

Aclaración: D10-D2.3/2.4

Requisitos identificados para el desarrollo de los Modelos de Calificación del BIM.

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LA ESTIMULACIÓN DE LA ENERGÍA
SOLAR EN LAS INSTALACIONES DE
LAS FÁBRICAS.**

**Red para el uso de BIM para aumentar el rendimiento
energético**

**Acuerdo de subvención número:754016
Net-UBIEP H2020**





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A. Detalles de la entrega	
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Breve descripción

Las tareas 2.3 y 2.4 son parte del paquete de trabajo 2. Para entender estos pasos y sus interconexiones, se ofrece a continuación una breve descripción de las tareas 2.1 a 2.4.

El propósito de este paquete de trabajo 2 es encontrar una identificación de los requisitos necesarios de BIM y de eficiencia energética para:

- a. Los grupos objetivo:
 - i. administración pública,
 - ii. profesionales,
 - iii. técnicos y
 - iv. propietarios.
- b. Los diferentes perfiles de BIM:
 - i. Gerente de BIM,
 - ii. Coordinator de BIM,
 - iii. Experto en BIM,
 - iv. Usuario experto de BIM,
 - v. Evaluador de BIM y
 - vi. Gerente de la instalación BIM .

Estos requisitos identificados son necesarios para desarrollar un modelo de calificación BIM en el paquete de trabajo 3.

Para lograrlo se siguen los pasos de la figura 1:

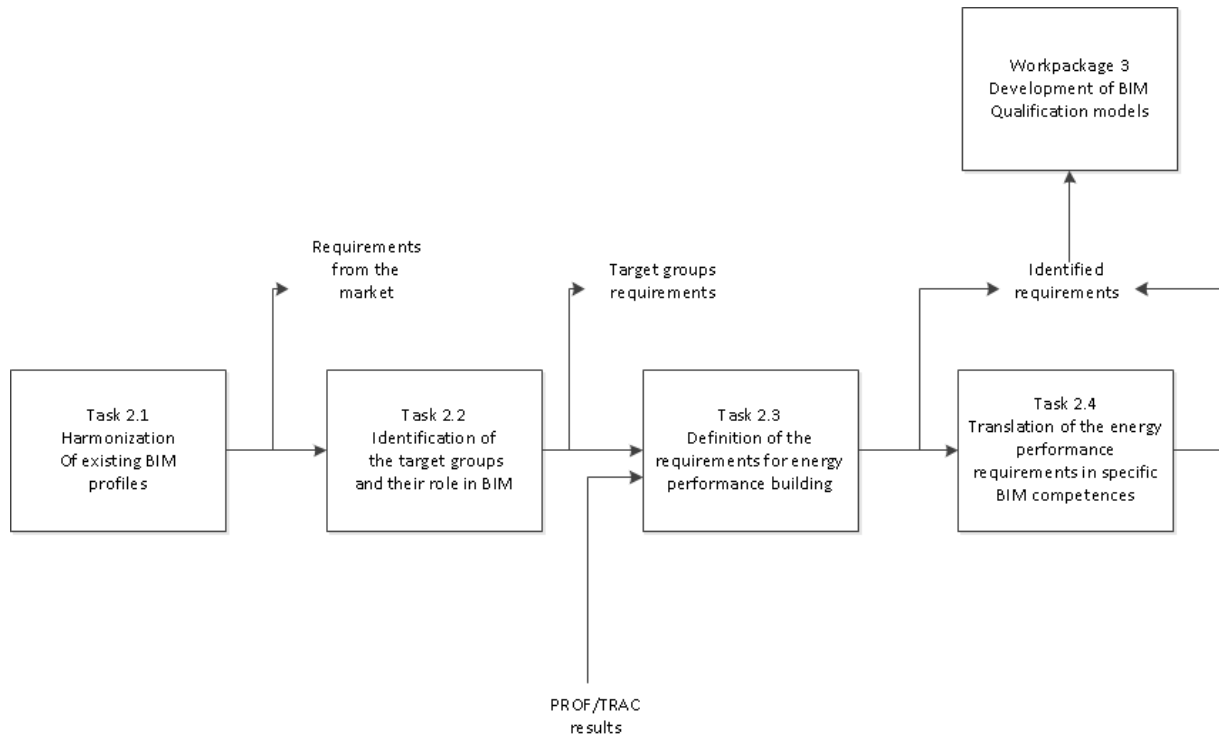


Figura 1: Paquete de trabajo de proceso general 2.

El proceso de cada tarea se describe en las secciones siguientes.

Tarea 2.1 Armonización de los perfiles BIM existentes de conformidad con la metodología del MEC

El propósito del paquete de trabajo 2.1 se describe como: "Armonización de los perfiles BIM existentes de conformidad con la metodología del MEC".

Se han tomado las siguientes medidas para obtener esta armonización:

1. 1. Inventario (a nivel nacional)
 - Investigación y armonización a nivel nacional

Cada país identifica y armoniza sus propios perfiles BIM. Cada país reúne información sobre el nivel del MEC, los campos de trabajo, las tareas y las competencias necesarias para los perfiles de Gerente de BIM, Coordinador de BIM, Experto de BIM, Usuario de BIM, Evaluador de BIM y Gerente de Instalaciones de BIM.

- A nivel nacional se discuten los resultados armonizados de los socios. Los resultados de este debate se integran en la armonización.

Tras estos pasos quedan aclarados los requisitos de mercado relacionados con los diferentes perfiles BIM. Estos requisitos son datos de entrada para la tarea 2.2.

2. Comparación (entre países)
 - Para cada **perfil de BIM (Gerente de BIM, Coordinador de BIM, Experto de BIM, Usuario de BIM, Evaluador de BIM y Gerente de Instalaciones de BIM)** los resultados armonizados de cada país se comparan e integran en una hoja. Los resultados integrados se comparten entre los países participantes.
 - A nivel europeo los resultados armonizados se discuten en una reunión en la web. Los resultados del debate se integran en el informe T2.1.

Tarea 2.2 Identificación de los grupos objetivo y su papel en el BIM

En la tarea 2.2 se describe la identificación de los **grupos objetivo** y su papel en el BIM. El papel de cada actor se identifica en el flujo de trabajo de la construcción.

Se considera que en esta tarea hay cuatro tipos de agentes que desempeñan un papel relevante en el sector de la construcción: **Administraciones públicas, profesionales (arquitectos-ingenieros), técnicos (instaladores-mantenedores), inquilinos/proprietarios/administradores de edificios.**

Al igual que en la tarea 2.1, se han tomado las siguientes medidas:

1. Inventario (a nivel nacional)
Para comprender el papel de cada actor en las diferentes fases del ciclo de vida del edificio, se pide a cada socio que haga un inventario del papel, las tareas y las competencias de cada actor.
2. Comparación entre países
Después de la invención, los resultados fueron discutidos entre los socios en las reuniones web.

Después de la comparación, los resultados se integraron en el informe de la tarea 2.2.

Tarea 2.3 Definición de los requisitos para el diseño y la construcción de edificios de alto rendimiento energético

En la tarea 2.3 se asignan las competencias sobre el rendimiento energético a los grupos objetivo definidos:

- i. La administración pública,
- ii. Profesionales,
- iii. Los técnicos y
- iv. Propietarios.

Los pasos seguidos para la tarea 2.3 y 2.4 se visualizan en la figura 2.

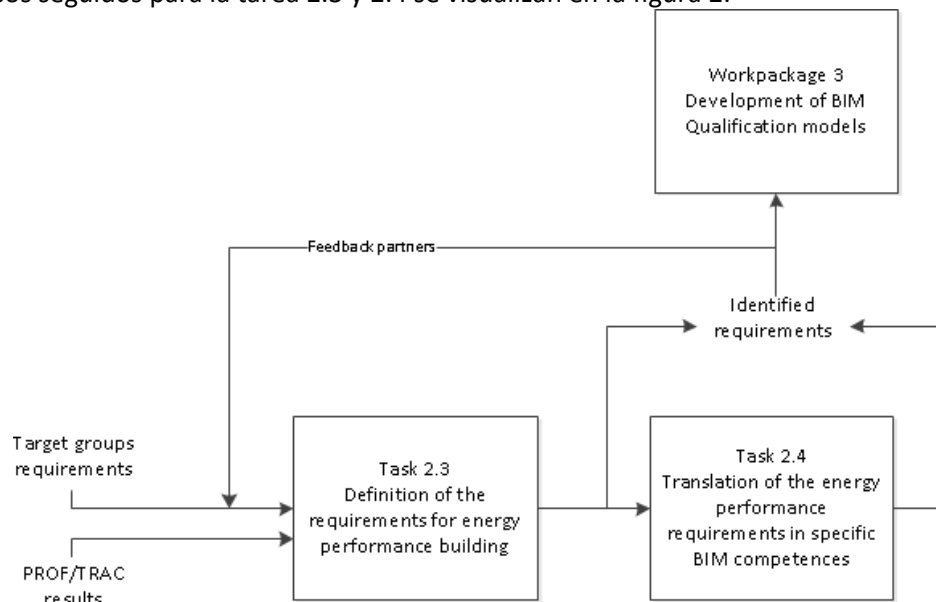


Figura 2: Proceso 2.3 y 2.4

Metodología de investigación para la tarea 2.3

Además de los requisitos de mercado encontrados en la tarea 2.1 y los requisitos del grupo objetivo en la tarea 2.2, la tarea 2.3 de NET-UBIEP utiliza el trabajo anterior del proyecto PROF/TRAC. El proyecto europeo PROF/TRAC es una plataforma de formación abierta para los profesionales de las NZEB. En el proyecto PROF/TRAC se construye un esquema de competencias y cualificaciones de las NZEB. Los socios del proyecto NET-UBIEP tienen permiso para utilizar los resultados del PROF/TRAC. Para aclarar la distinción entre los dos proyectos, los textos modificados de NET-UBIEP se muestran en rojo en la tabla de Excel 'NET-UBIEP 2.3 y 2.4_v18042018.xlsx'.

Figura 3: De la tabla de Excel 'NET-UBIEP 2.3 y 2.4_v18042018.xlsx', los textos PROF/TRAC están en negro, las adiciones/modificaciones de NET-UBIEP están en rojo.

Las competencias correspondientes pueden encontrarse en el cuadro de cada tecnología/tema (Figura 4) en base al nivel mínimo de competencia requerido para un campo de trabajo. En este cuadro se integran los resultados de las tareas 2.1 y 2.2.

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Asunto

Nivel de competencia

Back to "EU minimum competence levels"

Technology Nr.

IS6

Pestaña en la tabla

Integrated design

Being able to design integrally with the other involved NZEB building disciplines

Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
General	Understand integrated design processes and concepts	Theoretical knowledge of integrated design processes and concepts. Has theoretical understanding of design process and how designers think					
General	Understand the interplay of building location, design, use and outdoor climate	Knowledge on interplay between all aspects of building design, building use and outdoor climate. Able to understand the interplay between microclimate, buildings and their services. Understand the interplay between sustainable energy system, building energy demand and renewable energy production					
General	Understand design methods for passive energy technologies	Able to understand basic design methods for passive energy technologies. Able to apply and combine design methods for passive energy technologies					
General	Project life cycle concept	Able to integrate life cycle concepts in different project phases					
Preparation	Define and communicate integrated design goals	Can define and communicate design goals					
Preparation	Site analysis with BIM/GIS tools to evaluate properties in a given area	To be able to view, navigate and extract information to evaluate properties in a given area					
Design	Evaluate the integrated design	Can use goals and targets as means of measuring success of design proposals. Able to apply, combine and evaluate advanced methods for analysis of the interplay between energy systems, architectural concepts, building design, building use, outdoor climate and HVAC systems					

Competencia

Figura 4: Ejemplo de una ficha con las competencias, la tecnología/temática y los niveles de competencia.

En NET-UBIEP el nivel mínimo de competencias aconsejado para cada grupo objetivo se indica en la pestaña "Niveles mínimos de competencia de la UE para TG" (figura 5).

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D2.3

TECHNOLOGY AND INTERDISCIPLINARY COMPETENCIES PER TARGET GROUP

Grupo objetivo

TARGET GROUP	Public Administration	Professionals	Professionals	Professionals	Professionals	Technicians	Technicians	Technicians	Tenants/Users
Reference professions	Legislators	Architects	Civil Engineering (consultancy)	Electrical Engineer (consultancy)	Mechanical Engineer (consultancy)	Engineer (installer)	Installers (field)	Facility engineers	Users of the building
EM									
EM1	Smart grid systems	1	2	1	3	3	3	3	1
EM2	Domestic systems	1	2	1	3	2	2	3	2
EM3	Building management system	1	2	1	4	2	2	3	2
EP									
EP1	Geothermal energy	1	2	2	3	4	3	3	1
EP2	Biomass	1	2	2	3	4	3	3	1
EP3	Biogas	1	2	2	3	4	3	3	1
EP4	District heating and cooling	1	2	2	3	4	3	3	1
EP5	Heatpumps	1	2	2	3	4	3	3	1
EP6	Solar power systems for electricity generation	1	2	2	3	4	3	3	1
EP7	Solar thermal systems for cooling generation	1	2	2	3	4	3	3	1
EP8	Solar thermal systems for domestic hot water and/or space heating	1	2	2	3	4	3	3	1
EP9	Mini wind power	1	2	2	3	4	3	3	1
EP10	Combined Heat and Power (CHP)	1	2	2	3	4	3	3	1
ER									
ER1	Insulation	1	2	2	3	3	2	3	1
PR1	Airtightness building	1	2	2	3	3	2	3	1

Asunto

Nivel Mínimo de competencia

Figura 5: Pestaña "Niveles mínimos de competencia aconsejados por la UE para cada grupo objetivo".

Sobre la base del nivel mínimo de competencia requerido para una materia, las competencias correspondientes pueden encontrarse en el cuadro de cada tecnología (como en la figura 4).

Ejemplo:

Se requiere que los arquitectos tengan un nivel mínimo de competencia 3 en la mini energía eólica EP9 (figura 6). En la tabla de Excel 'NET-UBIEP 2.3 y 2.4_v18042018.xlsx' de la pestaña EP9 se pueden encontrar las competencias correspondientes. En consecuencia, se puede determinar la necesidad de formación adicional.

Grupo objetivo

NET UBIEP		PROF / TRAC		
TARGET GROUP	Public Administration	Professionals	Professionals	TECHNOLOGY AND IP
Reference professions	Legislators	Architects	Civil Engineering (consultancy)	
	Civil servants			
EM				
EM1	Smart grid systems	2	2	2
EM2	Domestic systems	1	2	1
EM3	Building management systems	1	2	1
EP				ENERGY PRODUCTION (or)
EP1	Geothermal energy	1	2	2
EP2	Biomass	1	2	2
EP3	Biogas	1	2	2
EP4	District heating and cooling	1	2	2
EP5	Heatpumps	1	2	2
EP6	Solar power systems for electricity generation	1	2	2
EP7	Solar thermal systems for cooling generation	1	2	2
EP8	Solar thermal systems for domestic hot water and/or	1	2	2
EP9	Mini wind power	1	3	2

Asunto

Figura 6: Ejemplo Arquitectos/EP9 Mini energía eólica

El cuadro resultante se envió a todos los asociados y se debatió en dos reuniones en la web diferentes. La tabla de Excel 'NET-UBIEP 2.3 y 2.4_v18042018.xlsx' fue finalizada con los comentarios de los socios.

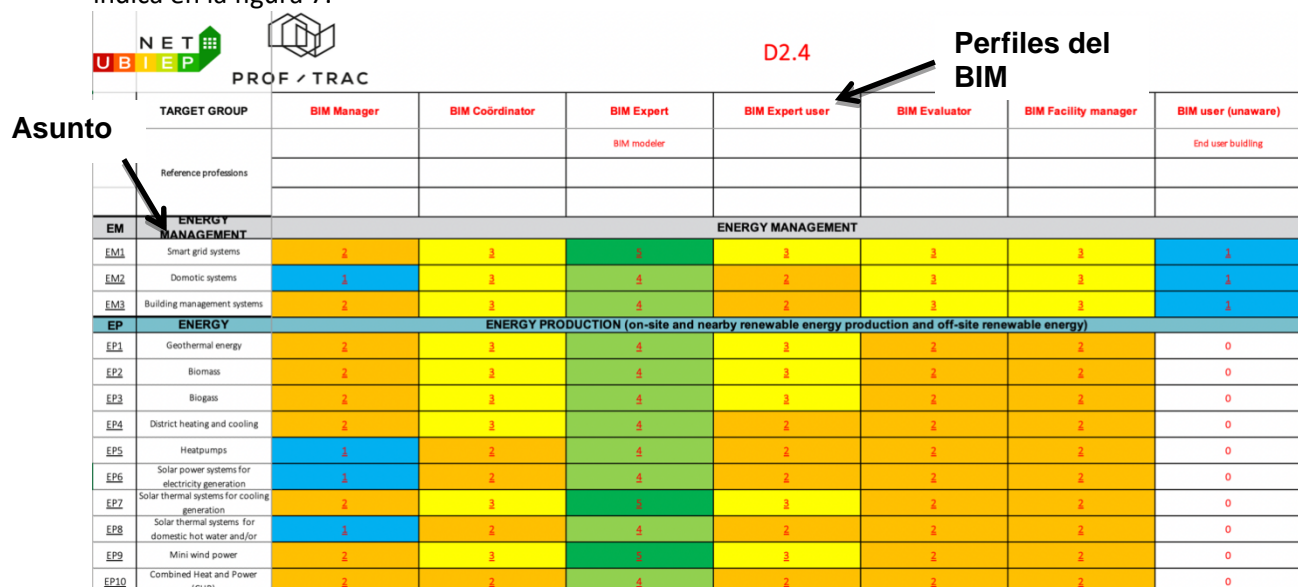
Tarea 2.4 Traducir los requisitos de rendimiento energético en competencias BIM específicas para cada uno de los diferentes grupos objetivo

En la tarea 2.4 BIM se recogen las competencias relacionadas con el rendimiento energético. Se necesitaba una traducción de los diferentes grupos objetivo a los diferentes perfiles BIM. El Acuerdo de Subvención 754016 Net-UBIEP describe esta relación como se indica en la tabla 1.

Tabla 1: Relación de los grupos destinatarios con los perfiles de la BIM (Acuerdo de subvención 754016 Net-UBIEP)

Grupo objetivo	Administraciones públicas	Profesionales (ingenieros y arquitectos)	Técnicos (instaladores y mantenedores)	Inquilinos, propietarios y administradores de edificios
Papel	Necesitan preparar correctamente las reglas y definir adecuadamente los requisitos para la licitación pública utilizando BIM para el rendimiento energético	Necesitan trabajar en un ambiente de colaboración utilizando el mismo modelo básico BIM implementado con los requisitos de rendimiento energético a través de herramientas de análisis de ingeniería	Necesitan saber cómo leer un modelo BIM, interpretar correctamente los datos y asegurar al propietario que toda la información para el mantenimiento está disponible en el formato correcto	Necesitan saber cómo definir los requisitos para el correcto mantenimiento de un edificio y cómo manejar el modelo BIM para la vida útil del edificio
Perfiles BIM	Evaluador BIM Gerente de la instalación BIM	Gerente de BIM Coordinador del BIM Experto en BIM	Usuario experto del BIM	Evaluador BIM Gerente de la instalación BIM

Con esta relación los resultados de la tarea 2.3 pueden transformarse en la tarea 2.4 como se indica en la figura 7.



Asunto	TARGET GROUP	BIM Manager	BIM Coordinator	BIM Expert	BIM Expert user	BIM Evaluator	BIM Facility manager	BIM user (unaware)
Reference professions				BIM modeller				End user building
EM ENERGY MANAGEMENT								
EM1 Smart grid systems		2	3	4	5	3	3	1
EM2 Domotic systems		1	3	4	2	3	3	1
EM3 Building management systems		2	3	4	2	3	3	1
EP ENERGY								
EP1 Geothermal energy		2	3	4	5	2	2	0
EP2 Biomass		2	2	4	3	2	2	0
EP3 Biogas		2	3	4	3	2	2	0
EP4 District heating and cooling		2	3	4	2	2	2	0
EP5 Heatpumps		2	2	4	2	2	2	0
EP6 Solar power systems for electricity generation		1	2	4	2	2	2	0
EP7 Solar thermal systems for cooling generation		2	3	5	3	2	2	0
EP8 Solar thermal systems for domestic hot water and/or		1	2	4	2	3	2	0
EP9 Mini wind power		2	3	5	3	2	2	0
EP10 Combined Heat and Power (CHP)		2	2	4	2	2	2	0

Figura 7: Perfiles BIM relacionados con los niveles de competencia aconsejados (Tab "Niveles mínimos de comp. de la UE para BP" en "NET-UBIEP 2.3 y 2.4_v18042018.xlsx")

También esta tabla resultante se envió a todos los socios y se discutió. La tabla de Excel 'NET-UBIEP 2.3 y

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2.4_v18042018.xlsx' fue finalizada con los comentarios de los socios.

El cuadro final vincula los grupos destinatarios, los perfiles BIM, las competencias, los niveles de competencia, las fases del proyecto y el tema de la tecnología/gestión de manera muy detallada. Por lo tanto, las tablas resultantes de la tarea 2.3 y 2.4 son una aportación necesaria que se utilizará en el paquete de trabajo 3 "Desarrollo de modelos de cualificación BIM".

Apéndice

En este apéndice encontrará los resultados de la entrega en Excel de NET-UBIEP 2.3 y 2.4_v18042018.xlsx. Los resultados presentados son el esfuerzo combinado de NetUBIEP y Prof/Trac.

0	Not applicable / no knowledge and competence required	
1	Has little knowledge and competences with respect to the relevant field / technology, possibly outside the own field of expertise; understands basic principles and is able to take part in project team discussions	
2	Understands basic knowledge and has practical competences within the field / technology, is able to solve simple problems by selecting and applying basic methods, tools, materials and information (mostly outside the own field of expertise)	
3	Has comprehensive factual and theoretical knowledge and competences within the field / technology, is capable of solving standard problems within the field	
4	Has advanced knowledge involving a critical understanding of theories and principles and competences, required to solve complex and unpredictable problems in the field and is aware of the boundaries	
5	Has specialised knowledge and problem-solving competences, partly at the forefront of knowledge in the field, in order to develop new knowledge and procedures and to integrate knowledge from different fields	

OVERVIEW OF TECHNOLOGIES AND INTERDISCIPLINARY COMPETENCIES		
EM ENERGY MANAGEMENT		
EM1	Smart grid systems	Electronic digital control of production, distribution and use of electricity; information management of the components
EM2	Domestic systems (homes)	Residential intelligent building installations for lighting, heating, security etc. Improving quality of life for elderly and disabled people
EM3	Building management systems BMS (utility buildings)	Computer-based control system of most building installations, HVAC, lighting, security, etc. Use of an open standard protocol to exchange information
EP ENERGY PRODUCTION (on-site and nearby renewable energy production and off-site renewable energy)		
EP0	Heating and Cooling GENERAL	Overview of different types of heating and cooling generation systems
EP1	Geothermal energy systems	Low temperature heating and high temperature cooling, generated by use of geothermal energy
EP2	Biomass energy production	Energy production for heating and potable hot water making use of biomass, e.g. wood pellets
EP3	Bio gas energy production	Energy production for heating and potable hot water making use of biogas (the biogas is generated off-site)
EP4	District heating and cooling	Energy for heating and potable hot water delivered by a warm water system, generated in off-site energy production
EP5	Planning and design of heat pump installations	Energy production for heating, cooling and potable hot water, making use of an energy source with low temperature and bringing it to a higher temperature
EP6	Solar power systems for electricity generation	Photovoltaic panels eventually combined with storage systems (batteries)
EP7	Solar absorption cooling	Vapor absorption cooling with use of solar heat by tube collectors for regeneration
EP8	Solar thermal energy systems for domestic hot water and/or heating generation	Solar tube collectors generating warm water, storage systems for heating or potable hot water. In addition a second heating generating system to add warmth when lack of sunshine
EP9	Mini wind power generation	Mini wind turbines for use on-site (on roofs etc.)
EP10	Combined Heat and Power (CHP) generation	Energy production by turbines that generate heat and electricity. By the low heating efficiency mostly used when there is high need of electricity.
ER ENERGY REDUCTION		
ER1	Insulation	Thermal insulations of ground floors, walls, roofs, thermal bridges
ER2	Airtightness building	Airtightness of openings such as doors and windows
ER3	Micro climates	Green roof, cool roof, exterior landscaping/trees, earth sheltering
ER4	Envelope systems	Trombe wall, double envelope, facade systems, Barris system
ER5	Hot water systems	Heat recovery, smart distribution
ER6	Window and/or glazing systems	Insulation glass, Smart glass, Blinds (sun reflection), Brise soleil, daylighting systems, solar tubes
ER7	Heating and cooling emission systems	Low temperature heating systems and high temperature cooling systems, surface heating/cooling
ER8	Electric heating systems	Electric heating systems such as infrared and electric floor/wall heating can contribute to indoor comfort and energy saving under the right conditions (low frequency use, or very high insulated buildings)
ER9	Artificial lighting systems	Artificial lighting systems have a high power consumption. By using HF fluorescent lighting, LED lighting, natural daylight and programmed control systems energy can be used efficiently
ER10	Ventilation systems	Ventilation system to guarantee good indoor air quality. The energy use of this system is very much dependent on the type of system, and the quality


EM2	Domotic systems	1	4	1	4
EM3	Building management systems	1	2	1	4
EP ENERGY PRODUCTION (on-site and nearby renewable energy sources)					
EP1	Geothermal energy	1	2	2	3
EP2	Biomass	1	2	2	3
EP3	Biogas	1	2	2	3
EP4	District heating and cooling	1	2	2	3
EP5	Heatpumps	1	2	2	3
EP6	Solar power systems for electricity generation	1	3	3	5
EP7	Solar thermal systems for cooling generation	1	2	2	3
EP8	Solar thermal systems for domestic hot water and/or heating/cooling generation	1	2	2	3
EP9	Mini wind power	1	3	3	4
EP10	Combined Heat and Power (CHP)	1	2	2	4
ER ENERGY REDUCTION					
ER1	Insulation	1	5	3	3
ER2	Air tightness building	1	5	3	3
ER3	Micro climates	1	4	4	4
ER4	Envelope systems	1	5	4	4
ER6	Window and/or glazing systems	1	4	3	3
ER ENERGY REDUCTION					
ER5	Hot water systems	1	2	3	3
ER7	Heating and cooling emission systems	1	2	3	3
ER8	Electric heating systems	1	2	3	3
ER9	Artificial lighting systems	1	2	4	4
ER10	Ventilation systems	1	2	4	4
IS SUSTAINABLE IN					
IS5	Sustainable architectural design	1	4	4	3
IS6	Integrated design	1	4	4	4
IS7	Sustainable building materials	1	4	4	3
IS8	Sustainable installation materials	1	3	3	4
IS9	Environmental (indoor) quality	1	3	3	4





D2.4

TARGET GROUP	BIM Manager	BIM Coordinator	BIM Expert	BIM Expert user	BIM Evaluator	BIM Facility manager	BIM user (unaware)
Reference professions			BIM modeler				End user building
EM	ENERGY MANAGEMENT						
EM1	Smart grid systems	2	3	3	3	3	1
EM2	Domotic systems	1	3	4	2	3	1
EM3	Building management systems	2	3	4	2	3	1
EP	ENERGY PRODUCTION (on-site and nearby renewable energy production and off-site renewable energy)						
EP1	Geothermal energy	2	3	4	2	2	0
EP2	Biomass	2	3	4	3	2	0
EP3	Biogas	2	3	4	3	2	0
EP4	District heating and cooling	2	3	4	2	2	0
EP5	Heatpumps	1	2	4	2	2	0
EP6	Solar power systems for electricity generation	1	2	4	2	2	0
EP7	Solar thermal systems for cooling generation	2	3	5	3	2	0
EP8	Solar thermal systems for domestic hot water and/or	1	2	4	2	2	0
EP9	Mini wind power	2	3	5	3	2	0
EP10	Combined Heat and Power (CHP)	2	2	4	2	2	0
ER	ENERGY REDUCTION of construction						
ER1	Insulation	1	2	3	2	1	0
ER2	Air tightness building	2	2	3	2	2	1
ER3	Micro climates	2	3	4	3	2	1
ER4	Envelope systems	2	3	4	3	2	0
ER6	Window and/or glazing systems	1	2	3	2	2	1
ER	ENERGY REDUCTION of installations						
ER5	Hot water systems	1	2	3	3	2	1
ER7	Heating and cooling emission systems	1	2	3	3	2	0
ER8	Electric heating systems	1	2	3	3	2	0
ER9	Artificial lighting systems	2	3	4	3	2	1
ER10	Ventilation systems	2	3	4	3	2	1
IS	SUSTAINABLE INTEGRATED DESIGN						
IS5	Sustainable architectural design	2	3	4	3	2	1
IS6	Integrated design	2	3	4	3	3	1
IS7	Sustainable building materials	2	3	4	3	3	0
IS8	Sustainable installation materials	2	3	4	3	3	0
IS9	Environmental (indoor) quality	2	3	4	3	3	1
IS	INTERDISCIPLINARY competencies						
IS1	Communication	4	4	3	3	3	2
IS2	Information management	4	3	3	3	3	2
IS3	Collaboration	5	4	4	3	1	2
IS4	Quality assurance	3	4	4	3	3	0
IS10	Economics	3	1	1	0	3	2
IS11	Procurement	3	2	1	0	3	0




Technology Nr.							
EM1		Smart grid systems	 Electronic digital control of production, distribution and use of electricity; information management of the components				
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
General	Understand smart grids in relation to energy performance	Has general knowledge and an holistic view on smart grids and buildings' energy profiles, understanding of it's contribution to energy performance					
General	Information management of smart grids in NZEB design	Can provide the (smart) grid manager with basic information on buildings' energy profiles					
General	Holistic approach of smart grids in NZEB design	Can think in a holistic way concerning energy demand, energy supply, storage and is able to make trade-offs					
Preparation	Determine smart grid concepts	Can perform a feasibility study to determine the basic concept within the project, based on energy saving contribution, costs, restrictions, etc.					
Preparation	Perform energy simulations	Can perform energy simulations in order to define building energy profiles (such as heat load duration curves)					
Preparation	Define energy profiles	Can define the energy profile of the building, i.e. the energy demand profiles, energy supply profiles, storage (in relation with heat pumps), based on input from team members.					
Design	Engineer smart grids	Can design and calculate the smart grid system, based on heat load duration curves, energy simulations etc.					
Construction	Specify smart grids in tender contracts	Can specify and describe the smart grid system in a tender contract, in a way that ensures the contribution to energy saving is realised.					
Construction	Quality assurance of smart grids according contract	Can manage, instruct and audit contractors on site during the realisation of a smart grid system, based on information given in the tender documents and given by the designer.					
Construction	Commission smart grids to ensure operation as planned	Can commission a smart grid system on it's functionality and quality, and determine whether the system operates as planned. Make sure the foreseen contribution to energy saving is realised.					
In use	Ensure optimal operation of smart grids during life cycle	Monitor and control of the smart grid system on critical parameters, in order to guarantee the designed performance during life cycle. Takes action on abnormalities and adjust settings to ensure optimal operation.					

Technology Nr.							
EM2		Domotic systems (homes)		 Residential intelligent building installations for lighting, heating, security etc. Improving quality of life for elderly and disabled people			
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
General	Understand contribution of domotic systems to energy performance	General knowledge on domotic systems, understanding it's contribution to energy saving possibilities					
Preparation	Determine energy saving potential regarding human behaviour	Calculate and predict the amount of energy that can be saved by automatic systems and knowledge on influence of human behaviour on energy demand / use.					
Preparation	Determine installations to include in domotic concept	Is able to make a weighting and balancing between which components and systems should be included in domotics and which are less usefull to include, in relation to energy saving.					
Preparation	Assess available integrated domotic systems	Is able to choose a concept that fulfills specific needs within the project. Domotic systems are mostly provided by producers of fully integrated systems, including switches, modules etc. Is able to understand designs and specifications provided by producers of integrated systems					
Design	Engineer a domotic system in NZEB residential buildings	Engineering of a complete domotic system. From design to contract documents and drawings					
Construction	Specify domotic systems in tender contracts	Detailed description of the demands and functionality of the domotic system, to enable the contractor to choose a product that fulfills the demands.					
Construction	Assure quality of realised systems according contract	Can manage, instruct and audit contractors on site during the realisation of a domotic system, based on information given in the tender documents and given by the designer.					
Construction	Commission domotic systems to ensure planned energy saving	Is able to commission the domotic system after realisation, in order to check if the system fulfills all demands and full functionality. This must be done under different conditions (e.g. day/night, residents are present / absent , etc)					
In use	User instruction to ensure optimal operation of domotic systems	Can write a clear userguide and/or instruct users, based on the type of residents (elderly, young, foreign etc), to see that the system is used as designed for in order to achieve the energy saving goals.					

Technology Nr.				
EM3		Building management systems BMS (utility buildings)		
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)	
			1	2 Back to EU
General	Understand BMS systems in relation to energy performance	General knowledge on the concept of building management systems and its contribution to energy saving		
Preparation	Determine installations to include in BMS	Knowledge of installations that can be automatised (heating, cooling, sun blinds, lighting, security etc). Is aware of the difference between automatised strategies for one room or the whole building.		
Preparation	Determine IAQ parameters to be controlled in BMS	Knowledge of essential indoor environmental quality parameters and the impact of the BMS on it's performance		
Preparation	Determine energy saving potential regarding human behaviour	Knowledge of the amount of energy that can be saved by automatic systems and knowledge on influence of human behaviour on energy demand / use.		
Preparation	Perform a feasibility study	Can perform a feasibility study based on technical aspects as well as return of investment. BMS systems are expensive and will pay back in user phase of the building. During pre-design phase it must become clear how costs of investment can return, who is responsible etc.		
Design	Engineer the BMS system in interdisciplinary team	Can design and engineer the building management system in an interdisciplinary team		
Design	Describe functionality and automatised strategy	Describing the automatised strategies, what is the demanded functionality. The person who designs the BMS must get input from other design partners what is needed. (heating/cooling: mechanical engineer. Lighting, security etc: electrical engineer. Sun blinds etc: architect).		
Construction	Specify the BMS for contracting	Specification of building management system for use in contracting. Make detailed descriptions of the BMS strategies, including drawings, so the contractor and supplier can program the hardware / software.		
Construction	Assure quality of realised systems according contract	Management, instruction and auditing of contractors during the realisation of the BMS system		
Construction	Commission BMS system to ensure operation as planned	Is able to commission the BMS during, and after realisation, in order to check if the system fulfills all demands and full functionality. This must be done under different conditions (e.g. day/night, residents are present / absent, winter /summer, etc)		
In use	Ensure optimal operation of the BMS during life cycle	Can design a maintenance plan and instruct the facility manager, to guarantee that the system achieves the energy saving goals. Takes action on abnormalities and adjust settings to ensure optimal operation.		


Technology Nr.							
EPO		Heating and Cooling GENERAL		Overview of different types of heating and cooling generation systems			
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
General	Understand influence of heating and cooling generation on energy performance	Has general knowledge on the application and specifics of several types of heating and cooling generation systems. Is able to take part in discussions in the design team. Is aware of the importance of the decisions made in the pre design phase for the total energy performance.					
General	Understand specifics and basic parameters	Has knowledge on specifics of heating and cooling generation types, and why or when to choose a specific type. E.g. energy sources, energy balance (smart grids)					
Preparation	Assess systems related to building function and architecture	Is able to select heating and cooling systems, specifically in relation with the buildings' architectural design and building function(s). Is able to discuss the relation between architectural design (esthetics) and selection of heating and cooling systems in a multidisciplinary team					
Preparation	Determine systems that fit NZEB demands	Can determine the appropriate system in relation to available energy sources (soil, gas, electricity, district etc) and that fit the NZEB demands.					
Preparation	Perform a feasibility study on financial and technical aspects	Is able to perform a feasibility study including financial and technical aspects and discuss the outcomes					

Technology Nr.							
EP1		Geothermal energy systems	<div>Low temperature heating and high temperature cooling, generated by use of geothermal energy</div>				
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
Design	Engineer geothermal energy systems	Detailed engineering of the geothermal energy system. Can determine construction site boundaries e.g. needed space, area, depth. Make detailed descriptions and drawings of the design.					
Construction	Specification of a geothermal energy system for contracting purpose	Is able to select products that fit specifications and demands on given quality aspects. Is able to make financial calculations related to contracting phase.					
Construction	Quality assurance of geothermal energy systems	Can manage, instruct and audit contractors during the realization of the geothermal energy system, based on information given by the designer and the tender documents. Can audit on construction site, on critical points.					
Construction	Commissioning of geothermal energy systems	Can commission the geothermal energy installation on functionality in all seasons, under full and partial load. Is aware of critical points and makes sure the designed energy performance is realised.					
In use	Design of a maintenance and operation plan	Can design a maintenance and operation plan that guarantees trouble free performance, and instruct the facility manager on the designed performance and monitoring parameters					
In use	Ensure optimal operation of geothermal energy systems during life cycle	Monitoring and control of the system in order to guarantee the designed performance during life cycle. Takes action on anomalies and adjust system settings to ensure optimal operation.					

Technology Nr.

EP2

Biomass energy production




Energy production for heating and potable hot water making use of biomass, e.g. wood pallets

Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
General	Understand biomass systems in relation to energy performance	Has general knowledge on biomass energy production, an holistic view on contribution of biomass tot energy performance. Knows the difference between small products (consumerproducts) and large custom made installations.					
Pre design	Perform a feasibility study on (large) biomass systems	Is able to perform a feasibility study on energy performance, including financial aspects and discuss the outcomes for large biomass installations.					
Design	Engineer small biomass systems	Detailed engineering of the biomass energy system. Can determine construction boundaries e.g. needed space, weight. Make detailed descriptions and drawings of the design					
Design	Engineer large biomass installations	Detailed engineering of the biomass energy system. Can determine construction boundaries e.g. needed space, weight. Calculate capacity, flow, temperatures etc. Make detailed descriptions and drawings of the design					
Construction	Specify a biomass energy system for contracting purpose	Is able to select products that fit specifications and demands on given quality aspects. Is able to make financial calculations related to contracting phase					
Construction	Quality assurance of large biomass installations	Can manage, instruct and audit contractors on site during realisation of large biomass installations, based on information given in tender contracts, the designer and supplier.					
Construction	Commission large biomass energy system	Can commission the biomass energy installation on functionality in all seasons, under full and partial load. Can determine if the system operates as planned and makes sure the calculated energy saving is realised.					
In use	Design a maintenance and operation plan for large biomass installations	Design a maintenance and operations plan, critical parameters. Give instructions to user or facility manager.					
In use	Ensure optimal operation during life cycle	Monitor and control the biomass installation on critical parameters, take action on anomalies and ensure optimal operation.					

Technology Nr.

EP3

Biogas energy production




Energy production for heating and potable hot water making use of biogas (the biogas is generated off-site)

Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
General	Understand biogas in relation to other forms of energy production and contribution to energy performance.	Has general knowledge on biogas energy production, which waste materials are used to generate biogas in biogas installations, knows the specifics that characterize biogas systems.					
Preparation	Perform a feasibility study on use of biogas energy	Can perform a feasibility study to determine the usefulness of generating biogas from waste materials (e.g. from own activities or from third parties). Is able to determine total cost of ownership. Can consider pros and cons of using biogas or other forms of heat / energy generation.					
Design	Integrate biogas energy in the installation concept	Can design and calculate installations for heating and potable hot water (PHW) making use of biogas. The biogas is produced off-site (biogas production is not part of the NZEB project).					
Construction	Specify biogas systems in tender contracts	Can specify a biogas energy system for contracting purpose. The realisation of the biogas plant is not part of the project. Is able to select components that are fit for use with biogas.					
Construction	Quality assurance of installations using biogas	Can manage, instruct and audit contractors on site during realisation of the installation for heating and PHW with use of biogas.					
Construction	Commissioning of installations using biogas	Can commission installations for heating and PHW that use biogas on quality and functionality and make sure the foreseen contribution to energy saving is realised.					
In use	Ensure optimal operation of biogas installations	Monitor and control the installations for heating and PHW that use biogas on critical parameters, in order tot guarantee the designed performance during life cycle. Can design a maintenance plan.					

Technology Nr.

EP4

District heating and cooling






Energy for heating and potable hot water delivered by a warm water system, generated in off-site energy production


Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
Preparation	Understand district heating/cooling in relation to other forms of energy production and contribution to energy performance.	Has general knowledge on district heating and cooling systems, knows the specifics that characterize these systems. Understands the contribution to energy saving potential and the boundary conditions.					
Preparation	Perform a feasibility study on use of district heating and cooling.	Can investigate the need for district heating and cooling, is aware of consequences later on in the project. Can determine heating and cooling demand of the building and demand of potable water.					
Design	Engineer district heating and cooling energy systems	Can engineer a district heating and cooling system, including calculations of heat loss and cooling load, determining of capacity, flow, temperatures, hydraulic concepts etc.					
Construction	Specify district heating and cooling systems in tender contracts	Can specify a district heating and cooling energy system for contracting purpose, including description of hydraulic concept.					
Construction	Quality assurance of district heating and cooling inside the building	Can manage, instruct and audit contractors on site during realisation of the installation of district heating and cooling systems inside the building and integration with the building installations.					
Construction	Commissioning of district heating and cooling installations, inside the building	Can commission district heating and cooling systems inside the building, on quality and functionality and make sure the foreseen contribution to energy saving is realized. Is able to determine critical parameters for monitoring and control.					
In use	Ensure optimal operation of district heating and cooling installations	Monitor and control the district heating and cooling installations inside the building on critical parameters, in order tot guarantee the designed performance during life cycle. Can design a maintenance plan.					


Technology Nr.			
EP5		Planning and design of heat pump installations	 <p>Energy production for heating, cooling and potable hot water, making use of an energy source with low temperature and bringing it to a higher temperature</p>
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)
			1 2 3 4 5
General	Understand heat pumps in relation to energy performance	General knowledge of heat pumps, design and application. Is aware of specific need for low temperature energy source. Can take part in discussions in the design team.	
Preparation	Identify and select fitted heat source for use with heat pumps	Can determine available heat/energy sources. Is aware of types of available heat sources for use with heat pumps, understands the influence of source temperature on energy efficiency.	
Preparation	Perform a feasibility study on heat pump installations	Can perform a feasibility study on what type of heat pump fits the demands, including financial aspects, weighing and balancing of components that are needed in relation to energy saving.	
Design	Engineer standard heat pump installations	Can engineer a (standard) heat pump system, including calculations of heat loss (transmission), needed capacity, mono- or bivalent, energy balances (e.g. important when using geothermal energy), noise reduction.	
Design	Engineer complex and innovative heat pump installations	Can engineer a complex heat pump system, using innovative products, alternative heat sources etc. Can make detailed drawings and hydraulic schemes that determine it's functionality. Can describe the automatization strategies.	
Construction	Specify heat pump installations in tender contracts	Can specify heat pump installations in tender documents. Can make detailed descriptions and drawings and select fitted products.	
Construction	Quality assurance of heat pump systems during realisation	Can manage, instruct and audit contractors on site during realisation of a heat pump system, based on information given by the designer and the tender documents.	
Construction	Commission a heat pump installation	Can commission a heat pump installation on functionality in all seasons, under full and partial load, seasonal performance. Can determine if the installation operates as planned, makes sure the foreseen energy performance is realised.	
In use	Ensure optimal operation of heat pump installations	Can design a maintenance plan and instruct the facility manager on monitoring parameters, to guarantee that the system achieves the designed energy saving goals	


Technology Nr.			
EP6		Solar power systems for electricity generation	 <p>Photovoltaic panels eventually combined with storage systems (batteries)</p>
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)
			1 2 3 4 5
General	Understand PV systems in relation tot NZEB	Understands the basic working and application of PV systems, is able to explain and take part in discussions. Is familiar with different types (e.g. panels, roofs). Understands the influence of external aspects e.g. orientation, shadowing on the performance.	
Preparation	Perform a feasibility study on Photovoltaic systems	Can perform a feasibility study including financial aspects, the use of batteries and discuss the outcomes. Has knowledge of different types of PV systems, quality aspects, energy efficiency.	
Design	Engineer a PV system	Can engineer a solar power system, including calculations of energy gain, required capacity, needed space, weight, orientation, Vp, Wp/m2, power inverter. Knowledge and understanding of batteries to store power generated with PV cells. Can determine construction boundaries e.g. needed space, weight. Engineering of the electrical components e.g. connection to the grid.	
Construction	Specify a PV system in tender documents	Is able to select products that fit specifications and demands on given quality aspects. Make detailed descriptions and drawings of the design. Is able to make financial calculations related to contracting phase	
Construction	Quality assurance on realisation of PV systems	Can manage, instruct and audit contractors on site during realisation of a PV system, based on information given by the designer and the tender documents. Is able to instruct the contractor on the specifics of the system. Can audit the realisation on critical points.	
Construction	Commission a PV system	Can commission a PV installation on functionality. Can determine if the installation operates as planned, makes sure the foreseen energy performance is realised.	
In use	Ensure optimal operation of PV during life cycle	Can give instructions to users (or to facility manager). Is able to set up a maintenance plan	


Technology Nr.			
EP7		Solar absorption cooling	 <p>Vapor absorption cooling with use of solar heat by tube collectors for regeneration</p>
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)
			1 2 3 4 5
General	Understand solar absorption cooling systems	Understands the basic working and application of an absorption cooling system. Knows how absorption cooling is regenerated by heat from solar tube collectors. Can explain and discuss the application within the project team.	
Preparation	Perform a feasibility study on solar absorption cooling	Can perform a feasibility study on the application of solar cooling, can estimate the cooling demand of the building. Is aware of financial aspects and life cycle analysis.	
Design	Engineer a solar absorption cooling system	Can engineer an absorption cooling generation system with solar regeneration by heat tube collectors. Calculate accurate cooling demand of the building in order to select the right capacity (kW). Can make a detailed design of the installation, principle, automatization strategy, using available products and concepts, select fitted products.	
Construction	Specify a solar absorption cooling system in tender contracts	Specify a solar cooling generation system for use in contracting. Is able to select products that fit specifications and demands on given quality aspects. Can make detailed and accurate descriptions and drawings of the design. Is able to make financial calculations related to contracting phase	
Construction	Quality assurance on realisation of solar cooling systems	Can manage, instruct and audit contractors on site during realisation of a solar cooling system, based on information given by the designer and the tender documents. Is able to instruct the contractor on the specifics of the system. Can audit the realisation on critical points.	
Construction	Commission a solar cooling system	Is able to commission the solar cooling system on functionality in all seasons, under full and partial load. Can determine if the installation operates as planned, makes sure the foreseen energy performance is realised.	
In use	Ensure optimal operation of solar cooling system	Monitor and control the solar cooling installation on critical parameters, in order to guarantee the designed performance during life cycle. Can design a maintenance plan.	
In use	Communicate the appropriate use and maintenance of the solar cooling system	Can instruct the facility manager on monitoring parameters, to guarantee that the system achieves the designed energy saving goals	


Technology Nr.			
EP8		Solar thermal energy systems for domestic hot water and/or heating generation	 <p>Solar tube collectors generating warm water, storage systems for heating or potable hot water. In addition a second heating generating system to add warmth when lack of sunshine</p>
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)
			1 2 3 4 5
General	Understand solar heating systems	Has general knowledge on solar thermal energy systems by heat tube collectors. Understands the basic working, is aware of boundary conditions. Is able to discuss within project team.	
Preparation	Perform a feasibility study on solar heating systems	Can perform a feasibility study and choose the most appropriate solar energy. Can estimate the needs of the building and heating demand. Can determine the demands of domestic hot water (average, peak demand). Can estimate the needed storage volume and possible types of storage tanks. Understands the interaction between water storage / peak demand / available solar energy / external heating.	
Design	Engineer a solar heating system	Can engineer a solar thermal energy system. Calculate accurate heating demand of the building, calculate accurate domestic hot water demand in order to select the right capacity (kW, litres). Can make a detailed design of the installation, principle, automatization strategy, using available products and concepts. Can determine and calculate external heating.	
Construction	Specify a solar heating system in tender contracts	Can specify solar heating installations in tender documents. Can make detailed descriptions and drawings and select fitted products. Is able to make financial calculations related to contracting phase.	
Construction	Quality assurance of realisation of solar heating systems.	Can manage, instruct and audit contractors on site during realisation of a solar heating system, based on information given by the designer and the tender documents. Is able to instruct the contractor on the specifics of the system. Can audit the realisation on critical points.	
Construction	Commission a solar heating system	Can commission a solar heating installation on functionality in all seasons, under full and partial load, seasonal performance. Can determine if the installation operates as planned, makes sure the foreseen energy performance is realised.	
In use	Ensure optimal operation of solar heating system	Monitor and control the solar heating installation on critical parameters, in order to guarantee the designed performance during life cycle. Can design a maintenance plan.	
In use	Communicate the appropriate use and maintenance of the solar heating system	Can instruct the facility manager on monitoring parameters, to guarantee that the system achieves the designed energy saving goals	
Technology Nr.			
EP9		Mini wind power generation	 <p>Mini wind turbines for use on-site (on roofs etc.)</p>
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)
			1 2 3 4 5
General	Understand mini wind power related to nZEB	Understands the basic working and application of mini wind power, is able to explain and discuss within the project team. Is aware of constraints and boundary conditions (regulations, construction, available energy sources)	
Preparation	Perform a feasibility study on mini wind power	Is able to perform a feasibility study on mini wind power including financial aspects. Can estimate needed electrical power demand of the building. Can determine the part of mini wind power on total power supply. Understands basic principles needed in design and calculation, e.g. orientation, wind, power inverter.	
Design	Engineer the mini wind power system	Detailed engineering of the mini wind power system, including batteries and power inverters, in coherence with other power supply sources. Engineering of the construction strength for placing mini turbine. Accurate calculation of the needed power (kW)	
Construction	Specify a mini wind power system in tender contracts.	Can specify a mini wind power system for use in contracting. Is able to select products that fit specifications and demands on given quality aspects. Make detailed and accurate descriptions and drawings of the design. Is able to make financial calculations related to contracting phase.	
Construction	Quality assurance of mini wind power	Can manage, instruct and audit contractors on site during realisation of a mini wind power, based on information given by the designer and the tender documents. Is able to instruct the contractor on the specifics of the system. Can audit the realisation on critical points.	
Construction	Commission a mini wind power system	Is able to commission the mini wind turbine on functionality. Can determine if the installation operates as planned, makes sure the foreseen energy performance is realised.	
In use	Ensure optimal operation of mini wind power during life cycle	Can give instructions to users (or to facility manager). Is able to set up a maintenance plan to ensure optimal operation of the mini wind power system.	
Technology Nr.			
EP10		Combined Heat and Power (CHP) generation	 <p>Energy production by turbines that generate heat and electricity. By the low heating efficiency mostly used when there is high need of electricity.</p>
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)
			1 2 3 4 5
General	Understand CHP and its contribution to nZEB	Has basic understanding on the principles of combined heat and power generation, can discuss within the project team.	
Preparation	Has knowledge on CHP in the project definition phase	Has knowledge on CHP in the project definition phase, regarding regulations, technical demands, energy sources, temperature levels.	
Preparation	Perform a feasibility study on CHP	Can perform a feasibility study on the use of CHP, regarding technical demands, regulations and costs. Can estimate the needed electrical power and heating demand as well as the heat storage needed in order to determine possibilities of CHP by means of load and load duration curves. Can make an inventory of possible solutions for power supply and heating (energy flows).	
Design	Engineer a CHP system	Engineer the CHP system. Can estimate the heating and cooling demands of the building. Can determine the demands of domestic hot water (average, peak demand). Can make a hydraulic scheme to fit in the CHP unit with a guaranteed return temperature and acceptable on/off switch numbers. Can make a description of the control strategy.	
Construction	Specify a CHP-system in tender documents	Specify a CHP-system for use in contracting. Is able to select products that fit specifications and demands on given quality aspects. Can make detailed and accurate descriptions and drawings of the design. Is able to make financial calculations related to contracting phase.	
Construction	Quality assurance of a CHP system	Can manage, instruct and audit contractors on site during realisation of a CHP system, based on information given by the designer and the tender documents. Is able to instruct the contractor on the specifics of the system. Can audit the realisation on critical points.	
Construction	Commission a CHP-system	Is able to commission the CPH system on functionality in all seasons, under full and partial load	
In use	Ensure optimal operation of a CHP system	Monitor and control the CHP installation on critical parameters, in order to guarantee the designed performance during life cycle.	
In use	Design a maintenance and operation plan for CHP systems	Design a maintenance and operations plan, determine critical parameters. Give instructions to user or facility manager.	


Technology Nr.							
ER1		Insulation		Thermal insulation of ground floors, walls, roofs, thermal bridges			
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
General	Understand the importance of insulation in relation to nZEB	Has general knowledge on insulation. Understands the basic concept of energy conservation, is able to take part in discussions within a project. Is aware of constraints and boundary conditions (regulations, construction)					
Preparation	Determine the insulation concept within a nZEB project	Considers the concept of energy conservation (reduction of losses) in terms of building shape, zoning of rooms, insulation, airtightness etc. Understands the nature of the thermal bridge. Can discuss and, to some extent evaluate, possible solutions for the thermal bridge problem. Can determine the effect of application of different types of construction elements for the energy performance of the building					
Design	Engineer the insulation concept and thermal bridges	Detailed engineering of insulation and solutions for thermal bridges					
Construction	Specify the insulation concept in tender documents	Specification of building insulation for contracting purpose. Is able to select products that fit specifications and demands on given quality aspects. Make detailed descriptions and drawings of the design					
Construction	Quality assurance of building insulation	Can manage, instruct and audit contractors on construction site, on critical points. Has knowledge on methodologies to measure quality, e.g. thermography.					
Construction	Commission building insulation	Knows how to measure and evaluate the insulation of the building and its effect on building energy performance					


Technology Nr.							
ER2		Air tightness building		Air tightness of openings such as doors and windows			
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
General	Understand the importance of air tightness on energy performance	Has general understanding of the influence of air tightness building on energy performance. Understands the nature of air leakage, is able to take part in discussions within a project.					
Design	Design an air tight building	Can address the air tightness of the building as a part of energy conservation concept. Can guide the design on air tightness towards the desired level of air tightness. Has knowledge on materials, techniques and measures to reach the demanded air tightness.					
Construction	Specify air tightness in tender documents	Specify air tightness for contracting purpose. Is able to select products or suppliers that fit specifications and demands on given quality aspects. Make detailed drawings when needed. Is able to make financial calculations related to contracting phase					
Construction	Quality assurance on air tightness	Can manage, instruct and audit contractors on construction site, on critical points. Has knowledge on methodologies to measure quality, e.g. blower door test.					
Construction	Commission building air tightness	Knows how to measure and evaluate the air tightness of the building and its effect on building energy performance.					





Technology Nr.							
ER3		Micro climates		Green roof, cool roof, exterior landscaping/trees, earth sheltering			
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
General	Understand micro climates in nZEB projects	General knowledge on micro climates. Can understand the interplay between micro climate, buildings and their services. Understands climatic design principles.					
Preparation	Investigate micro climates as strategy to reach nZEB	Can investigate the appropriate solution and is aware of the importance of early decisions later in the project. Has knowledge of the main passive design strategies (i.e. daylight, passive cooling, natural cooling, thermal mass, solar heating, etc.)					
Design	Design of micro climates in nZEB	Can discuss and evaluate climatic and indoor conditions on the site for application of optimal passive strategies (micro and macro climate). Can understand, evaluate and follow climatic design strategies for an optimal energy performance. Can combine several design strategies and evaluate their performance as a whole building energy concept. Can perform optimal design of buildings					

Technology Nr.							
ER4		Envelope systems		Trombe wall, double envelope, facade systems, Barra system			
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
General	Understand envelope systems and contribution to energy performance	Has general knowledge on heat transfer within envelope systems, understands the principles and contribution to energy saving.					
Preparation	Investigate envelope systems as means to reach nZEB	Is aware of physical characteristics of envelope systems and their limitations. Can understand the heat transfer principle in the envelope systems. Can explain and address pros and cons of the envelope systems. Can name physical characteristics of such constructions and their limitations.					
Design	Design envelope systems	Can perform design of envelop system as a part of complete building energy system.					
Construction	Commission an envelope system	Has knowledge of performance evaluation of the envelope systems.					

Technology Nr.							
ERS		Hot water systems	 Heat recovery, smart distribution				
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
General	Understand function of hot water systems	General knowledge on hot water distribution systems; is aware of it's function to distribute heating, cooling and potable hot water.					
Preparation	Investigate solutions for distribution of heating, cooling, potable hot water.	Understands the design principles of water distribution systems for e.g. heating, cooling and domestic hot water and non-energetic water insulation, energy saving by optimal hydraulic design. Understands the nature of energy loss in these systems caused by heat transfer, pressure loss (resistance of tubes and valves) and electrical power for pumps and valves. Is able to avoid large distribution system losses by optimal hydraulic design.					
Design	Engineer hot water systems	Can engineer a hot water distribution system for e.g. heating, potable hot water. Can perform the design of the system regarding insulation and solutions for heat recovery. Can describe and explain physical properties (e.g. static/dynamic pressure, authority, velocity, heat transfer). Is aware of the influence of insulation on total energy demand. Can calculate the needed insulation thickness					
Design	Hydraulic balancing of hot water systems	Can make a hydraulic balancing calculation, is able to calculate and select projects and components in the installation e.g. A-label pumps, balancing valves.					
Construction	Specify distribution systems in tender documents	Specification of a distribution system for contracting purpose, including drawings, hydraulic schemes, quality aspects and valves and monitoring devices.					
Construction	Quality assurance on distribution systems	Can manage, instruct and audit contractors on correct realisation of water distribution systems, hydraulic balancing and setting of parameters e.g. flow and temperatures					
Construction	Commission a hot water distribution system	Is able to commission the distribution system on functionality in all seasons, under full and partial load. Can determine if the installation operates as planned, makes sure the foreseen energy performance is realised.					
In use	Ensure optimal operation of hot water distribution systems	Can design a maintenance plan and instruct the facility manager, to guarantee that the system achieves the designed energy saving goals, including hydraulic balancing en monitoring parameters.					

Technology Nr.							
ER6		Window and/or glazing systems	 Insulation glass, Smart glass, Blinds (sun reflection), Brise soleil, daylighting systems, solartubes				
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
General	Understand window / glazing systems in relation to energy performance	General knowledge on window and/or glazing systems					
Design	Engineer window / glazing systems	Can understand and address the heat transfer principle in a glazing system. Can calculate properties of the glazing system. Can describe and explain physical properties of the glazing system (i.e. g-value, u-value, light transmittance).					
Preparation	Design energy efficient solutions for window / glazing systems	Can discuss and design window/glazing system for optimal comfort and energy performance. Can understand the effect of shading device for performance of a glazing system. Can evaluate and design optimal shading system and its control strategy.					

Technology Nr.							
ER7		Heating and cooling emission systems	 Low temperature heating systems and high temperature cooling systems, surface heating/cooling				
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
General	Understand heating and cooling emission in relation to comfort and energy performance	General knowledge on heating and cooling emission systems; influence on human comfort and energy demand. Understanding of relation with heating and cooling generation, high and low temperatures.					
Preparation	Investigate energy efficient solutions for heating and cooling emission	Understands the basic design principles of heating and cooling emission systems and can explain, regarding human comfort and energy use. Can investigate and select the appropriate system according to the heating and cooling generation system. Understands the specifics of high temperature cooling and low temperature heating. Is familiar with the specifications and functionality of e.g. climate ceilings, radiators, wall-heating, floor-heating, convectors, induction air units.					
Design	Engineer heating and cooling emission systems	Can design and evaluate solutions for different types of rooms and spaces regarding square metres, height, human comfort and occupation (Fanger model, PMV), adaptation and control strategies. Is able to design a system taking into account the relation with the heating and cooling generation system					
Construction	Specify heating and cooling emission systems in tender contracts	Specify heating/cooling emission systems for contracting purpose. Can make detailed drawings and descriptions of the demanded systems, in a way the contractor can offer a system or products that fulfill the demands.					
Construction	Quality assurance of heating / cooling emission systems	Can manage, instruct and audit contractors on site during realisation of heating/cooling systems, based on information given by the designer and the tender documents. Is able to instruct the contractor on the specifics of the system. Can audit the realisation on critical points.					
Construction	Commission heating / cooling emission systems	Is able to commission the heating / cooling emission system on functionality in all seasons, under full and partial load. Can determine if the installation operates as planned, makes sure the foreseen energy performance is realised.					
In use	Ensure optimal operation of heating / cooling emission systems	Can set up a maintenance plan and give instructions to users in order to maintain settings and energy efficiency					

Technology Nr.			
ER8		Electric heating systems	 <p>Electric heating systems such as InfraRed and electric floor/wall heating can contribute to indoor comfort and energy saving under the right conditions (low frequency use, or very high insulated buildings).</p>
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)
			1 2 3 4 5
General	Understand contribution of electrical heating to NZEB	Has general knowledge on electric heating, understands the basic working and properties of electric heating systems, is able to take part in discussions. Is aware of the potential contribution to energy saving by local heating. Is aware of the interactions between electric heating versus power supply capacity.	
Preparation	Perform a feasibility study on electric heating	Is able to perform a feasibility study in order to determine whether application of electric heating is appropriate and sustainable under the given conditions (e.g. room occupation, temperature, comfort, available heat/energy source, construction of walls/floors/ceiling). Is familiar with different types of electric heating systems (Infra red, floor and wall heating foil or panels).	
Design	Engineer an electric heating system.	Detailed engineering of electric heating systems. Is able to calculate the needed capacity for space heating under given conditions. Has specialist knowledge of radiation heating, PMV, properties and human interaction (e.g. how to design for high spaces). Is able to comply with available electrical power supply.	
Construction	Specify electric heating systems in tender documents	Is able to define and specify the electric heating system for use in contracting phase.	
Construction	Quality assurance of electric heating	Can instruct, manage and audit contractors on site during realisation of a electric heating system, to ensure the designed energy saving goals are met.	
Construction	Commission electric heating systems	Commission an electric heating system on functionality, energy efficiency and human comfort.	
In use	Ensure optimal operation of electric heating systems	Can design a maintenance plan and instruct the facility manager on monitoring parameters, to guarantee that the system achieves the designed energy saving goals	
Technology Nr.			
ER9		Artificial lighting systems	 <p>Artificial lighting systems have a high power consumption. By using HF fluorescent lighting, LED lighting, natural daylight and programmed control systems energy can be used efficiently.</p>
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)
			1 2 3 4 5
General	Understand artificial lighting systems in relation to energy performance in NZEB	Understands and can explain the basic design principles of artificial lighting systems. Has general knowledge on different types of lighting and contribution to energy efficiency.	
Preparation	Investigate energy efficient solutions for artificial lighting regarding human factors.	Can investigate solutions for artificial lighting systems, taking into account human comfort, energy efficiency, maintenance, costs.	
Design	Engineer an artificial lighting system	Can design an artificial lighting system based on e.g. daylight, timer, occupation of spaces. Is aware of technical specifications and restrictions, such as power quality and energy efficiency (LED, HF fluorescent lighting). Is aware of influence of used materials in light bulbs(LED's on environment (chemical elements, mercury...))	
Construction	Specify artificial lighting in tender documents.	Specify an artificial lighting system for contracting purpose. Choose products that fit specifications of lighting (lux, lumen) as well as electric restrictions (power quality), taking into account sustainability of products.	
Construction	Commission an artificial lighting system	Can commission artificial lighting systems on quality and functionality and make sure the foreseen contribution to energy saving is realised.	
Technology Nr.			
ER10		Ventilation systems	  <p>Ventilation system to guarantee good indoor air quality. The energy use of this system is very much dependent on the type of system, and the quality of engineering and construction.</p>
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)
			1 2 3 4 5
General	Understand ventilation systems in relation to energy performance	Has general knowledge on ventilation systems, understands basic principles, is aware of the importance of IAQ on human performance and well being. Is familiar with concepts of oxygen, exhaust of carbon dioxide, pollution, allergens.	
General	Understand basic design principles of ventilation and IAQ systems.	Understands the basic design principles of ventilation systems, such as natural, semi natural and mechanical systems, central or decentral (façade) systems.	
Preparation	Advise on required IAQ	Explain, discuss and advise to project developer and future user which minimum indoor air quality is wished for.	
Preparation	Investigate and select fitted ventilation systems	Can investigate and advise on a ventilation system that fits the energy demands but also guarantees good indoor air quality according the minimum IAQ levels. Is open to alternative ways of ventilation (e.g. stack ventilation, use of chimney effect). Also advises on need or use of opening windows.	
Preparation	Perform energy calculation of ventilation systems	Can calculate and evaluate the total energy use of the ventilation system regarding electrical power consumption, heat loss of the system and the building, on a yearly base in order to select a fitted concept.	
Preparation	Advise on natural ventilation for (summer) night cooling	Can advise on the use of natural ventilation at night to cool down the building during summer time.	
Design	Engineer a ventilation system	Can engineer a ventilation system, regarding future aspects of maintenance. Knows the interplay between an nZEB building, it's use (occupation) and the right ventilation strategy. Can design a system regarding specific needs of the building and its users. Engineer the air ducts, inlets, outlets, fans, filters etc.	
Construction	Specify a ventilation system in tender contracts	Can specify the design, describe important specifications, make drawings of the ventilation system, in a way that ensures optimal performance on energy and IAQ (indoor air quality).	
Construction	Quality assurance of a ventilation system according tender contract	Can manage, instruct and audit contractors on site during realisation of the ventilation systems, based on information given by the designer and the tender contracts.	
Construction	Commission a ventilation system in relation to energy performance and IAQ	Can commission a ventilation system on functionality, quality and realised energy performance. Can determine whether the system operates as planned and the designed energy performance is realised.	
In use	Ensure optimal operation of ventilation systems on energy performance and IAQ	Can monitor and control the ventilation system on critical performance parameters, in order to guarantee performance as designed. This includes monitoring of settings, design of a maintenance plan for cleaning of air ducts, filters etc.	
In use	Communicate with customers on appropriate use of ventilation	Can instruct building users in order to make sure the system is used as designed for in relation to energy performance and IAQ.	

Technology Nr.								
IS1		Communication		Being able to listen and summarize conversations (in common language); Realizing common understanding and involving other people in the project objectives				
Project (if applicable)	Short description	Detailed description of competencies		for competence level(s)				
				1	2	3	4	5
General	Effective communication within NZEB projects	Understand the customer needs, and the opinions of actors involved in the project planning and implementation. Explain own ideas, plans and requirements to customers, and partners from other sectors.						
Concept design	Present the design and reach consensus on decisions.	Present the design concept to customers, project developers and decision makers. Moderate discussions, reach consensus about the final design.						
Construction	Communicate in contracting phase, understand and respect the role of all actors involved.	Negotiate with contractor / customer / project developer / decision maker. Understand and apply the requirements of the different actors in the contract.						
Construction	Coordinate contractors and suppliers by effective communication	Coordinate contractors and suppliers.						
Construction	Communicate with customers on construction progress and experience of building performance	Follow-up and report back to customers about the implementation and construction phase. Understand the users experience regarding building performance						
In use	Communicate with suppliers and facility employers on energy performance	Communicate and exchange with the technology suppliers, maintenance personal. Ask the right questions.						
In use	Instruct users and facility managers on energy performance of the building	Explain / understand the maintenance plan to maintain energy performance and proper IEQ in the building. Train and instruct facility managers and building users.						
General	BIM project management	To be able to perform BIM project management						
General	BIM coordination process	To be able to perform BIM coordination						
General	Giving support on BIM tools to employees	Able to give support on BIM tools to employees.						
General	External context for BIM, global, national, standards and support communities	Able to describe and use external context for BIM standards and support communities						
General	Barriers to successful adoption of BIM	Able to see and overcome barriers with the purpose to successful adopt BIM						
General	The value, benefits and investment associated with BIM	Able to see and communicate the value, benefits and investment associated with BIM						
General	Facilitate BIM communication between different stakeholders	Able to facilitate BIM communication between different stakeholders						
General	Ensure compliance with BIM standards	Able to ensure compliance with BIM standards						
General	Establish organization/project BIM goals	Able to establish organization/project BIM goals						
General	Establish organization/project budgets, planning and costs for BIM implementation and maintenance.	Able to establish organization/project budgets and costs for BIM implementation and maintenance.						
General	Test new staff in BIM knowledge and skills	Able to test new staff in BIM knowledge and skills						
General	Modeling competencies.	To be able to create, update and evaluate BIM (aspect)models						
General	Troubleshoot problems as they relate to the BIM systems	Able to troubleshoot problems related to BIM systems						

Technology Nr.		Information management	Understanding technical drawings (2D/3D) and texts; Being able to interpret information (also in BIM-models); Understanding of the complete NZEB building process				
IS2							
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
Preparation	Select appropriate modelling tools for NZEB design	Can select appropriate design and modelling tools. Has knowledge on the different available models for NZEB design.					
Design	Supervise the use of information modelling in design teams	Is able to analyse and interpret data from modelling tools; has experience to guide the team.					
Design	Use and management of information models within the NZEB design	Can use design and BIM software to prepare technical drawings. Can define dataset criteria, manage and analyse data, calculate (nZEB) energy performance.					
Construction	Manage data, keep records of implementation, monitor outcomes.	Can manage data within the information model, keep records of implementation, monitor outcomes					
Construction	Monitor the energy and IEQ performance with use of information modelling.	Manage data, continuously monitor the building (nZEB) energy and IEQ performance.					
Construction	Site utilization planning to graphically represent both permanent and temporary facilities on site during multiple phases of the construction process	Able to graphically represent utilization planning during construction					
Construction	Perform 4D visualization of construction schedules	Able to perform 4D visualization of construction schedules					
Construction	3D construction control and planning to layout facility assemblies or automate control of equipment's movement and location	Able to layout facility assemblies/automate control of the location/movement.					
Construction	Record modelling to depict an accurate representation of the physical conditions, environment, and assets of a facility	Able to record modelling to depict an accurate representation of the physical conditions/environment, and assets of a facility					
General	Integrate with project partner (supply chain) databases	Able to integrate models in different databases					
In use	Building maintenance scheduling to maintain the functionality of the building structure and equipment serving the building over the operational life of a facility	Able to build maintenance schedulings					
In use	Building system analysis to measures how a building's performance compares to the specified design	Able to build analysis systems					
In use	Asset management, an organized management system where information is bi-directionally linked to a record model to efficiently aid in the maintenance and	Able to set up an organized management system					
In use	Space management and tracking to effectively distribute, manage, and track appropriate spaces and related resources within a facility	Able to set up an space management systems					
General	Use laser scanning pointclouds to model, compare and evaluate facility and related systems	Able to use laser scanning pointclouds to model, compare and evaluate facility and related systems					
General	Photogrammetry to model, compare and evaluate facility and related systems	Able to photogrammetry to model, compare and evaluate facility and related systems.					
General	BIM workflows and processes	To be able to set up BIM workflows and processes					
General	BIM execution plan	To be able to set up an BIM execution plan					
General	Advantages and disadvantages of BIM for design and construction processes	To be able to evaluate the use of BIM for design and construction processes					
General	Manage BIM knowledge in organizations/projects	Able to manage BIM knowledge in organizations/projects.					
General	Manage BIM roles and responsibilities in organizations/projects	Able to manage BIM roles and responsibilities in organizations/projects					
General	Managing organization and project BIM risks	Able to manage organization and project BIM risks					
General	Monitor, report and control BIM implementation in organizations/projects	Able to monitor, report and control BIM implementation in organizations/projects					
General	Stay up to date on BIM trends, current developments and new directions	Able to incorporate information about BIM					
General	Study and evaluate new BIM or related technologies	Able to evaluate new BIM related technologies					
General	Study, analyze and evaluate best BIM processes, routines and workflows	Able to evaluate BIM processes, routines and workflows					
General	BIM standards development, implementation and enforcement in organizations/projects	Able to develop and implement in organizations/projects					
General	Have a thorough knowledge of current BIM standards in the office	Able to apply BIM standards					

Technology Nr.							
IS3		Collaboration	Working together in cross-trade settings, with all involved NZEB building disciplines; Being able to connect the individual performance to a team performance; Raising enthusiasm for sustainable NZEB				
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
Preparation	Work together in cross-trade teams towards common goals	Contribute to the work in cross-trade teams applying, adapting own methods and knowledge from its own sector/discipline. Follow a cross-disciplinary approach, able to define and work towards common goals.					
Design							
Construction							
Construction							
Construction							
In use							
Technology Nr.							
IS4		Quality assurance	Taking responsibility in assuring quality of its own work; Being aware of the consequences of actions on the energy performance of the NZEB building and the building process; Being able to implement and assess				
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
Preparation	Define QA criteria to ensure energy and IEQ performance	Define measureable QA criteria with appropriate data input, according to customer needs to ensure nZEB energy and IEQ performance.					
Design	Apply QA criteria in design phase	Apply the defined QA criteria in the design phase. Integrate the means of QA measurement and monitoring in the design, using BIM and BAC where applicable.					
Construction	Define QA monitoring methodology	Define the QA monitoring methodology with measureable QA criteria as part of the contract					
Construction	Manage QA during realisation	Apply quality management according to the agreed QA methodology throughout the realisation phase					
Construction	Monitor QA data and manage performance gaps	Measure and analyse the defined QA input data, define and manage performance gaps					
General	Establish quality management in organizations/projects: assurance, control and improvement	Able to establish quality management					
Technology Nr.							
ISS		Sustainable architectural design	Being able to design (with all project partners involved) a nZEB building with comfort and sustainability as an aim; Having a good understanding on the energetic consequences of every decision made during the design				
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
General	Understand the impact of architectural design on sustainability and energy performance	Has knowledge on a holistic and integrative sustainable architectural design approach, understands the various participants and roles in the sustainable construction project. Is familiar with means for energy reduction, production and management.					
Preparation	Select sustainable constructions and materials	Has knowledge on various construction materials and technologies, their performance, benefits versus costs. Is able to describe project demands regarding sustainability performance and discuss within project team how to achieve					
Preparation	Design passive energy measures	Knowledge on how far the performance can be achieved using passive measures, less prone to failures and without maintenance costs and requirements. Complement passive measures with as few as necessary active measures					
Design	Design of an architectural sustainable building	Has an holistic view on integrative sustainable architectural design process. Can produce an holistic design, which includes passive measures that are complemented by active technologies in a sensible way. Is able to select materials and technologies that fulfill the specified demands on sustainability, taking into account national regulations and certification structure of materials.					
Design	Design of a sustainable and flexible floorplan	Can design location of technologies in an easy to access for maintenance location and to not interfere with the occupant and her comfort. Can design, based on the project room book, in a flexible and hence durable sustainable way: the floorplan can be easily adapted over the years to various occupants and their needs in order to extend the life expectancy of whole building. How to translate project requirements into a roombook used for sustainable design					
Construction	Define the buildings' energy performance in tender documents	Define building performance as part of the contract. Select companies with experience and training of the selected technologies					
Construction	Coordinate the project team to ensure building quality	Apply quality management throughout the realisation phase. Coordinate between team members of different disciplines					
Construction	Quality performance control on site	Measure and analyse the realised performance, define and manage performance gaps					
In use	Instruct the facility manager on running and maintaining the buildings energy performance	Ensuring the building manager has all the knowledge he/she needs to run the building in a way the energy performance is achieved. Hand over and train building manager in running and maintaining the building.					

Technology Nr.							
IS6		Integrated design	Being able to design integrally with the other involved NZEB building disciplines				
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
General	Understand integrated design processes and concepts	Theoretical knowledge of integrated design processes and concepts. Has theoretical understanding of design process and how designers think					
General	Understand the interplay of building location, design, use and outdoor climate	Knowledge on interplay between all aspects of building design, building use and outdoor climate. Able to understand the interplay between microclimate, buildings and their services. Understand the interplay between sustainable energy system, building energy demand and renewable energy production					
General	Understand design methods for passive energy technologies	Able to understand basic design methods for passive energy technologies. Able to apply and combine design methods for passive energy technologies					
General	Project life cycle concept	Able to integrate life cycle concepts in different project phases.					
Preparation	Define and communicate integrated design goals	Can define and communicate design goals					
Preparation	Site analysis with BIM/GIS tools to evaluate properties in a given area	To be able to view, navigate and extract information to evaluate properties in a given area					
Design	Evaluate the integrated design	Can use goals and targets as means of measuring success of design proposals. Able to apply, combine and evaluate advanced methods for analysis of the interplay between energy systems, architectural concepts, building design, building use, outdoor climate and HVAC systems.					
Technology Nr.							
IS7		Sustainable building materials	Being able to assess building materials regarding their sustainability and make the right selections during the design phase				
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
General	Understand sustainability of materials	Has general knowledge on sustainability of building materials, influence of materials on the global environment during its whole lifecycle. Can explain the importance of using sustainable materials.					
General	Understand the importance of correct application of materials on sustainability	Can explain the necessity of use of sustainable materials. Is aware of the consequences of wrong application of materials on their and the building's sustainability. Knowledge on how far the performance can be achieved using passive measures such as sustainable construction materials, less prone to failures and without maintenance costs and requirements					
Pre-design	Knowledge on various installation materials, their performance, benefits versus costs	Is able to describe demands on sustainability of materials within the project and discuss within project team. E.g. life expectancy, recycling. Follows developments and innovations.					
Design	Select sustainable materials in design	Is able to select materials that fulfill the specified demands on sustainability, taking into account national regulations and certification structure of materials. Has general knowledge on applicable regulations. Holistic design with chosen materials applied in correct manner and composition with each other and other materials.					
Tender	Define performance of materials in tender documents	Can define sustainability of materials in tender documents. Can select companies with experience and training of the selected technologies					
Realisation	Quality assurance of sustainable materials	Can apply quality management throughout the realisation phase on sustainability of materials.					
Commissioning	Quality performance control	Measure and analyse the defined performance, define and manage performance gaps. Measure indoor air quality/ pollution of used materials (VOC source)					
Use & Maintain	Ensure optimal maintenance of materials	Has knowledge on any requirements of materials (maintenance, cleaning). Train building manager in any requirements regarding the materials					
Technology Nr.							
IS8		Sustainable installation materials	Being able to assess materials on sustainability and make the right selections in the design				
Project phase (if applicable)	Short description	Detailed description of competencies	for competence level(s)				
			1	2	3	4	5
General	Understand sustainability of technologies and appropriate application	Has general knowledge on sustainability of technologies, influence of them on the global environment during its whole lifecycle. Is aware of the consequences of wrong application of technologies on their and the building's sustainability.					
Pre-design	Understand performance, benefits and costs of various technologies	Has knowledge on various technologies, their performance, benefits versus costs. Is able to describe project demands regarding sustainability performance and discuss within project team how to achieve.					
Pre-design	Understand application of passive or active technologies	Has knowledge on how far the performance can be achieved using passive measures, less prone to failures and without maintenance costs and requirements. Complement passive measures with as few as necessary technologies					
Design	Select sustainable technologies in NZEB design	Produce a holistic design, which includes passive measures that are complemented by active technologies in a sensible way. Is able to select materials and products that fulfill the specified demands on sustainability, taking into account national regulations and certification structure of materials.					
Tender	Define performance of materials in tender documents	Choose companies with experience and training of the selected technologies					
Realisation	Quality assurance of sustainable materials	Can apply quality management throughout the realisation phase on sustainability of materials. Coordinate the project team to ensure design intent is built in correctly					
Commissioning	Quality performance control	Measure and analyse the realised performance, define and manage performance gaps. Train building manager in running and maintaining technologies					
Use & Maintain	Ensure optimal maintenance and operation	Has knowledge on any requirements of materials and technologies (operate, maintenance, cleaning). Train building manager in any requirements regarding the materials					

Technology Nr.								
IS9		Environmental (indoor) quality		Having a clear view on indoor environmental consequences of every choice made in the design process				
Project phase (if applicable)	Short description	Detailed description of competencies		for competence level(s)				
				1	2	3	4	5
General	Understand the interplay between energy performance and IEQ.	Has general knowledge on environmental indoor quality, understands the interplay between energy performance and indoor environmental quality.						

Technology Nr.								
IS10		Economics		Having a clear view of issues on cost-benefit analysis, cost optimal calculation and pricing; Having financial engineering knowledge and competencies; Taking into account LCC analysis during the nZEB building				
Project phase (if applicable)	Short description	Detailed description of competencies		for competence level(s)				
				1	2	3	4	5
Financial planning	Define the financial boundary condition, prepare a financial plan	Prepare a financial plan with cost-benefit analysis, and LCC scenarios about the nZEB construction project. Collect information on market prices. Identify available public and private incentives and funding.						
Design / tendering	Comply with the financial boundary conditions of the decision maker.	Apply cost optimal calculation for the nZEB construction project. Design bankable projects. Apply LCC analysis. Define the financial framework and plan for the energy performance contracting offer according to the call for tender.						
Contracting	Negotiate the financial plan of the contract	Negotiate the financial plan of the contract with acceptable prices, contracting with private and public funding. Negotiate better prices with suppliers. Evaluate the financial feasibility of the offers, select the best value for money offer. Agree and integrate a financial plan with appropriate financial guarantees in the contract.						
Contracting	Design a bankable project, apply for funding	Apply for private and public funding, present bankable projects, negotiate the loan agreement with financial institutions/funding bodies.						
Realisation	Ensure compliance of spendings	Monitor and ensure that spendings comply with the financial plan and boundary conditions. Monitor the spending and manage the financing of the investment. Identify and handle deviations from the financial plan, apply financial guarantees of the contract.						
Realisation	Financial management	Financial management of the agreements involving public funding and the energy performance contracts.						
Commissioning and use	Identify and solve problems in financing	Identify and handle deviations from the financial plan, apply financial guarantees of the contract						

Technology Nr.								
IS11		Procurement		Being able to facilitate the process of nZEB tenders and (sub)contracts; Being able to set proper tender specifications to meet nZEB requirements; Being familiar with green procurement, energy performance contracting, national				
Project phase (if applicable)	Short description	Detailed description of competencies		for competence level(s)				
				1	2	3	4	5
General	Understand tender and contracting phase	Has knowledge on the criteria for a successful tender and contracting. Is aware of compliance with legal and technical aspects and green procurement. Is able to define appropriate tender specifications within the own field of expertise						
Tender specification	Specify tender to achieve nZEB performance	Prepare appropriate tender specifications to achieve nZEB level performance. Understand the technical needs, define the adequate technical specification including measurable energy and IEQ performance criteria.						
Tender specification	Define, understand and comply with the legal, financial and project management related criteria.	Has knowledge of the legislation, technical aspects, and international good practice of green procurement and energy performance contracting. Knowledge of national and international public procurement legislation, state aid rules and the use of public funding.						
Tender specification	Define guarantees to nZEB performance	Define appropriate guarantees that apply if the technical / performance criteria is not met. Integrate appropriate guarantees in the contract that apply if the technical / performance criteria is not met.						
Tendering and contracting	Negotiate and achieve contracts enabling nZEB.	Prepare offers that meet the tender specification to reach nZEB performance. Successfully manage the public procurement process, analyse tenders and select the appropriate offer. Handle legal issues, manage contract preparation. Negotiate with tenderers/contractor.						
Realisation	Monitor project realisation and handle deviations	Monitor project realization according to the TS and the contract. Identify and handle deviations/breach of the contract, negotiate eventual changes.						
Commissioning	Monitor building performance	Hand and take-over the building, monitor whether the contracted performance is met. Analyse and report whether the contracted nZEB performance is met, identify and report about performance gaps at handover and during the operational phase.						
Use & Maintain	Identify and solve problems in building performance	Identify and handle deviations/breach of the contract, apply guarantees during the operational phase. Negotiate and take the necessary legal steps if the contractual requirements were not met.						

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