledge of: - default service life of the products - end of life calculation method - service life calculation method - technical standards and regulations.	Calculating service life and replacement impacts of the construction materials using BIM.	W	2	Co
MN1.3.3	Calculating the product-specific service life values per manufacturer	Basic knowledge of: - Product-specific service life - the settings from the EPD for the products - technical standards and regulations.	Estimating the product-specific service life values, per manufacturer based on the settings from the EPD.	W	2	Co
MN1.3.4	Estimating end of Life Scenarios for Construction Products	Medium knowledge of: - end of Life Scenarios for Construction Products (e.g., market-based end-of-life scenario, EPD end-of-life scenario, etc.) - life cycle stages based on the standards	Estimating end of life scenarios for construction products in a project, and proposing design solutions and building products based on the project requirements.	W	3	Co, D

MN1.3	Estimation of materials service life					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- end of life calculation method - technical standards and regulations.				
MN1.3.5	Estimating the service life prediction (SLP) of the envelopes components	Medium knowledge of: - material durability factors of the construction elements - the building components' serviceability factors, concerning climate change impacts - the properties of building materials and their testing methods - LCC assessment of the components, their replacement time, and type of maintenance or adaptation interventions.	Estimating the service life of the construction systems of outer walls and roofs (envelopes) based on the reference service life. Performing standardized calculation methods and/ or simulations. Performing building material tests, and interpreting the properties of building materials.	W	3	Co, D, U
MN1.3.6	Estimating the service life prediction (SLP) of mechanical, electrical, plumbing (MEP) building equipment	Medium knowledge of: - technical service life setting for MEP building equipment - the properties of building materials/ products and their testing methods - LCC assessment of the components, their replacement time, and type of maintenance or adaptation interventions.	Estimating the service life (maintenance, repair, replacement, refurbishment, operation) of MEP building equipment, and comparison with sustainable products, based on the product and use conditions. Performing the product tests, and interpreting the properties of the products.	W	3	Co, D, U
MN1.3.7	Estimating the service life prediction (SLP) of the outer surfaces of internal elements	Medium knowledge of: - service life of outer surfaces of internal elements - material design for excellence frameworks - the properties of building materials and their testing methods - LCC assessment of the components, their replacement time, and type of maintenance or adaptation interventions.	Estimating the service life of the outer surfaces of internal elements (finishing materials), specifically for retail and hotel projects that replace more often. Performing building material tests, and interpreting the properties of building materials.	W	3	Co, D, U
MN1.3.8	Estimating the service life prediction (SLP) of the operational energy and water use	Medium knowledge of: - operational energy use (e.g. operation of the heating system and other building-related installed services) - the properties of building materials/ products and their testing methods - LCC assessment of the components, their replacement time, and type of maintenance or adaptation interventions.	Estimating the life cycle stage of the operational energy and water use of the buildings. Performing building material/products tests, and interpreting the properties of building materials.	W	3	Co, D, U
MN1.3.9	Programming performance-based capital investments	Advanced knowledge of: - estimated service life of the products - interdisciplinary approach for consideration of different factors - material design for excellence framework - End-to-end material lifecycle management - the properties of building materials/ products and their testing methods - LCC assessment of the components, their replacement time and type of maintenance and adaptation - technical standards and regulations.	Programming performance-based capital investments for the entire service life (and its maintenance and replacement cycles, including the link to operational expenditure) in a building.	W	4	D, U

MN1.3	Estimation of materials service life					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
MN1.3.10	Performing material life cycle management process	In-depth knowledge of: - selective construction/deconstruction planning, and methods to recover components - transition from a linear economic model towards a circular model - value chain of the built environment - end-to-end material and substance management process - relevant environmental data - technical standards and regulations.	Performing material life cycle management process, through interface management of multiple stakeholders (Designers and Engineers, Environmental managers, Health and Safety officers, etc.), using appropriate tools.	W	5	D

A.4.5 Thematic field: Built Environment Certification systems

A.4.5.1 Macro Area: BE1 - Building sustainability certification

Table A.90 – BE1.1 – Energy Performance Certification

BE1.1	Energy Performance Certification					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
BE1.1.1	Understanding the importance of energy efficiency	Minimal knowledge of: - energy efficiency; - energy certificates.	Taking part in discussions regarding energy efficiency	W	1	Co
BE1.1.2	Understanding the positive impact on the energy transition through energy management and energy building retrofits	Minimal knowledge of: - energy efficiency; - energy certificates; - energetic building retrofit.	Discussing the benefits of energy building retrofits.	W	1	Co
BE1.1.3	Applying specific legislation, interpreting indicators and standards in the energy sector	Basic knowledge of: - energy regulations and technical standards requirements; - energy efficiency; - energy certificates.	Applying indicators and standards of energy efficiency. Consulting existing energy databases.	W	2	Co, D
BE1.1.4	Applying basic solutions for energy performance	Basic knowledge of: - energy regulations and technical standards requirements; - energy efficiency and performance; - energy certificates; - tools and software for energy simulation.	Performing simplified energy simulation to verify energy performance and its compliance with energy performance certification (EPC) requirements. Proposing basic solutions to improve energy efficiency.	W	2	Co

BE1.1	Energy Performance Certification					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
BE1.1.5	Analysing building designs and documents compliance for EPC	Medium knowledge of: - energy regulations and technical standards requirements; - energy efficiency and performance; - energy certificates; - tools and software for energy simulation; - building energy systems.	Analysing building designs and documents compliance for EPC. Performing energy simulation and calculations. Identifying energy conservation opportunities.	W	3	Co, D
BE1.1.6	Performing an energy analysis for EPC	Advanced knowledge of: - energy regulations and technical standards requirements; - energy efficiency and performance; - energy certificates; - building energy systems; - building envelope; - building science; - tools and software for energy simulation; - EPC requirements.	Evaluating and analysing energy use in a building. Identify energy conservation opportunities and making recommendations where consumption can be reduced or optimised. Undertaking energy efficiency assessments.	W	4	Co, D
BE1.1.7	Developing an EPC	In-depth knowledge of: - energy regulations and technical standards requirements; - energy efficiency and performance; - energy certificates; - building energy systems; - building envelope; - building science; - tools and software for energy simulation; - EPC requirements - energy measurement techniques.	Evaluating and analysing energy use in a building. Evaluating building envelope systems designs. Developing an energy audit strategy and plan. Providing an economic analysis. Making energy calculations. Developing an energy efficiency assessment.	W	5	Co, D, Cn
BE1.1.8	Auditing energy systems during construction	In-depth knowledge of: - energy regulations and technical standards requirements; - energy efficiency and performance; - energy certificates; - building energy systems; - building envelope; - building science; - systems measurement; - EPC requirements.	Auditing energy system and building envelope during the construction stage. Evaluating building envelope systems in the mid-construction stage. Verifying tender documents and procurements for building energy systems. Verifying compliance with EPC developed for the design stage. Providing analysis report and making suggestions for improvements.	W	5	Cn, B
BE1.1.9	Commissioning energy systems	In-depth knowledge of: - energy regulations and technical standards requirements; - energy efficiency and performance; - energy certificates; - building energy systems; - building envelope; - building science; - systems measurement;	Testing energy systems. Verifying construction documents and equipment datasheets. Evaluating systems performance and operation. Verifying compliance with EPC developed for the design stage. Providing analysis report.	W	5	B

BE1.1	Energy Performance Certification					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- EPC requirements.				
BE1.1.10	Auditing energy systems for recertification	In-depth knowledge of: - energy regulations and technical standards requirements; - energy efficiency and performance; - energy certificates; - building energy systems; - building envelope; - building science; - systems measurement; - EPC requirements - energy data analysis.	Auditing energy systems for recertification. Evaluating building operations and energy data. Developing a monitoring plan within the scope of the energy audit and calculating the energy savings. Assessing energy savings and making corrective actions. Developing the energy certificate.	W	5	U

Table A.91 – BE1.2 – Building sustainability certification systems

BE1.2	Building sustainability certification systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
BE1.2.1	Understanding of sustainability assessment methodologies	Minimal knowledge of: - sustainability concepts; - sustainability assessment; - green buildings.	Understanding sustainability concepts and the impacts of the construction sector. Discussing sustainability assessment methodologies.	W	1	Co
BE1.2.2	Understanding building sustainability certification (BSC) systems processes	Minimal knowledge of: - green buildings; - sustainability concepts; - SDGs; - BSC systems.	Participating in discussions within the project concerning the certification processes and rules.	B, W	1	Co, Cn
BE1.2.3	Applying a sustainability certification process	Basic knowledge of: - green buildings; - sustainability concepts; - SDGs; - BSC systems - sustainable construction; - technical standards and regulations.	Recognizing and reflecting impacts on sustainability and determining holistic planning. Applying a triple bottom line approach.	W	2	Co, D
BE1.2.4	Selecting the appropriate sustainability certification system	Medium knowledge of: - green buildings; - sustainability concepts; - SDGs; - BSC systems - sustainable construction; - technical standards and regulations; - sustainable guidelines.	Analysing building designs and selecting and BSC system for a project. Proposing sustainable solutions. Explaining BSC requirements. Checking synergies between disciplines and opportunities to improve the sustainability of a project.	W	3	Co, D, U

BE1.2	Building sustainability certification systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
BE1.2.5	Facilitating and supporting project teams in pursuing a sustainability certification	Advanced knowledge of: - green buildings; - sustainability concepts; - SDGs; - BSC systems - sustainable construction; - technical standards and regulations; - sustainable guidelines; - integrated design process (IDP); - BIM.	Leading the project team in pursuing a sustainability certification. Evaluating sustainable aspects of the project and how to improve them. Facilitating cross-project consideration and collaboration on solutions to scheme compliance, target setting, and performance monitoring. Providing a cost-benefit analysis for the BSC solutions.	W	4	Co, D, Cn, B, U
BE1.2.6	Evaluating building documents compliance with BSC requirements	Advanced knowledge of: - green buildings; - sustainability concepts; - SDGs; - BSC systems - sustainable construction; - technical standards and regulations; - sustainable guidelines; - integrated design process (IDP); - BIM.	Evaluating building documents compliance with the BSC requirements. Monitoring design changes and materials specifications. Inspecting site construction and evaluating procurement documents. Reviewing the documentation. Providing analysis reports.	W	4	Co, D, Cn, B, U
BE1.2.7	Managing a sustainability certification process	In-depth knowledge of: - green buildings; - sustainability concepts; - SDGs; - BSC systems - sustainable construction; - technical standards and regulations; - sustainable guidelines; - integrated design process (IDP); - BIM - practical rules, implications, and steps of a certification process.	Defining a work plan to manage the certification process during the design and construction of a building. Developing a certification strategy for the project. Managing the team to work efficiently and comply with the BSC requirements. Managing the certification process within the sustainability certification organizations. Administering documentation and certification process of a project.	W	5	Co, D, Cn, B, U
BE1.2.8	Optimising building performance through the BSC system	In-depth knowledge of: - green buildings; - sustainability concepts; - SDGs; - BSC systems - sustainable construction; - technical standards and regulations; - sustainable guidelines; - integrated design process (IDP); - BIM; - building systems;	Optimising building sustainable performance through the BSC system. Using BSC guidelines to identify opportunities to achieve synergies across disciplines and building systems. Performing dynamic simulations to evaluate and optimise building systems. Creating design and construction solutions to reach sustainable goals taking into consideration the BSC system guidelines.	W	5	Co, D, Cn, B, U

BE1.2	Building sustainability certification systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- the interconnectivity of systems; - construction technologies; - synergies across disciplines.				
BE1.2.9	Implementing a sustainable strategy in the site construction	In-depth knowledge of: - green buildings; - sustainability concepts; - SDGs; - BSC systems - sustainable construction; - technical standards and regulations; - sustainable guidelines; - BIM; - building systems; - the interconnectivity of systems; - construction technologies - collaborative methods for contracts (e.g., Integrated Project Delivery Method - IPD).	Developing and implementing a sustainable strategic plan for the site construction. Verifying compliance with the BSC requirements. Developing and implementing the best sustainable practices for the site construction. Monitoring construction activities to achieve sustainable goals. Orienting and training construction site workers, maintenance and operations staff. Hosting regular site meetings to review design approach and sustainable practices.	W	5	Cn, B
BE1.2.10	Commissioning building system in compliance with the BSC requirements	In-depth knowledge of: - green buildings; - sustainability concepts; - SDGs; - BSC systems - sustainable construction; - technical standards and regulations; - sustainable guidelines; - BIM; - building systems; - the interconnectivity of systems; - construction technologies - common practice in measuring, - building automation and mechanisms of regulation and control.	Testing building systems and their interoperability. Ensuring, through documented verification, that all building systems perform interactively according to the design intent. Verifying construction documents and equipment datasheets. Evaluating systems performance and operation. Providing analysis report.	W	5	B
BE1.2.11	Implementing a sustainability certification for operation and maintenance	In-depth knowledge of: - green buildings; - sustainability concepts; - SDGs; - BSC systems for operations and maintenance; - technical standards and regulations; - sustainable guidelines for building operation; - BIM; - building management systems; - the interconnectivity of systems; - common practice in measuring, - building automation and mechanisms of regulation and control.	Developing and implementing a sustainable strategic plan for the building operation and maintenance. Testing building systems. Evaluating building performance and verifying compliance with the BSC requirements. Verifying datasheets, data analysis, building analysis reports, energy and water data. Integrating BIM models and digital inspection systems to improve building performance. Monitoring building performance.	W	5	U
BE1.2.12	Integrating BIM and building sustainability certification systems	In-depth knowledge of: - BIM methodology; - BSC systems);	Integrating BSC systems in a BIM model. Using BIM to evaluate sustainable performance in buildings. Designing solutions to enhance building	W	5	Co, D, Cn, B, U

BE1.2	Building sustainability certification systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- BIM dimensions (especially 7D); - Common data environment (CDE); - IFC (Industrial Foundation Class); - BIM Tools and software; - technical standards and codes.	sustainability. Extracting data from the BIM model to document BSC approaches.			

A.4.5.2 Macro Area: BE2 - Small Urban scale assessment systems

Table A.92 – BE2.1 – Small Urban scale assessment certification systems

BE1.3	Small Urban scale assessment certification systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
BE2.1.1	Understanding the importance of sustainable communities concepts	Minimal knowledge of: - sustainability concepts; sustainable communities concepts and their benefits.	Understanding sustainable communities concepts (e.g., energy communities, green mobility, district systems, etc).	W	1	Co
BE2.1.2	Understanding certification systems processes for small urban areas	Minimal knowledge of: - sustainability concepts; - SDGs; - sustainability certification systems for small urban areas.	Participating in discussions within the project concerning the certification processes and rules.	W	1	Co
BE2.1.3	Applying a sustainability certification process for small urban areas	Basic knowledge of: - sustainability concepts; - SDGs; - sustainability certification systems for small urban areas; - renewable energy communities; - green mobility.	Recognizing and reflecting impacts on sustainability and determining holistic planning for small urban areas. Applying triple bottom line approach.	W	2	Co, D
BE2.1.4	Selecting the appropriate sustainability certification system	Medium knowledge of: - sustainability concepts; - SDGs; - sustainability certification systems for small urban areas; - renewable energy communities; - green mobility - green infrastructure and connectivity; - technical standards and regulations.	Analysing designs and selecting a sustainable certification system for small urban areas. Proposing sustainable solutions on a cluster scale. Explaining certification system requirements. Checking synergies between disciplines and opportunities to improve the sustainability of a project.	W	3	Co, D, U
BE2.1.5	Facilitating and supporting project teams in pursuing a	Advanced knowledge of: - sustainable communities; - sustainability concepts;	Leading the project team in pursuing a sustainability certification. Evaluating sustainable aspects of the project and how to improve them. Facilitating cross-	W	4	Co, D, Cn, B, U

BE1.3	Small Urban scale assessment certification systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
	sustainability certification	- SDGs; - sustainability certification systems for small urban areas; - renewable energy communities; - green mobility - green infrastructure and connectivity; - technical standards and regulations; - sustainable guidelines; - integrated design process (IDP).	project consideration and collaboration on solutions to scheme compliance, target setting, and performance monitoring. Providing a cost-benefit analysis to pursue the certification. Evaluating economic and technical aspects of energy systems and the feasibility of a cluster becomes a renewable energy community. Providing cost-benefit analysis. Analysing technical standards and local regulations.			
BE2.1.6	Facilitating citizen participation process to establish sustainable goals to a small urban areas	Advanced knowledge of: - sustainability concepts; - SDGs; - sustainability certification systems for small urban areas; - renewable energy communities; green mobility; - citizen participation workshops; - standards and regulations.	Facilitating citizen participation processes regarding small urban planning, preparing working sessions and developing content. Establishing sustainable goals. Using a certification system for small urban areas as a guideline.	W	5	Co, D
BE2.1.7	Evaluating project documents compliance	Advanced knowledge of: - sustainable communities; - sustainability concepts; - SDGs; - sustainability certification systems for small urban areas; - renewable energy communities; - green mobility; - green infrastructure and connectivity; - technical standards and regulations; - sustainable guidelines; - integrated design process (IDP).	Evaluating project documents compliance with the sustainability certification requirements. Monitoring design changes and materials specifications. Inspecting site construction and evaluating procurement documents. Reviewing the documentation. Providing analysis reports.	W	5	Co, D, Cn, B, U
BE2.1.8	Managing a sustainability certification process	In-depth knowledge of: - sustainable communities; - sustainability concepts; - SDGs; - sustainability certification systems for small urban areas; - renewable energy communities; - green mobility - green infrastructure and connectivity; - technical standards and regulations; - sustainable guidelines; - integrated design process (IDP); - practical rules, implications, and steps of a certification process.	Defining a work plan to manage the certification process during the design and construction. Developing a certification strategy for the project. Managing the team to work efficiently and comply with the certification requirements. Managing the certification process within the sustainability certification organizations. Administering documentation and certification process of a project.	W	5	Co, D, Cn, B, U
BE2.1.9	Integrating Small Urban Sustainability Assessment methods in a DIM framework	In-depth Knowledge of: - DIM and BIM methodologies; - Urban Sustainability Assessment methods; - Geographic Information System (GIS) information; - BIM dimensions (especially 7D); - Common data environment (CDE); - interoperability of systems;	Integrating Urban Sustainability Assessment methods in a DIM framework. Using BIM to evaluate sustainable performance in buildings and GIS for spatial analysis. Designing solutions to enhance sustainability in clusters.	W	5	Co, D

BE1.3	Small Urban scale assessment certification systems					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- IFC (Industrial Foundation Class); - CityGML; - integration of BIM and GIS tools; - BIM Tools and software; - standards and codes.				

A.4.6 Thematic field: Interdisciplinary Skills

A.4.6.1 Macro Area: IS1 – Procurement

Table A.93 – IS1.1 – Green Procurement

IS1.1	Green Procurement					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
IS1.1.1	Understanding the importance of green procurement	Minimal knowledge of: - sustainable resource management from a life cycle perspective - triple bottom line - B Corporation (certification) - benefits and important aspects of green procurement	Understanding the important aspects of sustainable procurement, and the longe term impacts of each purchase. Promoting sustainable procurement in a workplace.	W	1	Co
IS1.1.2	Evaluating and proposing basic solutions for green purchasing	Basic knowledge of: - sustainable resource management from a life cycle perspective - green purchasing strategies - financial impacts of green products and services	Evaluating and proposing the potential alternative approaches relevant to green purchasing and supply chain management practices, based on the requirements of a project. Evaluating the financial impacts of inclusion of environmental criteria in the procurement.	W	22	Co
IS1.1.3	Managing the environmental criteria for the selection of suppliers	Medium knowledge of: - indicators of green procurement for supplier management - environmental criteria and standards for selection and exclusion of suppliers - environmentally responsible supply chain management - Environmentally Preferable Purchasing (EPP) products - CSR specifications	Determining alternative criteria for selection and exclusion of suppliers, in terms of their compliance requirements to have responsible environmental management (e.g., being CSR audited, the licences and relevant certificates, etc.), based on the project's requirements. Creating a supplier database that can fulfil the procurement contract and provide the best value for money.	W	3	Co, D
IS1.1.4	Preparing the tender documentation in a conventional contract	Medium knowledge of: - Integrated Project Delivery (IPD) procurements (e.g., design-build-operate-maintain (DBOM), and design-build (DB) contracts)	Preparing the tender documentation, corresponding to the procurement of project-related needs, based on the green procurement requirements and	W	3	D

IS1.1	Green Procurement					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- Environmentally Preferable Purchases (EPP) - existing schemes and tools for tender procurement	specifications, for Integrated Project Delivery (IPD) contracts.			
IS1.1.5	Managing green procurement for products and services	Advanced knowledge of: - Integrated Project Delivery (IPD) - sustainability requirements for products and services - indicators of green procurement for procurement management - interface management - CSR specifications - standards and legal requirements	Determining products and services, meeting environmental and social objectives of green procurement, for the project. Assessing, reviewing, and prioritizing the elements of the green procurement, technical requirements, and the best price considerations, by managing information between the core design teams (Architects, Service engineers, Structural engineers, Specialist environmental consultants, and Cost consultants).	W	4	Co, D
IS1.1.6	Optimising and measuring the performance of a green procurement	In-depth knowledge of: - Integrated Project Delivery (IPD) - the contracting authority's performance requirements - sustainability requirements for products and services - indicators of green procurement for procurement management - CSR specifications in procurement - standards and legal requirements	Assuring the effective implementation of the process of green procurement. Auditing the procurement, Monitoring the performance to troubleshoot issues or barriers to the implementation of GP requirements, and identifying potential savings.	W	5	D, Cn, B

A.4.6.2 Macro Area: IS2 - Quality assurance

Table A.94 – IS2.1 – Quality assurance planning and management

IS2.1	Quality assurance planning and management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
IS2.1.1	Understanding the contents of quality assurance planning	Minimal knowledge of: - quality assurance framework - contents of a quality assurance planning and management	Performing preliminary assistance services regarding the preparation of quality assurance planning and management.	W	1	Co
IS2.1.2	Defining the integrated design approach in the project	Basic knowledge of: - construction plans and specifications - quality assurance framework	Defining the strategies that optimise quality assurance requirements throughout the construction	W	2	Co

IS2.1	Quality assurance planning and management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- overall environmental quality requirements for the project - aspects of the integral planning process (Collaboration of multiple disciplines to inform a building, its benefits, etc.)	phase and into operations, and optimising planning in terms of problem/ solution issues.			
IS2.1.3	Proposing and selecting legal responsibilities of quality assurance auditing	Basic knowledge of: - construction plans and specifications - quality assurance framework - regulations and legal requirements	Proposing the legal responsibilities of the auditor within the project team. Monitoring the compliance of the documents with industry standards, laws, and guidelines.	W	2	Co, D
IS2.1.4	Proposing and selecting the quality procedures in relation to the Quality Assurance	Basic knowledge of: - construction plans and specifications - quality procedures framework - the context of a specific organisation	Performing simplified evaluation of the current system and processes, and proposing alternative corrective actions to prevent the risks.	W	2	Co, D
IS2.1.5	Determining the Quality Assurance auditing concept	Medium knowledge of: - quality assurance audit tasks based on different projects (conducting QA systems, conformance, compliance, process, etc.) - regulations and legal requirements	Determining the quality assurance auditing concept (objectives, and process activities such as testing, and evaluation requirements).	W	3	Co, D
IS2.1.6	Determining Environmental Management (EM) Quality Assurance concepts	Medium knowledge of: - the construction plans and specifications - quality assurance requirements - EM quality systems - lifecycle QA expectations - regulations and legal requirements	Determining the environmental management quality assurance framework at the early phase, based on the performance requirements needed.	W	3	Co
IS2.1.7	Developing Quality Assurance Plan	Advanced knowledge of: - construction plans and specifications - quality assurance framework and plans, reflecting the quality assurance strategy and deliverables for the coming year - EM quality systems - regulations and legal requirements	Assessing the design activities (design inputs, design criteria, design change control process) to ensure adequate and appropriate quality assurance requirements are defined within the specifications of the engineering decisions. Determining corrective actions for the addressed problems in the documents. Developing operating-level plans.	W	4	D, Cn, B, U
IS2.1.8	Commissioning quality assurance auditing	In-depth knowledge of: - construction plans and specifications - quality auditing and certification activity - EM quality systems - requirements of the defined quality regulations and customer expectations - regulations and legal requirements	Performing Quality Assurance Audit based on the Quality Assurance Plan. Ensuring that Structures, Systems, and Components will perform as expected, and taking effective corrective actions where deficiencies are identified. Developing Final Project Closeout Report.	W	5	D, Cn, B

IS2.1	Quality assurance planning and management					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
IS2.1.9	Managing quality assurance of energy-saving contracts	In-depth knowledge of: - construction plans - EM quality systems - project management methodologies for quality assurance of energy-saving contracts from the planning of energy audit, to the implementation and monitoring of energy efficiency results.	Performing project management for quality assurance of energy saving contracts and organise audit processes	W	5	D, Cn, B
IS2.1.10	Discussing the basic quality control for a renewable energy product	Medium knowledge of: - technical risks of a renewable energy product - quality assurance of the product and services	Discussing how a renewable energy product can be tested for finding the possible technical risks during its use stage to meet the expectations of its quality assurance, building up a market trust to scale up its deployment.	B	3	Co
IS2.1.11	Ensuring quality assurance of installations	In-depth knowledge of: - the construction plan and specifications - inspection plan that covers installation - quality assurance of a product and service	Ensuring the quality of an installed item, based on the quality assurance requirements.	B	5	B

A.4.6.3 Macro Area: IS3 - Collaboration and Communication

Table A.95 – IS3.1 – Motivation and communication - Design Team

IS3.1	Motivation and communication - Design Team					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
IS3.1.1	Understanding effective communication technics	Basic knowledge of: - principals of high-performance teams - effective communication strategies that influence motivation and innovation - communication competencies for engineers (i.e., oral presentation, public speaking, writing and team communication)	Understanding the importance of effective and efficient communication in a design team, how to communicate to support inclusion and equality, and the benefits of teamwork.	W	1	Co
IS3.1.2	Communicating design	Basic knowledge of: - principals of high-performance teams - communication competencies for engineers (i.e., oral presentation, public speaking, writing and team communication) - advising clients, and basic deals requirements - technical explanation, and regulation requirements - the role of clients about the costs and benefits of SB - remote communication tools	Providing advice to clients regarding environmental requirements of a product or service in the design and construction process. Articulating considered design decisions and approaches (specifications or features of a product or service), and the regulatory requirements to non-designer stakeholders (and designers) effectively, using presentation materials.	W	2	Co, D, B
IS3.1.3	Providing advisory service for clients	Medium knowledge of: - communication competencies for engineers (i.e., oral presentation, public speaking, writing and team communication) - technical knowledge, brakes and levers of sustainable design and renovation - data gathering and analysing skills - remote communication tools	Applying interpersonal communication skills and basic leadership competencies for advising and supporting a client effectively during the design process. Identifying the clients' needs and providing suitable solutions.	W	3	Co, B

IS3.1	Motivation and communication - Design Team					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
IS3.1.4	Supervising and coordinating of the design team in a sustainable building process	Advanced knowledge of: - integrated design approach to recognise sustainability aspects - collaborative working methods - principals of high-performance teams - features of entrepreneurship mindset - learning skill - commercializing an idea to generate value-added products and services - critical examination and reformulation of requirements and solutions - background knowledge of different technical professionals	Encouraging designers to utilize their technical knowledge to find sustainable alternative design solutions, and new innovative opportunities that fulfil the demanding requirements. Stimulating a team's understanding of the design that needs to be produced collectively and collaboratively, and assuring the information flow.	W	4	Co, D
IS3.1.5	Communication and marketing in relation to all the aspects connected to the energy audit process and building efficiency	Advanced knowledge of: - principles of business communication (technical and financial, strategic and operational marketing, etc.) - communication techniques to advise technical and non-technical end-users - aspects of the energy audit and energy audit process - supply chain - background knowledge of different technical professionals	Articulating and well-communicating concepts and ideas with technical and non-technical persons, concerning the aspects connected to the energy audit process, and building efficiency regarding the client's goals, needs and expectations.	W	4	Co, D, B
IS3.1.6	Managing interdisciplinary areas of a project (design teams) and external business communications in a sustainable building process	In-depth knowledge of: - principals of high-performance teams - close the academic and industry knowledge void - collaborative working methods and system integration requirements - business communication techniques in an ethical and professional manner - elements of a negotiation process - effective methods of information management	Managing the process of interdisciplinary collaboration with multiple disciplines, and integrating the knowledge of managers, specialists and suppliers (design and construction) to work complementarily, to form a sustainable building. Negotiating solutions to facilitate the design process, within the internal and external communities.	W	5	Co, D, Cn

A.4.6.4 Macro Area: IS4 - Information management

Table A.96 – IS4.1 – Management of information in a design process

IS4.1	Management of information in a design process					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
IS4.1.1	Understanding the importance of multidisciplinary management of information	Basic knowledge of: - multidisciplinary design team (IDP) using BIM and BES - multilevel requirements of SBs - integrated design process	Understanding the importance of multidisciplinary management of information between the design teams (Architects, Structural engineers, environmental consultants, Cost consultants, etc), regarding the performance optimisation of SBs.	W	1	Co
IS4.1.2	Analyzing costs, risks and market value	Minimal knowledge of: - sustainability considerations in financing processes and lending procedures - property databases including SB indices - linkage of SB with the corporate policies and market-related issues - value–performance – quality approach - interface agreements (IAs) management	Analyzing costs, risks and market value, based on the initial design developments of the project design teams, and reporting cost information to design teams and the stakeholders. Performing simulation tools to help integrate design development.	W	2	Co, D, Cn
IS4.1.3	Managing evidence-based design decisions	Medium knowledge of: - multidisciplinary design process for executing sustainable design - the concepts of Building Information Model (BIM), Integrated Project Delivery (IPD), Integrated Design Process (IDP) and Building Energy Simulation (BES) - the design of high performance buildings	Supervising evidence-based design decisions (including BES) to optimize the design process. Coordinating using BIM for a fluid communication among design consultants as the central repository of data.	W	3	Co, D, Cn
IS4.1.4	Managing information between interface stakeholders	Advanced knowledge of: - multidisciplinary design process for executing sustainable design - interaction of suppliers, professionals and users - interaction of components and the general performance of SBs - the concepts of BIM, IPD, IDP and BES - high performance buildings - interface management system (IMS)	Managing information and deliverables between interface design teams and stakeholders (the owner, the developer, the builder, the tenant and the facility operator). Coordinating loops of discussion and analysis, for the choice of MEP systems (mechanical, electrical and plumbing), the environmental strategies and other design alternatives, using basic massing analysis (e.g., BES tools).	W	4	Co, D
IS4.1.5	Commissioning the project, using BIM	In-depth knowledge of: - interaction of components and the general performance of SBs - design collaboration management - interface management during the construction phase - the concepts of BIM, IPD, IDP and BES - high-performance buildings - Building Information Modelling (BIM)	Assuring that the performance goals are reached, and managing interface problems during the construction phase through interdisciplinary coordination of all parties involved in the process, including designers (structural, MEP, etc.), assessors and verification methods (post-occupancy analysis, building commissioning, BES), and installers. Commissioning the project through using BIM to streamline the construction process, the building's performance and clash detection.	W	5	Cn, B, U

A.4.6.5 Macro Area: IS5 - Safety Assurance

Table A.97 – IS5.1 – Risk prevention, safety, and health of workers

IS5.1	Risk prevention, safety, and health of workers					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
IS5.1.1	Understanding occupational safety and health (OSH)	Minimal knowledge of: - responsibility and accountability of the employers, and workers' rights - occupational safety and health management systems and environmental knowledge - national laws and regulations	Understanding occupational safety and health, as well as workers´ rights. Discussing the relevant issues during the construction process with the project team.	W	1	Cn
IS5.1.2	Providing employees with safety training	Basic knowledge of: - labour and working conditions in contractors management plans - hazards and risks within a workplace, and control measures to minimise exposure to the risks - hazards and risks affecting specific tasks or operations, and how to work safely - measures to be taken in an emergency - environmental knowldege - safety provision requirements on workplaces based on the regulations - occupational exposure standards and guidelines (OSHA PELs, NIOSH RELs, etc.)	Providing employees with instruction, information and training necessary to ensure their health and safety, as well as the rights of the workers, and the ways in which they help reduce environmental impact during the construction process.	W	2	Co, D, Cn
IS5.1.3	Providing employers with safety training	Medium knowledge of: - responsibility and accountability of the employers, and workers' rights in contractors' management plans - occupational safety and health management systems - environmental management (e.g., noise level monitoring, dust reduction technology, heat level mapping, health monitoring approaches for workers affecting specific tasks) - environmentally responsible supply chain management - national laws and regulations - occupational exposure standards and guidelines (OSHA PELs, NIOSH RELs, etc.)	Providing employers with interdisciplinary instruction, information and training necessary to ensure occupational health and safety of their employers. Defining the environmental responsibilities of employers during the design decision, and constructions process.	W	3	Co, D, Cn
IS5.1.4	Proposing conceptual model for occupational safety and health	Medium knowledge of: - contractors' management plan - the connections between sustainability and OSH targets - potential actions for leveraging sustainability to advance worker safety and health - hazardous products and services in construction developments - safety provision requirements on workplaces based on the regulations - environmentally responsible supply chain management - occupational exposure standards and guidelines (OSHA PELs, NIOSH RELs, etc.)	Proposing solutions to integrate occupational safety and health (OSH) issues into the design and construction process and the benefits of doing so, addressed to the decision-makers. Auditing compliance of first-tier suppliers' facilities with OSH standards (manufacturing, production, or warehousing facilities that have OSH management systems auditing).	W	3	Co, D, Cn
IS5.1.5	Auditing performance	Advanced knowledge of: - occupational safety and health management systems - risk management process, and job safety analyses	Developing an integrated safety management plan into the planning and design stages of a construction project, and ensuring that the work practices are	W	4	Co, D, Cn

IS5.1	Risk prevention, safety, and health of workers					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- hazardous products and services in construction developments - key OSH risks and mitigation strategies - environmentally responsible supply chain management - national laws and regulations	complying with the law. Providing a practical knowledge of key duty holder requirements under the Construction, Design and Management (CDM) Regulations. Managing risks to protect workers in the construction process, and devising actions for improvements (preventive and corrective actions, continual improvements) to ensure the hazards and risks cannot cause harm to workers. Providing leadership for OSH activities in the organization.			
IS5.1.6	Ensuring safety, health, and welfare of the workers	In-depth knowledge of: - occupational safety and health management systems - risk management process, and job safety analyses - hazardous products and services in construction developments - key OSH risks and mitigation strategies - environmental management (e.g., noise level monitoring, dust reduction technology, heat level mapping, health monitoring approaches for workers affecting specific tasks) - national laws and regulations - occupational exposure standards and guidelines (OSHA PELs, NIOSH RELs, etc.)	Evaluating the working environment regarding the safety, health, and welfare of the worker (e.g., providing medical examinations, and assessing the success of worker health programs). Monitoring the implementation of the recommendations. Recognizing opportunities and challenges, and potential actions in the workplace to advance OSH measures. Measuring the impact of safety and health performance on business outcomes. Providing access to data on safety and health for sustainability reporting.	W	5	Cn, B

A.4.7 Thematic field: Listed Buildings

A.4.7.1 Macro Area: LB1 - Improving energy performance of listed buildings

Table A.98 – LB1.1 – Handling and architectural conservation of listed buildings

LB1.1	Handling and architectural conservation of listed buildings					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
LB1.1.1	Promoting a sustainable approach to conservation of the historic built environment	Minimal knowledge of: - basic sustainable approaches to conservation - energy efficiency measures for heritage buildings - standards of rehabilitation projects	Providing relevant information on sustainable practices to relevant professionals, and building owners. Encouraging them to prioritise the incorporation of sustainable knowledge into the practice of renovating historic buildings.	W	1	Co
LB1.1.2	Managing an integrated approach for conservation-compatible solutions	Basic knowledge of: - basic sustainable approaches to conservation - energy efficiency measures for heritage buildings - interface management	Coordinating between planners, local community leaders, private businesses and government officials from the ministry of tourism and culture. Ensuring that the documents are compatible with relevant standards and regulations.	W	2	Co, D, B

LB1.1	Handling and architectural conservation of listed buildings					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
	for retrofitting a listed building	- national planning policy framework and heritage protection regulations and standards				
LB1.1.3	Proposing and selecting basic solutions for optimal methods of conservation	Medium knowledge of: - conservation principles, and policies for sustainable management of the historic environment - energy efficiency measures for heritage buildings - national planning policy framework and heritage protection regulations and standards	Identifying the general principles of heritage care affects a building. Evaluating optimal methods of caring for, and conserving the building that allows for updates and using green building technologies, while protecting historic design and building fabric, and compatibility with the standards and regulations.	W	3	Co
LB1.1.4	Diagnosing building deficiencies	Medium knowledge of: - building pathologies and diagnostic techniques, hypothesis formation, and hypothesis testing - retrofit solutions for listed buildings - evaluation of the HVAC systems - hygrothermal behaviour of the built heritage - conservation principles, and policies for sustainable management of the historic environment - national planning policy framework and heritage protection regulations	Investigating building deficiencies based on diagnosing techniques. proposing alternative optimal interventions for the problems. Performing appropriate tests of the hypothesis and selecting the right tools and professionals in responding to the specific problem.	W	3	Co, B, U
LB1.1.5	Engineering the sustainable conservation-compatible solutions	Advanced knowledge of: - improvement of energy strategy (thermal conditions and weatherproofness) - compatible solutions for historic buildings retrofitting for walls, windows, HVAC systems, and solar technologies - standards of rehabilitation projects - the risks of energy efficiency retrofit measures - national planning policy framework and heritage protection regulations	Engineering an integrated approach for conservation-compatible solutions for retrofitting a listed building, based on environmental performance considerations (e.g., thermal insulation). Identifying effective, cost-efficient and less risky measures that have minimal impact on heritage significance. Performing numerical models concerning the technical risks of retrofit measures.	W	4	D
LB1.1.6	Engineering indoor thermal performance	Advanced knowledge of: - improvement of energy strategy (thermal conditions and weatherproofness) - compatible solutions for historic buildings retrofitting for facades, walls, doors and windows - the risks of energy efficiency retrofit measures - national planning policy framework and heritage protection regulations	Engineering suitable solutions for indoor thermal performance of listed simulations concerning the energy performance of the building.	W	4	D
LB1.1.7	Engineering appropriate renewable energy sources	Advanced knowledge of: - renewable energy sources (ground source heat pumps, solar panels and wind turbines, etc.) - the risks of energy efficiency retrofit measures - national planning policy framework and heritage protection regulations	Engineering suitable renewable energy sources to be appropriately integrated into a listed building. Performing dynamic simulations concerning the energy performance of the building.	W	4	D
LB1.1.8	Engineering indoor water management and sustainable drainage	Advanced knowledge of: - improvement of water-saving strategy (low-flow plumbing fixtures and aerators), runoff and water reuse solutions for historic buildings retrofitting	Engineering suitable solutions for indoor water management and sustainable drainage of listed buildings. Performing dynamic simulations concerning the energy performance of the building.	W	4	D

LB1.1	Handling and architectural conservation of listed buildings					
LO code	**LO Description**	**Knowledge**	**Skill**	**B/W**	**Comp. Level**	**Project's stage**
		- the risks of retrofitting measures - national planning policy framework and heritage protection regulations				
LB1.1.9	Assuring the quality of building elements	In-depth knowledge of: - Repair and maintenance techniques and standards - the risks of energy efficiency retrofit measures - national planning policy framework and heritage protection regulations	Managing regular maintenance, and repair of listed buildings (for rehabilitated and/or existing condition). Diagnosing insulation and infiltration conditions. Evaluating the HVAC systems, lighting conditions, windows and plumbing fixtures. Developing potential actions for the deficiencies.	W	5	Co, B, U
LB1.1.10	Repairing by a new or rewarding local skills	Medium knowledge of: - local traditional skills (craftsmen) for making products (e.g., replacing windows, doors and other similar structures) of the historic buildings - heritage protection standards	Implementing local traditional skills (craftsmen) for making products, such as replacing windows, doors and other similar structures of the historic buildings based on sustainability principles, which operate with a minimal carbon footprint for the repair and adaptation of historic buildings.	B	4	Cn
LB1.1.11	Repairing structures and components	In-depth knowledge of: - repair and maintenance of structures and components of the historic buildings - heritage protection standards	Replacing structures and components of the historic buildings based on sustainability principles.	B	5	Cn

Annex B
(informative)

Applicable Areas of Expertise in relation to Work Fields and recommended minimum competence's levels

Table B.1 - White Collars - Environment

Environment		#1 Architecture	#2 Mech. Eng.	#3 Civil eng.	#4 Electr. Eng.	#5 Envi. Eng.	#6 Energy Eng.	#7 Const Man.	#8 Build.Man.	#9 Financing
EN	**Energy**									
EN1	**Energy Performance Assessment**									
EN1.1	Energy Simulation	2	3	2	2	2	3	1	1	1
EN2	**Energy Management**									
EN2.1	Smart grid systems	1	3	2	3	2	3	2	1	1
EN2.2	Home automation/Domotic systems	2	3	2	3	2	3	2	2	1
EN2.3	Building Management Systems (BMS)	2	3	2	3	2	3	2	2	1
EN2.4	Renewable Energy communities (smart neighbourhoods)	1	3	2	3	2	3	2	1	1
EN3	**Energy Production and HVAC systems**									
EN3.1	Heating and cooling systems	2	3	2	3	2	3	2	1	1
EN3.2	Ventilation systems	2	3	2	3	2	3	2	1	1
EN3.3	Hot water systems (DHW)	2	3	2	3	2	3	2	1	1
EN3.4	Electric heating systems	2	3	2	3	2	3	2	1	1
EN3.5	Heat pump systems and geothermal energy systems	2	3	2	3	2	3	2	1	1
EN3.6	Solar thermal energy systems for heating, cooling and DHW	2	3	2	3	2	3	2	1	1
EN3.7	Solar power systems for electricity generation	2	3	2	3	2	3	2	1	1
EN3.8	Combined Heat and Power (CHP) generation	2	3	2	3	2	3	2	1	1
EN3.9	Mini wind power generation	2	3	2	3	2	3	2	1	1
EN3.10	Energy storage systems (long duration storage, central/ decentralised)	2	3	2	3	2	3	2	1	1
EN4	**Energy Reduction**									
EN4.1	Thermal insulation	3	3	3	2	2	3	2	1	1
EN4.2	Building air tightness	2	3	2	2	2	3	2	1	1
EN4.3	Window and glazing systems	3	3	3	2	2	3	2	1	1
EN4.4	Solar shading systems	3	3	3	2	2	3	2	1	1
EN4.5	Passive systems for cooling and heating	3	3	3	2	2	3	2	1	1
EN4.6	Energy saving strategies for lighting	3	3	3	3	2	3	2	2	1
EN4.7	Mitigation strategies for urban thermal effects	3	3	3	1	3	3	1	1	1
EN4.8	Building occupancy behavior	3	3	2	2	1	3	1	3	1

WA	**Water**									
WA1	**Water efficiency**									
WA1.1	Outdoor water use management	2	3	3	2	1	1	2	2	1
WA1.2	Indoor water use management	3	3	2	1	1	1	2	2	1
WA2	**Effluents management**									
WA2.1	Rainwater collection and reuse systems	3	3	1	1	1	2	2	2	1
WA2.2	Graywater collection and reuse systems	2	3	1	1	1	2	2	2	1
WA2.3	Urban Waste Water Treatment	1	2	3	1	3	1	2	1	1
MA	**Materials**									
MA1	**Design for Deconstruction, reuse and recycling**									
MA1.1	Materials and components for ease of disassembly	3	3	3	1	1	1	3	1	1
MA1.2	Adaptive reuse	3	3	3	3	1	1	3	1	1
MA2	**Sustainable materials**									
MA2.1	Life Cycle Assessment (building scale)	3	3	3	3	2	3	1	1	1
MA2.2	Recycled and reused materials	3	1	3	1	1	1	2	1	1
MA2.3	Regenerative materials and technologies	3	1	3	1	1	3	2	1	1
MA3	**Solid waste**									
MA3.1	Solid waste management	2	2	2	1	2	1	3	2	1
HA	**Habitat**									
HA1	**Land Use**									
HA1.1	Site preservation, regeneration and development	3	na	3	na	3	na	2	1	1
HA1.2	Urban and peri-urban agriculture	2	1	3	1	3	1	1	1	1
HA2	**Biodiversity**									
HA2.1	Management of biodiversity on the site	2	na	2	na	3	na	2	1	1

Table B.2 - White Collars - Society

Society		#1 Architecture	#2 Mech. Eng.	#3 Civil eng.	#4 Electr. Eng.	#5 Envi. Eng.	#6 Energy Eng.	#7 Const Man.	#8 Build.Man.	#9 Financing
CO	**Comfort and well being**									
CO1	**Indoor air quality**									
CO1.1	Low Emitting materials	3	2	3	2	2	3	2	2	1
CO1.2	Indoor air pollutants management	3	3	3	3	3	3	2	2	1
CO1.3	Outdoor air pollutants management	2	3	2	2	3	3	2	1	1
CO2	**Thermal comfort**									
CO2.1	Indoor Thermal Comfort	3	3	3	2	2	3	2	2	1
CO2.2	Outdoor Thermal Comfort	3	2	2	2	3	3	2	1	1
CO3	**Visual comfort**									
CO3.1	Daylighting	3	3	2	3	2	3	2	1	1
CO3.2	Indoor lighting	3	3	2	3	2	3	2	2	1
CO3.3	Outdoor lighting	2	3	2	3	2	3	2	2	1
CO4	**Acoustic comfort**									
CO4.1	Sound insulation	2	3	3	2	2	3	2	2	1
CO4.2	Room acoustics	2	3	3	2	2	3	2	2	1
CO4.3	Indoor noise management	2	3	3	2	2	3	2	2	1
CO4.4	Environmental noise management	2	3	3	2	2	3	2	2	1
CO5	**Electromagnetic pollution**									
CO5.1	Management of indoor exposure to ELF magnetic fields	3	3	2	3	2	3	2	2	1
CO5.2	Management of indoor exposure to RF/MW electromagnetic fields	1	3	2	3	3	3	2	2	1
CO6	**Ergonomics**									
CO6.1	Ergonomic and Active Furnishing	3	1	1	1	na	na	1	2	1
SA	**Safety**									
SA1	**Fire protection**									
SA1.1	Risk to occupants and facilities from fire	3	3	3	3	na	2	2	2	1
SA2	**Earthquacke**									
SA2.1	Risk to occupants and facilities from earthquake	3	2	3	2	na	na	3	2	1
AC	**Accessibility**									

AC1	**Barrier free accessibility**									
AC1.1	Accessibility of public spaces	3	1	2	1	2	1	1	1	1
AC1.2	Design for All	3	1	2	1	2	na	1	1	1
MO	**Mobility**									
MO1	**Alternative mobility**									
MO1.1	Sustainable mobility strategies	2	na	1	1	1	na	na	1	1
SE	**Services**									
SE1	**Communication**									
SE1.1	Communication services	2	2	2	3	1	1	1	1	1
SE2	**Services for inhabitants**									
SE2.1	Functional mix	2	na	1	na	1	na	na	na	1
SE2.2	Infrastructure and connectivity	2	na	2	1	1	na	2	1	na
AD	**Adaptation and resilience to climate change**									
AD1	**Climate chenge resilient buildings**									
AD1.1	Resilience to extreme weather events	2	3	2	2	2	1	2	1	1
AD1.2	Sustainable drainage	2	2	2	1	3	1	2	1	1
AD1.3	Resilience to heatwaves	2	3	2	3	2	3	2	1	1
AD1.4	Resilience to windstorms	2	2	2	2	2	1	2	1	1
AD1.5	Resilience to wildfire	2	1	2	2	3	1	2	1	1

Table B.3 - White Collars - Economy

Economy		**#1 Architecture**	**#2 Mech. Eng.**	**#3 Civil eng.**	**#4 Electr. Eng.**	**#5 Envi. Eng.**	**#6 Energy Eng.**	**#7 Const Man.**	**#8 Build.Man.**	**#9 Financing**
EQ	**Economical quality**									
EQ1	**Cost planning and management**									
EQ1.1	Construction cost planning	3	3	3	3	2	3	3	1	3
EQ1.2	Life cycle cost assessment	3	3	3	3	2	3	2	1	2

EQ2	**Green value**									
EQ2.1	Value creation and risk exposure	2	2	2	2	2	2	1	1	3
EQ2.2	Communication of green building value	3	2	2	2	2	1	1	2	3
EQ3	**Financing schems and business models**									
EQ3.1	Financing schemes for sustainable building	2	2	2	2	2	2	2	1	3
EQ3.2	Business models preparation	2	2	2	2	2	2	2	1	3
EQ4	**Operative costs**									
EQ4.1	Operating and maintenance cost management	3	3	3	3	2	3	1	2	2
EQ4.2	Use stage energy cost management	2	3	2	3	1	3	1	2	2
EQ4.3	Use stage water cost management	2	3	2	2	1	1	1	2	2

Table B.4 - White Collars - Process

Process		**#1 Architecture**	**#2 Mech. Eng.**	**#3 Civil eng.**	**#4 Electr. Eng.**	**#5 Envi. Eng.**	**#6 Energy Eng.**	**#7 Const Man.**	**#8 Build.Man.**	**#9 Financing**
BD	**Sustainable Building Design**									
BD1	**Integrative design**									
BD1.1	Integrated Design Process	3	3	3	3	3	3	3	3	3
BD1.2	Quality of site assessment	3	3	3	3	3	3	2	1	1
BD1.3	Value engineering	2	2	2	2	2	2	2	1	3
ID	**Innovative Digital Solutions**									
ID1	**Building Information Modelling**									
ID1.1	Operation of BIM systems	3	3	3	3	3	3	3	3	3
ID2	**Small urban Information Modelling**									
ID2.1	Operation of DIM systems for small urban areas	2	2	2	2	2	2	1	1	1
ID3	**GIS Systems**									
ID3.1	GIS Systems for design and planning	2	2	2	2	2	2	2	2	1
ID4	**Lean Management**									
ID4.1	Lean Management solutions	2	2	2	2	2	2	2	2	3
ID5	**Measuring**									

ID5.1	Smart meters	2	3	2	3	2	3	2	3	1
ID5.2	Smart Building Sensors	2	3	2	3	2	3	2	3	1
ID6	**Digital Twins Solutions**									
ID6.1	Digital Twins systems	2	2	2	2	2	2	2	2	2
SC	**Sustainable costruction**									
SC1	**Sustianable construction management**									
SC1.1	Construction Activity Pollution Management	2	2	2	2	2	2	3	3	1
SC1.2	Sustainability awareness	2	2	2	2	2	2	2	2	2
MN	**Maintenance and operating**									
MN1	**Maintenance**									
MN1.1	Building maintenance	3	2	2	2	2	2	2	3	1
MN1.2	Building degradation diagnosis	3	3	3	3	1	3	2	3	1
MN1.3	Estimation of materials' service life	3	3	3	3	3	3	2	2	1
BE	**Built Environment Certification systems**									
BE1	**Building sustainability certification**									
BE1.1	Energy Performance Certification	3	3	3	3	2	3	2	2	1
BE1.2	Building sustainability certification systems	3	3	3	3	2	3	2	2	1
BE2	**Small Urban scale assessment systems**									
BE2.1	Small Urban scale sustainability assessment systems	3	1	1	1	2	1	2	1	1
IS	**Interdisciplinary Skills**									
IS1	**Procurement**									
IS1.1	Green Procurement	3	3	3	3	3	3	3	3	1
IS2	**Quality assurance**									
IS2.1	Quality assurance planning and management	3	3	3	3	3	3	3	2	1
IS3	**Collaboration and Communication**									
IS3.1	Motivation and communication - Design Team	3	2	2	2	2	2	2	1	1
IS4	**Inormation management**									
IS4.1	Management of information in a design process	3	3	3	3	3	3	3	1	1
IS5	**Safety Assurance**									

IS5.1	Risk prevention, safety and health of workers	3	2	2	2	2	1	3	na	1
LB	**Listed Buildings**									
LB1	**Improving energy performance of listed buildings**									
LB1.1	Handling and architectural conservation of listed buildings	3	2	2	2	2	2	2	1	1

Table B.5 - Blue Collars - Environment

Environment		#10.a Bricklayer	#10.b Carpenter	#10c Façade W	#10d Insulation	#10e Roofer	#10f Window In	#11a Electrical In	#11b Plumber	#11c Renewable E	#11d Renewable T	#11.e HVAC	#11f Heating
EN	**Energy**												
EN1	**Energy Performance Assessment**												
EN1.1	Energy Simulation	na	na	1	1	1	1	1	na	1	1	1	1
EN2	**Energy Management**												
EN2.1	Smart grid systems	na	na	na	na	na	na	3	na	3	3	1	1
EN2.2	Domotic systems	na	na	na	na	na	na	3	na	1	1	3	3
EN2.3	Building Management Systems (BMS)	na	na	na	na	na	na	3	na	1	1	3	3
EN2.4	Renewable Energy communities (smart neighbourhoods)	na	na	na	na	na	na	3	na	3	3	1	1
EN3	**Energy Production and HVAC systems**												
EN3.1	Heating and cooling systems	na	na	na	na	na	na	1	na	3	3	3	3
EN3.2	Ventilation systems	na	na	na	na	na	na	1	na	1	1	3	3
EN3.3	Hot water systems (DHW)	na	na	na	na	na	na	1	na	3	3	3	3
EN3.4	Electric heating systems	na	na	na	na	na	na	2	na	2	2	3	3
EN3.5	Heat pump systems and geothermal energy systems	na	na	na	na	na	na	1	na	3	3	3	3
EN3.6	Solar thermal energy systems for heating, cooling and DHW	na	na	na	na	na	na	1	na	3	3	3	3
EN3.7	Solar power systems for electricity generation	na	na	na	na	na	na	1	na	3	3	3	3
EN3.8	Combined Heat and Power (CHP) generation	na	na	na	na	na	na	1	na	3	3	3	3

EN3.9	Mini wind power generation	na	na	na	na	na	na	1	na	3	3	3	3
EN3.10	Energy storage systems (long duration storage, central/ decentralised)	na	na	na	na	na	na	1	na	3	3	3	3
EN4	**Energy Reduction**												
EN4.1	Thermal insulation	1	1	3	3	1	3	na	na	3	3	1	1
EN4.2	Building air tightness	1	1	3	3	1	*3*	na	na	3	3	1	1
EN4.3	Window and glazing systems	1	1	1	1	1	3	na	na	3	3	1	1
EN4.4	Solar shading systems	na	na	1	1	na	1	1	na	3	3	1	1
EN4.5	Passive systems for cooling and heating	na	na	1	1	na	1	1	na	3	3	3	3
EN4.6	Energy saving strategies for lighting	na	na	1	1	na	1	3	na	3	3	1	1
EN4.7	Mitigation strategies for urban thermal effects	na	na	1	1	na	1	na	na	1	1	1	1
EN4.8	Building occupancy behavior	na	na	1	1	na	1	na	na	1	1	1	1
WA	**Water**												
WA1	**Water efficiency**												
WA1.1	Outdoor water use management	na	na	na	na	na	na	na	1	na	na	na	na
WA1.2	Indoor water use management	na	na	na	na	na	na	na	2	na	na	na	na
WA2	**Effluents management**												
WA2.1	Rainwater collection and reuse systems	na	na	na	1	1	na	na	3	na	na	na	na
WA2.2	Graywater collection and reuse systems	na	na	na	na	1	na	na	3	na	na	na	na
WA2.3	Urban Waste Water Treatment	na	na	na	na	na	na	na	3	na	na	na	na
MA	**Materials**												
MA1	**Design for Deconstruction, reuse and recycling**												
MA1.1	Materials and components for ease of disassembly	1	1	1	1	1	1	na	na	na	na	na	na
MA1.2	Adaptive reuse	na	na	na	na	na	na	na	na	na	na	na	na
MA2	**Sustainable materials**												

MA2.1	Life Cycle Assessment (building scale)	na	1	na	na	na	na	na	na	na	na	na	na
MA2.2	Recycled and reused materials	1	1	1	1	1	1	na	na	na	na	na	na
MA2.3	Regenerative materials and technologies	1	1	1	1	1	na	na	na	na	na	na	na
MA3	**Solid waste**												
MA3.1	Solid waste management	1	1	1	1	1	1	1	1	1	1	1	1
HA	**Habitat**												
HA1	**Land Use**												
HA1.1	Site preservation, regeneration and development	na	na	na	na	na	na	na	na	na	na	na	na
HA1.2	Urban and peri-urban agriculture	na	na	na	na	na	na	na	na	na	na	na	na
HA2	**Biodiversity**												
HA2.1	Management of biodiversity on the site	na	na	na	na	na	na	na	na	na	na	na	na

Table B.6 - Blue Collars – Society

Society		**#10.a Bricklayer**	**#10.b Carpenter**	**#10c Façade W**	**#10d Insulation**	**#10e Roofer**	**#10f Window In**	**#11a Electrical In**	**#11b Plumber**	**#11c Renewable E**	**#11d Renewable T**	**#11.e HVAC**	**#11f Heating**
CO	**Comfort and well being**												
CO1	**Indoor air quality**												
CO1.1	Low Emitting materials	3	1	3	3	3	1	na	1	1	1	1	1
CO1.2	Indoor air pollutants management	1	1	1	1	1	1	na	na	1	1	1	1
CO1.3	Outdoor air pollutants management	1	1	1	1	1	1	na	na	1	1	1	1
CO2	**Thermal comfort**												
CO2.1	Indoor Thermal Comfort	1	1	3	3	3	3	na	na	3	3	3	3
CO2.2	Outdoor Thermal Comfort	1	1	3	1	1	1	na	na	1	1	1	1
CO3	**Visual comfort**												
CO3.1	Daylighting	na	na	3	na	3	3	1	na	1	1	1	1
CO3.2	Indoor lighting	na	na	na	na	1	1	3	na	1	1	1	1

CO3.3	Outdoor lighting	na	na	na	na	1	1	3	na	1	1	1	1
CO4	**Acoustic comfort**												
CO4.1	Sound insulation	3	3	3	3	3	3	na	3	1	1	3	3
CO4.2	Room acoustics	1	1	1	3	1	1	na	1	1	1	1	1
CO4.3	Indoor noise management	1	1	1	1	1	1	na	3	1	1	3	3
CO4.4	Environmental noise management	1	1	1	1	1	1	na	na	1	1	1	1
CO5	**Electromagnetic pollution**												
CO5.1	Management of indoor exposure to ELF magnetic fields	na	na	na	na	na	na	2	na	na	na	na	na
CO5.2	Management of indoor exposure to RF/MW electromagnetic fields	na	na	na	na	na	na	2	na	na	na	na	na
CO6	**Ergonomics**												
CO6.1	Ergonomic and Active Furnishing	na	na	na	na	na	na	na	na	na	na	na	na
SA	**Safety**												
SA1	**Fire protection**												
SA1.1	Risk to occupants and facilities from fire	na	na	na	na	na	na	na	na	na	na	na	na
SA2	**Earthquacke**												
SA2.1	Risk to occupants and facilities from earthquake	na	na	na	na	na	na	na	na	na	na	na	na
AC	**Accessibility**												
AC1	**Barrier free accessibility**												
AC1.1	Accessibility of public spaces	na	1	na	na	na	na	1	na	na	na	na	na
AC1.2	Design for All	na	na	na	na	na	na	na	na	na	na	na	na
MO	**Mobility**												
MO1	**Alternative mobility**												
MO1.1	Sustainable mobility strategies	na	na	na	na	na	na	na	na	na	na	na	na
SE	**Services**												
SE1	**Communication**												
SE1.1	Communication services	na	na	na	na	na	na	1	na	na	na	1	na

SE2	**Services for inhabitants**												
SE2.1	Functional mix	na	na	na	na	na	na	na	na	na	na	na	na
SE2.2	Infrastructure and connectivity	na	na	na	na	1	na	1	1	1	1	1	na
AD	**Adaptation and resilience to climate change**												
AD1	**Climate chenge resilient buildings**												
AD1.1	Resilience to extreme weather events	2	na	2	2	2	2	na	na	na	na	na	na
AD1.2	Sustainable drainage	na	na	na	3	na	na	na	1	na	na	na	na
AD1.3	Resilience to heatwaves	na	na	na	4	na	na	na	na	na	4	4	4
AD1.4	Resilience to windstorms	na	na	5	5	na	4	na	na	na	na	na	na
AD1.5	Resilience to wildfire	na	na	3	3	4	5	na	na	na	na	na	na

Table B.7 - Blue Collars – Economy

Economy		**#10.a Bricklayer**	**#10.b Carpenter**	**#10c Façade W**	**#10d Insulation**	**#10e Roofer**	**#10f Window In**	**#11a Electrical In**	**#11b Plumber**	**#11c Renewable E**	**#11d Renewable T**	**#11.e HVAC**	**#11f Heating**
EQ	**Economical quality**												
EQ1	**Cost planning and management**												
EQ1.1	Construction cost planning	na	na	na	na	na	na	na	na	na	na	na	na
EQ1.2	Life cycle cost assessment	na	na	na	na	na	na	na	na	na	na	na	na
EQ2	**Green value**												
EQ2.1	Value creation and risk exposure	na	na	na	na	na	na	na	na	na	na	na	na
EQ2.2	Communication of green building value	na	na	na	na	na	na	na	na	na	na	na	na
EQ3	**Financing schems and business models**												
EQ3.1	Financing schemes for sustainable building	na	na	na	na	na	na	na	na	na	na	na	na
EQ3.2	Business models preparation	na	na	na	na	na	na	na	na	na	na	na	na
EQ4	**Operative costs**												
EQ4.1	Operating and maintenance cost management	1	1	1	1	1	1	1	1	1	1	1	1

EQ4.2	Use stage energy cost management	na	na	na	na	na	na	1	na	1	1	1	1
EQ4.3	Use stage water cost management	na	na	na	na	na	na	na	1	na	na	na	na

Table B.8 - Blue Collars – Process

Process		#10.a Bricklayer	#10.b Carpenter	#10c Façade W	#10d Insulation	#10e Roofer	#10f Window In	#11a Electrical In	#11b Plumber	#11c Renewable E	#11d Renewable T	#11.e HVAC	#11f Heating
BD	**Sustainable Building Design**												
BD1	**Integrative design**												
BD1.1	Integrated Design Process	na	na	na	na	na	na	na	na	na	na	na	na
BD1.2	Quality of site assessment	na	na	na	na	na	na	na	na	na	na	na	na
BD1.3	Value engineering	na	na	na	na	na	na	na	na	na	na	na	na
ID	**Innovative Digital Solutions**												
ID1	**Building Information Modelling**												
ID1.1	Operation of BIM systems	na	na	na	na	na	na	na	na	na	na	na	na
ID2	**Small urban Information Modelling**												
ID2.1	Operation of DIM systems for small urban areas	na	na	na	na	na	na	na	na	na	na	na	na
ID3	**GIS Systems**												
ID3.1	GIS Systems for design and planning	na	na	na	na	na	na	na	na	na	na	na	na
ID4	**Lean Management**												
ID4.1	Lean Management solutions	na	na	na	na	na	na	na	na	na	na	na	na
ID5	**Measuring**												
ID5.1	Smart meters	na	na	1	na	na	na	1	1	1	1	1	1
ID5.2	Smart Building Sensors	na	na	1	na	na	na	1	1	1	1	1	1
ID6	**Digital Twins Solutions**												
ID6.1	Digital Twins systems	na	na	na	na	na	na	na	na	na	na	na	na

SC	**Sustainable costruction**												
SC1	**Sustianable construction management**												
SC1.1	Construction Activity Pollution Management	1	1	1	1	1	1	1	1	1	1	1	1
SC1.2	Sustainability awareness	1	1	1	1	1	1	1	1	1	1	1	1
MN	**Maintenance and operating**												
MN1	**Maintenance**												
MN1.1	Building maintenance	1	1	1	1	1	1	1	1	1	1	1	1
MN1.2	Building degradation diagnosis	1	na	1	1	1	na	na	1	na	1	na	1
MN1.3	Estimation of materials' service life	na	na	na	na	na	na	na	na	na	na	na	na
BE	**Built Environment Certification systems**												
BE1	**Building sustainability certification**												
BE1.1	Energy Performance Certification	1	1	1	1	1	1	1	na	1	1	1	1
BE1.2	Building sustainability certification systems	1	1	1	1	1	1	1	1	1	1	1	1
BE2	**Small Urban scale assessment systems**												
BE2.1	Small Urban scale sustainability assessment systems	na	na	na	na	na	na	na	na	na	na	na	na
IS	**Interdisciplinary Skills**												
IS1	**Procurement**												
IS1.1	Green Procurement	na	na	na	na	na	na	na	na	na	na	na	na
IS2	**Quality assurance**												
IS2.1	Quality assurance planning and management	na	na	na	na	na	3	3	na	3	3	3	3
IS3	**Collaboration and Communication**												
IS3.1	Motivation and communication - Design Team	na	na	na	na	na	na	na	na	na	na	na	na
IS4	**Inormation management**												
IS4.1	Management of information in a design process	na	na	na	na	na	na	na	na	na	na	na	na
IS5	**Safety Assurance**												

IS5.1	Risk prevention, safety and health of workers	na	na	na	na	na	na	na	na	na	na	na	na
LB	**Listed Buildings**												
LB1	**Improving energy performance of listed buildings**												
LB1.1	Handling and architectural conservation of listed buildings	1	1	1	1	1	1	1	1	3	3	3	3
Process		**#10.a Bricklayer**	**#10.b Carpenter**	**#10c Façade W**	**#10d Insulation**	**#10e Roofer**	**#10f Window In**	**#11a Electrical In**	**#11b Plumber**	**#11c Renewable E**	**#11d Renewable T**	**#11.e HVAC**	**#11f Heating**
BD	**Sustainable Building Design**												
BD1	**Integrative design**												
BD1.1	Integrated Design Process	na	na	na	na	na	na	na	na	na	na	na	na
BD1.2	Quality of site assessment	na	na	na	na	na	na	na	na	na	na	na	na
BD1.3	Value engineering	na	na	na	na	na	na	na	na	na	na	na	na
ID	**Innovative Digital Solutions**												
ID1	**Building Information Modelling**												
ID1.1	Operation of BIM systems	na	na	na	na	na	na	na	na	na	na	na	na
ID2	**Small urban Information Modelling**												
ID2.1	Operation of DIM systems for small urban areas	na	na	na	na	na	na	na	na	na	na	na	na
ID3	**GIS Systems**												
ID3.1	GIS Systems for design and planning	na	na	na	na	na	na	na	na	na	na	na	na
ID4	**Lean Management**												
ID4.1	Lean Management solutions	na	na	na	na	na	na	na	na	na	na	na	na
ID5	**Measuring**												
ID5.1	Smart meters	na	na	1	na	na	na	1	1	1	1	1	1
ID5.2	Smart Building Sensors	na	na	1	na	na	na	1	1	1	1	1	1
ID6	**Digital Twins Solutions**												
ID6.1	Digital Twins systems	na	na	na	na	na	na	na	na	na	na	na	na

SC	**Sustainable costruction**												
SC1	**Sustianable construction management**												
SC1.1	Construction Activity Pollution Management	1	1	1	1	1	1	1	1	1	1	1	1
SC1.2	Sustainability awareness	1	1	1	1	1	1	1	1	1	1	1	1
MN	**Maintenance and operating**												
MN1	**Maintenance**												
MN1.1	Building maintenance	1	1	1	1	1	1	1	1	1	1	1	1
MN1.2	Building degradation diagnosis	1	na	1	1	1	na	na	1	na	1	na	1
MN1.3	Estimation of materials' service life	na	na	na	na	na	na	na	na	na	na	na	na
BE	**Built Environment Certification systems**												
BE1	**Building sustainability certification**												
BE1.1	Energy Performance Certification	1	1	1	1	1	1	1	na	1	1	1	1
BE1.2	Building sustainability certification systems	1	1	1	1	1	1	1	1	1	1	1	1
BE2	**Small Urban scale assessment systems**												
BE2.1	Small Urban scale sustainability assessment systems	na	na	na	na	na	na	na	na	na	na	na	na
IS	**Interdisciplinary Skills**												
IS1	**Procurement**												
IS1.1	Green Procurement	na	na	na	na	na	na	na	na	na	na	na	na
IS2	**Quality assurance**												
IS2.1	Quality assurance planning and management	na	na	na	na	na	3	3	na	3	3	3	3
IS3	**Collaboration and Communication**												
IS3.1	Motivation and communication - Design Team	na	na	na	na	na	na	na	na	na	na	na	na
IS4	**Inormation management**												
IS4.1	Management of information in a design process	na	na	na	na	na	na	na	na	na	na	na	na
IS5	**Safety Assurance**												

IS5.1	Risk prevention, safety and health of workers	na	na	na	na	na	na	na	na	na	na	na	na
LB	**Listed Buildings**												
LB1	**Improving energy performance of listed buildings**												
LB1.1	Handling and architectural conservation of listed buildings	1	1	1	1	1	1	1	1	3	3	3	3

Annex C
(informative)
Guidelines and specifications for Learning Outcomes (LOs) drafting

C.1 Introduction

This Annex describes the guideline used by the team of experts who contributed to the drafting of the LOs in order to ensure a shared and common approach.

C.2 Vocabulary

C.2.1 Knowledge's adjectives related to the levels of competence

Concerning the adjectives used to describe a requested knowledge for the levels of competence, a specific adjective for each of the five levels of competence has been defined:

Table C.1 - Knowledge's adjectives related to the levels of competence

MINIMAL knowledge	**1**	Has little knowledge and skills with respect to the thematic area. Understands basic principles and is able to take part in project team discussions
BASIC knowledge	**2**	Understands basic knowledge and has practical skills within the thematic area, is able to solve simple problems by selecting and applying basic methods, tools, materials and information.
MEDIUM knowledge	**3**	Has comprehensive, factual and theoretical knowledge and skills within the thematic area, is capable of solving standard problems within the field
ADVANCED knowledge	**4**	Has advanced knowledge involving a critical understanding of theories and principles and skills, required to solve complex and unpredictable problems in the field and is aware of the boundaries
IN-DEPTH knowledge	**5**	Has specialized knowledge and problem-solving skills, partly at the forefront of knowledge in the field, in order to develop new knowledge and procedures and to integrate knowledge from different fields

C.2.2 Verbs used in relation to the levels of competence

In order to harmonise the descriptions of the LOs and skills in relation to the level of competence, some reference verbs have been defined.

Table C.2 - Verbs used in relation to the levels of competence

LO description	KNOWLEDGE	SKILL		
UNDERSTANDING DISCUSSING REASONING	MINIMAL knowledge	UNDERSTANDING DISCUSSING REASONING	1	Has little knowledge and skills with respect to the thematic area. Understands basic principles and is able to take part in project team discussions
APPLYING SELECTING PROPOSING (basic solutions)	BASIC knowledge	APPLYING SELECTING PROPOSING (basic solutions)	2	Understands basic knowledge and has practical skills within the thematic area, is able to solve simple problems by selecting and applying basic methods, tools, materials and information.
INVESTIGATING ANALYSING CHECKING EXPLAINING ENGINEERING (medium) DESIGNING (medium) PROPOSING (solutions)	MEDIUM knowledge	INVESTIGATING ANALYSING CHECKING EXPLAINING ENGINEERING (medium) DESIGNING (medium) PROPOSING (solutions)	3	Has comprehensive, factual and theoretical knowledge and skills within the thematic area, is capable of solving standard problems within the field
EVALUATING MEASURING PERFORMING USING PROVIDING ENGINEERING (advanced) DESIGNING (advanced)	ADVANCED knowledge	EVALUATING MEASURING PERFORMING USING PROVIDING ENGINEERING (advanced) DESIGNING (advanced)	4	Has advanced knowledge involving a critical understanding of theories and principles and skills, required to solve complex and unpredictable problems in the field and is aware of the boundaries

CREATING FORMULATING DEVELOPING OPTIMISING MANAGING INSTALLING TESTING ENGINEERING (in-depth) DESIGNING (in-depth)	IN-DEPTH knowledge	CREATING FORMULATING DEVELOPING OPTIMISING MANAGING INSTALLING TESTING ENGINEERING (in-depth) DESIGNING (in-depth)	5	Has specialized knowledge and problem-solving skills, partly at the forefront of knowledge in the field, in order to develop new knowledge and procedures and to integrate knowledge from different fields

C.3 Harmonisation of sentences wording

The harmonisation of sentences wording for LOs, knowledge and skill is a crucial aspect to ensure high quality of the final result; therefore, some guidance for the proper writing and a couple of key examples have been provided.

More in general, the verbal form to be preferred in all the sentences for LOs and skills is the "*-ing*" form.

C.3.1 Description of a Learning Outcome

The Learning Outcome is the elementary unit and consists of a specific knowledge and a specific skill. The sentence describing the LO is a synthesis of what the stakeholder is able to do practically.

Since each LO is associated with a level of expertise, ranging from 1 (generic) to 5 (very expert), when formulating the sentence related to the description of the LO, the verbs suitable for the belonging level of competence, have been formulated in the "-ing" form.

An example of a LO's description is the following:

LO description	**Suggested verb in *"-ing"* form**

Below few examples of proper formulation of LO sentences.

Table C.3 – Examples of proper formulation for "LO descriprion" field

LO description	**KNOWLEDGE**	**SKILL**	**LEVEL**
Understanding of standards for visual comfort			1
Applying photometric calculations / measurements			2

Performing the LCA analysis			4

C.3.2 Description of a KNOWLEDGE

Sentences related to the knowledge **have been formulated using the proper adjective in relation to the reference level of competence**. It has been preferred the use of bullet points describing the knowledge possessed.

The right way to formulate the description of the knowledge is the following:

KNOWLEDGE	**Suggested Adjective**	**+**	**Knowledge of**	**+**	**Bullet points**

Table C.4 – Examples of proper formulation for "KNOWLEDGE" field

LO description	KNOWLEDGE	SKILL	LEVEL
Understanding of standards for visual comfort	**Minimal knowledge of:** - fundamentals of visual comfort - main standards for visual comfort		1
Applying photometric calculations / measurements	**Basic knowledge of:** - proper illuminance spot measurements		2
Performing the LCA analysis	**Advanced knowledge of:** - LCA assessment		4

C.3.3 Description of a SKILL

Sentences related to the skill have been formulated using **suggested verbs** in relation to the reference level of competence, in the **"*-ing*" form**.

The right way to formulate the description of the skill is the following:

SKILL	**Suggested verb in *"-ing"* form**

Table C.5 – Examples of proper formulation for "SKILL" field

LO description	KNOWLEDGE	SKILL	LEVEL
Understanding of standards for visual comfort	**Minimal knowledge of:** - fundamentals of visual comfort main standards for visual comfort	**Discussing** on visual comfort fundamentals in simple projects	1
Applying photometric calculations / measurements	**Basic knowledge of:** - proper illuminance spot measurements	**Applying basic** illuminance spot measurements using a luxmeter	2
Performing the LCA assessment	**Advanced knowledge of:** - LCA assessment	**Performing** the LCA assessment, **providing** solutions and **comparing** different results for different solutions	4

C.4 Reference fields for Learning Outcomes

To provide consistency among the Areas of Expertise in terms of the kind of Learning Outcomes described, the following reference fields were used. It may be that, for some AoEs, some fields do not have a corresponding LO, as well as more LOs may correspond to a certain field.

Table C.6 – Description of reference fields to be use for Los definition

Field	Content Description
Fundamentals and metrics	Field relies on measures of quantities and on fundamentals of the area of expertise investigated, as for example: its relevance for sustainability, its basic qualitative and quantitative information, etc.
Technical standards and regulations	Field relies on the existence of technical standards and regulations concerning the area of expertise
Technical solutions	Field relies on the identification of the existing and emerging technologies related to the area of expertise investigated
Calculation and simulation	Field relies on calculation codes, basic method for assessing the parameter, simulation software, integrated simulation solutions, etc.
Installation / Construction	Field relies on making ready to use a solution technology or a building component, foresees installation activities
Measurement and verification	Field relies on measuring instruments and their use, on the measurement's typologies and on-site verification

Operation and maintenance	Field relies on activities related to the in-use stage of the project, focused on maintenance and operation

Here below three examples of LOs related to the corresponding fields.

Table C.7 - Examples of LOs in relation to reference fields

Field	LO description	KNOWLEDGE	SKILL	LEVEL
T	**Understanding** of standards for visual comfort	**Minimal knowledge of:** - fundamentals of visual comfort main standards for visual comfort	**Discussing** on visual comfort fundamentals in simple projects	1
Y	**Applying** photometric calculations / measurements	**Basic knowledge of:** - proper illuminance spot measurements	**Applying basic** illuminance spot measurements using a luxmeter	2
W	**Performing** the LCA assessment	**Advanced knowledge of:** - the LCA assessment	**Performing** the LCA assessment, **providing** solutions and **comparing** different results for different solutions	4

The fields are **strictly related to one or more stages of the project**. Below the table with the specifications.

Table C.8 – Reference field in relation to Project Stage

FIELD	Project Stage
Fundamentals and metrics	*Concept*
Technical standards and regulations	*Concept + Design*
Technical solutions	*Design*
Calculation and simulation	*Design*
Installation / Construction	*Construction*
Measurement and verification	*As Built*
Operation and maintenance	*In Use*